Niina Vieno <niina.vieno@lakijavesi.fi> aika 28.05.2018 13:01:34

Vastaanottaja: vaasa.hao@oikeus.fi,
Kopio: Maria Arjonen <maria.arjonen@lakijavesi.fi>,
Aihe: Valitus Vaasan hallinto-oikeudelle

Hei,

toimitan ohessa valittajan valituksen asiassa, joka koskee Etelä-Suomen aluehallintoviraston ympäristölupapäätöstä nro 61/2018/1, dnro ESAVI/278/2018, 27.4.2018.

Tämä viesti sisältää yhteensä 7 tiedostoa. Tulemme varmistamaan viestin ja sisällön saapumisen kirjaamoon erikseen.

Ystävällisin terveisin,
Niina Vieno
TkT, vesiasiantuntija

Laki ja Vesi Oy
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p. 050 544 8431

valitus_v04_28052018.pdf

liite 1_Valtakirja Jujo Thermal_Laki ja Vesi 16052018.pdf

liite 3_JVP-Eura_vuosiraportti_2017.pdf

liite 5_EU_risk assessment_BisphenolA_2008.pdf

liite 6_ESAVI_paatos_71_2013_1-2013-04-03.pdf

liite 2_Ympäristolupapaatos 61-2018-1.pdf

liite 4_E-PRTR raportti_2017.pdf

Vaasan hallinto-oikeudelle

Asia

Valitus Etelä-Suomen aluehallintoviraston ympäristölupapäätöksestä nro 61/2018/1, dnro ESAVI/278/2018, 27.4.2018.

Valittaja

Jujo Thermal Oy (jäljempänä valittaja)
Y-tunnus: 0842018-1, kotipaikka: Eura

Valittajan asiamies

Maria Arjonen,
OTM, luvan saanut oikeudenkäyntiavustaja

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Vaatimukset

Valittaja vaatii kunnioittavasti, että Vaasan hallinto-oikeus muuttaa Etelä-Suomen aluehallintoviraston ympäristölupapäätöksestä nro 61/2018/1, dnro ESAVI/278/2018, 27.4.2018 lupamääräystä 2a ja velvoittaa Etelä-Suomen aluehallintoviraston korvaamaan valittajalle asian käsittelystä aiheutuvat oikeudenkäyntikulut ja asiassa määrättävän oikeudenkäyntimaksun täysimääräisesti korkolain (633/1982) 4 § 1 momentin mukaisine viivästyskorkoineen siitä lukien, kun kuukausi on kulunut päivästä, jona hallinto-oikeuden päätös on ollut asianosaisten saatavissa hallintolainkäyttölain (586/1996) 13 luvun 75 §:n 2 momentin mukaan.

Valitus

<u>Miltä kohdin päätökseen haetaan muutosta</u>

Valittaja hakee muutosta lupamääräykseen 2a:

> Jätevesien yhteispuhdistukseen johdettavan jäteveden bisfenoli A -pitoisuus (CAS 80-05-7) saa olla 1.1.2019 alkaen korkeintaan 2,0 mg/l. Raja-arvoa katsotaan noudatetun, kun mittaustulosten vuosikeskiarvo ilman mittausepävarmuuksien vähentämistä alittaa raja-arvon.

Mitä muutoksia vaaditaan tehtäväksi

Valittaja vaatii lupamääräyksen muuttamista seuraavasti:

> Jätevesien yhteispuhdistukseen johdettavan jäteveden bisfenoli-A-pitoisuus (CAS 80-05-7) saa olla 1.1.2019 alkaen korkeintaan 3,1 mg/l. Raja-arvoa katsotaan noudatetun, kun vähintään kahdentoista (12) näytteen mittaustulosten vuosikeskiarvo ilman mittausepävarmuuksien vähentämistä alittaa raja-arvon.

Perusteet bisfenoli-A:n raja-arvon muuttamiseksi

Ympäristönsuojelulain 52 §:n 1 mom. 1 kohdan mukaan ympäristöluvassa on annettava tarpeelliset määräykset päästöistä, päästöraja-arvoista, päästöjen ehkäisemisestä ja rajoittamisesta sekä päästöpaikan sijainnista. Ympäristönsuojeluasetuksen 41 §:n 1 mom. kohta 4 mukaan teollisuusjätevedet viemäriin on esikäsiteltävä asianmukaisella tavalla jäteveden ja lietteen käsittelyprosessien toiminnan vaikeutumisen estämiseksi.

Ympäristönsuojeluasetuksen 42 §:n ympäristöluvassa on annettava tarpeelliset päästöraja-arvot ja muut päästömääräykset vesihuoltolaitoksen viemäriin johdettaville teollisuusjätevesille ja muille vesille, jos ne sisältävät liitteessä 1 tarkoitettuja aineita, sen varmistamiseksi, että jätevedet esikäsitellään asianmukaisesti ja päästöjä tarkkaillaan.

Ympäristönsuojeluasetuksen liitteen 1 mukaisesti aineet ja valmisteet, joilla osoitetaan olevan lisääntymiseen vaikuttavia ominaisuuksia, tulee huomioida päästöjen raja-arvoja asetettaessa. Bisfenoli A on CLP-asetuksen yhdenmukaistetun luokituksen perusteella tällainen aine. Etelä-Suomen aluehallintovirasto on päätöksellään nro 61/2018/1 (**liite 2**) määrännyt, että jätevesien yhteispuhdistukseen johdettavan jäteveden bisfenoli A -pitoisuus (CAS 80-05-7) saa olla 1.1.2019 alkaen korkeintaan 2,0 mg/l. Valittaja hyväksyy raja-arvon asettamisen, mutta vaatii muutosta raja-arvoon, koska nyt asetettu raja-arvo perustuu virheelliseen laskentaan.

Annetun päätöksen perusteluissa (s. 17) on todettu, että jos paperitehtaan jäteveden bisfenoli A -pitoisuus on annetun raja-arvon mukainen, 2,0 mg/l, laskennallinen pitoisuus 99 % poistoteholla on Eurajokeen johdettavassa vedessä 0,02 mg/l, mikä vastaa puhdistamoyhtiön lainvoimaisen ympäristöluvan tavoitteellista raja-arvoa. Koska puhdistamoyhtiön luvan raja-arvo on asetettu sellaiseksi, ettei haitatonta pitoisuutta (PNEC 1,6 µg/l) ylitetä Eurajoessa, pystytään raja-arvolla täten estämään bisfenoli A:n haitalliset vaikutukset vesistössä.

Valittajan näkemyksen mukaan raja-arvon laskenta on virheellinen. Laskelma ei ota huomioon sitä, että JVP-Eura Oy:n puhdistamolle tulee jätevesiä myös muista lähteistä kuin valittajan tehtaalta. JVP-Eura Oy:n jätevedenpuhdistamon tarkkailututkimuksen (**liite 3**) mukaan JVP-Eura Oy:n puhdistamolle johdettiin vuonna 2017 jätevesiä yhteensä 2 774 372 m^3, joista 64 % eli 1 761 765 m^3 johdettiin valittajan paperitehtaalta. Asiassa tulee lisäksi huomioida, että valittajan osuus jätevedenpuhdistamon tulovirtaamasta on jatkossakin olemaan n. 65 %, vaikka puhdistamolle tulevan jäteveden määrä on vuoden 2017 lopulla pienentynyt.

Jäteveden määrä on pienentynyt, koska sijaintipaikassa ja toimintaympäristössä on tapahtunut muutoksia. Vuoden 2017 lopussa HKScan Finland Oy lopetti toimintansa, jolloin puhdistamon tulovirtaama pienentyi marras- ja joulukuussa n. 30 000 m^3/kk. Valittajan paperitehtaan jätevesien osuus JVP-Eura Oy:n tulovirtaamasta oli näiden kuukausien aikana 62 %. Valittajan osuus jätevedenpuhdistamon tulovirtaamasta tulee jatkossa olemaan arviolta 65 %. Valittajan jätevesien määrään ei ole odotettavissa muutoksia tulevien vuosien aikana. Toimenpiteet tehtaalla tähtäävät kuitenkin jätevesimäärän vähentämiseen tulevaisuudessa.

Valittajan osuus jätevedenpuhdistamon tulovirtaamasta ja valittajan tuottama bisfenoli A:n määrä tulee huomioida vaaditulla tavalla, koska muiden JVP-Eura Oy:n puhdistamolle johdettavien jätevesien vaikutuksesta bisfenoli A:n pitoisuus pienenee ennen biologista käsittelyvaihetta. Muista lähteistä tulevien jätevesien osuus bisfenoli A:n kokonaispitoisuudesta on vähäinen.

Muista lähteistä tulevien jätevesien osuus bisfenoli A:n kokonaispitoisuudesta on kuvattu vuoden 2017 JVP-Eura Oy:n ja Jujo Thermal Oy:n E-PRTR asetuksen mukaisten yhdisteiden päästöt -raportissa (**liite 4**), jonka mukaan valittajan paperitehtaan jätevesien mukana jätevedenpuhdistamolle tuli bisfenoli A:ta 1216 kg/vuosi ja muista lähteistä 32 kg/a eli 2,5 % koko kuormituksesta. Muiden kuin paperitehtaan jätevedet siis pienentävät bisfenoli-A:n pitoisuutta.

Yllä todella tavalla valittajan osuus jätevedenpuhdistamon tulovirtaamasta on jatkossa n. 65 %, joten valittajan paperitehtaan bisfenoli-A:n raja-arvon tulisi olla 2 mg/l ÷ 0,65 = 3,1 mg/l. Tällöin valittajan paperitehtaan jätevesien sekoittuminen muihin JVP-Eura Oy:n puhdistamolle johdettaviin jätevesiin on huomioitu.

Valittajan näkemyksen mukaan raja-arvon nostaminen 3,1 mg/l:ssa paperitehtaan jätevedessä ei vaaranna JVP-Eura Oy:n puhdistamon toimintaa, puhdistamon biolietteen hyötykäyttöä, vastaavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön hyötykäyttöä. Tällä pitoisuustasolla jätevedenpuhdistamo kykenee normaalitoimintansa aikana puhdistamaan jätevetensä niin, ettei se ylitä sille asetettua käsitellyn jäteveden bisfenoli-A:n raja-arvopitoisuutta 0,02 mg/l. Tätä raja-arvoa noudatettaessa Euroopan Unionin bisfenoli-A:lle tehdyssä riskinarvioinnissa (**liite 5**) määritetty haitaton vesistöpitoisuus ei ylity. Tämän riskinarvioinnin mukaan bisfenoli-A:n arvioitu haitaton pitoisuus (PNEC) jätevedenpuhdistamolla on 320 mg/l, joka on huomattavasti korkeampi kuin valittajan vaatima 3,1 mg/l eli tämä ei vaaranna puhdistamon toimintaa tai vesistön vesiekosysteemin tilaa tai vastaanottavan vesistön hyötykäyttöä.

Puhdistamon biolietteen hyötykäyttö ei vaarannu. Tämä johtuu siitä, että bisfenoli-A on nopeasti biohajoava, joten se ei kerry biolietteeseen. Tämä on todettu myös annetun lupamääräyksen 2a perusteluissa (s. 16). Se täyttää siten valittajan voimassaolevan ympäristöluvan (**liite 6**) lupamääräyksen 2, jonka mukaan jätevesien sisältämien kehittimien, reaktiivisten värien tai muiden haitallisuudeltaan näihin rinnastettavien osittain jätevesiin päätyvien kemikaalien määrä ei saa ylittää pitoisuutta, joka vaarantaa puhdistamon toiminnan, puhdistamon biolietteen hyötykäytön, vastaanottavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön veden hyötykäytön.

Perusteet bisfenoli-A:n raja-arvon muuttamiseksi näytteiden määrän osalta

Valittajan voimassaolevan ympäristöluvan (**liite 6**) lupamääräyksen nro 18 mukaan ”Prosessijätevesistä tulee lisäksi määrittää julkisen valvonnan alaisessa laboratoriossa neljännesvuosittain fenoliset yhdisteet ja bisfenoli-A, sekä kokonaisorgaaninen hiili (TOC).” Valittajan nykyisen omavalvonnan mukaan bisfenoli-A:n pitoisuuksia prosessijätevesistä mitataan tällä hetkellä 24 kertaa vuodessa. Valittajan näkemyksen mukaan bisfenoli-A:n vuosikeskiarvon laskeminen vain neljään mittaukseen perustuen ei anna todellista kuvaa aineen pitoisuudesta prosessijätevesissä. Valittaja vaatii, että bisfenoli-A:n pitoisuutta tulisi mitata prosessijätevesistä julkisen valvonnan alaisessa laboratoriossa vähintään 12 kertaa vuodessa. Tällöin vuosikeskiarvo edustaa todellista aineen pitoisuutta paremmin kuin vain neljännesvuosittain otettavat näytteet.

Johtopäätökset ja oikeudenkäyntikuluvaatimus

Valittajan vaatimukset ovat perusteltuja ja nyt asetettu raja-arvo bisfenoli-A:lle perustuu viranomaisen laskentavirheeseen. Valittajan paperitehtaan bisfenoli-A:n raja-arvon tulisi olla 2 mg/l ÷ 0,65 = 3,1 mg/l, jolloin on huomioitu valittajan paperitehtaan jätevesien sekoittuminen muihin JVP-Eura Oy:n puhdistamolle johdettaviin jätevesiin.

Valittaja vaatii oikeudenkäyntikulujensa korvaamista. Etelä-Suomen aluehallintoviraston virheellinen menettely huomioon ottaen asiassa olisi kohtuutonta, mikäli valittaja joutuisi pitämään oikeudenkäyntikulunsa kokonaan vahinkonaan. Valittaja varaa tilaisuuden esittää lopullisen oikeudenkäyntikululaskun kirjallisen valmistelun päätyttyä. Tällä hetkellä valittajan arvonlisäverottomat oikeudenkäyntikulut ovat 2.981,25 euroa. Tähän summaan tulee lisättäväksi vielä Vaasan hallinto-oikeuden määräämä oikeudenkäyntimaksu ja korvaamista valittaja vaatii Etelä-Suomen aluehallintovirastolta. Valittaja saa vähentää arvonlisäveron määrän eikä vaadi sen korvaamista.

Kunnioittavasti valittajan asiamiehenä,

Maria Arjonen
Turku

Liite 1 Valtakirja
Liite 2 Päätös nro 61/2018/1, dnro ESAVI/278/2018, 27.4.2018
Liite 3 JVP-Eura Oy:n jätevedenpuhdistamon tarkkailututkimuksen vuosiraportti 2017 (15.3.2018)
Liite 4 JVP-Eura Oy:n ja Jujo Thermal Oy:n E-PRTR asetuksen mukaisten yhdisteiden päästöt. Tarkkailututkimusten yhteenveto vuosi 2017. 12.3.2018.
Liite 5 European Union Risk Assessment Report. Environment Addendum of April 2008 (to be read in conjunction with published EU RAR of BPA, 2003) 4,4'-ISOPROPYLIDENEDIPHENOL (Bisphenol-A) Part 1 Environment.
Liite 6 Päätös nro 71/2013/1, dnro ESAVI/118/04.08/2012, 3.4.2013

Liite 1.

Valtakirja

Allekirjoittaneena valtuutan lakimies, OTM Maria Arjosen ja Tkt Niina Vienon sekä heidän edustaman lakitoimiston Laki ja Vesi Oy:n (Y-tunnus: 2555146-6) edustamaan asiassa, joka koskee valitusta Vaasan hallinto-oikeudelle aluehallintoviraston tekemästä ympäristölupapäätöksestä nro 61/2018/1, Dnro ESAVI/278/2018, 27.4.2018.

Valtuutus koskee myös muita asian vaatimia toimenpiteitä ja oikeusasteita.

Paikka ja aika: Kauhava 16.5.2018

Allekirjoitus:

Nimenselvennys ja asema: Pertti Mäkelä Tehtaanjohtaja

Jens Remmer Myynti- ja markkinointijohtaja

Valtuutettuna annan suostumukseni.

Paikka ja aika: Turku, 14.5.2018

Allekirjoitus:

Nimenselvennys ja asema: Maria Arjonen, tj., OTM, luvan saanut oikeudenkäyntiavustaja

Aluehallintovirasto
Etelä-Suomi

Liite 2.

PÄÄTÖS

Nro 61/2018/1
Dnro ESAVI/278/2018

Annettu julkipanon jälkeen
27.4.2018

ASIA Kauttuan paperitehtaan ympäristöluvan lupamääräyksen 2 mukainen suunnitelma, Eura

HAKIJA

Jujo Thermal Oy
PL 92
27500 KAUTTUA

Y-tunnus: 0842018-1

TOIMINTA JA SEN SIJAINTI

Suunnitelma koskee Jujo Thermal Oy:n paperitehdasta, joka sijoittuu Euran kunnassa kiinteistölle 50-406-13-53 (tehdas) ja 50-406-2-591 (hiilisuuli/jätevedenpuhdistamo). Laitoksen käyntiosoite on Paperitehtaankatu 15, 27500 Kauttua. Kiinteistöt omistaa Jujo Thermal Oy.

ASIAN VIREILLETULO

Asia on tullut vireille Etelä-Suomen aluehallintovirastossa 8.1.2018.

ASIAN KÄSITTELYN PERUSTE

Ympäristönsuojelulain 54 § ja 90 §.

Jujo Thermal Oy:n Kauttuan paperitehtaiden lainvoimaisen ympäristölupapäätöksen nro 71/2013/1 lupamääräys 2.

Paperitehtaan toiminta on ympäristöluvanvaraista ympäristönsuojelulain 27 §:n 1 momentin ja liitteen 1 taulukon 1 kohdan 1a perusteella.

TOIMIVALTAINEN VIRANOMAINEN

Etelä-Suomen aluehallintovirasto on toimivaltainen viranomainen ympäristönsuojelulain 34 §:n 1 momentin ja valtioneuvoston asetuksen ympäristönsuojelusta 1 §:n 1 momentin perusteella.

TOIMINTAA KOSKEVAT LUVAT JA PÄÄTÖKSET

Voimassa olevat ympäristöluvat

Etelä-Suomen aluehallintoviraston 3.4.2013 myöntämä ympäristölupa (nro 71/2013/1, dnro ESAVI/118/04.08/2012). Päätös koskee Kauttuan paperitehtaan ympäristölupapäätöksen lupamääräysten tarkistamista. Päätös sisältää ratkaisun toiminnan käyttö- ja päästötarkkailusuunnitelmasta.

- Vaasan hallinto-oikeuden 3.11.2015 antama päätös (nro 15/0296/2, dnro 01074/13/5101), jolla hallinto-oikeus on muuttanut lupamääräystä 2.

- Korkeimman hallinto-oikeuden 9.1.2017 antama päätös (taltionro 16, dnro 3901/1/15), jolla hallinto-oikeus on pysyttänyt Vaasan hallinto-oikeuden päätöksen.

Keskeiset valvontaviranomaisen lausunnot

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen 24.6.2015 antama arvio ympäristöluvan tarkistamisen tarpeesta uusien päätelmien vuoksi (diaarinumero VARELY/1060/2015). Lausunnon mukaan ympäristölupaa ei ole tarpeen tarkistaa massan, paperin ja kartongin valmistuksen päätelmien julkaisun johdosta.

Tarkkailua koskevat päätökset

Lounais-Suomen ympäristökeskus on 28.10.2008 hyväksynyt (nro 99 YLO, dnro LOS-2007-Y-367-121) Eurajoen ja Eurajoensalmen vesistön päivitetyn yhteistarkkailuohjelman.

TOIMINNAN SIJAINTIPAIKKA JA SEN YMPÄRISTÖ

Yleiskuvaus alueesta

Jujo Thermal Oy:n paperitehtaat sijaitsevat Euran kunnan Kauttuan taajamassa Eurajoen varrella, vajaan kilometrin etäisyydellä Pyhäjärvestä. Alueella on ollut teollista toimintaa yhtäjaksoisesti yli 300 vuoden ajan. Rautaruukista alkanut teollisuus on synnyttänyt paikalle asumis- ja teollisuusympäristön, Kauttuan ruukinpuiston. Paperin valmistusta on harjoitettu alueella vuodesta 1908.

Alueen nykyinen rakennuskanta on syntynyt noin 200 vuoden aikana, ja lähinnä tehdasta, sen itäpuolella Sepäntien varrella sijaitsee 1800 ja 1900 -lukujen vaihteen asuinrakennuksia, jotka ovat edelleen asuinkäytössä.

Sijaintipaikassa ja toimintaympäristössä ei ole tapahtunut merkittäviä muutoksia lainvoimaisen luvan myöntämisen jälkeen. Ahlstrom Tampere Oy:n toiminta samalla kiinteistöllä on kuitenkin lopetettu.

SUUNNITELMA

Lainvoimaisen ympäristöluvan lupamääräys 2, jossa selvityksen jättämisestä on määrätty, kuuluu Vaasan hallinto-oikeuden päätöksellään (nro 15/0296/2, dnro 01074/13/5101) muuttamassa muodossa seuraavasti:

”2. Jätevesien sisältämien kehittimien, reaktiivisten värien tai muiden haitallisuudeltaan näihin rinnastettavien osittain jätevesiin päätyvien kemikaalien määrä ei saa ylittää pitoisuutta, joka vaarantaa puhdistamon toiminnan, puhdistamon biolietteen hyötykäytön, vastaanottavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön veden hyötykäytön.

Toiminnanharjoittajan tulee kuuden kuukauden kuluessa tämän päätöksen lainvoimaiseksi tulosta toimittaa Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle selvitys bisfenoli A:ta tai haitallisuudeltaan siihen rinnastettavaa muuta kehitintä tai kemikaalia korkeina pitoisuuksina sisältävistä prosessivesijakeista

Selvityksen pohjalta toiminnanharjoittajan on laadittava suunnitelma teknistaloudellisesti toteuttamiskelpoisista kemikaalien kuormitusta olennaisesti jätevesiyhtiön jätevedenpuhdistamolle vähentävistä toimenpiteistä. Suunnitelmaan tulee sisältyä hakijan esitys jätevedenpuhdistamolle johdettavista bisfenoli-A:n tai vastaavan kemikaalin kuormitus- ja pitoisuusraja-arvoiksi (kg/d ja mg/l) siten, että jätevedenpuhdistamolle asetettu vastaava raja-arvo on mahdollista saavuttaa.

Suunnitelma on toimitettava Etelä-Suomen aluehallintovirastolle vuoden kuluessa tämän päätöksen lainvoimaiseksi tulosta. Suunnitelman perusteella Etelä-Suomen aluehallintovirasto voi antaa tarvittavat lupamääräykset toimenpiteistä tai muutoin täydentää lupaa.”

Suunnitelma on laadittu Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle 7.7.2017 lähetetyn selvityksen perusteella. Bisfenoli A:n ja haitallisuudeltaan sitä vastaavien kemikaalien pitoisuutta paperitehtaalta jätevesilaitokselle lähtevässä jätevedessä pystytään vähentämään jätevesien ultrasuodatusta lisäämällä. Tämä perustuu näiden kemikaalien heikkoon vesiliukoisuuteen. Vesiliukoiset kemikaalit johdetaan hallitusti jäteveden joukossa jätevesilaitokselle puhdistettaviksi. Haitallisuudeltaan bisfenoli A:ta vastaavilla kemikaaleilla tässä suunnitelmassa tarkoitetaan lämpöherkän paperin valmistuksessa käytettäviä kehittimiä, herkistimiä ja reaktiivisia väriaineita.

Bisfenoli A:n ja haitallisuudeltaan vastaavien kemikaalien käyttömäärät

Lämpöpaperin valmistuksessa käytetyistä kehittimistä bisfenoli A:n käyttömäärä on edelleenkin suurin. Vuonna 2016 bisfenoli A:ta käytettiin 430 tonnia ja vuonna 2017 bisfenoli A:n käyttömäärä oli 450 tonnia. Myös tuotantomäärät kasvoivat vuoteen 2016 verrattuna.

2.7.2017 astui voimaan lakimuutos, joka asetti bisfenoli A:lle pitoisuusrajan lämpöherkälle paperille EU:n alueella. Vuoden 2020 jälkeen Euroopan markkinoille ei saa toimittaa lämpöherkkää paperia, joka sisältää bisfenoli A:ta yli säädetyn pitoisuuden (0,02 %). Tämän rajoituksen seurauksena kemikaalin käyttömäärä tulee hakijan toiminnassa laskemaan.

Toistaiseksi bisfenoli A:n ensisijaisesti korvaa bisfenoli S (jatkossa BPS, CAS 80-09-1). Vuonna 2016 BPS:n käyttö oli 53 tonnia ja vuonna 2017 724 tonnia. Suhteessa muihin kehittimiin bisfenoli A:n määrä on laskenut noin 6 %, kun verrataan vuoden 2017 käyttömäärää vuoden 2016 lukuihin.

Muiden käytössä olevien kehittimien vesiliukoisuus on huomattavasti bisfenoli A:n vesiliukoisuutta alhaisemmalla tasolla. Näiden veteen liukenemattomien kemikaalien pitoisuuden vähentämiseksi jätevesissä, ensisijaisena toimenpiteenä Jujo Thermal Oy tulee lisäämään jätevesien ultrasuodatuskapasiteettia.

Bisfenoli A:n pitoisuus paperitehtaan jätevesissä

Taulukoissa alla esitetään vuonna 2012 laadittuun laskentamalliin perustuen tietoa Eurajoen bisfenoli A -pitoisuudesta sekä laskennallisesti arvioitua tietoa bisfenoli A:n käyttäytymisestä ja päästömääristä prosessista Eurajokeen.

Taulukko 1 Bisfenoli A:n (BPA) kulkeutuminen prosessista vesistöön

	2012	2013	2014	2015	2016	2017
BPA päästöstä jätevesiin	50 %	20 %	20 %	20 %	20 %	20 %
Jäteveteen joutuvan BPA:n määrä, kg/a	4997	2120	2080	2024	2199	2265
BPA:n reduktio biologisella puhdistamolla	80 %	90 %	93 %	96 %	99 %	99 %
Eurajokeen päätyvän BPA:n määrä, kg/a	999	212	146	85	22	23

Taulukko 2 Eurajoen laskennallinen pitoisuus eri virtaamilla ja keskimääräisellä päästöllä

	2012	2013	2014	2015	2016	2017
BPA-pitoisuus, virtaamalla 2 m^3/s, µg/l	16	3	2	1	0,3	0,4
BPA-pitoisuus, virtaamalla 4 m3/s, µg/l	8	2	1	1	0,2	0,2
BPA-pitoisuus, virtaamalla 8 m3/s, µg/l	4	1	1	0,3	0,1	0,1

Bisfenoli A:n pitoisuuksista Eurajoessa on lisäksi mittaustietoa vuosilta 2016–2017. Niiden perusteella pitoisuudet ovat vuosikeskiarvona olleet 0,26 µg/l ja 0,33 µg/l. Nämä toteutuneet arvot ovat vuosikeskiarvoja 2 kertaa kuukaudessa suoritetusta tarkkailusta. Jokivesinäytteet on otettu Eurajoen Kuurnamäensillan näytteenottopisteestä nro 22.

Vuonna 2011 tapahtuneen bisfenoli A -päästön jälkeen Jujo Thermal Oy on tehnyt useita toimenpiteitä lämpöherkässä päällysteessä käytettyjen kemikaalien pitoisuuden vähentämiseksi tehtaan jätevesissä. Toimenpiteillä, kuten päällystepitoisten vesien talteenotolla, bisfenoli A -pitoisuus tehtaalta lähtevässä jätevedessä on saatu vähenemään merkittävästi. Vuonna 2012 paperitehtaalta lähtevän jäteveden bisfenoli A:n pitoisuus oli keskimäärin 3,8 mg/l, kun taas vuoden 2017 keskimääräinen pitoisuus on ollut 1,4 mg/l. Myös JVP-Eura Oy:n biologisen puhdistuksen hyvä toimivuus on vaikuttanut siihen, että bisfenoli A:n pitoisuus Eurajoessa on ollut huomattavasti alle kemikaalille määritetyn haitattoman pitoisuuden eli PNEC-arvon (1,6 µg/l).

Muiden kemikaalien pitoisuudet

Kun tarkastellaan haitallisuudeltaan bisfenoli A:han rinnastettavia kemikaaleja niiden fysikaalisten ominaisuuksien osalta, voidaan todeta niiden olevan heikommin veteen liukenevia kuin BPA ja vaikeammin biologisesti hajoavia.

Keväällä 2017 toteutettiin tutkimus yhteistyössä muiden eurooppalaisten lämpöherkän paperin valmistajien kanssa (ETPA, The European Thermal Paper Association), missä tutkittiin tehtaalta lähtevän jäteveden ja jätevesilaitoksella puhdistetun jäteveden BPS-pitoisuutta. Tutkimuksessa saatiin BPS:n reduktioksi JVP-Eura Oy:n jätevedenpuhdistamolla keskimäärin 93 %. Bisfenoli S:n pitoisuus oli alle kemikaalille määritetyn makean veden PNEC-arvon jo puhdistamolta lähtevässä jätevedessä.

Muiden haitallisuudeltaan BPA:han verrattavien aineiden pitoisuuksia ei ole mitattu paperitehtaan jätevesissä eikä jätevedenpuhdistamon vesissä. Hakemuksessa arvioidaan aineiden pitoisuuksien jäävän alle aineille määritettyjen haitattomien pitoisuuksien. Nykytilanteessa jätevedenpuhdistamo toimii hyvin ja se pystyy poistamaan biologisesti hajoavat yhdisteet jätevedestä lähes täydellisesti. BPS:llä tehty tutkimus osoittaa myös, ettei veteen heikosti liukenevien aineiden pitoisuus nykyisillä tehtaalta lähtevän jäteveden kemikaalipitoisuuksilla ylitä aineiden haitattomia pitoisuuksia vesistössä.

BPA:n pitoisuus tehtaalta lähtevässä jätevedessä vaihtelee keskimäärin 1–10 mg/l ja BPS:n vastaavasti 0,2–4,0 mg/l. Jätevesilaitos pystyy saavuttamaan asetetut vastaavat raja-arvot myös korkeimmilla mitatuilla pitoisuuksilla. Tämän vuoksi on vaikea asettaa näille kemikaaleille yksittäistä raja-arvoa tehtaalta lähtevälle puhdistamattomalle jätevedelle.

Näiden kemikaalipitoisten jätevesien sisältämien liukenemattomien ja biologisesti heikosti hajoavien aineosien pitoisuutta voidaan edelleen pienentää paperitehtaalla lisäämällä päällystepitoisten vesien ultrasuodatusta.

Ultrasuodatuskapasiteetin lisääminen

Lämpöherkän paperin valmistuksessa käytettävien päällystekemikaalien käsittelyn yhteydessä syntyvät pesuvedet on johdettu ultrasuodatuksen kautta tehtaan jätevesijärjestelmään. Ultrasuodatuksen avulla pyritään erottamaan mahdollisimman tarkasti vesiin liukenemattomat kemikaalit ja vesi ohjataan jätevedenpuhdistamolle kirkastettuna. Ultrasuodatuksessa muodostuva sakka poltetaan hakkeeseen imeytettynä Kauttuan voimalaitoksella. Kaikkia päällystepitoisia pesuvesiä ei kuitenkaan ole voitu käsitellä nykyisellä ultrasuodatuslaitteistolla johtuen laitteiston liian pienestä kapasiteetista. Ultrasuodattimen kapasiteettia suunnitellaan lisättävän.

Ultrasuodattimen yleiskuvaus

Varsinainen ultrasuodatus suoritetaan ns. dynaamisella cross-rotation tyyppisellä ultrasuodatusjärjestelmällä, jossa nestevirtaus jaetaan kahteen osaan. Ultrasuodatussakka (konsentraatti) sisältää kaikki syötön mukana suotimeen tulleet kiintoaineet. Suodos eli kirkaste on pääasiassa vettä sekä ultrasuodatuskalvon läpäisemiä pienimolekyylisiä aineita.

Prosessia ajetaan siten, että konsentraattia kierrätetään takaisin ultrasuodattimen syöttösäiliöön ja syöttösäiliöön otetaan tarpeen mukaan lisää puhdistamatonta vettä. Ultrasuodattimen läpäissyt kirkaste johdetaan jätevesijärjestelmän kautta jätevedenpuhdistamolle. Ultrasuodatussakka pumpataan säiliöautoon ja viedään polttoon.

Laajennus

Nykyisen syöttösäiliön (30 m^3) rinnalle asennetaan toinen 30 m^3 varastosäiliö lisäämään ja tehostamaan ultrasuodatusta. Tehostamaan siinä mielessä, että ultrasuodatusta pystytään ajamaan lisäämättä uusia puhdistamattomia pesuvesiä jo puhdistetun sakan joukkoon. Tällöin ultrasuodatussakka saadaan korkeammassa kuiva-aineessa polttoon. Projektin yhteydessä uusitaan letkulinjat kiinteiksi putkistoiksi ja ultrasuodatussakan tyhjennys siirretään ympäristöturvallisuuden parantamiseksi sisätiloihin. Nykyinen tyhjennyspaikka on ollut ulkona tehtaan joenpuoleisella pihalla. Uusi tyhjennyspaikka sijaitsee samassa laiturissa kuin tapahtuu kemikaalien purku. Uudessa tyhjennyspaikassa on varoallastus sekä tehtaan jätevesijärjestel-

mään johtava viemäri. Putkilinjat tullaan rakentamaan niin, että uutta ultrasuodattimen varastosäiliötä voidaan käyttää häiriötilanteessa jäteveden varoaltaana.

Ennen ultrasuodatuskapasiteetin lisäämistä thermal-päällystekeittämön helmimyllyjen ja esijauhimien sekä päällystyskoneiden 3 (PÄK3) ja 4 (CM4) ensimmäiset pesuvedet on pystytty ohjaamaan ultrasuodatuksen kautta jätevesiin. Näitä määriä tullaan lisäämään, kun suodatuskapasiteettia saadaan lisää.

Kaikkia CM4:en jätevesiä ei pystytä tämän projektin tuomilla muutoksilla edelleenkään ultrasuodattamaan. Nämä jätevesijakeet eivät kuitenkaan sisällä kehittimiä, herkistimiä tai reaktiivisia väriaineita.

Projekti on aloitettu kesäkuussa 2016. Uuden ultrasuodattimen varastosäiliön asennus on tehty joulukuussa 2017. Projektin on arvioitu valmistuvan kesäkuussa 2018.

Hakijan esitys lupamääräyksiksi

Suunnitelman ja selvityksen perusteella hakija katsoo, että kemikaaleille on vaikea asettaa yksittäistä raja-arvoa tehtaalta lähtevälle puhdistamattomalle jätevedelle.

HAKEMUKSEN KÄSITTELY

Hakemuksesta tiedottaminen

Hakemuksesta on ympäristönsuojelulain 96 §:n mukaisesti tiedotettu julkaisemalla asian tiedot osoitteessa www.avi.fi/lupa-tietopalvelu. Enempi tiedottaminen ei asian luonteen vuoksi ole ollut tarpeen.

Lausunnot

Aluehallintovirasto on ympäristönsuojelulain 96 §:n mukaisesti pyytänyt hakemuksesta lausunnon Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen ympäristö ja luonnonvarat -vastuualueelta (jatkossa ELY-keskus) sekä Euran kunnan ympäristönsuojelu- ja terveydensuojeluviranomaisilta.

1) Varsinais-Suomen ELY-keskus on selvityksen johdosta antanut seuraavan lausunnon:

Suunnitelmassa esitetään Jujo Thermal Oy:n jätevesien kemikaalikuormituksen vähentämistä ultrasuodatuskapasiteettia lisäämällä. Ultrasuodatuksen avulla pyritään erottamaan mahdollisimman tarkasti vesiin liukenemattomat kemikaalit ja vesi ohjataan jätevedenpuhdistamolle kirkastettuna.

Suunnitelman mukaan nykyisen syöttösäiliön rinnalle asennetaan toinen 30 m^3 varastosäiliö. Tällöin pystytään ajamaan ultrasuodatusta lisäämättä uusia puhdistamattomia pesuvesiä jo puhdistetun sakan joukkoon. Projektin yhteydessä siirretään ultrasuodatussakan tyhjennys sisätiloihin. Uudessa tyhjennyspaikassa on varoallastus sekä tehtaan jätevesijärjestelmään johtava viemäri. Putkilinjat rakennetaan niin, että uutta ultrasuodattimen varastosäiliötä voidaan käyttää häiriötilanteessa jäteveden varoaltaana. Projektin on arvioitu valmistuvan kesäkuussa 2018.

Euroopan komissio on joulukuussa 2016 (Komission asetus (EU) 2016/2235) päättänyt rajoittaa bisfenoli-A:n (BPA) käyttöä lämpöpaperissa EU:ssa. Rajoitus tulee voimaan vuonna 2020 ja sen seurauksena Jujo Thermal Oy:n BPA:n käyttömäärä tulee myös laskemaan. Toistaiseksi BPA:n ensisijaisesti korvaa bisfenoli-S (BPS). BPS on tällä hetkellä aineen arvioinnin menettelyssä ja Euroopan komissio on pyytänyt Euroopan kemikaalivirastoa (ECHA) tutkimaan lisää BPS:n käyttöä lämpöpaperissa BPA:n korvikkeena.

EU:n jäsenmaiden komitea on 12.1.2017 sopinut BPA:n päivityksestä kandidaattilistalle. BPA on entuudestaan kandidaattilistalla sen lisääntymismyrkyllisyyden ja terveydelle hormonitoimintaa häiritsevien ominaisuuksien takia. Nyt sen on todettu aiheuttavan erityistä huolta ympäristölle hormonitoimintaa häiritsevien ominaisuuksien takia.

Jujo Thermal Oy:n ympäristöluvan lupamääräyksen 2 perusteella (VaHo:n päätös 3.11.2015) suunnitelmaan tulee sisältyä hakijan esitys jätevedenpuhdistamolle johdettavista BPA:n tai vastaavan kemikaalin kuormitus- ja pitoisuusraja-arvoksi (kg/d ja mg/l) siten, että jätevedenpuhdistamolle (JVP-Eura Oy) asetettu vastaava raja-arvo on mahdollista saavuttaa. Vaasan hallinto-oikeus on valituksesta muuttanut JVP-Eura Oy:n ympäristöluvan lupamääräyksessä 4a asetetun BPA:n raja-arvon 0,02 mg/l tavoitteelliseksi.

JuJo Thermal Oy:n suunnitelmassa todetaan, että on vaikea asettaa BPA:lle ja BPS:lle yksittäistä raja-arvoa tehtaalta lähtevälle puhdistamattomalle jätevedelle. BPA:n pitoisuus tehtaalta lähtevässä jätevedessä vaihtelee keskimäärin 1–10 mg/l ja BPS:n vastaavasti 0,2–4,0 mg/l. Paperitehtaalta lähtevän jäteveden BPA-pitoisuus oli keskimäärin 1,4 mg/l vuonna 2017.

JVP-Eura Oy:n Eurajokeen lähtevästä vedestä on vuonna 2016 mitattu kaksi kertaa bisfenoli-A:n tavoitearvon ylittäviä pitoisuuksia ja vuonna 2017 vastaavasti kolme kertaa. Tavoitearvo on annettu vuosikeskiarvona ja vuositasolla tavoitearvo on alittunut. JVP-Eura Oy:n puhdistamon puhdistusteho BPA:lle on parantunut huomattavasti viime vuosina. JuJo Thermal Oy:n nyt vireillä olevan suunnitelman mukaan BPA:n reduktio JVP-Eura Oy:n puhdistamolla on ollut vuosina 2016 ja 2017 99 %. Keväällä 2017 suoritetussa tutkimuksessa saatiin BPS:n reduktioksi JVP-Eura Oy:n jätevedenpuhdistamolla keskimäärin 93 %. Eurajoen tarkkailupisteellä, Kuurnamäensillan kohdalla on vuosina 2016 ja 2017 mitattu kaksi kertaa BPA:n pitoisuuksia jotka ylittävät PNEC-arvon (1,6 µg/l) jokivedessä.

Jujo Thermal Oy:n ympäristöluvan lupamääräyksessä 1 todetaan, että *"jätevedet tulee johtaa jätevesiyhtiön kanssa tehtyä sopimusta noudattaen ja tarvittaessa siten esikäsiteltynä, että puhdistamon tulokuormitus noudattaa jätevedenpuhdistamon suunnitteluarvoja."*

Lupamääräyksessä 2 todetaan, että *"jätevesien sisältämien kehittimien, reaktiivisten värien tai muiden haitallisuudeltaan näihin rinnastettavien osittain jätevesiin päätyvien kemikaalien määrä ei saa ylittää pitoisuutta, joka vaarantaa puhdistamon toiminnan, puhdistamon biolietteen hyötykäytön, vastaanottavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön veden hyötykäytön."*

Ympäristönsuojelulain 52 §:n 1 mom. 1 kohdan mukaan ympäristöluvassa on annettava tarpeelliset määräykset päästöistä, päästöraja-arvoista, päästöjen ehkäisemisestä ja rajoittamisesta sekä päästöpaikan sijainnista. Ympäristönsuojeluasetuksen 41 §:n 1 mom. kohta 4 mukaan teollisuusjätevedet viemäriin on esikäsiteltävä asianmukaisella tavalla jäteveden ja lietteen käsittelyprosessien toiminnan vaikeutumisen estämiseksi.

Varovaisuusperiaatteen ja toiminnanharjoittajan selvilläolovelvollisuuteen nojaten, ELY-keskus katsoo, että JVP-Eura Oy:n jätevedenpuhdistamolle johdettavan jäteveden BPA-pitoisuudelle tulee asettaa yläraja. BPA:n vähentäminen tulee lähteä Jujo Thermal Oy:n prosesseista, jotta jäteveteen joutuvan bisfenoli-A:n määrä on mahdollisimman pieni. ELY-keskus toteaa, että BPA on riskitekijä Eurajoen ekosysteemille ja Eurajoen vesi on lisäksi Rauman kaupungin raakaveden oton lähde. ELY-keskus viittaa myös aiempiin annettuihin lausuntoihin koskien Jujo Thermal Oy:n ympäristölupaa.

Tarkkailutulosten perusteella, ELY-keskus toteaa, että Jujo Thermal Oy:n lähtevän veden BPA-pitoisuudet vaihtelevat merkittävästi. Luparaja Jujo Thermal Oy:n luvassa tulee asettaa puhdistamolle johdettavalle vedelle, koska korkeat haitta-ainepitoisuudet voivat aiheuttaa vesistön lisäksi ongelmia myös puhdistamon biologisen osion toiminnalle. Jujo Thermal Oy:n tulee myös sopimusjärjestelyin sopia JVP-Eura Oy:n kanssa BPA:n raja-arvoista jätevedenpuhdistamolle johtamissaan jätevesissä. Raja-arvon asettamisella ympäristöluvassa varmistetaan, että puhdistamolle johdettavan BPA:n kuormitus on mahdollisimman pieni ja satunnaiset kuormituspiikit saadaan vähennettyä.

Hakemuksessa todetaan, että muiden haitallisuudeltaan BPA:han verrattavien aineiden pitoisuuksia ei ole analysoitu JuJo Thermal Oy:n jätevesissä eikä JVP-Eura Oy:n vesissä. Aineiden ominaisuuksien ja käyttömäärien perusteella arvioidaan niiden vesistöpitoisuuksien jäävän alle aineille määritettyjen haitattomien pitoisuuksien. ELY-keskuksen näkemyksen mukaan, toiminnanharjoittajan tulee ainakin kertaluontaisesti tutkia BPA:han verrattavien aineiden pitoisuudet puhdistamolle lähtevästä jätevedestä.

2) Euran kunnan ympäristönsuojelu- ja terveydensuojeluviranomaisena toimiva Pyhäjärviseudun ympäristölautakunta on antanut seuraavan lausunnon:

Pyhäjärviseudun ympäristölautakunta pitää bisfenoli A:n pitoisuuksien vähenemistä paperitehtaalta lähtevissä jätevesissä myönteisenä ja positiivisena kehityksenä viime vuosina. Vuosina 2016 ja 2017 on kuitenkin ollut vielä ainakin kahdesti mittaamalla havaittu tilanne, jossa bisfenoli A:n PNEC-arvo jokivedessä on ylittynyt. Tehostuvalla ultrasuodatuksella ja muil la Jujo Thermal Oy:n omilla kehittämistoimilla sekä yhteistyössä JVP-Eura Oy:n kanssa pitää varmistaa, että jätevedenpuhdistuksen jälkeen jokeen purkautuvissa jätevesissä bisfenoli A:n ja muiden paperitehtaalta tulevien kemikaalien PNEC-arvot jokivedessä eivät ylity. Aluehallintoviraston tulisi antaa paperitehtaalta lähteville jätevesille raja-arvot tai muita määräyksiä, joilla Eurajoen jokiveden hyvä tila ko. kemikaalien pitoisuuksien näkökulmasta saavutetaan pysyvästi.

Bisfenoli A:n ja muiden kemikaalien osalta on annettava niiden tarkkailua koskevia määräyksiä.

Hakijan kuuleminen ja vastine

Hakija on toimittanut seuraavan vastineen annettujen lausuntojen johdosta:

Varsinais-Suomen ELY-keskuksen lausunto

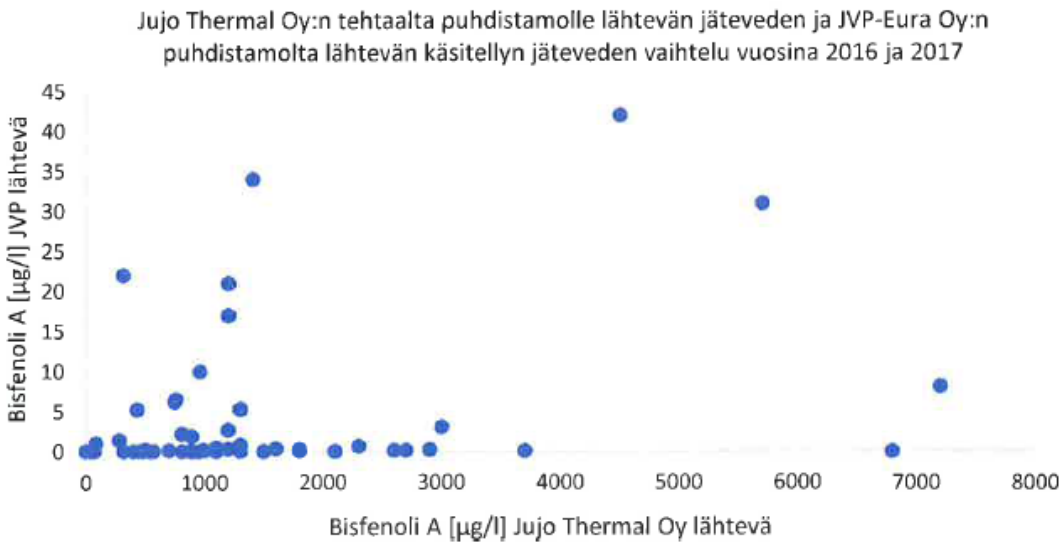
Jujo Thermal Oy on yhtenä osaomistajana JVP-Eura Oy:n jätevedenpuhdistamossa, joka käsittelee Jujo Thermal Oy:n tehtaan jätevedet. Lämpöherkän paperin valmistuksessa käytettävien päällystekemikaalien käsittelyn yhteydessä syntyvät pesuvedet johdetaan ultrasuodatuksen kautta tehtaan jätevesijärjestelmään. Ultrasuodatuksella pyritään erottamaan mahdollisimman tarkasti vesiin liukenemattomat kemikaalit ja vesi ohjataan jätevedenpuhdistamolle kirkastettuna. Ultrasuodatuksessa muodostuva sakka poltetaan hakkeeseen imeytettynä Adven Oy:n Kauttuan voimalaitoksella.

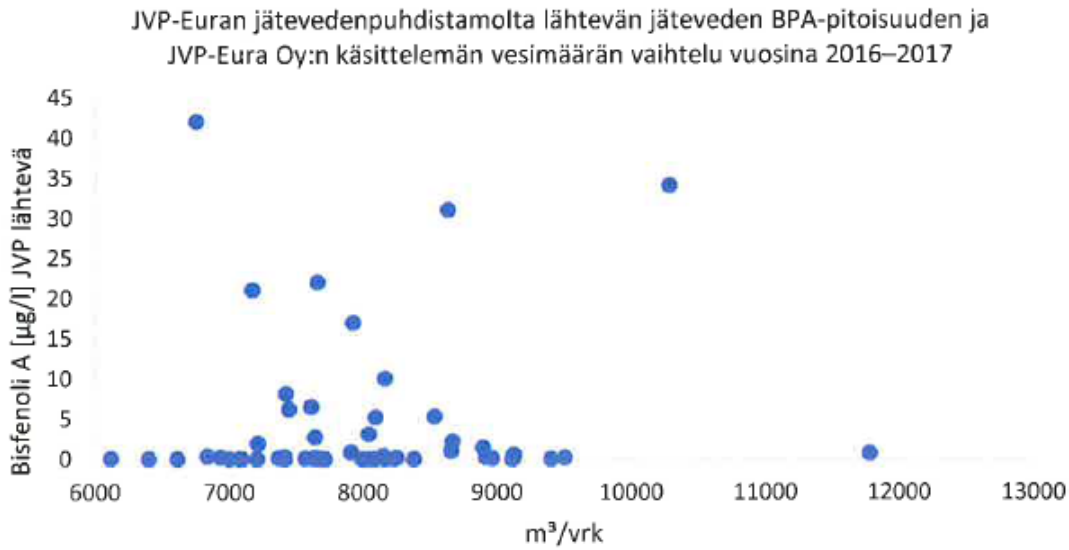
Kaikkia thermal-päällystepitoisia pesuvesiä ei kuitenkaan ole voitu käsitellä nykyisellä ultrasuodatuslaitteistolla johtuen laitteiston liian pienestä kapasiteetista. Kapasiteetin kasvattamisesta on tehty lupamääräyksen 2 mukainen erillinen suunnitelma, jonka avulla BPS- ja BPA-pitoisia jätevesiä pystytään käsittelemään tehokkaammin. Suunnitelman mukainen ultrasuodattimen lisäkapasiteetin rakentaminen ja prosessin käyttöönotto on jo aloitettu, ja sen arvioidaan olevan täydessä toiminnassa jo 2018 kesäkuussa eli hyvissä ajoin ennen lupamääräyksen 2 mukaista kahden vuoden aikarajaa.

JVP-Eura Oy:n Eurajokeen lähtevästä vedestä on vuonna 2016 mitattu kaksi kertaa bisfenoli-A:n tavoitearvon ylittäviä pitoisuuksia ja vuonna 2017 vastaavasti kolme kertaa. Varsinais-Suomen ELY-keskuksen mukaan Eurajoen tarkkailupisteellä, Kuurnamäensillan kohdalla on vuosina 2016 ja 2017

mitattu kaksi kertaa bisfenoli-A pitoisuuksia jotka ylittävät PNEC-arvon (1,6 µg/l) jokivedessä.

Ohessa on esitetty kuvaaja Jujo Thermal Oy:n tehtaalta puhdistamolle tulevan jäteveden ja JVP-Euran puhdistamolta lähtevän käsitellyn jäteveden vaihtelusta vuosina 2016 ja 2017. Kuvaajan perusteella voidaan havaita, ettei tehtaalta JVP:lle tulevan ja sieltä ulos käsiteltynä lähtevän jäteveden BPA-pitoisuus korreloi keskenään ja näin ollen voidaan BPA-pitoisuuden vaihteluiden arvioida selittyvän puhdistustehokkuuden vaihtelulla. Edelleen voidaan tehdä se johtopäätös, ettei pelkästään asettamalla yksittäinen BPA raja-arvo tehtaalta lähtevälle ultrasuodatetulle jätevedelle varmisteta JVP-Euran puhdistamolta lähtevän veden BPA-pitoisuuden pysymistä raja-arvojen sisällä.





BPA:n tavoitearvo on annettu JVP-Euran puhdistamolle vuosikeskiarvona ja vuositasolla tavoitearvo on alittunut. JVP-Eura Oy:n puhdistamon puhdistusteho BPA:lle on parantunut huomattavasti viime vuosina. Jujo Thermal Oy:n suunnitelman mukaan BPA:n reduktio JVP-Eura Oy:n puhdistamolla on ollut

vuosina 2016 ja 2017 99 % Keväällä 2017 suoritetussa tutkimuksessa saatiin BPS:n reduktioksi JVP-Eura Oy:n jätevedenpuhdistamolla keskimäärin 93 %. Näiden kemikaalipitoisten jätevesien sisältämien liukenemattomien ja biologisesti heikosti hajoavien aineosien pitoisuutta voidaan edelleen pienentää paperitehtaalla lisäämällä päällystepitoisten vesien ultrasuodatusta.

Jujo Thermal Oy on osarahoittajana JVP-Euran jätevedenpuhdistamon prosessin parantamishankkeessa, jonka tavoitteena on mm. parantaa prosessin toimintavarmuutta ja ehkäistä häiriöpäästöjä. Prosessin kehittämistoimet JVP-Euran puhdistamolla ovat Eurajoen-Lapinjoen-Sirppujoen toimenpideohjelma-alueen vesienhoitosuunnitelman yhdyskuntajätevedenpuhdistamoiden toimenpide-ehdotusten mukaisia: *"Typenpoiston merkityksestä tarvitaan lisätutkimuksia, joita on käynnissä. Jätevesien ohijuoksutuksista sekä hulevesistä aiheutuvaa kuormitusta tulee vähentää. Jätevesien haitallisten aineiden hallinta asettaa uusia haasteita."* Teollisuuden osalta ensisijaisia vesienhoitotoimenpiteitä ovat: *"Ensisijaisesti suositeltavia toimenpiteitä ovat ympäristöriskien hallinnan parantaminen, prosessitekniset parannukset haitta-aineiden ja jätevesi päästöjen minimoimiseksi sekä jätevesien käsittelyn tehostaminen."* Näitä tavoitteita toteuttaa Jujo Thermal Oy:n tehtaalle suunnitellut ultrasuodatusprosessin kapasiteetin nosto.

Nykytilanteessa JVP-Eura Oy:n puhdistamo toimii hyvin ja se pystyy poistamaan biologisesti hajoavat yhdisteet jätevedestä lähes täydellisesti. BPS:llä tehty tutkimus osoittaa myös, ettei veteen heikosti liukenevien aineiden pitoisuus nykyisillä Jujo Thermal Oy: n tehtaalta lähtevän jäteveden kemikaalipitoisuuksilla ylitä aineiden haitattomia pitoisuuksia vesistössä. Bisfenoli A:n pitoisuus tehtaalta lähtevässä jätevedessä vaihtelee keskimäärin 1–10 mg/l ja bisfenoli S:n vastaavasti 0,2-4,0 mg/l nykyisillä tuotantolajeilla ja tuotantomäärillä. Jätevesilaitos pystyy saavuttamaan asetetut vastaavat rajaarvot myös korkeimmilla mitatuilla pitoisuuksilla. Vuosina 2076 ja 2017 tapahtuneet korkeamman BPA-pitoisuuden sisältävien jätevesien johtaminen JVP-Euran puhdistamolle ei ole aiheuttanut puhdistamolta lähtevän jäteveden BPA-pitoisuuden luparajan ylityksiä. Tämä viittaa siihen, etteivät JVP-Euran puhdistamolta lähtevän käsitellyn jäteveden BPA-pitoisuuden vaihtelut selity yksinomaan Jujo Thermal Oy:n tehtaalta lähtevän jäteveden BPA-pitoisuuden vaihtelulla (katso myös kuvaaja). Syynä JVP-Euran puhdistamolta lähtevän jäteveden yksittäisiin luparajan ylityksiin BPA:n osalta ovat todennäköisemmin puhdistamon prosessin toiminnassa tapahtuneet hetkittäiset häiriöt, joiden aikana BPA-pitoisuus lähtevässä jätevedessä on noussut yli luparajan. Näitä tilanteita pyritään jatkossa ehkäisemään suunnitelluilla prosessin parantamistoimilla, jotka toteutetaan arviolta lähivuosina ja joiden investointiin Jujo Thermal Oy osallistuu.

Euran jätevedenpuhdistamon virtaamiin ja tulevan jäteveden laatuun vaikuttavat voimakkaasti mm. vuotovedet viemäriverkostosta, jotka voivat aiheuttaa puhdistamolle tulevan jätevesivirtaaman huomattavan nousun rankkasateiden seurauksena. Tällaisessa maksimivirtaamatilanteessa jätevedenpuhdistamon puhdistustehokkuus saattaa heikentyä hetkellisesti, jolloin pro-

sessi ei kykene poistamaan BPA:ta yhtä tehokkaasti kuin normaalitilanteessa. BPA-pitoisuuksien luparajojen ylittävät pitoisuudet jätevedenpuhdistamolta lähtevässä käsitellyssä jätevedessä saattavat joiltain osin liittyä edellä mainittuihin rankkasadetilanteisiin ja verkostosta tulevien vuotovesimäärien kasvuun, joihin Jujo Thermal Oy:n tehtaalla ei ole mahdollisuutta vaikuttaa. Kuvan 2 mukaan voidaan kuitenkin päätellä, etteivät myöskään rankkasadetilanteet selitä kaikki JVP-Euran lähtevän käsitellyn jäteveden vaihteluita, vaan osin vaihtelu selittyy prosessin epätasaisella toimivuudella.

Edellä mainitun perusteella tehtaalle asetettava pitoisuusraja ei välttämättä poistaisi ongelmaa ajoittaisista jätevedenpuhdistamon luparajojen ylityksistä BPA:n osalta. Jäteveden puhdistamon puhdistustehokkuuden tasaisuuteen pystytään tehokkaammin vaikuttamaan viemäriverkoston vuotovesi määrien rajoittamisella sekä jo suunnitteilla olevilla prosessi parannuksilla.

Euroopan komission BPA-rajoitus tulee voimaan vuonna 2020 ja sen seurauksena Jujo Thermal Oy:n BPA:n käyttömäärä tulee myös laskemaan. Toistaiseksi BPA:n ensisijaisesti korvaa bisfenoli-S (BPS). BPS on tällä hetkellä aineen arvioinnin menettelyssä ja Euroopan komissio on pyytänyt Euroopan kemikaalivirastoa (ECHA) tutkimaan lisää BPS:n käyttöä lämpöherkässä paperissa BPA:n korvikkeena.

Jujo Thermal Oy perustelee BPA:n pitoisuuden raja-arvon tarpeettomuutta sillä, että aineen käyttöä ollaan joka tapauksessa rajoittamassa voimakkaasti vuoteen 2020 mennessä. Lisäksi tehtaalle suunniteltu ultrasuodatuksen kapasiteetin tehostaminen tulee vaikuttamaan tehtaalta lähtevän jäteveden BPA-pitoisuutta laskevasti. Tämän myötä pitoisuuden ja satunnaisten kuormituspiikkien arvioidaan pienenevän nykyisestä siinä määrin, että JVP-Euralle asetettu vastaava raja-arvo (tavoitteellinen raja-arvo 0,2 mg/l) on jatkossa mahdollista saavuttaa lupaehtojen mukaisesti prosessin toimiessa normaalisti. Jätevedenpuhdistamon prosessin toimivuuteen tehtävien investointien jälkeen voidaan arvioida JVP-Euran puhdistamon pääsevän lupaehtojen mukaisiin tasoihin ilman luparajojen ylityksiä.

Jujo Thermal Oy ei näe jo tehdyt suunnitelmat puhdistustehokkuuden parantamisesta ja edellä esitetyt näkökohdat huomioiden kohtuulliseksi määrittää BPA-pitoisuudelle yksittäistä raja-arvoa. Yksittäisen liian tiukan raja-arvon asettaminen saattaisi aiheuttaa ajoittaisia luparajan ylityksiä, jotka hankaloittavat tehtaan lupaehtojen noudattamista.

Mikäli raja-arvo kuitenkin määritetään, tulee sen Jujo Thermal Oy:n näkemyksen mukaan perustua tehtaalta lähtevän viime vuosina mitatun jäteveden BPA-pitoisuuden vaihteluvälin ylärajaan eikä keskiarvoon.

Ylärajalle asetettavaa raja-arvoa perustellaan sillä, että BPA:n käyttöä on joka tapauksessa rajoitettu EU-komission toimesta, jonka myötä sen käyttömäärät laskevat selvästi myös Jujo Thermal Oy:n tehtaalla ja käytön rajoittaminen astuu voimaan jo kahden vuoden kuluessa. Tehtaan näkemyksen mukaan, jos yksittäinen raja-arvo asetetaan, tulee se asettaa määräajaksi

päättyen vuosi sen jälkeen, kun EU-komission rajoitukset astuvat voimaan. Jujo Thermal Oy:n tehtaalta lähtevän jäteveden BPA-pitoisuutta tarkkaillaan pitoisuusraja-arvoista riippumatta nykyisin ja tulevaisuudessa ja tarkkailun avulla saadaan ilmi, ovatko nyt suunnitellut ja osin käyttöönotetut toimet riittäviä lähtevän jäteveden BPA-pitoisuuden pitämiseksi ympäristölle haitallisten rajojen alapuolella.

Haitallisuudeltaan BPA:han verrattavien aineiden pitoisuuksien määrittäminen tehtaalta lähtevästä jätevedestä on tällä hetkellä ongelmallista, sillä kaikille tehdyssä selvityksessä käsitellyille aineille ei ole olemassa olevaa analyysimenetelmää. Tekemämme selvityksen mukaan Euroopan tasolla ei löydy standardoitua analytiikkaa näiden aineiden analysoimiseksi. Jujo Thermal katsoo kohtuuttomaksi vaatia haitallisuudeltaan BPA:han verrattavien aineiden analysoimista.

Euran kunnan ympäristö- ja terveydensuojeluviranomaisen lausunto

Jujo Thermal Oy viittaa Varsinais-Suomen ELY-keskuksen lausunnon johdosta esitettyyn vastineeseen muilta kuin alla kirjatun osalta.

Eurajoen veden laatuun vaikuttavat JVP-Euran kuormituksen lisäksi Säkylän kunta, Apetit Suomi sekä hajakuormitus joen valuma-alueelta. Jujo Thermal Oy:n JVP-Euran prosessin kautta Eurajokeen aiheuttama kuormitus on vain pieni osa kokonaiskuormituksesta niin ravinteiden kuin haitta-aineiden osalta. Asettamalla Jujo Thermal Oy:lle BPA:n pitoisuusraja ei voida näin ollen merkittävästi vaikuttaa Eurajoen veden kemialliseen tilaan.

ALUEHALLINTOVIRASTON RATKAISU

Aluehallintovirasto on tarkastanut Jujo Thermal Oy:n ympäristöluvan lupamääräyksen 2 mukaisen suunnitelman. Aluehallintovirasto hyväksyy esitetyn suunnitelman ja sen aikataulun. Lisäksi aluehallintovirasto täydentää ympäristölupaa seuraavilla määräyksillä:

Uudet lupamääräykset

2a. Jätevesien yhteispuhdistukseen johdettavan jäteveden bisfenoli A -pitoisuus (CAS 80-05-7) saa olla 1.1.2019 alkaen korkeintaan 2,0 mg/l. Raja-arvoa katsotaan noudatetun, kun mittaustulosten vuosikeskiarvo ilman mittausepävarmuuksien vähentämistä alittaa raja-arvon.

22a. Toiminnanharjoittajan tulee olla selvillä käyttämiensä kemikaalien vaikutuksista pintavesiin. Bisfenoli A:n tai muun jätevesiin päätyvän siihen rinnastettavan kemikaalin pitoisuustaso Eurajoessa tulee selvittää vähintään neljä kertaa vuodessa jätevesien purkupisteen ala- ja yläpuolisesta Eurajoen yhteistarkkailuohjelman mukaisesta pisteestä.

Päivitetty vaikutustarkkailusuunnitelma tulee toimittaa valtion valvontaviranomaiselle 3 kuukauden kuluessa tämän päätöksen lainvoimaisuudesta.

RATKAISUN PERUSTELUT

Aluehallintovirasto on tarkastanut esitetyn suunnitelman ja katsoo, että se vastaa lupamääräyksen 2 vaatimuksia. Hakija on merkittävästi vähentänyt puhdistamolle ja puhdistamon kautta vesistöön johdettua bisfenoli A -päästöä seurannan aloittamisen (2011–2012) jälkeen. Merkittävimmät muutokset on lainvoimaisen luvan myöntämisen (2013) jälkeen saavutettu JVP-Eura Oy:n jätevedenpuhdistamon toiminnan tehostumisen kautta sekä luvan tarkistamista ennen tehtaalla tehdyillä toimenpiteillä esimerkiksi päällystepitoisten vesien erilliskeräyksellä ja ultrasuodatuksella. Nyt esitetty suunnitelma ultrasuodatuskapasiteetin lisäämisestä tulee edelleen vähentämään jätevedenpuhdistamolle johdettavan bisfenoli A:n ja muiden siihen rinnastettavien kemikaalien määrää ja siten vähentämään päästöä vesistöön. Erityisesti ultrasuodatuskapasiteetin lisäyksellä voidaan varautua vähemmän vesiliukoisten kemikaalien kuormituksen vähentämiseen.

Toiminta ei vaaranna Kokemäenjoen-Saaristomeren-Selkämeren vesienhoitoalueen vesienhoitosuunnitelmassa vuosille 2016–2021 asetettuja tavoitteita. Esitetty suunnitelma on Eurajoen-Lapinjoen-Sirppujoen pintavesien toimenpideohjelman (2016–2021) mukainen, sillä se tähtää haitta-aineiden ja jätevesipäästöjen minimointiin ja jätevesienkäsittelyn tehostamiseen sekä ympäristöriskienhallinnan parantamiseen.

Toiminnan voidaan katsoa edustavan parasta käyttökelpoista tekniikkaa, kun laitos toimii esitetyn suunnitelman ja tämän päätöksen mukaisesti. Massan, paperin ja kartongin tuotannon parhaan käyttökelpoisen tekniikan päätelmiä koskeva Euroopan komission täytäntöönpanopäätös (2014/687/EU) on hyväksytty 30.9.2014. Päätelmissä tai vertailuasiakirjassa ei kuvata lämpöherkän paperin valmistukseen liittyvien jätevesien käsittelytekniikoita tai päästötasoja yksittäisten kemikaalien poistamisen näkökulmasta. Näin ollen parhaan käyttökelpoisen tekniikan arviointi perustuu esitetyn suunnitelman osalta ympäristönsuojelulain 53 §:ään.

Lupamääräysten yleiset perustelut

Lupamääräyksiä annettaessa on otettu huomioon laitoksen sijainti, sen yhteys muihin toimintoihin, nykyisestä toiminnasta aiheutunut haitta, toiminnasta aiheutuvan pilaantumisen todennäköisyys, onnettomuusriski sekä ympäristönsuojelulain vaatimus käyttää toiminnassa parasta käyttökelpoista tekniikkaa.

Bisfenoli A (CAS 80-05-7, aineen muita yleisesti käytettyjä nimiä: 4,4'isopropylidenediphenol, bisphenol A, BPA) on CLP-asetuksen (EY n:o 1272/2008) yhdenmukaistetun luokituksen mukaisesti merkittävä vaaralauseilla H318 (vaurioittaa vakavasti silmiä), H335 (saattaa aiheuttaa hengitysteiden ärsytystä), H317 (voi aiheuttaa allergisen ihoreaktion) ja H360F (saattaa heikentää hedelmällisyyttä). Lisäksi aine on usein merkitty vaaralauseella H411

(myrkyllistä vesieliöille, pitkäaikaisia haittavaikutuksia). Bisfenoli A ei ole valtioneuvoston asetuksen 1022/2006 tarkoittama vesiympäristölle vaarallinen tai haitallinen aine.

Bisfenoli A on ehdokasluettelossa erityistä huolta aiheuttavien aineiden lupamenettelyyn REACH-asetuksen (EY n:o 1907/2006) liitteen XIV mukaisesti. Syynä lisääntymisvaarallisuus (57c) ja hormonitoimintaan vaikuttavat ominaisuudet sekä ihmisen terveydelle että ympäristössä (57(f)). Bisfenoli A:n käyttöä rajoitetaan REACH-asetuksen liitteen XVII mukaisesti: lämpöherkkää paperia, jonka bisfenoli A:n pitoisuus on suurempi kuin 0,02 paino-% ei saa saattaa markkinoille 2.1.2020 alkaen.

Aluehallintovirasto katsoo bisfenoli A:n päästöjen rajoittamisen tarpeelliseksi tulossa olevasta REACH-asetuksen rajoituksesta huolimatta. Rajoitus ei koske lämpöherkän paperin tuotannossa käytettäviä kemikaaleja, mikäli tuote saatetaan markkinoille jossain muualla. Näin ollen on edelleen tarpeen asettaa toistaiseksi voimassa olevia määräyksiä jätevesien sisältämän bisfenoli A:n aiheuttaman pilaantumisen estämiseksi yksityiskohtaisista perusteluista ilmenevällä tavalla.

Lupamääräysten yksilöidyt perustelut

Lupamääräys 2a

Aluehallintovirasto on asettaa raja-arvon paperitehtaan jätevesien bisfenoli A-pitoisuudelle 1.1.2019 alkaen. Paperitehtaan jätevedet käsitellään JVP-Eura Oy:n jätevedenpuhdistamolla, joka on teollisuuden ja yhdyskuntien jätevesille tarkoitettu yhteispuhdistamo. Paperitehtaan ja puhdistamon välinen viemäri on puhdistamoyhtiön omistama ja hallinnoima. Hakija on yksi puhdistamon omistajista, eikä ole tämän johdosta tehnyt teollisuusjätevesisopimusta Euran kunnan kanssa. Näin ollen aluehallintovirasto katsoo, että kyseessä ei ole tavanomainen teollisuuslaitoksen ja viemärilaitoksen mukainen sopimussuhde vaan paperitehdas on järjestänyt jätevesiensä käsittelyn erillisessä teollisuuden jätevedenpuhdistamossa. Näin ollen kyse ei ole myöskään ympäristönsuojelulain 67 §:n mukaisista viemäriin johdettavan jäteveden raja-arvoista tai valtioneuvoston asetuksessa ympäristönsuojelusta 42 §:n mukaisista raja-arvoista. Sen sijaan aluehallintovirasto katsoo, että päästöraja-arvo on tarpeen pilaantumisen ehkäisemiseksi ja parhaan käyttökelpoisen tekniikan toteuttamiseksi. Sillä voidaan myös varmistaa, että puhdistamoyhtiöllä on tosiasiallinen mahdollisuus saavuttaa sille asetettu raja-arvo. Ympäristönsuojeluasetuksen liitteen 1 mukaisesti aineet ja valmisteet, joilla osoitetaan olevan lisääntymiseen vaikuttavia ominaisuuksia, tulee huomioida päästöjen raja-arvoja asetettaessa. Bisfenoli A on CLP-asetuksen yhdenmukaistetun luokituksen perusteella tällainen aine.

Raja-arvo perustuu JVP-Eura Oy:n ympäristöluvassa asetettuun raja-arvoon sekä tietoon jätevedenpuhdistamon poistotehosta bisfenoli A:lle. Aine on nopeasti biohajoava, joten sen ominaisuuksien sekä 2016–2017 tarkkailutulosten perusteella biologisen jätevedenpuhdistamon voidaan olettaa

poistavan 99 % bisfenoli A:sta. Poistotehossa tapahtuvat vaihtelut liittyvät pääasiassa jätevedenpuhdistamon poikkeavaan toimintaan, johon paperitehdas ei pysty omalla toiminnallaan suoraan vaikuttamaan. Näin ollen on kohtuullista, että raja-arvon lähtökohdaksi otetaan jätevedenpuhdistamon normaalitoiminta.

Jos paperitehtaan jäteveden bisfenoli A -pitoisuus on raja-arvon mukainen, 2 mg/l, laskennallinen pitoisuus 99 % poistoteholla on Eurajokeen johdettavassa vedessä 0,02 mg/l, mikä vastaa puhdistamoyhtiön lainvoimaisen ympäristöluvan tavoitteellista raja-arvo. Koska puhdistamoyhtiön luvan raja-arvo on asetettu sellaiseksi, ettei haitatonta pitoisuutta (PNEC 1,6 µg/l,) ylitetä Eurajoessa, pystytään raja-arvolla täten estämään bisfenoli A:n haitalliset vaikutukset vesistössä.

Puhdistamon ympäristöluvassa annettua raja-arvoa perustellaan aluehallintoviraston päätöksessä (nro 11/2013/1, 23.1.2013) seuraavasti: *Jokeen johdettavan jäteveden bisfenoli A:n päästölle on määrätty enimmäispitoisuus, joka perustuu riskinarviointiselvityksiin, joita on julkaistu EU:n lisäksi myös mm. USA:ssa, Kanadassa, Australiassa ja Japanissa, sekä WHO:n ja FAO:n yhteistyönä. Selvitysten pääasiallinen sisältö on ollut altistus bisfenoli A:lle mm. tuttipullojen tai äidinmaidonkorvikepakkausten kautta, mutta erityisesti EU:ssa, mutta myös Kanadassa, on lähestytty asiaa myös jokiekosysteemin ja teollisuuslaitosten päästöjen kautta. Tieteellisten julkaisujen perusteella bisfenoli A:n reduktio jätevedenpuhdistamolla on korkea, jos puhdistamo on mitoitettu oikein, varustettu jälkikäsittelyllä (hiekkasuodatus) ja hygienisoinnilla (otsonointi). Luvansaajan tuleekin huolehtia laitossuunnittelun, erityisesti teollisuuslinjan esikäsittelyn ja jätevesien jälkikäsittelyn, osalta siitä, että laajennettu laitos suunnitellaan myös bisfenoli A:n poiston osalta riittävän tehokkaaksi. Annettu bisfenoli A:n enimmäispitoisuus pohjautuu EU:n riskinarviontiin, jonka perusteella korkein haitattomaksi arvioitu pitoisuus jokivedessä (PNEC) on 1,6 µg/l. Lukuarvollisesti määrätty enimmäispitoisuus on verrannollinen Kanadassa vuonna 2012 solmittuun sopimukseen, joka rajoittaa paperin kierrätyslaitosten jäteveden bisfenoli A:n enimmäispitoisuuden arvoon 1,75 µg/l ja vastaanottavan vesistön enimmäispitoisuuden arvoon 0,175 µg/l. Bisfenoli A:n raja-arvolla halutaan erityisesti suojella jokiveden kalakantoja ja ekosysteemiä yleisemminkin, mutta toisaalta myös turvata Rauman kaupungin käyttämän raakaveden laatu. Julkaistujen tieteellisten tutkimusten, sekä eri puolilla maailmaa julkaistujen viranomaisselvitysten ja hakemuksesta annettujen lausuntojen perusteella pääteltynä jokiveden kohonneesta bisfenoli A -pitoisuudesta aiheutuneiden terveydellisten haittojen aiheutumisen todennäköisyys vaikuttaa kuitenkin alhaiselta.*

Hallinto-oikeus on muuttaessaan raja-arvon tavoitteelliseksi perustellut asiaa päätöksessään nro 15/0294/2 (3.11.2015) muun muassa seuraavasti: *Edellä lausutut seikat huomioon ottaen bisfenoli A:n on katsottava olevan riskitekijä Eurajoen ekosysteemille ja kalastolle. Eurajoen vesi on lisäksi Rauman kaupungin raakaveden oton lähde. JVP-Eura Oy:n jätevedenpuh-*

distamolla käsitellään Suomessa ainoan bisfenoli A:ta käyttävän teollisuuslaitoksen jätevedet. Kemikaalin haitallisuudesta saatavilla olevat tiedot ovat epävarmoja. Näin ollen hallinto-oikeus katsoo, että bisfenoli A:lle on ollut tarpeen määrätä päästöraja-arvo ympäristön pilaantumisen ehkäisemiseksi ympäristönsuojelulain 43 §:n 1 momentin 1 kohdan ja ympäristönsuojelulain 4 §:ssä säädetyn varovaisuusperiaatteen nojalla siten kuin aluehallintovirasto on määrännyt. Hallinto-oikeus on kuitenkin muuttanut lupamääräyksessä 4.a asetetun bisfenoli A:n raja-arvon tässä vaiheessa tavoitteelliseksi ottaen huomioon, että jätevedenpuhdistamon laajennus on ollut lupahakemusvaiheessa suunnitteilla, ja Jujo Thermal Oy:lle on sille 3.4.2013 annetussa lupapäätöksessä asetettu velvoite tietyn ajan kuluessa tuon päätöksen lainvoimaistumisesta selvittää aineen esiintymistä prosessivesijakeissa ja esittää toimenpiteet kuormituksen vähentämiseksi.

Tarkkailutulosten perusteella paperitehtaan jäteveden bisfenoli A -pitoisuudessa on suurta vaihtelua ja yksittäisissä näytteissä pitoisuus on poikennut keskimääräisestä tasosta huomattavasti. Joidenkin näytteiden pitoisuus on ollut niin poikkeava, että on syytä myös epäillä virhettä näytteenotossa tai mittauksessa. Aluehallintovirasto on tämän johdosta asettanut raja-arvon tulkittavaksi siten, että raja-arvo tulee alittaa vuosikeskiarvona.

Vakiintuneen käytännön mukaisesti raja-arvon valvonnan edellyttämä tarkkailu voidaan toteuttaa jätevedenpuhdistamolla suoritetun paperitehtaan jätevesien esikäsittelyn (esiselkeytys) jälkeen, ennen paperitehtaan jätevesien johtamista yhteispuhdistukseen yhdyskuntajätevesien kanssa. Tämä vastaa suunnitelmassa esitetyn mittaustietoa jäteveden bisfenoli A-pitoisuuksista.

Lupamääräys 22a

Hakija on vuodesta 2016 alkaen seurannut tiheällä näytteenotolla bisfenoli A:n pitoisuuksia Eurajoessa, Kuurnamäensillan kohdalla olevalla yhteistarkkailuohjelman mukaisella näytteenottopisteellä. Tarkkailun tulosten perusteella bisfenoli A:n pitoisuus jää keskimäärin haitattoman pitoisuuden (PNEC, 1,6 µg/l) alapuolelle ollen noin 0,3 µg/l. Kahdesti näytteenotossa on kuitenkin havaittu haitattoman pitoisuuden ylittävä pitoisuus: 1,9 µg/l (18.10.2016) ja 5,2 µg/l (26.4.2017). Tarkkailu on tehty samanaikaisesti jätevedenpuhdistamon näytteenoton kanssa ja voidaankin havaita, että tällöin myös jokeen johdetun jäteveden BPA-pitoisuus on ollut poikkeuksellisen korkea (34–42 µg/l) ja siten ylittänyt jätevedenpuhdistamolle tavoitteellisena vuosikeskiarvona annetun raja-arvon 20 µg/l.

Tarkkailun tuloksia laskennallisiin arvioihin verrattaessa havaitaan, että pitoisuuksia joessa voidaan melko luotettavasti arvioida päästön perusteella. Aluehallintovirasto kuitenkin katsoo, että on tarpeen varmistaa säännöllisen vesistöseurannan jatkuminen. Tämän johdosta ympäristölupaa on täydennetty määräyksellä bisfenoli A:n tai mahdollisesti jatkossa jonkin muun haitallisen kemikaalin päästötasosta kertovan aineen säännöllisellä vesistöseurannalla. Velvoite voidaan liittää osaksi Eurajoen yhteistarkkailuohjelmaa

sitä seuraavan kerran uudistettaessa. Valvontaviranomaisen tulee seurata kemikaalien käytön muutoksia ja tarvittaessa muuttaa tarkkailussa olevaa haitta-ainetta vastaamaan paremmin vaikutustarkkailun tarvetta.

Aluehallintovirasto katsoo vesistövaikutusten selvittämiseksi riittävän jatkossa neljä näytteenottokertaa vuodessa, mikä vastaa lainvoimaisen ympäristöluvan lupamääräyksessä 18 annettua vähimmäistarkkailutiheyttä jäteveden bisfenoli A:lle.

Vastaus yksilöityihin vaatimuksiin ja lausuntoon

Aluehallintovirasto katsoo, että nykytiedon perusteella ei ole mahdollista asettaa raja-arvoja tai säännöllisiä tarkkailuvaatimuksia bisfenoli A:ta korvaaville kemikaaleille ELY-keskuksen lausunnossa vaaditun mukaisesti. Esimerkiksi BPS (CAS 80-09-1, 4,4'-sulphonyldiphenol), joka toimii pääasiallisena bisfenoli A:ta korvaavana kemikaalina, ei toistaiseksi ole CLP:n yhdenmukaistetun luokittelun piirissä eikä siten suoraan vaaralliseksi luokiteltu vaan luokitus perustuu kemikaalin valmistajien tai maahantuojien omiin arvioihin. Aine on kuitenkin tällä hetkellä uudelleen arvioitavana. REACH-asetuksen mukainen rajoitus bisfenoli A:lle tulee 2020 mennessä muuttamaan lämpöherkän paperin valmistukseen käytettäviä kemikaaleja, mutta aluehallintovirasto ei pysty nykyisen tiedon perusteella arvioimaan tulevaa muutosta ja sen jälkeen käytössä olevien kemikaalien suhteita.

Käytössä olevia muita kehittimiä, herkistimiä ja värejä varten ei myöskään ole luotettavia, yleisesti käytössä olevia määritysmenetelmiä. Tilanteen muuttuessa määritysmenetelmien ja luokittelujen osalta valvontaviranomainen voi päätöksellään lainvoimaisen ympäristöluvan määräyksen 23 mukaisesti muuttaa tehtaan tarkkailusuunnitelmaa vastaamaan tarkkailun tarvetta. Lainvoimaisen ympäristöluvan määräyksen 25 perusteella toiminnanharjoittaja on velvollinen raportoimaan yksityiskohtaisesti kemikaalien käytössä ja luokituksissa tapahtuvista muutoksista vuosiraportoinnin yhteydessä. Valvontaviranomaiselle on siten käytössä tarvittavat tiedot esimerkiksi tarkkailuun tarvittavia muutoksia varten. Lainvoimaisen ympäristöluvan määräyksen 2 mukaisesti on edelleen voimassa se, että *"jätevesien sisältämien kehittimien, reaktiivisten värien tai muiden haitallisuudeltaan näihin rinnastettavien osittain jätevesiin päätyvien kemikaalien määrä ei saa ylittää pitoisuutta, joka vaarantaa puhdistamon toiminnan, puhdistamon biolietteen hyötykäytön, vastaanottavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön veden hyötykäytön."*

Ympäristönsuojelulain 89 §:n mukaisesti valvontaviranomainen voi tarvittaessa saattaa ympäristöluvan muutoksen vireille, jos käytettävissä olevan tiedon perusteella on syytä asettaa raja-arvoja uusille aineille tai muutoin muuttaa lupaa. Luvan haltija voi saattaa asian vireillä myös itse.

Muilta osin lausunnoissa esitetyt seikat on huomioitu lupamääräyksistä ja niiden perusteluista ilmenevin tavoin.

Päätöksen voimassaolo

Tämä päätös on voimassa toistaiseksi.

Lupaa ankaramman asetuksen noudattaminen

Jos valtioneuvoston asetuksella annetaan tämän luvan määräystä ankarampia säännöksiä tai tästä luvasta poikkeavia säännöksiä luvan voimassaolosta tai tarkistamisesta, asetusta on luvan estämättä noudatettava.

KORVATTAVAT PÄÄTÖKSET

Tällä päätöksellä ei korvata muita päätöksiä.

PÄÄTÖKSEN TÄYTÄNTÖÖNPANO

Tämä päätös on lainvoimainen valitusajan päättymisen jälkeen, jos päätökseen ei haeta muutosta valittamalla.

SOVELLETUT SÄÄNNÖKSET

Ympäristönsuojelulaki (527/2014) 6–8, 19, 20, 51–53, 54, 64–65, 67, 70, 75, 83, 87, 90, 96, 140, 190–191 §, liite 1
Valtioneuvoston asetus ympäristönsuojelusta (713/2014) 1, 14–15, liite 1
Valtioneuvoston asetus aluehallintovirastojen maksuista vuonna 2018 (997/2017)

KÄSITTELYMAKSU JA SEN MÄÄRÄYTYMINEN

Tämän hakemuksen käsittelystä perittävä maksu on 2 400 euroa. Lasku lähetetään erikseen myöhemmin Valtion talous- ja henkilöstöhallinnon palvelukeskuksesta.

Asian käsittelystä peritään maksu, joka määräytyy aluehallintovirastojen maksuista vuonna 2018 annetun valtioneuvoston asetuksen (997/2017) mukaisesti. Asetuksen liitteen kohdan 3.1. taulukon alakohdan 5 mukaan lupapäätöksen edellyttämän suunnitelman käsittelystä perittävä maksu on 60 euroa/tunti. Tämän asian käsittelemiseen on käytetty 40 tuntia. Maksu määräytyy seuraavasti: 40 h × 60 €/h = 2 400 €.

PÄÄTÖKSESTÄ TIEDOTTAMINEN

Päätös

Jujo Thermal Oy
PL 92
27500 KAUTTUA

Jäljennös päätöksestä (sähköisesti)

Euran kunta
Euran kunnan ympäristönsuojeluviranomainen
Euran kunnan terveydensuojeluviranomainen
Turvallisuus- ja kemikaalivirasto (Tukes)
Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus
Suomen ympäristökeskus

Ilmoittaminen ilmoitustauluilla ja internetissä

Tieto päätöksen antamisesta julkaistaan Etelä-Suomen aluehallintoviraston ilmoitustaululla ja päätöksestä kuulutetaan Euran kunnan virallisella ilmoitustaululla. Päätös julkaistaan internetissä Lupatietopalvelussa osoitteessa www.avi.fi/lupa-tietopalvelu.

MUUTOKSENHAKU Päätökseen saa hakea muutosta Vaasan hallinto-oikeudelta valittamalla.

Liitteet Liite 1. Valitusosoitus

Kari Pirkanniemi

Anna Laiho

Asian on ratkaissut ympäristöneuvos Kari Pirkanniemi ja esitellyt ympäristöylitarkastaja Anna Laiho.

Asiakirja on hyväksytty sähköisesti. Merkintä sähköisestä hyväksymisestä on asiakirjan viimeisellä sivulla.

VALITUSOSOITUS

Valitusviranomainen

Etelä-Suomen aluehallintoviraston päätökseen saa hakea valittamalla muutosta **Vaasan hallinto-oikeudelta**. Asian käsittelystä perittävästä maksusta valitetaan samassa järjestyksessä kuin pääasiasta.

Valitusaika

Määräaika valituksen tekemiseen on kolmekymmentä (30) päivää tämän päätöksen antopäivästä sitä määräaikaan lukematta. Valitusaika päättyy **28.5.2018.**

Valitusoikeus

Päätöksestä voivat valittaa asianosaiset, sekä vaikutusalueella ympäristön-, terveyden- tai luonnonsuojelun tai asuinympäristön viihtyisyyden edistämiseksi toimivat rekisteröidyt yhdistykset tai säätiöt, sijaintikunta ja vaikutusalueen kunnat ja niiden ympäristönsuojeluviranomaiset, sekä elinkeino-, liikenne- ja ympäristökeskukset ja muut asiassa yleistä etua valvovat viranomaiset.

Valituksen sisältö

Valituskirjelmässä, joka osoitetaan Vaasan hallinto-oikeudelle, on ilmoitettava
- päätös, johon haetaan muutosta
- valittajan nimi ja kotikunta
- postiosoite ja puhelinnumero ja mahdollinen sähköpostiosoite, joihin asiaa koskevat ilmoitukset valittajalle voidaan toimittaa (mikäli yhteystiedot muuttuvat, on niistä ilmoitettava Vaasan hallinto-oikeudelle, PL 204, 65101 Vaasa, sähköposti vaasa.hao@oikeus.fi)
- miltä kohdin päätökseen haetaan muutosta
- mitä muutoksia päätökseen vaaditaan tehtäväksi
- perusteet, joilla muutosta vaaditaan
- valittajan, laillisen edustajan tai asiamiehen allekirjoitus, ellei valituskirjelmää toimiteta sähköisesti (faxilla tai sähköpostilla)

Valituksen liitteet

Valituskirjelmään on liitettävä
- asiakirjat, joihin valittaja vetoaa vaatimuksensa tueksi, jollei niitä ole jo aikaisemmin toimitettu viranomaiselle
- mahdollisen asiamiehen valtakirja tai toimitettaessa valitus sähköisesti selvitys asiamiehen toimivallasta

Valituksen toimittaminen

Valituskirjelmä liitteineen on toimitettava Vaasan hallinto-oikeudelle. **Valituskirjelmän on oltava perillä määräajan viimeisenä päivänä ennen virka-ajan päättymistä.** Valituskirjelmä liitteineen voidaan myös lähettää postitse, faxina tai sähköpostilla. Sähköisesti (faxina tai sähköpostilla) toimitetun valituskirjelmän on oltava toimitettu niin, että se on käytettävissä vastaanottolaitteessa tai tietojärjestelmässä määräajan viimeisenä päivänä ennen virka-ajan päättymistä.

Vaasan hallinto-oikeuden kirjaamon yhteystiedot

käyntiosoite:	Korsholmanpuistikko 43, 4. krs
postiosoite:	PL 204, 65101 Vaasa
puhelin:	029 56 42780
faksi:	029 56 42760
sähköposti:	vaasa.hao@oikeus.fi
aukioloaika:	klo 8–16.15

Oikeudenkäyntimaksu

Vaasan hallinto-oikeudessa valituksen käsittelystä perittävä oikeudenkäyntimaksu on 250 euroa. Mikäli hallinto-oikeus muuttaa valituksenalaista päätöstä muutoksenhakijan eduksi, oikeudenkäyntimaksua ei peritä. Maksua ei myöskään peritä eräissä asiaryhmissä eikä myöskään mikäli asianosainen on muualla laissa vapautettu maksusta. Maksuvelvollinen on vireillepanija ja maksu on valituskirjelmäkohtainen.

Tämä asiakirja ESAVI/278/2018 on hyväksytty sähköisesti / Detta dokument ESAVI/278/2018 har godkänts elektroniskt

Esittelijä Laiho Anna 25.04.2018 10:17

Ratkaisija Pirkanniemi Kari 25.04.2018 10:22

Liite 3.

JVP–EURA OY:N JÄTEVEDENPUHDISTAMON TARKKAILUTUTKIMUS

Vuosiraportti 2017

15.3.2018
Nro 206-18-497

Lounais-Suomen
vesi- ja ympäristötutkimus Oy

Sisällys

Liitteet

Jakelu

JVP–Eura Oy/Puhdistamo

Jakelu (sähköposti)

JVP–Eura Oy/pirjo.patala@JVP–Eura.fi
JVP–Eura Oy/jukka.valtonen@JVP–Eura.fi
JVP–Eura Oy/matti.virtanen@JVP–Eura.fi
JVP–Eura Oy/petri.nevala@JVP–Eura.fi
Euran kunta/kimmo.haapanen@eura.fi
Euran kunta/jarkko.leminen@eura.fi
Eurajoen kunta/kirjaamo@eurajoki.fi
HKScan Finland Oy/jenni.forsell@hkscan.com
HKScan Finland Oy/jussi.kosomaa@hkscan.com
HKScan Finland Oy/seppo.noko@hkscan.com
HKScan Finland Oy/paivi.paavola@hkscan.com
HKScan Finland Oy/eveliina.hakanpaa@hkscan.com
HKScan Finland Oy/ville.savolainen@hkscan.com
HKScan Finland Oy/ville.savolainen@hkscan.com
Jujo Thermal Oy/mari.ylinen@jujothermal.com
Jujo Thermal Oy/pekka.peippo@jujothermal.com
Jujo Thermal Oy/pertti.makela@jujothermal.com
Jujo Thermal Oy/saana.vahteristo@jujothermal.com
Jujo Thermal Oy/marko.miettinen@jujothermal.com
Pyhäjärviseudun ympäristötoimisto/jukka.reko@sakyla.fi
Pyhäjärviseudun ympäristötoimisto/anja.polvi@sakyla.fi
Varsinais-Suomen ELY-keskus/kirjaamo.varsinais-suomi@ely-keskus.fi
Varsinais-Suomen ELY-keskus/timo.stranius@ely-keskus.fi

Yhteystiedot

Lounais-Suomen vesi- ja ympäristötutkimus Oy (Y 1564941-9)
Telekatu 16, 20360 TURKU
puh. 02-274 0200, sähköp. etunimi.sukunimi@lsvsy.fi

1. YLEISTÄ

Puhdistamo on alun perin Euran kunnan vuonna 1975 valmistunut kaksilinjainen biologis-kemiallinen rinnakkaissaostuslaitos. Puhdistamoa saneerattiin vuonna 1996, jolloin toteutettiin kemiallinen esisaostus ja otettiin käyttöön kolmas ilmastusallas. Puhdistamoa saneerattiin vuosien 2003–2004 aikana JVP–Eura Oy:n jätevedenpuhdistamoksi, jossa käsitellään sekä teollisuuden että yhdyskunnan jätevesiä. Vanha rinnakkaissaostuslaitos saneerattiin 2003–2004 matalakuormitteiseksi biologiseksi typenpoistolaitokseksi (kantoaineprosessi, denitrifikaatio-nitrifikaatio). Lisäksi puhdistusprosessia tehostettiin lisäämällä flotaatiokäsittely väliselkeytyksen jälkeen. Saneeraus valmistui huhtikuussa 2004. Viimeisin laajennus- ja saneerausurakka aloitettiin vuonna 2013 ja saatiin valmiiksi 2014.

JVP–Eura Oy:n yhtiön osakkaita ovat Euran kunnan lisäksi Jujo Thermal Oy:n erikoispaperitehdas. Yhtiön osakkuudet muuttuivat vuonna 2015, kun Euran kunta osti HKScan Finland Oy:n osuuden yhtiöstä.

Jujo Thermal Oy:n paperitehtaan jätevedet on 9.4.2004 lähtien johdettu puhdistamolle yhteiskäsittelyyn Euran kunnan jätevesien kanssa. Euran kunnan viemäriverkoston kautta puhdistamolle johdetaan asumisjätevesistä poikkeavaa jätevettä kuten HKScan Finland Oy:n siipikarjatehtaan esikäsiteltyjä jätevesiä, Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan esikäsiteltyjä prosessijätevesiä, Hallavaaran jätekeskuksen suotovesiä ja biokaasulaitoksen rejektivesiä sekä Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitoksen esikäsiteltyjä rejektivesiä. Puhdistamolla otetaan vastaan myös sako- ja umpikaivolietteitä, jotka puretaan kuntalinjalta tulevaan jätevesilinjaan.

Puhdistamon vuonna 2013 alkanut laajennus- ja saneerausurakka saatiin valmiiksi lokakuussa 2014. Puhdistamolle rakennettiin toinen esiselkeytysallas, uusi ilmastusallas, tiivistämö ja metanolin annostelu. Nykyisin sekä kuntalinjan että paperitehtaan jätevesillä on omat esiselkeytykset, joista jätevedet johdetaan uuteen ilmastusaltaaseen. Uudessa ilmastusaltaassa (3 rinnakkaista linjaa) kokonaistypenpoisto on toteutettu denitrifkaatio-nitrifikaatio (DN) -prosessilla. Ilmastusaltaiden kaksi ensimmäistä lohkoa voi olla D- tai N-käytössä. Vanhat ilmastusaltaat muutettiin jälkidenitrifkaatioaltaiksi. Fosfori poistetaan jälkisaostuksena flotaatioon syötettävällä polyalumiinikloridilla (PAX-XL100), lisäksi väliselkeytyksestä lähtevään veteen syötetään polymeeriä. Puhdistamolla on metanolin annostelumahdollisuus. Puhdistamolta vesistöön lähtevä jätevesi (sis. mahdolliset puhdistamo-ohitukset) hygienisoidaan permuurahaishapolla tarvittaessa.

Puhdistamon virtaamakaavio on *liitteellä 18*. Vuonna 2014 laajennetun JVP–Eura Oy:n jätevedenpuhdistamon mitoitusarvot ovat seuraavat:

Jätevesivirtaama yhteensä (Q_{kesk})	8 100 m^3/d
Jujo Thermal Oy:n osuus mitoitusvirtaamasta (Q_{kesk})	4 500 m^3/d (56 % tulovirtaamasta)
Kuntalinjan osuus mitoitusvirtaamasta (Q_{kesk})	3 500 m^3/d (44 % tulovirtaamasta)
BOD_{7ATU}-kuorma	2 250 kg/d
Fosforikuorma	46 kg/d
Typpikuorma	540 kg/d
Kiintoainekuorma	5 600 kg/d

Etelä-Suomen aluehallintovirasto on myöntänyt 23.1.2013 annetulla päätöksellä nro 11/2013/1 (ESAVI/27/04.08/2011) JVP–Eura Oy:lle ympäristönsuojelulain mukaisen ympäristöluvan JVP–Eura Oy:n hakemuksen ja sen täydennysten mukaiselle jätevedenpuhdistamon laajennukselle sekä samalla tarkisti puhdistamon toiminnalle 27.12.2002 annetun ympäristöluvan määräykset. VHO antoi 3.11.2015 päätöksen nro 15/0294/2. ESAVI:n päätöksestä ja VHO:n muutospäätöksestä tuli lainvoimaiset 9.1.2017 KHO:n antaman päätöksen nro 17/2017 myötä.

JVP–Eura Oy:n jätevedenpuhdistamon toimintaa sekä vesistöön johdettavien jätevesien laatua ja määrää tarkkaillaan Lounais-Suomen vesi- ja ympäristötutkimus Oy:n 7.9.2005 laatiman tarkkailuohjelman mukaan, tosin tarkkailua on päivitetty lupapäätöksen ESAVI 11/2013/1 mukaiseksi vuonna 2013. Puhdistamon tarkkailuohjelma tullaan päivittämään lupapäätöksen nro 11/2013/1 määräysten mukaiseksi.

Vesistötarkkailu tehdään Lounais-Suomen ympäristökeskuksen 28.10.2008 hyväksymän (päätös nro 99 YLO, dnro LOS-2007-Y-367-121) Eurajoen ja Eurajoensalmen päivitetyn vesistötarkkailuohjelman (Lounais-Suomen vesi- ja ympäristötutkimus Oy, 29.12.2008) mukaisesti.

Lounais-Suomen vesi- ja ympäristötutkimus Oy teki puhdistamon päästötarkkailututkimukset kaksi kertaa kuukaudessa eli yhteensä 24 kertaa vuoden 2017 aikana (*liite 3*).

Päästötarkkailunäytteet kerättiin puhdistamolle kuntalinjalta tulevasta jätevedestä (Euran kunta, HKScan Finland Oy ja muut teollisuusliittyjät ja tuodut sako- ja umpikaivolietteet), Jujo Thermal Oy:n paperitehtaalta tulevasta jätevedestä, väliselkeytetystä jätevedestä ja puhdistamolta lähtevästä jätevedestä automaattisilla näytteenottimilla koko vuorokauden ajan virtaaman suhteen painottaen. Kuntalinjan ja paperitehtaan esiselkeytettyjen jätevesien kokoomanäytteet kerättiin manuaalisesti. Esiselkeytettyjen jätevesien laatu tutkittiin joka toinen tarkkailukerta eli yhteensä 12 kertaa vuodessa.

Lähtevän jäteveden fenolisten yhdisteiden tarkkailua kerättiin kertanäytteet lähtevän jäteveden näytepisteestä tammi–toukokuussa. Kesäkuusta 2017 alkaen lähtevän jäteveden fenoliset yhdisteet on tutkittu päästötarkkailun 24 h kokoomanäytteestä. Vesistöön johdetun jäteveden hygieenistä laatua tarkkailtiin purkuputken alkupään kaivosta otetulla kertanäytteellä, joka sisältää mahdolliset puhdistamo-ohitukset ja jäteveden hygienisoinnin (*liite 18*). Puhdistamolla tehtiin E-PRTR asetuksen mukaisten yhdisteiden tarkkailututkimus kesäkuussa 2017. E-PRTR asetuksen mukaisten yhdisteiden päästöt vesistöön on raportoitu erillisessä yhteenvedossa.

Puhdistamon jätevesinäytteet analysoitiin Lounais-Suomen vesi- ja ympäristötutkimus Oy:n laboratoriossa. Lounais-Suomen vesi- ja ympäristötutkimus Oy on FINAS-akkreditointipalvelun akkreditoima testauslaboratorio T101, joka täyttää standardin ISO/IEC 17025 vaatimukset. Laboratorion yleiset jätevesitutkimusten määritysmenetelmät mittausepävarmuuksineen sekä tarkkailukertakohtaiset mittausepävarmuudet on esitetty *liitteessä 17*. Laboratorion voimassaoleva pätevyysalue löytyy FINAS-akkreditointipalvelun internet-sivuilta: www.finas.fi kohdasta Akkreditoidut toimielimet » Testauslaboratoriot.

Kuormitustiedot on laskettu Turun vesi- ja ympäristöpiirin kirjeen 9.1.1990 (Nro 14/500 1990) mukaisesti. Koko vuoden jaksolta kuormitustiedot on laskettu VYH:n valvontaohjeen 42 mukaisesti neljännesvuosikeskiarvoista (*liite 4*).

Määritysrajan alittavien tulosten osalta kuormituslaskenta on tehty 1.1.2012 lähtien Ympäristöhallinnon 30.12.2011 laatiman ohjeistuksen (*Yhdyskuntajätevesien puhdistus-laitosten päästöjen seuranta ja raportointi – hyvien menettelytapojen kuvaus*) mukaisesti: määritysrajan alittavat tulokset on huomioitu kuormituslaskennassa käyttämällä mittaustuloksena määritysrajan puolikasta.

Paperitehtaalta vesistöön johdettujen jätevesien ohituskuorma lasketaan paperitehtaalta vesistöön johdetun jäteveden mitattujen pitoisuuksien ja ohitusvirtaaman mukaan. Paperitehtaan ohitukset lasketaan puhdistamon vesistökuormaan mukaan verkosto-ohituksina, eli ne eivät sisälly puhdistamon tulokuormaan, mutta ovat mukana vesistökuormassa. Euran kunnan viemäriverkoston ohitukset on laskettu ohitetun jätevesimäärän ja mitattujen pitoisuuksien perusteella, jos ohituksesta on otettu näyte. Muutoin käytetään kuntalinjalta tulevan jäteveden ohitusajankohtaa lähimpiä mitattuja pitoisuuksia. Koko puhdistusprosessin ohittaneen kuntalinjan jäteveden ohituskuorma lasketaan kuntalinjalta tulevan jäteveden ohitusajankohtaa lähimpien mitattujen pitoisuuksien ja ohitusvirtaaman mukaan. Väliselkeytyksen jälkeinen ohitus (=flotaation ohitus) sisältyy puhdistamon lähtevän jäteveden näytteeseen.

Lounais-Suomen vesi- ja ympäristötutkimus Oy on lähettänyt puhdistamon jakson 1-2017 päästötiedot 25.4.2017, jakson 2-2017 päästötiedot 13.7.2017, jakson 3-2017 päästötiedot 11.10.2017 ja jakson 4-2017 päästötiedot 17.1.2018 valvontaviranomaiselle ELY–keskukseen VAHTI–rekisteriin. Päästötietojen yhteydessä lähetettiin myös kuntalinjan kuivatun lietteen ja paperitehtaan kuivatun kuitusavilietteen laatutiedot VAHTI–rekisteriin.

1.1. Sääolot tutkimusvuonna 2017

Talvi 2016/2017 eli joulu-helmikuu oli Turun seudulla Ilmatieteen laitoksen säähavaintojen mukaan **joulukuusta 2016** lähtien poikkeuksellisen lauha mutta vähäsateinen. **Tammikuu** 2017 oli poikkeuksellisen lauha (*taulukko 1*), sillä kuun alkupuolen jälkeen päivän ylin lämpötila pysytteli pääosin nollan yläpuolella. Tammikuu oli kuitenkin hyvin niukkasateinen. **Helmikuussa** lämpötila vaihteli paljon, ja pakkasjaksojen välissä oli päiviä, jolloin keskilämpötila jäi nollan yläpuolelle. Kuun puoliväliin saakka sadetta tuli niukalti, mutta kuun lopussa lumisateita tuli muutamana päivänä runsaammin. Sekä tammi- että helmikuussa lämpötila oli 2–3 astetta ajankohdan keskiarvoa korkeampi (vertailujakso 1981–2010).

Maaliskuussa sää jatkui lauhana: keskilämpötila jäi Turussa nollan yläpuolelle ja oli lähes kolme astetta pitkänajan keskiarvoa korkeampi, mutta sademäärä jäi hieman tavanomaista pienemmäksi. Lumet ja jää sulivat pääosin jo maaliskuussa. **Huhtikuussa** keskilämpötila oli asteen verran vertailuarvoa alempi, ja sademäärä oli lähellä ajankohdan keskiarvoa. **Toukokuussa** sademäärä oli vain noin puolet tavanomaisesta ja lämpötila edelleen asteen normaalia kylmempi. Vappuna satoi monin paikoin lunta, ja vielä toukokuun puolivälin tienoilla oli yöpakkasia.

Kesäkuun alun sää oli varsin viileä. Vähän ennen kuun puoliväliä ilma lämpeni hieman, mutta juhannukseksi sää viileni uudelleen. Kuun viimeiset päivät olivat lämpimiä, mutta hellelukemiin ei päästy, ja Turussa kuukausikeskiarvo jäi hieman keskimääräistä alemmaksi. Noin puolet kesäkuun sademäärästä tuli muutamana päivänä puolenkuun tienoilla. Sademäärä vaihteli Turun seudulla: Turussa sademäärä oli lähellä keskimääräistä, mutta Kaarinan Yltöisten tietojen mukaan kesäkuu oli tavallista sateisempi. **Heinäkuussa** sää oli kesäisen lämmin, mutta lämpötila nousi hellerajan yli vain parina päivänä loppukuussa.

Turun ja Yltöisten tietojen mukaan heinäkuu olikin keskimääräistä viileämpi, mutta sademäärä jäi alle kolmannekseen pitkänajan keskiarvosta. **Elokuun** lämpötila oli lähellä vertailujakson keskiarvoa, eikä hellepäiviä ollut lainkaan. Sademäärä oli hieman keskimääräistä suurempi, mikä johtui alkukuun yhden päivän runsaista sateista.

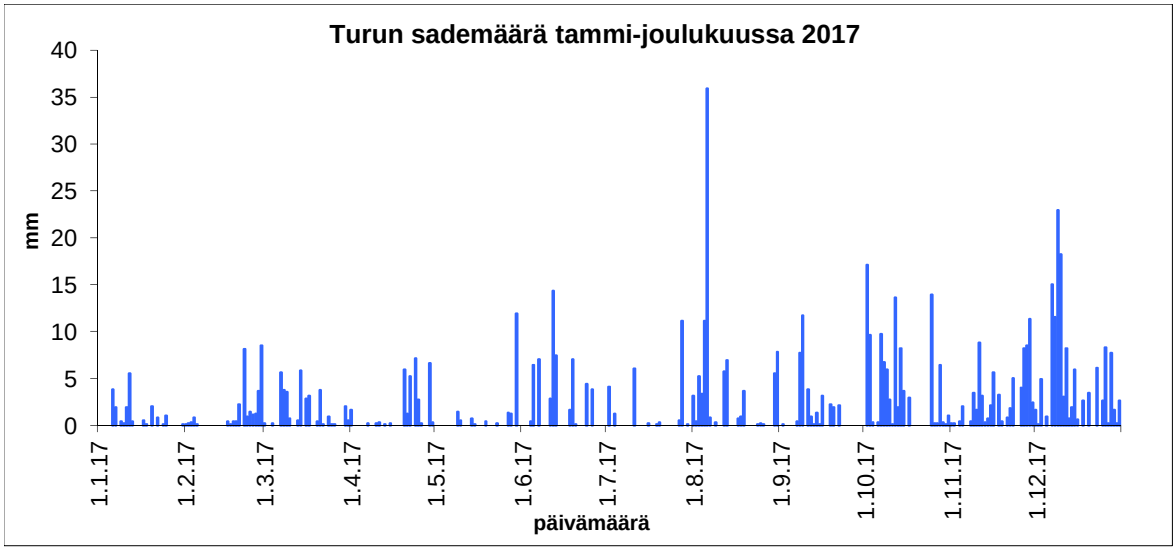
Syyskuun keskilämpötila oli lähellä vertailujakson keskiarvoa. Kuun loppupuolella oli lämmin jakso, ja Turussa mitattiin 18–19 ºC lämpötiloja; Yltöisissä korkein lämpötila oli jopa 19,6 ºC. Sademäärä jäi vertailujakson keskiarvoa pienemmäksi. **Lokakuu** oli lämpötilaltaan lähellä vertailujakson keskiarvoa. Kuun loppupuolella oli Turussa yöpakkasia, mutta päivällä oli yhä lämpöasteita. Maan etelä- ja länsiosassa oli tavanomaista sateisempaa, ja Turun seudulla satoi noin 30 mm tavallista enemmän. **Marraskuu** oli noin 3 ºC tavanomaista lämpimämpi mutta sademäärä varsin keskimääräinen. Kuun lopulla oli viileämpi jakso, ja Turun seudulla satoi hieman lunta, joka kuitenkin suli pois nopeasti. **Joulukuu** oli Turun seudulla selvästi tavanomaista lauhempi eikä kokonaisia pakkaspäiviä ollut, ja kuun keskilämpötila jäin nollan yläpuolelle. Joulukuun sademäärä oli noin 60 mm korkeampi kuin vertailujaksolla. Pääosa sateista tuli vetenä, ja muutamaan otteeseen kertynyt lumipeite suli pois nopeasti, ja vuoden päättyessä maaperä oli sula ja lumeton.

Vuosi 2017 oli Turun säätietojen perusteella keskilämpötilaltaan tavallista lämpimämpi ja vähäsateisempi. Vaikka kesäkuukaudet olivat viileitä, sekä alku- että loppuvuosi olivat leutoja. Sademäärä jäi usean keskimääräistä vähäsateisemman kuukauden johdosta tavallista pienemmäksi, vaikka loka- ja joulukuussa satoi poikkeuksellisen paljon.

TAULUKKO 1. Turun säätietoja vuodelta 2017 ja normaalijaksolta 1981–2010. Lähde: Ilmatieteen laitos. Lämpötilat lokakuun 2010 alusta lähtien Artukaisten automaattiasemalta (aiemmin Turun lentoasemalta) ja sademäärät heinäkuun 2006 alusta lähtien Artukaisista.

		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	yht.
Lämpötila	2017	-2,1	-2,2	1,2	3,0	9,6	13,9	16,5	16,2	11,9	5,5	3,6	1,3	**6,5***
(ºC)	1981–2010	-4,4	-5,2	-1,6	4,0	10,2	14,5	17,5	16,0	10,9	5,9	0,8	-2,6	**5,5***
Sademäärä	2017	19	30	34	32	18	55	24	92	35	105	74	131	**649#**
(mm)	1981–2010	61	42	43	32	39	59	79	80	64	78	76	70	**723#**

*keskiarvo #sademäärien summa



KUVA 1. Turun sademäärät (mm) päivittäin tammi–joulukuulta 2017. Lähde: Ilmatieteen laitos, Ilmastokatsaus.

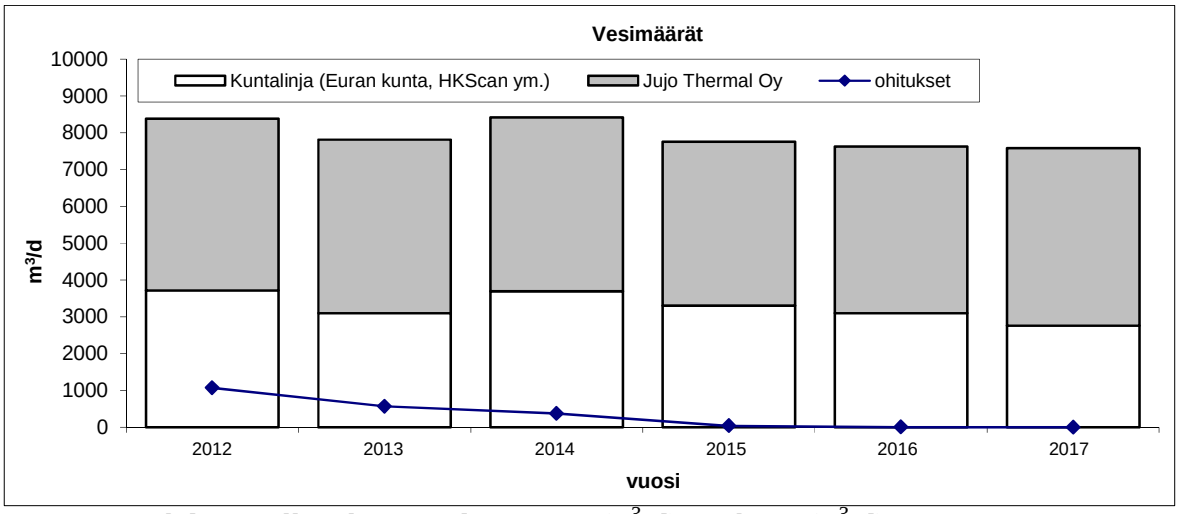
2. JÄTEVESIMÄÄRÄT JA TULOKUORMITUS

2.1. Puhdistamolle johdettu jätevesimäärä ja tulokuorma

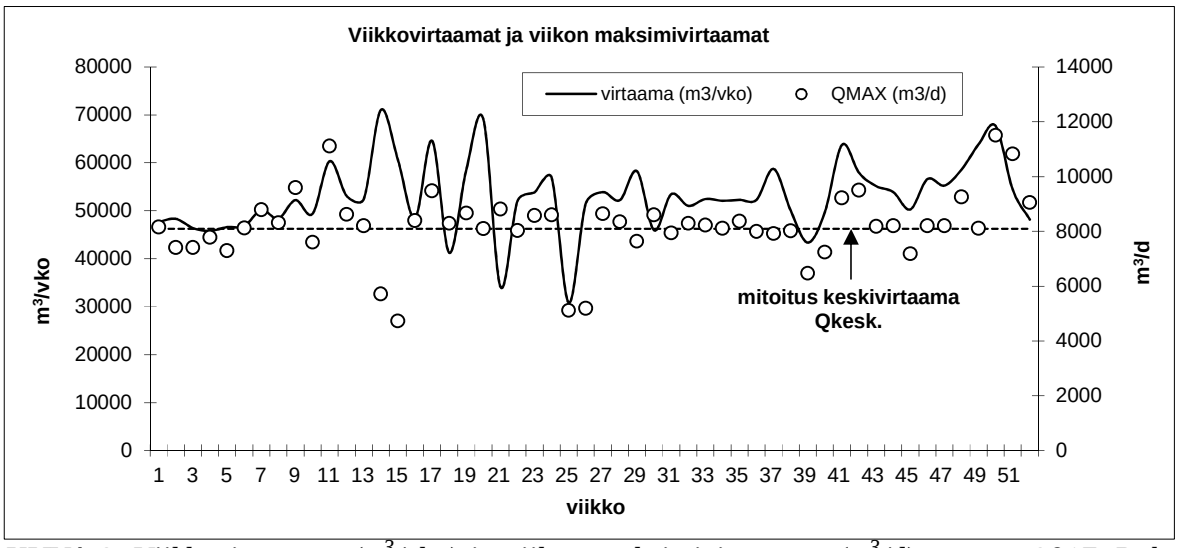
Puhdistamolle tuleva jätevesimäärä oli vuoden aikana 2 768 937 m^3 eli keskimäärin 7 586 m^3/d (sis. puhdistamolle tuodut sako- ja umpikaivolietteet) (*liite 1, kuva 2*). Kuntalinjasta tulevan jäteveden ohituksia hiekanerotusaltaasta ei ollut vuoden aikana. Myöskään väliselkeytetyn jäteveden ohituksia ei ollut vuoden aikana. Puhdistamolla käsitellyn jäteveden määrä oli yhteensä 2 768 937 m^3 eli keskimäärin 7 586 m^3/d.

Euran kunnan viemäriverkostossa oli ohitusta Sorkkisten pumppaamolla 16.5.2017 250 m^3. Ohitetusta jätevedestä otettiin näyte ja ohituksen aiheuttama kuormitus Eurajokeen on huomioitu jakson 2-2017 vesistöön johdetussa kuormassa ja puhdistustuloksessa (*liite 5*).

Puhdistamon viikkovirtaamat (m^3/vko) ja viikon päivittäiset maksimivirtaamat (m^3/d) ovat *kuvassa 3* (*liite 13*).

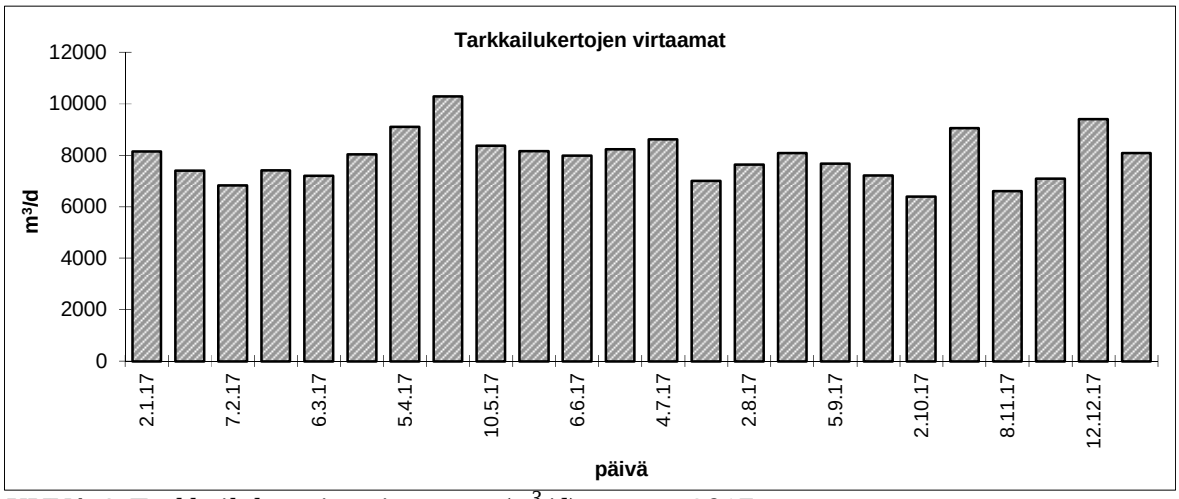


KUVA 2. Puhdistamolle tulevan veden määrä (m^3/d) ja ohitus (m^3/d) vuosina 2012–2017.



KUVA 3. Viikkovirtaamat (m^3/vko) ja viikon maksimivirtaamat (m^3/d) vuonna 2017. Puhdistamon mitoitettu keskivirtaama Q_{kesk} on 8 100 m^3/d.

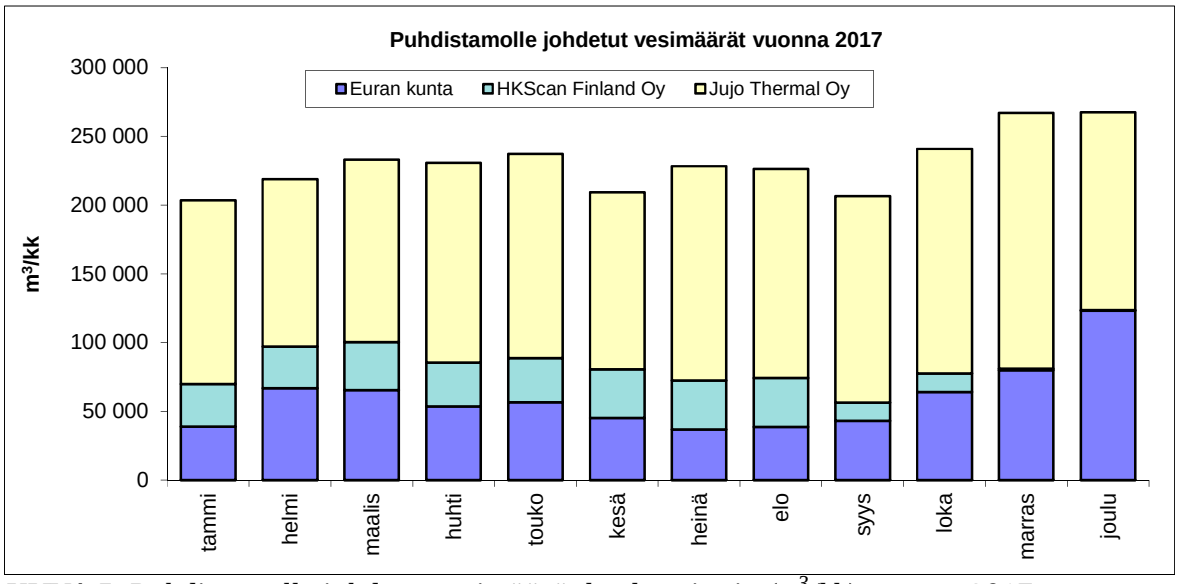
Kuormitustarkkailukertojen keskimääräinen käsitelty jätevesimäärä oli 7 926 m^3/d (*kuva 4, liite 3*).



KUVA 4. Tarkkailukertojen virtaamat (m^3/d) vuonna 2017.

Liitteellä 1 on eriteltyinä JVP–Eura Oy:n osakkailta (Jujo Thermal Oy ja Euran kunta) puhdistamolle johdetut jätevesimäärät (*kuva 5*). *Liitteen 1* taulukon kuntalinja tuleva sisältää Euran kunnan ja HKScan Finland Oy:n tehtaan sekä muiden teollisuusliittyjien jätevedet sekä. Kuvaan 5 on eritelty HKScan Finland Oy:n jätevedet kuntalinjalta johdetusta jätevedestä. Tehtaan teurastustoiminta loppui syksyllä 2017. Loppuvuodesta 2017 tehtaalta on johdettu pakkaustoiminnan ja henkilökunnan saniteettijätevesiä.

Puhdistamolla käsitelty jätevesimäärä raportoidaan puhdistamolle johdettujen jätevesimäärien perusteella. Puhdistamolle johdetaan jätevedet kahta linjaa pitkin: Jujo Thermal Oy:lta johdetut paperiteollisuuden jätevedet ja kuntalinjalta tulevat jätevedet. Kuntalinjan jätevesi sisältää Euran kunnan asumajätevedet sekä kunnan viemäriin liittyneiden teollisuusliittyjien jätevedet. Puhdistamolla käsitellyn lähtevän jäteveden virtaamamittaus ei täysin vastaa kuntalinjalta tulevan jäteveden ja paperiteollisuudesta tulevan jäteveden virtaamamittausten summaa, joten kuormitustiedot on päätetty raportoida tulevien virtaamien summan mukaisesti, josta on vähennetty puhdistamo-ohitukset (kuntalinjan tuleva ohitus).



KUVA 5. Puhdistamolle johdetut vesimäärät kuukausittain (m^3/kk) vuonna 2017.

Puhdistamolle tuleva kuormitus saadaan laskennallisesti kuntalinjalta tulevan jäteveden (Euran kunta, HKScan Finland Oy, muut teollisuusliittyjät ja tuodut sako- ja umpikaivolietteet) ja Jujo Thermal Oy:n paperitehtaan linjalta tulevan jäteveden näytteiden yhteiskuormasta. Tulevan jäteveden keskimääräiset pitoisuudet ja vastaavat kuormitukset koko vuoden ja neljännesvuosijaksojen osalta ovat *liitteellä 4*.

Vuoden keskimääräisen BOD_{7ATU}-tulokuorman mukaan laskettu asukasvastineluku AVL oli vuonna 2017 30 000 asukasta (70 g BOD_{7ATU}/as*d). Puhdistamon tulokuormitus on kehittynyt *taulukon 2* mukaisesti.

TAULUKKO 2. Puhdistamon tulokuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	7 100	6 000	6 400	5 400	6 800	6 700
BOD_{7ATU}	kg/d	1 900	1 800	1 900	1 500	2 100	2 100
Kokonaisfosfori	kg/d	61	40	35	23	36	27
Kokonaistyppi	kg/d	440	360	400	310	360	330
Kiintoaine	kg/d	4 700	5 700	5 800	4 400	6 600	5 300

2.2. Kuntalinjalta tulevat jätevedet

Puhdistamon päästötarkkailussa otetaan yhteisnäyte kuntalinjalta tulevasta jätevedestä, joka koostuu Euran kunnan jätevesistä, HKScan Finland Oy:n jätevesistä ja muiden kunnan viemäriin liittyneiden asumajätevedestä poikkeavaa jätevettä tuottavien liittyjien jätevesistä. Kuntalinjalta johdettiin jätevettä yhteensä 1 007 172 m^3 eli keskimäärin 2 759 m^3/d (sis. tuodut sako- ja umpikaivolietteet) (*kuva 4, liite 1*). Tämä oli 36 % puhdistamon tulovirtaamasta. Ilman tuotuja sako- ja umpikaivolietteitä kuntalinjalta tuleva virtaama oli 1 006 693 m^3. HKScan Finland Oy:n teurastustoiminta loppui syksyllä 2017. Loppuvuodesta 2017 tehtaalta on johdettu pakkaustoiminnan ja henkilökunnan saniteettijätevesiä, mikä näkyy kuntalinjalta tulevan jätevesimäärän vähentymisenä sekä kuormituksen laskuna.

Sako- ja umpikaivolietteitä tuotiin puhdistamolle yhteensä 479 m^3. Tuodut lietteet sisältyvät kuntalinjalta tulevan jäteveden näytteeseen, mutta tuotujen kuormien määrä mitataan erikseen kuntalinjan virtaamamittauksesta. Kuormituslaskennassa lietteiden määrä on lisätty kuntalinjan virtaamaan.

Kuntalinjalta tulevan jäteveden laatu ja kuormitus on esitetty *taulukossa 3* (*liite 6*). Kuntalinjalta johdettujen jätevesien kuormitus on kehittynyt *taulukon 4* mukaisesti.

TAULUKKO 3. Kuntalinjasta tulevan jäteveden puhdistamolle aiheuttama arvioitu keskimääräinen kuormitus ja osuus puhdistamon keskimääräisestä tulokuormasta vuonna 2017.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus puhdistamon tulokuormasta
COD_{Cr}	1 070	2 950	44 %
BOD_{7ATU}	500	1 370	65 %
Kokonaisfosfori	9,1	25,2	93 %
Kokonaistyppi	110	312	95 %
Kiintoaine	530	1 450	27 %

TAULUKKO 4. Kuntalinjalta johdettujen jätevesien puhdistamolle aiheuttama arvioitu keskimääräinen kuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	3 720	2 660	2 910	1 980	3 020	2 950
BOD_{7ATU}	kg/d	1 250	1 050	1 180	830	1 370	1 370
Kokonaisfosfori	kg/d	59	37	35	22	34	25
Kokonaistyppi	kg/d	420	330	390	290	340	312
Kiintoaine	kg/d	2 080	1 860	2 220	690	2 240	1 450

2.2.1. Euran kunnan jätevedet

Euran kunnan osuus kuntalinjalta tulevasta jätevesimäärästä ja kuormituksesta saadaan laskennallisesti vähentämällä HKScan Finland Oy:n kuormitus kuntalinjan kokonaiskuormituksesta (*taulukko 5, liitteet 6 ja 10*).

Euran kunnasta johdettiin jätevettä yhteensä 712 398 m^3 eli keskimäärin 1 952 m^3/d (*kuva 4, liite 1*). Tämä oli 25 % puhdistamon tulovirtaamasta ja 71 % kuntalinjalta tulevasta jätevesimäärästä.

Kunnan kuormitusosuuteen sisältyvät kunnan asumajätevedet ja viemäriin liittyneiden asumajätevedestä poikkeavaa jätevettä tuottavien liittyjien jätevedet, kuten Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan esikäsitellyt prosessijätevedet, Loimi-Hämeen Jätehuolto Oy:n Hallavaaran jätekeskuksen jätevedet ja Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitoksen rejektivedet sekä puhdistamolle tuodut sako- ja umpikaivolietteet. *Kappaleessa 2.4.* on eritelty Euran kunnan viemäriverkostoon liittyneiden merkittävimpien teollisuusliittyjien kuormitus sekä niiden osuus JVP–Eura Oy:n puhdistamon tulokuormasta.

TAULUKKO 5. Euran kunnan jätevesien puhdistamolle aiheuttama arvioitu keskimääräinen kuormitus ja osuus puhdistamon keskimääräisestä tulokuormasta vuonna 2017.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus kuntalinjan kuormasta	Osuus puhdistamon tulokuormasta
COD_{Cr}	1 680	2 880	98 %	43 %
BOD_{7ATU}	790	1 360	99 %	65 %
Kokonaisfosfori	14	24	95 %	89 %
Kokonaistyppi	160	270	87 %	82 %
Kiintoaine	840	1 440	98 %	27 %

Euran kunnan kuormitusosuus on kehittynyt *taulukon 6* mukaisesti.

TAULUKKO 6. Euran kunnan jätevesien puhdistamolle aiheuttama arvioitu keskimääräinen kuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	3 400	2 500	2 700	1 910	2 800	2 880
BOD_{7ATU}	kg/d	1 200	1 000	1 100	820	1 300	1 360
Kokonaisfosfori	kg/d	49	34	32	21	30	24
Kokonaistyppi	kg/d	350	280	340	250	280	270
Kiintoaine	kg/d	2 000	1 800	2 100	670	2 080	1 440

2.2.2. HKScan Finland Oy:n jätevedet

Koko vuoden aikana HKScan Finland Oy:n tehtaalta tullut jätevesimäärä oli 294 774 m^3 eli keskimäärin 808 m^3/d (*liite 1*). Tämä oli 11 % puhdistamon tulovirtaamasta ja 29 % kuntalinjalta tulevasta jätevesimäärästä. HKScan Finland Oy:n teurastustoiminta loppui syksyllä 2017. Loppuvuodesta 2017 tehtaalta on johdettu pakkaustoiminnan ja henkilökunnan saniteettijätevesiä.

HKScan Finland Oy:ltä Euran kunnan viemäriverkostoon ja edelleen JVP–Eura Oy:n jätevedenpuhdistamolle johdetun esikäsitellyn jäteveden keskimääräiset pitoisuudet, vastaavat kuormitukset sekä osuudet puhdistamolle tulevasta kuormituksesta on esitetty *taulukossa 7* (*liite 10*). JVP–Eura Oy:n puhdistamolle johdettu kuormitus on kehittynyt *taulukon 8* mukaisesti.

TAULUKKO 7. HKScan Finland Oy:ltä puhdistamolle johdetun jäteveden keskimääräiset pitoisuudet, kuormitukset ja osuudet puhdistamolle tulevasta kokonaiskuormituksesta.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus kuntalinjan kuormasta	Osuus puhdistamon tulokuormasta
COD_{Cr}	88	71	2 %	1,1 %
BOD_{7ATU}	21	17	1 %	0,8 %
Kokonaisfosfori	1,6	1,3	5 %	4,8 %
Kokonaistyppi	52	42	13,5 %	12,7 %
Kiintoaine	35	28	2 %	0,5 %
Rasvat*	<10	4,0		

* Rasvanäytteitä otettu 12 kertaa vuoden 2017 aikana (*liite 10*)

TAULUKKO 8. HKScan Finland Oy:n puhdistamolle aiheuttama keskimääräinen kuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	280	150	180	67	220	71
BOD_{7ATU}	kg/d	89	54	59	17	70	17
Kokonaisfosfori	kg/d	9,8	3,5	2,6	0,91	3,6	1,3
Kokonaistyppi	kg/d	67	51	44	46	61	42
Kiintoaine	kg/d	83	84	200	19	160	28
Rasvat	kg/d	<8,9	7,1	5,0	5,0	9,9	4,0

2.3. Jujo Thermal Oy:n paperitehtaan jätevedet

JVP–Eura Oy:n jätevedenpuhdistamolle johdettiin Jujo Thermal Oy:n paperitehtaalta jätevettä yhteensä 1 761 765 m^3 eli keskimäärin 4 827 m^3/d (*liite 1*). Tämä oli 64 % puhdistamon kokonaisvirtaamasta (*liite 1*).

Paperitehtaalta JVP–Eura Oy:n jätevedenpuhdistamolle johdetun jäteveden keskimääräiset pitoisuudet, vastaavat kuormitukset sekä osuudet puhdistamolle tulevasta kuormituksesta on esitetty *taulukossa 9* (*liite 7*). Paperitehtaalta puhdistamolle johdettu kuormitus on kehittynyt *taulukon 10* mukaisesti. Tehtaan saniteettijätevedet johdetaan Euran kunnan viemäriverkostoon.

TAULUKKO 9. Jujo Thermal Oy:ltä JVP–Eura Oy:n puhdistamolle tulevan jäteveden keskimääräiset pitoisuudet, kuormitukset ja osuudet puhdistamolle tulevasta kokonaiskuormituksesta.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus puhdistamon tulokuormasta
COD_{Cr}	780	3 750	56 %
BOD_{7ATU}	150	730	35 %
Kokonaisfosfori	0,37	1,8	7 %
Kokonaistyppi	3,7	18	5 %
Kiintoaine	790	3 830	72 %

TAULUKKO 10. Jujo Thermal Oy:n jätevesien puhdistamolle aiheuttama keskimääräinen kuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	3 000	3 200	3 900	3 440	3 730	3 750
BOD_{7ATU}	kg/d	590	710	800	650	680	730
Kokonaisfosfori	kg/d	0,84	1,1	1,2	1,3	1,5	1,8
Kokonaistyppi	kg/d	15	18	22	20	18	18
Kiintoaine	kg/d	2 500	3 800	3 900	3 670	4 280	3 830

2.4. Euran kunnan viemäriverkoston teollisuusliittyjien jätevedet

2.4.1. Amcor Flexibles Finland Oy Kauttuan paperinjalostustehdas

Amcor Flexibles Oy valmistaa joustopakkausmateriaaleja pakkaavan teollisuuden käyttöön. Tehtaan omalla erikoisjätevedenpuhdistamolla käsitellään happamia kupari- ja kromipitoisia jätevesiä, jotka muodostuvat syväpainotelanvalmistuksesta (painokoneiden osien ja telojen pesu- ja huuhteluvesistä sekä repro-osaston jätevesistä). Painopinnan valmistuksessa muodostuneet jätevedet esipuhdistetaan ennen viemäriverkostoon johtamista tarkoituksena poistaa biologis-kemiallista jätevedenpuhdistusta häiritsevät raskasmetallit ja väriemulsiot.

Koko vuoden aikana Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan jäteveden esikäsittelylaitokselta puhdistamolle tullut prosessijätevesimäärä oli yhteensä 835 m^3 eli keskimäärin 2,29 m^3/d. Tämä oli 0,03 % koko puhdistamolle tulevasta vesimäärästä ja 0,1 % Euran kunnan osuudesta. *Lähde: Amcor Flexibles Finland Oy Kauttuan esikäsittelylaitoksen jätevesien tarkkailututkimus, Vuosiraportti 2017, Lounais-Suomen vesi- ja ympäristötutkimus Oy 15.1.2018*

Esikäsittelylaitokselta JVP–Eura Oy:n puhdistamolle lähtevän jäteveden pitoisuuksien kehitys on esitetty *taulukossa 11*.

TAULUKKO 11. Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan esikäsitellyn jäteveden pitoisuudet vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
Kupari	mg/l	0,97	0,038	0,42	0,23	0,66	0,30
Kok.kromi	mg/l	0,073	0,072	0,070	0,12	0,042	0,096

Esikäsittelylaitokselta JVP–Eura Oy:n puhdistamolle johdettu kuormitus on kehittynyt *taulukon 12* mukaisesti.

TAULUKKO 12. Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan esikäsittelylaitokselta JVP–Eura Oy:n puhdistamolle tullut kuormitus vuosina 2012–2017.

		2012	2013	2014	2015	2016	2017
Kupari	kg/d	0,0020	0,000079	0,00097	0,00052	0,0015	0,00069
Kok.kromi	kg/d	0,00015	0,00015	0,00016	0,00027	0,000095	0,00022
Kiintoaine	kg/d	0,0025	0,0010	0,0012	0,0015	0,0012	0,0011

* Uusi esikäsittelylaitos otettiin käyttöön 1.5.2002

2.4.2. Loimi-Hämeen Jätehuolto Oy:n Hallavaaran jätekeskus

Loimi-Hämeen Jätehuolto Oy:n jätekeskus on alueellinen jätteenkäsittelylaitos, jossa käsitellään teollisuuden ja yhdyskunnan jätejakeita. Hallavaaran jätekeskuksen yhteydessä toimii myös biokaasulaitos, jossa käsitellään yhdyskuntajätevedenpuhdistamoiden lietteitä, elintarviketeollisuuden lietteitä sekä erilliskerättyjä biolietteitä. Hallavaaran jätekeskuksen alueen eri toiminnoista muodostuvat valuma- ja suotovedet, saniteettivedet sekä biokaasulaitoksella syntyvät mädätteen kuivauksen rejektivedet johdetaan 3 900 m^3 suuruiseen tasausaltaaseen, josta ne johdetaan Euran kunnan viemäriverkostoon ja edelleen JVP–Eura Oy:n jätevedenpuhdistamolle käsittelyyn.

Tasausaltaalta johdettiin viemäriverkostoon jätevettä yhteensä 36 290 m^3 eli keskimäärin 99,4 m^3/d, mikä oli 1,3 % puhdistamolle tulevasta vesimäärästä ja 5 % Euran kunnan vesimäärästä (*liite 11*). Tasausaltaalta johdettuja jätevesiä on tarkkailtu jätekeskuksen velvoitetarkkailututkimusten yhteydessä 12 kertaa vuoden aikana. Jätevedet aiheuttavat pääosin typpikuormitusta ja vastasivat laadultaan tyypillisiä kaatopaikan suotovesiä ja biokaasulaitoksen rejektivesiä (*liite 11*).

Taulukkoon 13 on laskettu kuormitusarvio käyttäen näytepäivien virtaamapainotteisia pitoisuuskeskiarvoja ja keskimääräistä pumpattua jätevesimäärää 99,4 m^3/d. Kuormitusarvion mukaan Hallavaaran jätevesien osuus puhdistamolle tulevasta typpikuormasta oli 39 %. Typpi oli pääosin ammoniumtyppimuodossa. Hallavaaran jätevedet sisältyvät Euran kunnan kuormitusosuuteen. Hallavaaran jätevesien osuus Euran kunnan typpikuormituksesta oli 48 %.

Vuonna 2017 Hallavaarasta puhdistamolle johdettu kuormitus oli etenkin COD_{Cr}:n, BOD_{7ATU}:n ja typen osalta suurempi kuin edellisvuonna (*taulukko 14*).

TAULUKKO 13. Hallavaaran jätekeskuksen tasausaltaalta JVP–Eura Oy:n puhdistamolle johdetun jäteveden kuormitusarvio sekä osuus puhdistamolle tulevasta kuormituksesta ja Euran kunnan kuormituksesta.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus puhdistamon tulokuormasta	Osuus Euran kunnan kuormasta
COD_{Cr}	3 720	370	6 %	13 %
BOD_{7ATU}	1 810	180	9 %	13 %
Kokonaisfosfori	14	1,4	5 %	6 %
Kokonaistyppi	1 280	130	39 %	48 %
Ammoniumtyppi	1 190	120		
Kiintoaine	170	17	0,3 %	1 %

TAULUKKO 14. Hallavaaran jätekeskuksen tasausaltaalta johdettujen jätevesien keskimääräinen kuormitus vuosina 2012–2017.

		2012*	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	260	220	800	690	160	370
BOD_{7ATU}	kg/d	120	98	160	360	49	180
Kokonaisfosfori	kg/d	1,8	1,5	4,2	4,6	1,1	1,4
Kokonaistyppi	kg/d	80	66	210	130	60	130
Kiintoaine	kg/d	23	19	120	150	28	17

* kuormitus arvioitu v. 2013 mittausten perusteella

2.4.3. Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitos

Länsi-Suomen Prosessivesi Oy:n laitoksella käsitellään rasvaa sisältäviä jätevesilietteitä ja hiekkaa, puukuituja ym. kiintoainetta sisältäviä sakkoja ja lietteitä erottamalla niistä rasvaa ja kiintoainesta. Lietteiden kuivauksesta erottunut rejektivesi johdetaan flotaatiokäsittelyn ja rasvan- ja hiekanerotuskaivojen kautta Euran kunnan viemäriverkostoon. Esikäsitellyt jätevedet sisältyvät Euran kunnan jätevesimääriin ja kuormituksiin.

Länsi-Suomen prosessivesi Oy:lta johdettiin viemäriverkostoon jätevettä yhteensä 1 634 m^3 eli keskimäärin 4,5 m^3/d, mikä oli 0,06 % puhdistamolle tulevasta vesimäärästä ja 0,2 % Euran kunnan vesimäärästä (*liite 12*). Näytepäivien keskimääräinen virtaama oli 39,1 m^3/d mikä on vuosikeskiarvoa suurempi, koska jätevesiä johdetaan vain toimintapäivinä viemäriverkostoon. Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitokselta Euran kunnan viemäriverkostoon ja JVP–Eura Oy:n puhdistamolle johdetun jäteveden laatua tutkittiin neljä kertaa vuoden aikana. Kuormitusarvio on laskettu käyttäen vuoden keskimääräistä jätevesimäärää 4,5 m^3/d (*taulukko 15, liite 12).* JVP–Eura Oy:n puhdistamolle johdettu kuormitus on kehittynyt *taulukon 16* mukaisesti.

TAULUKKO 15. Länsi-Suomen prosessivesi Oy:lta puhdistamolle johdetun jäteveden keskimääräiset pitoisuudet ja raja-arvot sekä osuus puhdistamolle tulevasta ja Euran kunnan kuormituksesta.

	Pitoisuus [mg/l]	Kuorma [kg/d]	Osuus puhdistamon tulokuormasta	Osuus Euran kunnan kuormasta	Raja-arvot [mg/l]
COD_{Cr}	220	1,0	0,015 %	0,035 %	3 000
BOD_{7ATU}	130	0,6	0,029 %	0,044 %	
Kokonaisfosfori	0,77	0,003	0,011 %	0,013 %	
Kokonaistyppi	25	0,11	0,033 %	0,041 %	
Kiintoaine	27	0,12	0,002 %	0,008 %	300
Rasvat*	<10	0,04			10

* ESAVI = Etelä-Suomen aluehallintovirasto 29.2.2012 päätös nro 37/2012/1, täytettävä vuosikeskiarvona

TAULUKKO 16. Länsi-Suomen prosessivesi Oy:lta johdettujen jätevesien keskimääräinen kuormitus vuosina 2012–2017.

		2012*	2013	2014	2015	2016	2017
COD_{Cr}	kg/d	95	140	38	47	7,2	1,0
BOD_{7ATU}	kg/d	65	100	25	33	5,0	0,6
Kokonaisfosfori	kg/d	1,0	3,9	0,4	0,42	0,03	0,003
Kokonaistyppi	kg/d	6,0	13	2,1	3,7	0,60	0,11
Kiintoaine	kg/d	7,0	11	2,3	2,7	0,69	0,12

* yksi tarkkailukerta vuonna 2012

3. PUHDISTUSTULOS JA VESISTÖN KUORMITUS

3.1. Ympäristölupa ESAVI nro 11/2013/1

Etelä-Suomen aluehallintoviraston 23.1.2013 päätöksen nro 11/2013/1 (dnro ESAVI/27/04.08/2011) mukaan puhdistustulosta koskevat lupamääräykset nro 2–4 kuuluvat seuraavasti:

3. Puhdistamoa ja puhdistamon piirissä olevaa viemärilaitosta kokonaisuudessaan on käytettävä ja hoidettava siten, että saavutetaan mahdollisimman hyvä puhdistustulos ja että jätevesistä ja puhdistamotoiminnasta aiheutuvat haitat jäävät mahdollisimman vähäisiksi.

Jätevesien biologisen käsittelyn on täytettävä yhdyskuntajätevesistä annetun valtioneuvoston asetuksen (888/2006) liitteen taulukon 1 vaatimukset (BOD_{7atu}, COD_{Cr} ja kiintoaine) asetuksen edellyttämällä tavalla tarkkailtuna. Fosforin ja typen poiston on puhdistamolla täytettävä asetuksen liitteen taulukon 2 vaatimukset. Tarkkailun on täytettävä asetuksen liitteen B-osassa asetetut vaatimukset.

Vesistöön johdettava jätevesi ei saa sisältää valtioneuvoston asetuksen (1022/2006) liitteen 1A-kohdassa tarkoitettuja vesiympäristölle vaarallisia aineita eikä liitteen 1B-kohdassa tarkoitettuja vesiympäristölle haitallisia aineita pitoisuuksina, jotka ylittävät mainitussa kohdassa tarkoitetut raja-arvot eikä muitakaan vesiympäristölle haitallisia aineita sellaisina pitoisuuksina, että niistä voi aiheutua vesistön pilaantumista. Vesistöön johdettava jätevesi ei saa aiheuttaa terveydellistä vaaraa.

4.a Käsitellyn jäteveden pitoisuusarvojen on oltava laajennetun puhdistamon käyttöönoton jälkeen, mutta kuitenkin viimeistään 1.1.2016 alkaen mahdolliset ohijuoksutukset, ylivuodot ja poikkeustilanteet (sekä puhdistamolla että viemäriverkostossa) mukaan lukien enintään seuraavat ja jäteveden käsittelytehojen vastaavalla tavalla laskettuna vähintään seuraavat:

	Enimmäispitoisuus (mg/l)	***Vähimmäisteho (%)***
BOD_{7atu}	15	90
Fosfori	0,3	90
Typpi	15	75
Ammoniumtyppi	5	90
COD_{Cr}	100	80
Kiintoaine	15	95
Bisfenoli-A	0,02	

Kokonaistypen, ammoniumtypen ja bisfenoli-A:n pitoisuusarvo ja poistoteho lasketaan vuosikeskiarvona, muut arvot neljännesvuosikeskiarvoina. Ammoniumtypen käsittelyn vähimmäistehon arvolla tarkoitetaan nitrifikaatioastetta.

Vesistöön johdettavat jätevedet on 1.5. – 31.10. hygienisoitava siten, että fekaalisten koliformien ja fekaalisten enterokokkien osalta saavutetaan laajennetun puhdistamon käyttöönoton jälkeen, mutta kuitenkin viimeistään 1.1.2016 alkaen mahdolliset ohijuoksutukset, ylivuodot ja poikkeustilanteet mukaan lukien kolmen kuukauden keskiarvona laskettuna vähintään seuraava käsittelytulos:

	Pitoisuus (pmy/100ml)
Fekaaliset koliformit	2 000
Fekaaliset enterokokit	500

Myös puhdistamolta vesistöön johdetut ohitusvedet on hygienisoitava viimeistään 1.1.2016 alkaen ainakin 1.5. – 31.10. välisenä aikana.

4 b. Käsitellyn jäteveden pitoisuusarvojen ja vesistöön johdettujen kokonaispäästöjen on oltava ennen puhdistamon laajennuksen käyttöönottoa, kuitenkin enintään 31.12.2015 asti mahdolliset ohijuoksutukset, ylivuodot ja poikkeustilanteet (sekä puhdistamolla että viemäriverkostossa) mukaan lukien enintään seuraavat ja jäteveden käsittelytehojen vastaavalla tavalla laskettuna vähintään seuraavat:

	Enimmäispitoisuus (mg/l)	***Vähimmäisteho (%)***	***Päästö vesistöön enintään (kg/d)***
BOD_{7atu}	15	90	120
Fosfori	0,3	90	
Typpi		70	
COD_{Cr}	125	75	1200
Kiintoaine	35	90	350

Kokonaistypen poistoteho lasketaan vuosikeskiarvona, muut arvot neljännesvuosikeskiarvoina.

Vaasan hallinto-oikeus muutti 3.11.2015 päätöksellään nro 15/0294/2 ESAVI:n päätöstä. ESAVI:n päätöksestä ja VHO:n muutospäätöksestä tuli lainvoimaiset KHO:n 9.1.2017 antaman päätöksen 17/2017 myötä.

3.2. Biologis-kemiallisesti puhdistettu jätevesi

Eurajokeen johdetun jäteveden keskimääräiset pitoisuudet, kuormitukset ja puhdistamon puhdistustehot on esitetty *taulukossa 17* (*liite 4*). Puhdistustulosta on verrattu voimassa olevan ympäristöluvan (Etelä-Suomen aluehallintoviraston 23.1.2013 päätös nro 11/2013/1 ja Vaasan hallinto-oikeuden 3.11.2015 päätös nro 15/0294/2) puhdistusvaatimuksiin.

Puhdistamo toimi hyvin **jakson 1-2017** aikana ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. **Jakson 2-2017** puhdistustulos täytti ympäristöluvan puhdistusvaatimukset vesistöön johdettua kokonaisfosfori- ja kiintoainepitoisuutta sekä kiintoaineen puhdistustehoa lukuun ottamatta. Jakson keskimääräistä puhdistustulosta heikensivät tarkkailukerran 5.4.2017 kohtalainen ja tarkkailukerran 22.5.2017 melko huono puhdistustulos. **Jakson 3-2017** puhdistustulos täytti voimassa olevan ympäristöluvan (ESAVI, VHO) puhdistusvaatimukset lukuun ottamatta puhdistamolta lähtevää kiintoainepitoisuutta. Puhdistamo toimi kohtalaisesti 2.8. ja 22.8.2017 tarkkailukerroilla. Puhdistamolta karkasi kiintoainetta, mikä heikensi puhdistustulosta ko. tarkkailukerroilla ja vaikutti myös jakson keskimääräiseen puhdistustulokseen etenkin kiintoaineen osalta. **Jakson 4-2017** puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta puhdistamolta lähtevää kiintoainepitoisuutta.

Puhdistamo saavutti kokonaistypen pitoisuus- ja puhdistustehovaatimuksen sekä vesistöön johdetun ammoniumtyppipitoisuuden vaatimuksen vuosikeskiarvoina tarkasteltuna.

Vuoden keskimääräinen nitrifikaatioaste jäi hieman luvan vaatimusta heikommaksi. Nitrifikaatio oli keskimäärin voimakasta jaksoilla 1-2017, 2-2017 ja 3-2017 ja jaksolla 4-2017 kohtalaista.

Vesistöön johdetun Bisfenoli A pitoisuuden tavoitearvo saavutettiin vuosikeskiarvona tarkasteltuna.

Jäteveden ohitusta oli vain jaksolla 2-2017 (Euran kunnan viemäriverkosto-ohitus), mutta ohituksesta aiheutunut kuormitus oli pieni, eikä ohitus vaikuttanut merkittävästi jakson 2-2017 puhdistustulokseen (*liite 5*).

TAULUKKO 17. Vesistöön johdetun jäteveden keskimääräiset pitoisuudet ja kuormitukset sekä puhdistustehot neljännesvuosijaksojen ja koko vuoden osalta. Jos jaksolla on ollut ohituksia, suluissa on puhdistamon käsittelytulos ilman ohituksia. Arvot, jotka eivät täyttäneet puhdistusvaatimuksia, on esitetty punaisella. Arvot jotka eivät täyttäneet puhdistustavoitteita, on esitetty sinisellä.

	Pitoisuus [mg/l]					Raja-arvot
	I/2017	II/2017	III/2017	IV/2017	Vuosikeskiarvo	ESAVI VHO
BOD_{7ATU}	7,6	14 (14)	9,1	12	11 (11)	15
COD_{Cr}	43	65 (64)	56	66	58 (58)	100
Kokonaisfosfori	0,082	0,42 (0,42)	0,28	0,23	0,25 (0,25)	0,3
Kokonaistyppi	5,2	8,0 (7,9)	6,8	9,8	7,5 (7,5)	15**
Ammoniumtyppi	2,7	4,9 (4,9)	3,1	7,1	4,6 (4,6)	5**
Kiintoaine	9,9	42 (41)	24	28	26 (26)	15
Bisfenoli A	0,0018	0,0067 (0,0067)	0,012	0,0	0,0049 (0,0049)	0,02*/**

	Vesistökuorma [kg/d]					Raja-arvot
	I/2017	II/2017	III/2017	IV/2017	Vuosikeskiarvo	ESAVI VHO
BOD_{7ATU}	55	100 (100)	65	100	80 (80)	
COD_{Cr}	310	480 (480)	400	560	440 (440)	
Kok.fosfori	0,60	3,1 (3,1)	2,0	1,9	1,9 (1,9)	
Kok.typpi	38	59 (59)	49	83	57 (57)	
Ammoniumtyppi	20	36 (36)	22	60	35 (35)	
Kiintoaine	72	310 (310)	170	240	200 (200)	
Bisfenoli A	0,013	0,05 (0,05)	0,086	0,0	0,037	

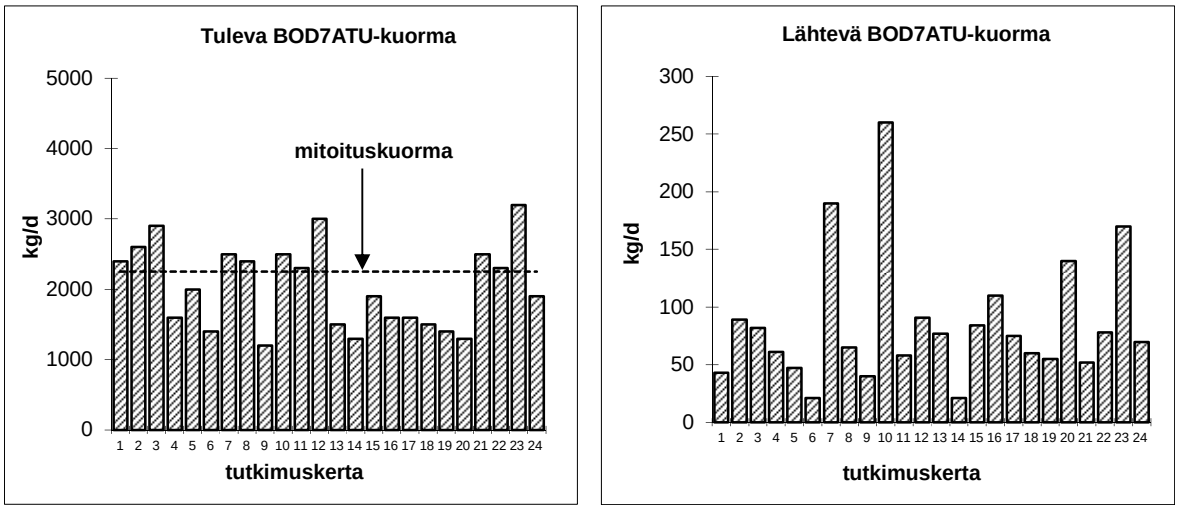
	Puhdistusteho [%]					Raja-arvot
	I/2017	II/2017	III/2017	IV/2017	Vuosikeskiarvo	ESAVI VHO
BOD_{7ATU}	98	96 (96)	96	95	96 (96)	90
COD_{Cr}	96	94 (94)	93	91	94 (94)	80
Kok.fosfori	98	91 (91)	92	92	93 (93)	90
Kok.typpi	89	85 (85)	84	69	82 (82)	75**
Nitrifikaatioaste	94	91 (91)	93	78	89 (89)	90**
Kiintoaine	99	94 (94)	96	95	96 (96)	95

ESAVI = Etelä-Suomen aluehallintovirasto 23.1.2013 nro 11/2013/1, VHO 3.11.2015 nro 15/0294/2 (1.1.2016 alkaen). ESAVI ja VHO päätökset lainvoimaiseksi 9.1.2017 alkaen (KHO päätös nro 17/2017). Vaatimukset täytettävä neljännesvuosikeskiarvoina, mutta kokonaistypen, ammoniumtypen ja bisfenoli A:n osalta vuosikeskiarvona * tavoitearvo ** vuosikeskiarvo

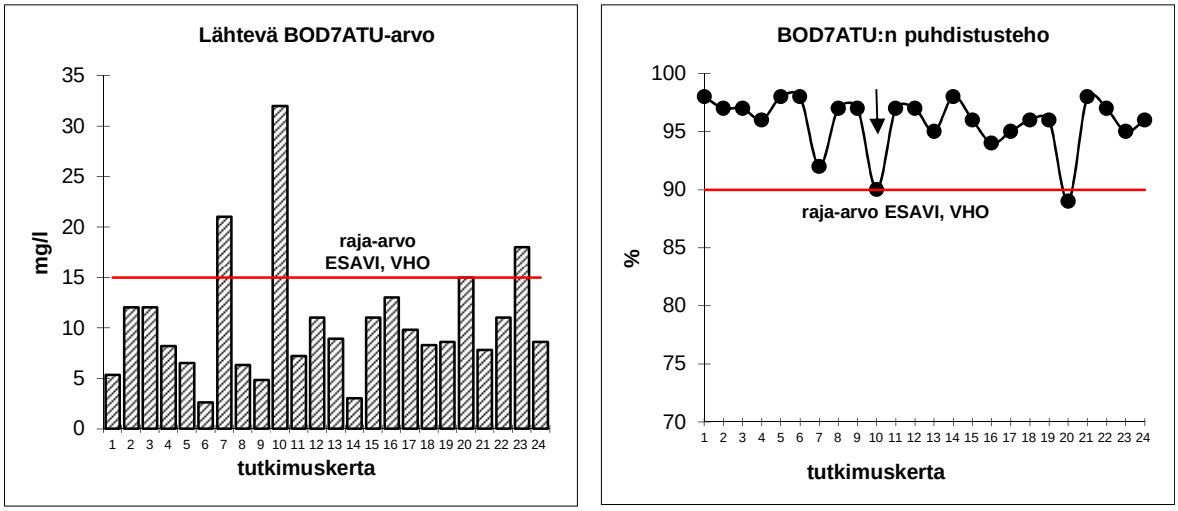
Lähtevän jäteveden hygieeninen laatu täytti ympäristöluvan puhdistusvaatimukset kolmen kuukauden keskiarvoina tarkasteltuna (touko–heinäkuu ja elo–lokakuu) ajanjaksolla 1.5.–31.10.2017 (*liite 16*):

		2017 1.5.–31.7.	2017 1.8.–31.10.	ESAVI raja-arvo 3 kk keskiarvo
Fekaaliset koliformit	pmy/100 ml	895	101	2000
Suolistoperäiset enterokokit	pmy/100 ml	486	408	500

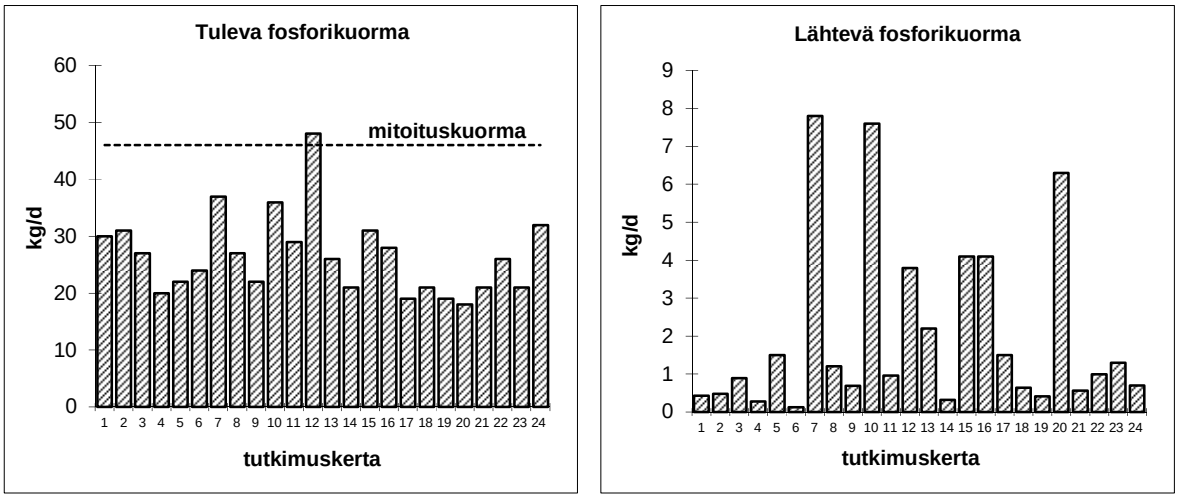
Eurajokeen johdetun jäteveden keskimääräiset pitoisuudet, kuormitukset ja puhdistamon puhdistustehot sekä luvan puhdistusvaatimusten täyttyminen tarkkailukerroilla on esitetty *kuvissa 6–16* (*liite 3*). Tarkkailukerroilla ei ollut ohituksia. Vuoden aikana tapahtuneet ohitukset ovat jaksojen vesistökuormissa mukana.



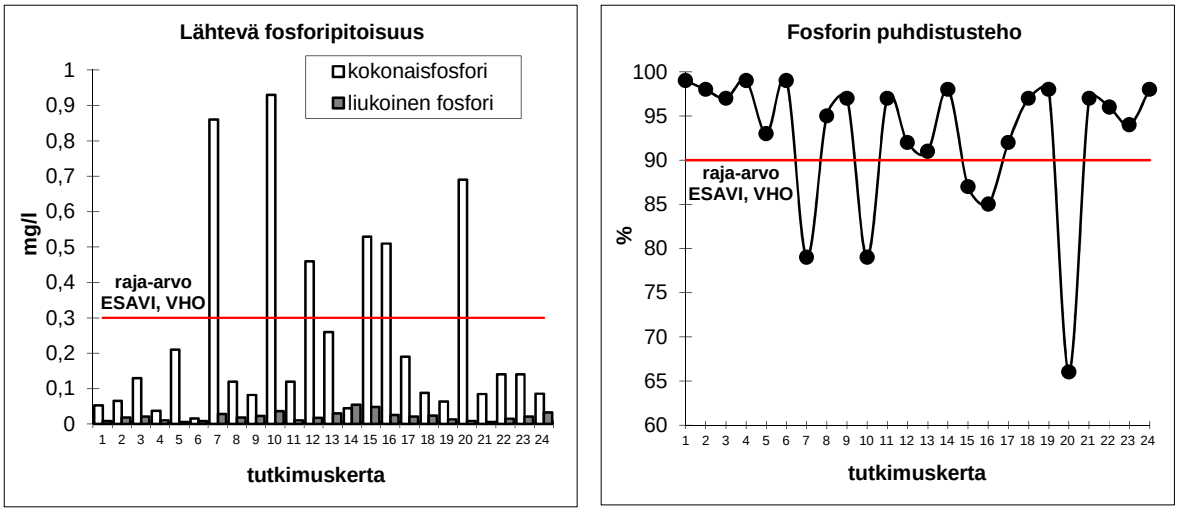
KUVA 6. Tulevan ja lähtevän veden BOD_{7ATU}-kuorma (kg/d) tarkkailukerroilla. Laajennetun puhdistamon mitoitusarvo tulevalle BOD_{7ATU} -kuormalle on 2 250 kg/d.



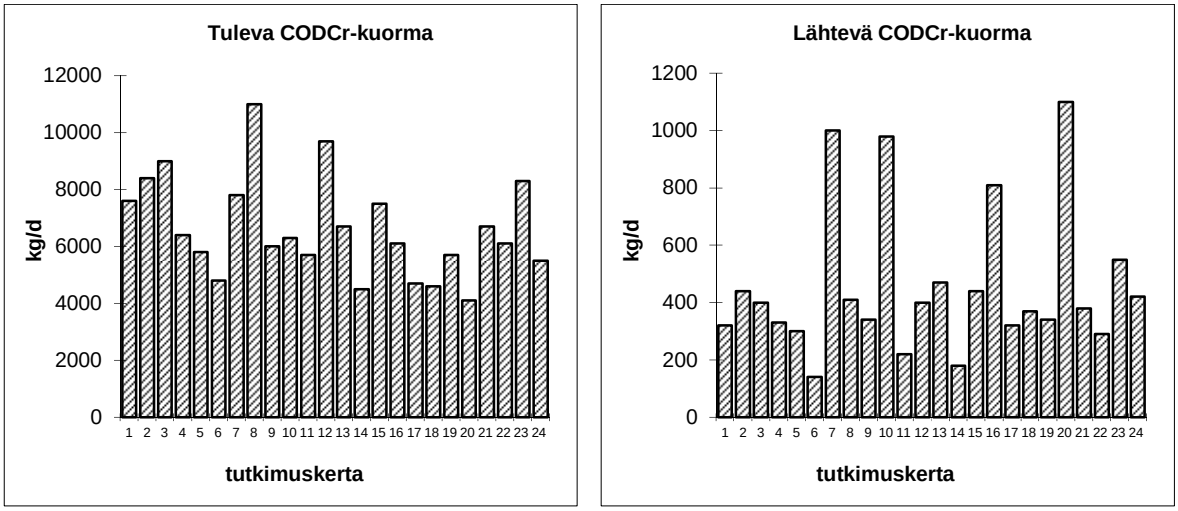
KUVA 7. Lähtevän veden BOD_{7ATU}-arvo (mg/l) ja puhdistusteho (%) tarkkailukerroilla.



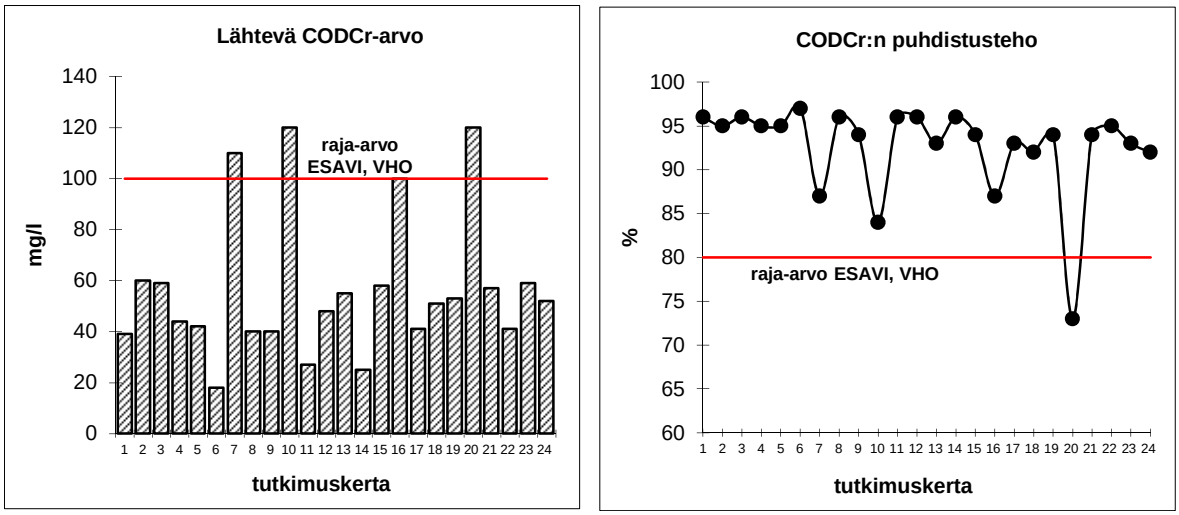
KUVA 8. Tulevan ja lähtevän veden fosforikuorma (kg/d) tarkkailukerroilla. Laajennetun puhdistamon mitoitusarvo tulevalle fosforikuormalle on 46 kg/d.



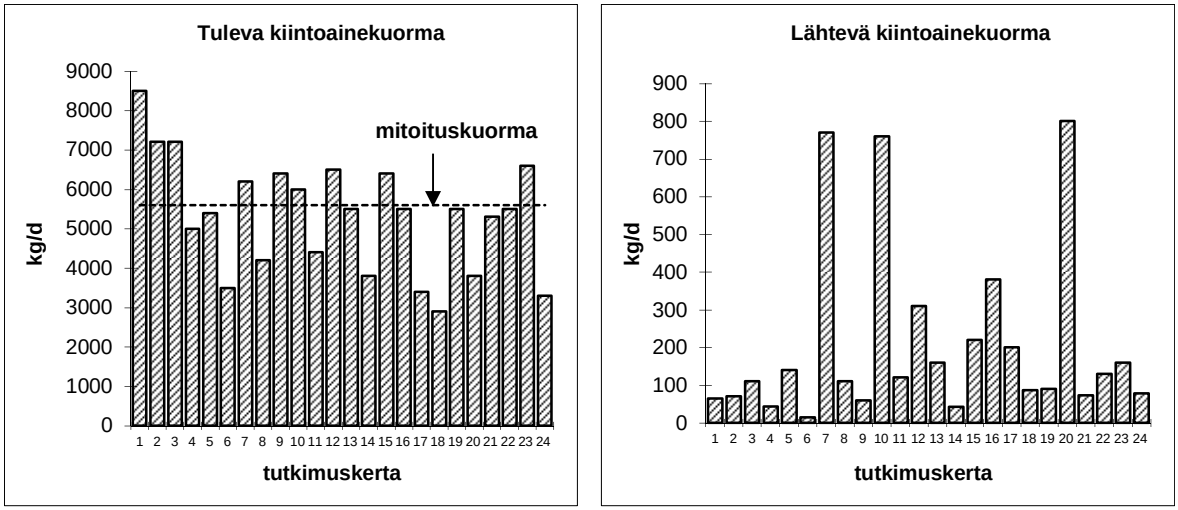
KUVA 9. Lähtevän veden fosforipitoisuus (mg/l) ja puhdistusteho (%) tarkkailukerroilla.



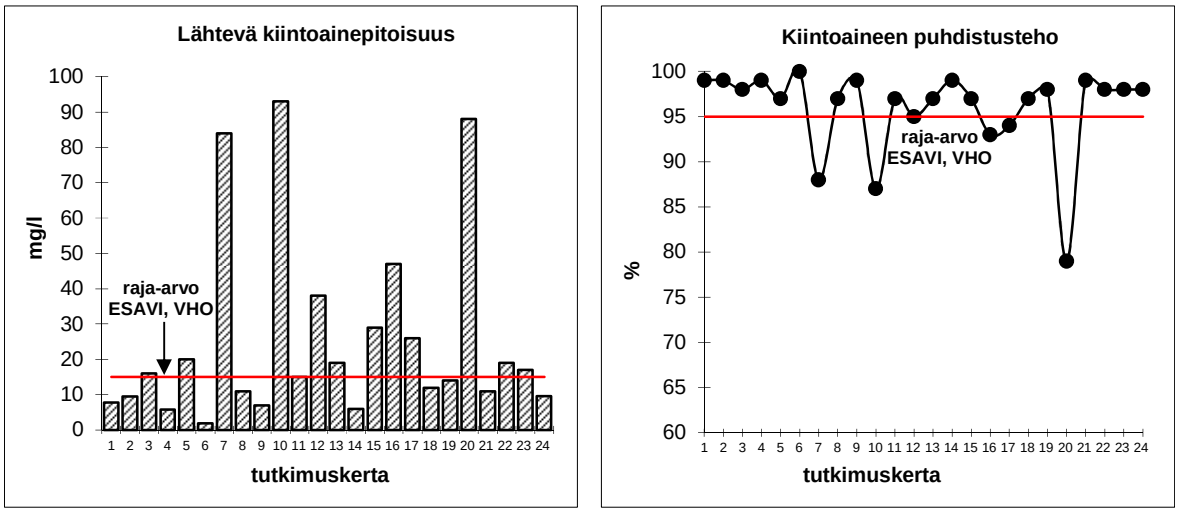
KUVA 10. Tulevan ja lähtevän veden COD_{Cr}-kuorma (kg/d) tarkkailukerroilla.



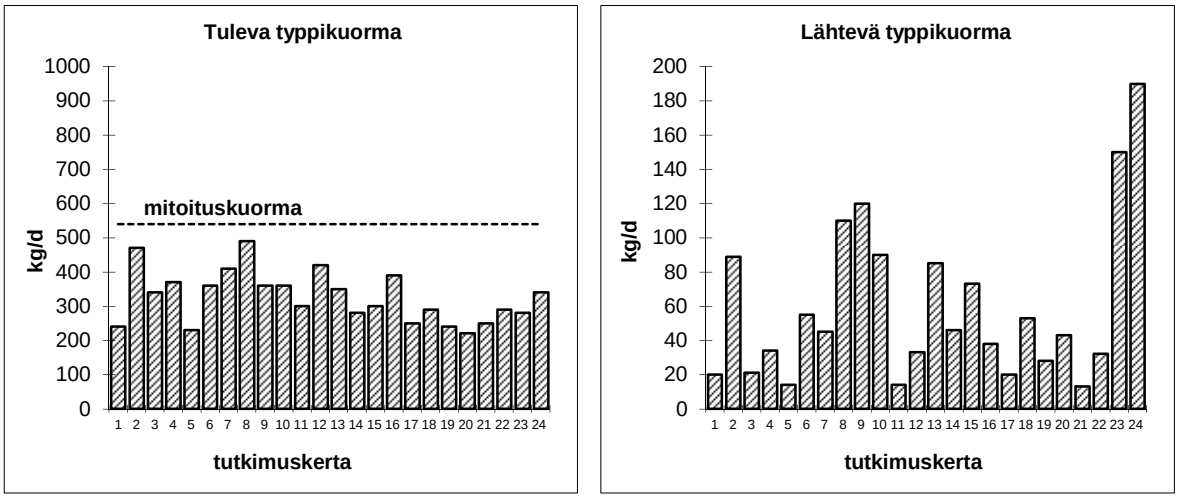
KUVA 11. Lähtevän veden COD_{Cr}-arvo (mg/l) ja puhdistusteho (%) tarkkailukerroilla.



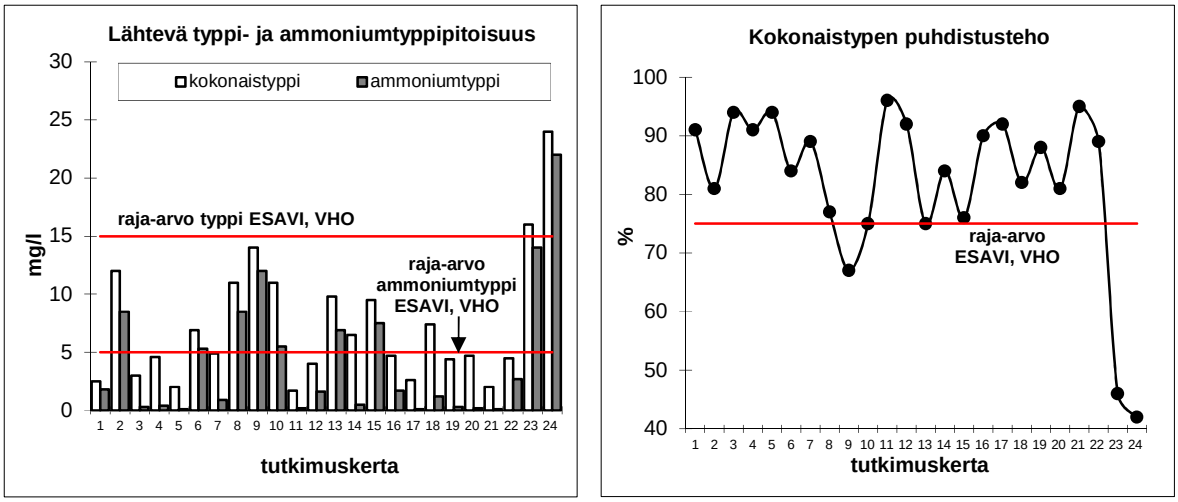
KUVA 12. Tulevan ja lähtevän veden kiintoainekuorma (kg/d) tarkkailukerroilla. Laajennetun puhdistamon mitoitusarvo tulevalle kiintoainekuormalle on 5 600 kg/d.



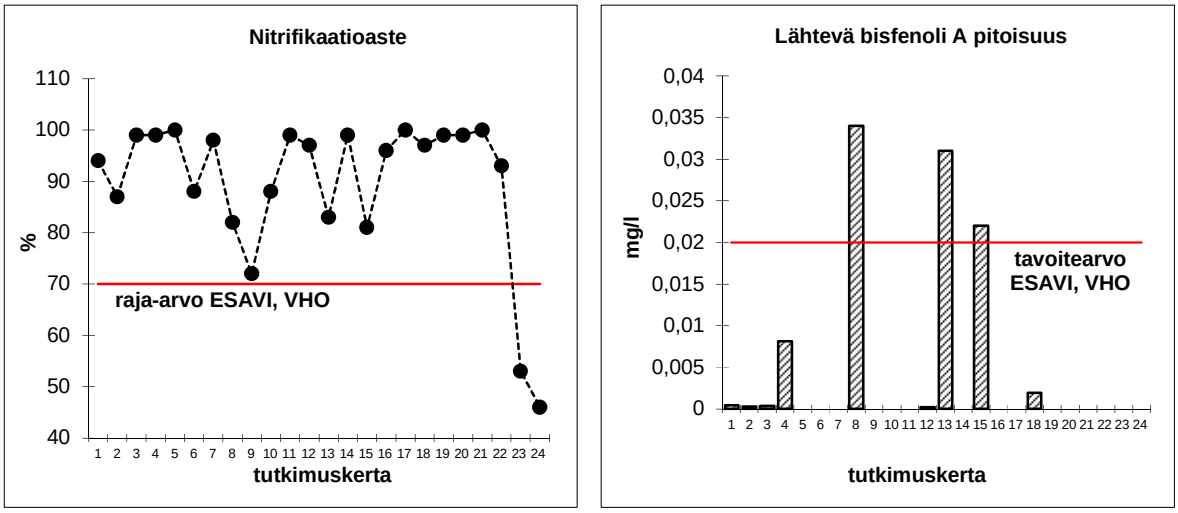
KUVA 13. Lähtevän veden kiintoainepitoisuus (mg/l) ja puhdistusteho (%) tarkkailukerroilla.



KUVA 14. Tulevan ja lähtevän veden typpikuorma (kg/d). Laajennetun puhdistamon mitoitusarvo tulevalle typpikuormalle on 540 kg/d.



KUVA 15. Lähtevän veden typpi- ja ammoniumtyppipitoisuus (mg/l) sekä kokonaistypen puhdistusteho (%) tarkkailukerroilla.



KUVA 16. Nitrifikaatioaste (%) ja lähtevän veden bisfenoli A:n pitoisuus (mg/l) tarkkailukerroilla.

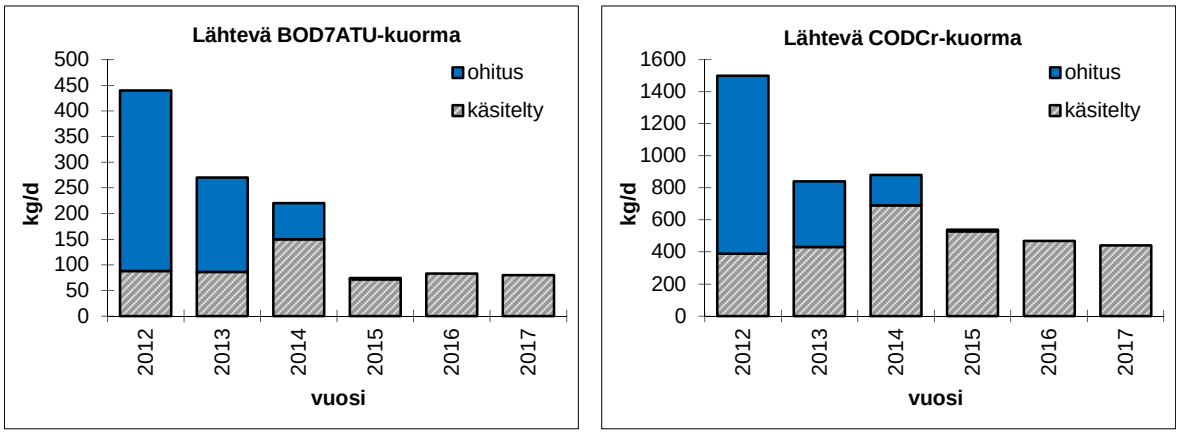
Jäteveden Eurajokeen aiheuttama kuormitus on kehittynyt *taulukon 18* mukaisesti (*kuvat 17–19, liite 4*).

Kuvissa 17–19 sinisellä merkityt osuudet ovat vuosittain raportoitujen ohituksien osuudet kokonaisvesistökuormasta. Vuodesta 2012 lähtien vesistökuormassa on ollut mukana kuntalinjalta tulevan jäteveden ohitukset.

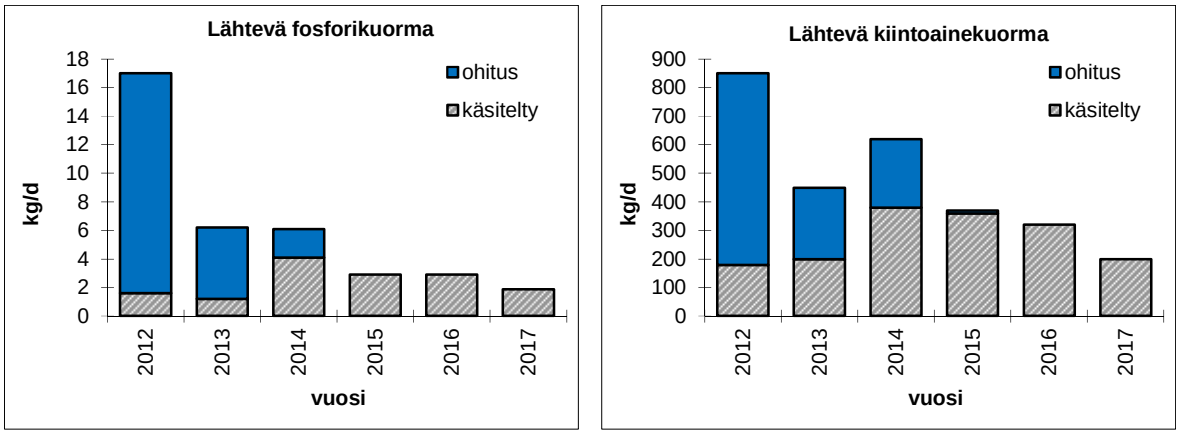
TAULUKKO 18. Jäteveden vesistöön aiheuttama kuormitus vuosina 2012–2017.

		2012*	2013	2014	2015	2016	2017
BOD_{7ATU}	kg/d	440	270	220	74	83	80
COD_{Cr}	kg/d	1 500	840	880	540	470	440
Kokonaisfosfori	kg/d	17	6,2	6,1	2,9	2,9	1,9
Kokonaistyppi	kg/d	170	160	250	100	54	57
Ammoniumtyppi	kg/d	140	120	200	61	16	35
Kiintoaine	kg/d	850	450	620	370	320	200
Bisfenoli A	kg/d	1,6	0,61	0,82	0,35	0,034	0,037

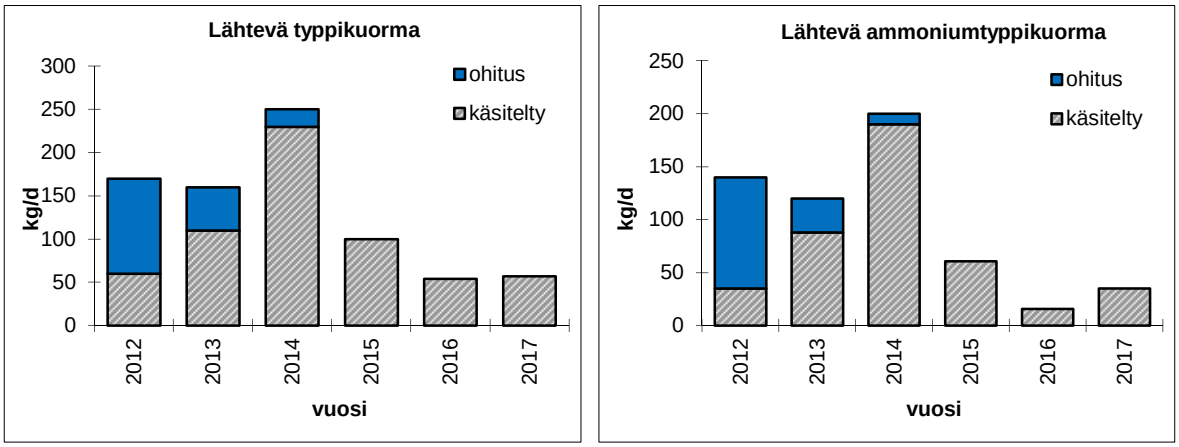
* kuntalinjan ohitukset mukana vesistökuormituksessa 2012 lähtien.



KUVA 17. Jäteveden vesistöön aiheuttama keskimääräinen BOD_{7ATU}- ja COD_{Cr}-kuorma (kg/d) vuosina 2012–2017.



KUVA 18. Jäteveden vesistöön aiheuttama keskimääräinen fosfori- ja kiintoainekuorma (kg/d) vuosina 2012–2017.



KUVA 19. Jäteveden vesistöön aiheuttama keskimääräinen typpi- ja ammoniumtyppikuorma (kg/d) vuosina 2012–2017.

3.3. Valtioneuvoston asetuksen 888/2006 mukainen tarkastelu

Yhdyskuntajätevesien tulee täyttää oman ympäristöluvan vaatimusten lisäksi myös valtioneuvoston asetuksen yhdyskuntajätevesistä (888/2006) mukaiset vaatimukset. Asetus 888/2006 tuli voimaan 1.11.2006 ja kumosi samalla valtioneuvoston päätökset 365/1994 ja 757/1998. Asetusta sovelletaan ympäristönsuojelulain (86/2000) 28 §:n mukaista ympäristölupaa edellyttävään yhdyskuntajätevesien käsittelyyn ja johtamiseen. Valtioneuvoston asetuksessa 888/2006 edellytetään vuositasolla *taulukon 19* mukaisia tuloksia.

Asetuksen 888/2006 mukaan vesistöön laskettavaa jätevettä koskevien vaatimusten tarkkailemiseksi on samoista kohdista kerättävä jätevesimäärään verrannolliset 24 tunnin kokoomanäytteet puhdistamolta lähtevästä ja tarvittaessa puhdistamolle tulevasta jätevedestä. Jätevedenpuhdistamon, jonka AVL on enintään 499, tarkkailu voidaan kuitenkin tehdä päiväajan vähintään kahdeksan tunnin kokoomanäytteestä.

Näytteiden vähimmäismäärä määräytyy puhdistamon koon mukaan seuraavasti: AVL enintään 499 2 näytettä/vuosi, AVL 500–1999 4 näytettä/vuosi, AVL 2 000–9 999 12 näytettä ensimmäisen vuoden aikana ja neljä näytettä seuraavina vuosina (jos voidaan osoittaa tulosten täyttävän ensimmäisen vuoden aikana vaatimukset), AVL 10 000–49 999 12 näytettä/vuosi ja AVL vähintään 50 000 24 näytettä/vuosi.

Lisäksi asetuksen 888/2006 mukaan veden laadun ääriarvoja ei oteta huomioon, jos ne johtuvat poikkeuksellisista tilanteista, kuten rankkasateista.

Länsi-Suomen ympäristölupaviraston 27.12.2002 myöntämässä päätöksessä nro 78/2002/4 vaaditaan, että vesistöön johdettavan jäteveden pitoisuusarvojen ja käsittelytehon prosentuaalisten arvojen on täytettävä valtioneuvoston päätösten 365/1994 ja 757/1998 edellyttämät pitoisuuden ja käsittelytehon raja-arvot päätösten edellyttämällä tavalla tarkkailtuna.

Etelä-Suomen aluehallintoviraston päätöksen 11/2013/1 mukaan jätevesien biologisen käsittelyn on täytettävä yhdyskuntajätevesistä annetun valtioneuvoston asetuksen 888/2006 liitteen taulukon 1 vaatimukset (BOD_{7atu}, COD_{Cr} ja kiintoaine) asetuksen edellyttämällä tavalla tarkkailtuna. Fosforin ja typen poiston on puhdistamolla täytettävä asetuksen liitteen taulukon 2 vaatimukset. Tarkkailun on täytettävä asetuksen liitteen B-osassa asetetut vaatimukset.

TAULUKKO 19. Valtioneuvoston asetuksessa 888/2006 vuositasolla edellytetyt tulokset.

	Pitoisuus mg/l	Poistoteho %	Huom.
BOD_{7ATU}	30	70	1, 6, 7
COD_{Cr}	125	75	1, 6, 7
Kiintoaine	35	90	1, 6, 7
Kokonaisfosfori	3/2/1	80	1, 2, 4
Kokonaistyppi	15/10	70	1, 3, 4, 5

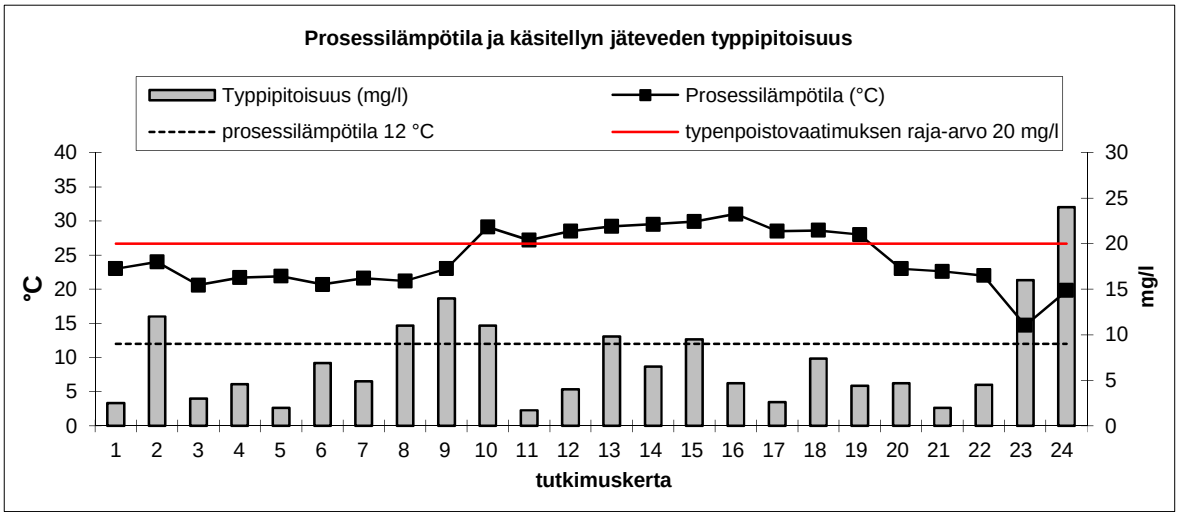
Huom 1. Pitoisuus ja poistoteho voivat olla vaihtoehtoisia.
Huom 2. 3 mg/l on puhdistamoille, joiden AVL on alle 2 000. 2 mg/l on puhdistamoille, joiden AVL on 2 000-100 000. 1 mg/l on puhdistamoille, joiden AVL on yli 100 000.
Huom 3. 15 mg/l on puhdistamoille, joiden AVL on 10 000-100 000. 10 mg/l on puhdistamoille, joiden AVL on yli 100 000.
Huom 4. Ravinteiden (fosfori ja typpi) osalta arvot on saavutettava vuosikeskiarvoina.
Huom 5 Typpeä koskevien vaatimusten mukaisuus saadaan kuitenkin varmistaa käyttämällä päivittäisiä keskiarvoja, jos voidaan osoittaa, että vastaava suojelun taso saavutetaan. Tällöin **jokaisen** 24 tunnin kokoomanäytteen kokonaistyppipitoisuus voi olla **enintään 20 mg/l**, kun veden lämpötila laitoksen biologisessa prosessissa on **vähintään 12 °C**. Lämpötilarajan asettamisen sijasta voidaan rajoittaa typpeä koskevien vaatimusten voimassaoloaikaa alueellisten ilmastoolosuhteiden huomioon ottamiseksi.
Huom 6. Puhdistamoita, joiden AVL ≥ 2 000, tarkastellaan tarkkailukertakohtaisesti. Puhdistamoita, joiden AVL < 2 000, näytteiden vuosikeskiarvojen tulee täyttää pitoisuuden tai poistotehon vaatimukset.
Huom 7. Enimmäispitoisuus voidaan ylittää tavanomaisissa käyttöolosuhteissa enintään 100 %:lla. Kiintoainepitoisuuden osalta voidaan kuitenkin hyväksyä ylitykset 150 %:iin asti.

VN:n asetuksen 888/2006 mukainen puhdistustuloksen tarkastelu tehdään vesistöön johdetun kokonaiskuormituksen perusteella (ohitukset mukaan luettuna).

Viiden vuoden (2013–2017) tarkkailukertojen BOD_{7ATU}-tulokuormien perusteella puhdistamon AVL_{90} on 41 860 asukasta. AVL_{90} on laskettu luvulla, joka on viiden viimeisen vuoden näytepäivien BOD_{7ATU}-tulokuormien jakauman arvo (2 930 kg/d), jonka alle jää 90 % tulokuormista. Raportointivuoden tarkkailukertojen maksimi BOD_{7ATU}-tulokuorman mukaan puhdistamon AVL on 45 700 asukasta ja keskimääräisen tulokuorman mukaan 29 000 asukasta.

JVP–Eura Oy:n jätevedenpuhdistamon AVL on >10 000, joten VN asetuksen mukaista tulosta tarkastellaan BOD_{7ATU}:n, COD_{Cr}:n, kiintoaineen, fosforin ja typen osalta (*taulukko 18*). Pitoisuusvaatimus on fosforin osalta 2 mg/l ja typen osalta 15 mg/l. BOD_{7ATU}:n, COD_{Cr}:n ja kiintoaineen osalta tuloksia tarkastellaan tarkkailukertakohtaisesti. Fosforin ja typen osalta näytteiden vuosikeskiarvojen tulee täyttää vaatimukset.

Puhdistamon prosessilämpötila oli >12 °C 24 tarkkailukerralla (24/24, *kuva 20*). Käsitellyn jäteveden typpipitoisuus oli <20 mg/l 23 tarkkailukerralla (23/24). Typen osalta tulosta tarkastellaan vuosikeskiarvona.



KUVA 20. Tarkkailukertojen prosessilämpötila (°C) ilmastusaltaassa ja käsitellyn veden typpipitoisuus (mg/l) tarkkailukerroilla. Kun prosessilämpötila on vähintään 12 °C, saa jokaisen kokoomanäytteen typpipitoisuus olla enintään 20 mg/l (asetuksen 888/2006 mukainen typenpoistovaatimuksen varmistaminen, taulukko 19 Huom. 5).

Jätevedenpuhdistamon VN asetuksen 888/2006 mukaisen tarkastelun tulokset on esitetty *taulukoissa 20* ja *21* (*liite 3*). Vuosikeskiarvot on laskettu *liitteen 4* mukaisen laskentatavan mukaan koko vuoden osalta.

TAULUKKO 20. VN asetuksen 888/2006 mukaisen tarkastelun tulokset BOD_{7ATU}:n, COD_{Cr}:n ja kiintoaineen osalta tarkkailukertakohtaisesti tarkasteltuna. Arvot, jotka eivät täyttäneet vaatimuksia, on esitetty punaisella. Sallittu määrä näytteitä, jotka eivät täytä vaatimuksia, on 3/24.

	Saavutettu pitoisuus*) [kpl/tarkkailukertaa]	Saavutettu teho*) [kpl/tarkkailukertaa]	Vaadittu määrä [kpl/tarkkailukertaa]
BOD_{7ATU}	23/24	24/24	21/24
COD_{Cr}	24/24	23/24	21/24
Kiintoaine	19/24	21/24	21/24

* Pitoisuus ja poistoteho voivat olla vaihtoehtoisia, taulukko 19 Huom.1

TAULUKKO 21. VN asetuksen 888/2006 mukaisen tarkastelun tulokset fosforin ja typen osalta vuosikeskiarvoina laskettuna. Arvot, jotka eivät täyttäneet vaatimuksia, on esitetty punaisella.

	Saavutettu pitoisuus [mg/l]	Saavutettu teho [%]	Pitoisuusvaatimus [mg/l]*	Puhdistusteho-vaatimus [%]*
Kokonaisfosfori	0,25	93	2	80
Kokonaistyppi	7,5	82	15	70

* Pitoisuus ja poistoteho voivat olla vaihtoehtoisia

VN asetuksen 888/2006 vaatimukset saavutettiin BOD_{7ATU}:n ja COD_{Cr}:n pitoisuuden ja puhdistustehon osalta sekä kiintoaineen puhdistustehon osalta tarkkailukertakohtaisesti tarkasteltuna. Koska pitoisuus ja puhdistustehot ovat vaihtoehtoisia, saavutettiin vaadittu puhdistustulos myös kiintoaineen osalta (*taulukko 20*). Kokonaisfosforin ja kokonaistypen osalta asetuksen 888/2006 vaatimukset saavutettiin vuosikeskiarvoina tarkasteltuna (*taulukko 21*).

VN asetuksen 888/2006 mukaan (*taulukko 19 huomautus 7*) enimmäispitoisuus voidaan ylittää tavanomaisissa käyttöolosuhteissa enintään 100 %:lla (BOD_{7ATU}-arvo max 60 mg/l ja COD_{Cr}-arvo max 250 mg/l) ja kiintoaineen osalta 150 %:lla (kiintoainepitoisuus max 88 mg/l). Lähtevä kiintoainepitoisuus ylitti maksimiarvon kerran (1/24) (*kuva 12*).

4. PUHDISTAMOLIETE JA MUUT JÄTTEET

4.1. Lietteitä ja jätteitä koskeva lainsäädäntö

Yhdyskuntajätevesilietteen tuottajan on määritettävä lietteen sisältämien raskasmetallien (Cd, Cr, Cu, Ni, Pb, Zn) ja tarvittaessa muiden haitallisten aineiden pitoisuudet sekä kokonaistypen ja kokonaisfosforin pitoisuudet. Lietteen laatu on tutkittava asetuksen 179/2012 liitteen 5 mukaisesti. Analysointitiheys on >40 000–100 000 AVL puhdistamoille ensimmäisenä vuonna ≥ 6 krt/a, muina vuosina ≥ 3 krt/a. Jos puhdistamolle tulevan jäteveden laatu muuttuu merkittävästi, on analyysikertoja lisättävä vähintään sellaiselle tasolle, jota edellytetään ensimmäisenä vuonna.

Jos tutkittua lietettä tai lietteestä valmistettua lannoitevalmistetta käytetään maa- tai puutarhataloudessa, maisemoinnissa, viherrakentamisessa tai metsätaloudessa, tulee sen laadun täyttää maa- ja metsätalousministeriön lannoitevalmisteasetuksessa (24/11 ja asetuksen muutos 12/12) asianomaiselle tyyppinimelle asetetut vaatimukset. Sellaisenaan käytettävän lietelannoitevalmisteen on täytettävä myös lannoitevalmisteasetuksen nojalla asetetut hygieniavaatimukset (Salmonella 0 kpl/25 g ja Escherichia coli <1000 kpl/g). Lannoitevalmisteasetus ei kuitenkaan koske kaatopaikkojen tai muiden suljettujen alueiden maisemoinnissa käytettäviä lannoitevalmisteita.

Toukokuussa 2013 annettu Valtioneuvoston asetus kaatopaikoista 331/2013 rajoittaa biohajoavan ja muun orgaanisen jätteen sijoittamista kaatopaikalle. 1.1.2016 voimaan astuvan asetuksen 28 §:n mukaan kaatopaikan jätetäyttöön hyväksytään vain sellaista tavanomaista jätettä, jonka biohajoavan ja muun orgaanisen aineksen pitoisuus määritettynä orgaanisen hiilen kokonaismääränä (TOC) tai hehkutushäviönä on enintään 10 %. Vesihuoltolaitosten toiminnassa tyypillisesti syntyviä orgaanista ainesta sisältäviä jätteitä ovat muun muassa puhdistamoliete, välppäjäte sekä pesun tehosta riippuen hiekanerotushiekka.

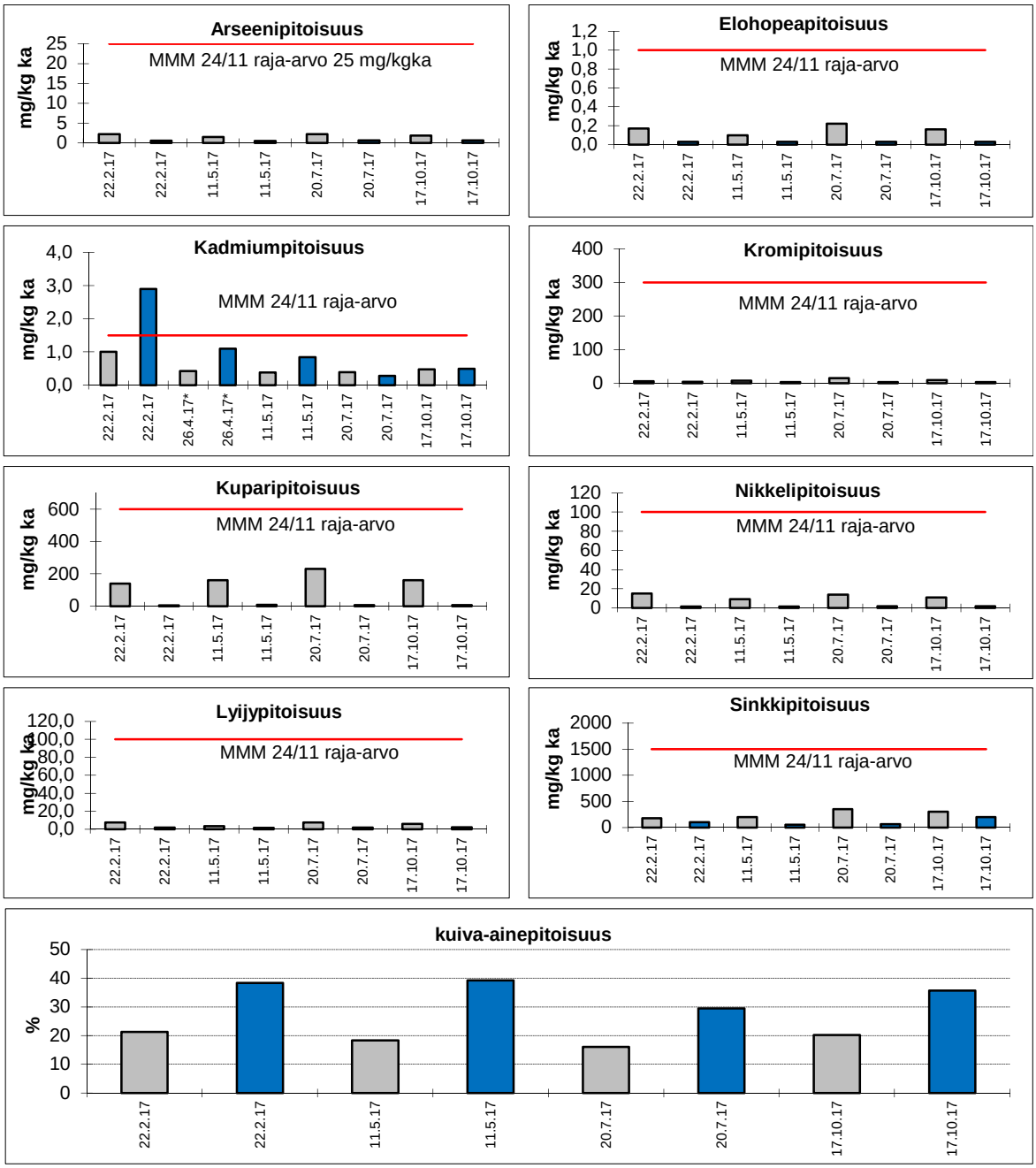
4.2. Puhdistamolietteen määrä, laatu ja sijoitus

Kuntalinjan esiselkeytyksessä muodostuva liete johdetaan tiivistämöön. Biologisen prosessin ylijäämäliete poistetaan väliselkeytysaltaasta (kuntalinjan jätevedet ja paperitehtaan jätevedet yhteensä) ja flotaatiossa muodostuva kemiallinen liete poistetaan flotaatioaltaasta ja johdetaan tiivistämöön. Näiden eri lietejakeiden tiivistetty seosliete kuivataan lingolla. Puhdistamolta vietiin vuoden aikana yhteensä 4 030,4 tn kuivattua kuntalinjan, biologisen ja kemiallisen prosessin seoslietettä Gasum Biotehdas Oy:n Vambion biokaasulaitokselle mädätettäväksi (*liite 2*). Seoslietteen laatua tutkittiin neljä kertaa vuoden aikana (*liite 15*). Kuivatun seoslietteen kuiva-ainepitoisuus oli keskimäärin 19,0 % ja kuiva-aineen määrä oli yhteensä 766 tn/a. Erotetun lietteen kuiva-aine käsiteltyä jätevesimäärää kohden oli 0,28 kg/m^3.

Paperitehtaalta tuleva kuitusaviliete poistetaan esiselkeytysaltaasta, sakeutetaan omassa tiivistämössä ja kuivataan omalla lingolla. Paperitehtaan kuivattua kuitusavilietettä syntyi vuoden aikana yhteensä noin 2 540,8 tn ja lietteet toimitettiin Loimi-Hämeen Jätehuolto Oy:n Hallavaaran jätekeskukseen ja marraskuusta 2017 lähtien Adven Oy:lle. Kuitusavilietteen laatua tutkittiin neljä kertaa vuoden aikana (*liite 15*). Kuivatun kuitulietteen kuiva-ainepitoisuus oli keskimäärin 35,7 % ja kuiva-aineen määrä oli yhteensä 759 tn/a. Erotetun lietteen kuiva-aine paperitehtaalta tulevaa jätevesimäärää kohden oli 0,33 kg/m^3.

Tutkittujen lietenäytteiden raskasmetallipitoisuudet olivat lannoitevalmisteelle sallittuja enimmäispitoisuuksia pienempiä lukuun ottamatta 22.2.2017 kuitusavilietteen kadmiumpitoisuutta, joka oli koholla raja-arvoon nähden (*MMM, asetus lannoitevalmisteita 24/11*). 22.2.2017 myös seoslietteen kadmiumpitoisuus oli tavanomaista korkeampi. Lietteiden kadmiumpitoisuudet olivat olleet tavanomaista korkeammat myös 28.9.2016 näytteissä (*Lähde: Puhdistamon vuosiyhteenveto 2016*). Seoslietteen ja kuitusavilietteen kadmiumpitoisuudet tutkittiin ylimääräisellä tutkimuksella 26.4.2017 ja tällöin pitoisuudet alittivat raja-arvot (*kuva 21, liite 15*).

JVP–Eura Oy:n kuivatun seoslietteen ja kuitusavilietteen kuiva-ainepitoisuudet ja raskasmetallipitoisuudet vuonna 2017 on esitetty *kuvassa 21*. Kuivatun kuitusavilietteen laatu on merkitty kuviin sinisillä pylväillä.



KUVA 21. Kuivatun lietteen kuiva-aine ja raskasmetallipitoisuus vuonna 2017. Sinisellä on merkitty paperitehtaan kuitusaviliete.

4.3. Muut puhdistusprosessissa syntyvät jätteet

Puhdistusprosessissa syntyy puhdistamolietteen lisäksi välpettä sekä hiekanerotuksessa erottuvaa hiekkajätettä, joiden yhteismäärä oli noin 16,5 tn/a. Vuoden aikana syntyneiden jätteiden määrät ja loppusijoitustiedot on raportoitu *liitteessä 2*.

5. TUNNUSLUVUT

JVP–Eura Oy:n jätevedenpuhdistamon tunnusluvut vuodelta 2017 ovat *taulukossa 22*.

TAULUKKO 22. Puhdistamon tunnusluvut vuosilta 2012–2017.

		2012	2013	2014	2015	2016	2017
Käsitelty vesimäärä Q	m^3	2 675 823	2 646 998	2 986 188	2 830 533	2 790 684	2 768 937
Käsitelty vesimäärä Q_{kesk}	m^3/d	7 310	7 250	8 180	7 755	7 625	7 586
Maksimivesimäärä Q_{max}	m^3/d	9 614	10 839	12 019	13 505	13 209	11 509
Paperiteollisuuslinjan ohitus	m^3	0	0	49 093	13 635	482	0
Verkosto-ohitus (Euran kunta)	m^3	0	765	0	540	400	250
Kuntalinjan ohitus	m^3	379 813	206 190	86 412	760	0	0
Väliselkeytetty ohitus (sis.käsitelty)	m^3	12 250	23 544	17 254	19 780	3 085	0
Sako- ja umpikaivoliete	m^3	2 676	0	0	95	622	479
AVL keskimäärin	asukasta	27 000	26 000	27 000	21 400	30 000	30 000
AVL max	asukasta	51 000	43 000	70 000	55 700	67 100	45 700
Tuleva BOD-kuorma kesk.	kg/d	1 900	1 800	1 900	1 500	2 100	2 100
Tuleva BOD-kuorma max	kg/d	3 600	3 000	4 900	3 900	4 700	3 200
Tuleva fosforikuorma kesk.	kg/d	61	40	35	23	36	27
Tuleva fosforikuorma max	kg/d	170	83	66	55	61	48
Tuleva typpikuorma kesk.	kg/d	440	360	400	310	360	330
Tuleva typpikuorma max	kg/d	990	680	980	790	760	490
Paperitehdas ES pintakuorma [1)]	m/h	0,75	0,75	0,8	0,71	0,73	0,77
Kuntalinja ES pintakuorma [1)]	m/h			0,55	0,53	0,5	0,44
Uusi ilmastusallas [2)]							
Lietekuorma (L_{MLSS}) 1-linja	$kg_{BOD}/kg_{MLSS}*d$			0,13	0,086	0,76	0,093
Lietekuorma (L_{MLSS}) 2-linja	$kg_{BOD}/kg_{MLSS}*d$			0,13	0,085	0,75	0,093
Lietekuorma (L_{MLSS}) 3-linja	$kg_{BOD}/kg_{MLSS}*d$			0,13	0,085	0,76	0,094
Tilavuuskuorma (L_v 1-3 linjat)	kg_{BOD}/m^3*d			0,38	0,31	0,31	0,30
VS pintakuorma 1-2 linjat kesk.[3)]	m/h	1,1	1,1	1,2	1,15	1,14	1,13
Polyalumiinikloridi [4)]	g/m^3	132	125	80	60	62	66,4
Polymeeri jäteveteen	g/m^3	0,6	1,2	0,92	0,8	0,6	0,73
Sooda	g/m^3	0,65	-	-	-	-	-
Permuurahaishappo [5)]				15,2	9,5	11,4	16,8
- Muurahaishappo	g/m^3			7,2		5,7	8,4
- Vetyperoksidi (H_2O_2)	g/m^3			8		5,7	8,4
Sähkönkulutus	kWh/m^3	0,58	0,6	0,72	0,95	1,1*	1,0
Kuivattu seoslietemäärä	tn	3 542	4 078	3 633	3 979	4 230	4 030
Lietteen kuiva-aine	$kgTS/m^3_{jv}$	0,31	0,3	0,24	0,26	0,34	0,28
Kuivattu pap.teoll.kuituliete	tn	1 770	1 553	1 711	1 852	2 379	2 540
Lietteen kuiva-aine	$kgTS/m^3_{jv}$	0,3	0,29	0,3	0,37	0,31	0,33

[1)] 28.1.2014 lähtien paperiteollisuuslinjan ja kuntalinjan jätevesillä omat esiselkeytykset
[2)] Uuden ilmastusaltaan kuormitusarvot laskettu esiselkeytetyn jäteveden yhteiskuormasta 1.10.2014 lähtien
[3)] Oletus, että molemmat linjat olivat käytössä ja virtaama jakautui tasaisesti
[4)] Saostuskemikaali v. 2012 alkaen PAX-XL100
[5)] Laskettu syöttöajan käsiteltyä jätevesimäärää kohden
* arvioitu keskimääräisen vrk kulutuksen mukaan

6. TULOSTEN TARKASTELU

Puhdistamo on saneerattu vuosien 2003–2004 aikana keskusjätevedenpuhdistamoksi, jossa käsitellään sekä teollisuuden (paperi- ja elintarviketeollisuus) että yhdyskunnan jätevesiä. Puhdistamolla käytetään matalakuormitteista biologista kantoaineprosessia (denitrifikaatio-nitrifikaatio) typenpoistoon. Lisäksi puhdistusprosessia on tehostettu lisäämällä flotaatio-käsittely väliselkeytyksen jälkeen. Sako- ja umpikaivolietteiden vastaanotto puhdistamolle keskeytettiin lokakuusta 2012 lähtien. Lietteiden vastaanotto aloitettiin marraskuussa 2015.

Vuonna 2013 alkanut laajennus- ja saneerausurakka saatiin valmiiksi lokakuussa 2014. Puhdistamolle rakennettiin toinen esiselkeytysallas, uusi ilmastusallas, tiivistämö ja metanolin annostelu. Nykyisin sekä kuntalinjan että paperitehtaan jätevesillä on omat esiselkeytykset, joista jätevedet johdetaan uuteen ilmastusaltaaseen. Uudessa ilmastusaltaassa (3 rinnakkaista linjaa) kokonaistypenpoisto on toteutettu denitrifkaatio-nitrifikaatio (DN) -prosessilla.

Päästötarkkailunäytteet kerättiin puhdistamolle kuntalinjalta tulevasta jätevedestä (Euran kunta, HKScan Finland Oy ja muut teollisuusliittyjät, tuodut sako- ja umpikaivolietteet), Jujo Thermal Oy:n paperitehtaalta tulevasta jätevedestä, väliselkeytetystä jätevedestä ja puhdistamolta lähtevästä jätevedestä automaattisilla näytteenottimilla koko vuorokauden ajan virtaaman suhteen painottaen. Kuntalinjan ja paperitehtaan esiselkeytettyjen jätevesien kokoomanäytteet kerättiin manuaalisesti. Lähtevän jäteveden fenolisten yhdisteiden tarkkailua kerättiin kertanäytteet lähtevän jäteveden näytepisteestä. Vesistöön johdetun jäteveden hygieenistä laatua tarkkailtiin purkuputken alkupään kaivosta otetulla kertanäytteellä, joka sisältää mahdolliset puhdistamo-ohitukset ja jäteveden hygienisoinnin. Näytepaikat ja näytteiden keräystavat on esitetty *liitteessä 18*.

6.1. Puhdistusvaatimusten täyttyminen

Puhdistustulosta on verrattu voimassa olevan ympäristöluvan (Etelä-Suomen aluehallintoviraston 23.1.2013 päätös nro 11/2013/1 ja Vaasan hallinto-oikeuden 3.11.2015 päätös nro 15/0294/2) puhdistusvaatimuksiin.

Puhdistamo toimi hyvin **jakson 1-2017** aikana ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. **Jakson 2-2017** puhdistustulos täytti ympäristöluvan puhdistusvaatimukset vesistöön johdettua kokonaisfosfori- ja kiintoainepitoisuutta sekä kiintoaineen puhdistustehoa lukuun ottamatta. Jakson keskimääräistä puhdistustulosta heikensivät tarkkailukerran 5.4.2017 kohtalainen ja tarkkailukerran 22.5.2017 melko huono puhdistustulos. **Jakson 3-2017** puhdistustulos täytti voimassa olevan ympäristöluvan (ESAVI, VHO) puhdistusvaatimukset lukuun ottamatta puhdistamolta lähtevää kiintoainepitoisuutta. Puhdistamo toimi kohtalaisesti 2.8. ja 22.8.2017 tarkkailukerroilla. Puhdistamolta karkasi kiintoainetta, mikä heikensi puhdistustulosta ko. tarkkailukerroilla ja vaikutti myös jakson keskimääräiseen puhdistustulokseen etenkin kiintoaineen osalta. **Jakson 4-2017** puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta puhdistamolta lähtevää kiintoainepitoisuutta.

Puhdistamo saavutti kokonaistypen pitoisuus- ja puhdistustehovaatimuksen sekä vesistöön johdetun ammoniumtyppipitoisuuden vaatimuksen vuosikeskiarvoina tarkasteltuna.

Vuoden keskimääräinen nitrifikaatioaste jäi hieman luvan vaatimusta heikommaksi. Nitrifikaatio oli keskimäärin voimakasta jaksoilla 1-2017, 2-2017 ja 3-2017 ja jaksolla 4-2017 kohtalaista.

Vesistöön johdetun Bisfenoli A pitoisuuden tavoitearvo saavutettiin vuosikeskiarvona tarkasteltuna.

Jäteveden ohitusta oli vain jaksolla 2-2017 (Euran kunnan viemäriverkosto-ohitus), mutta ohituksesta aiheutunut kuormitus oli pieni, eikä ohitus vaikuttanut merkittävästi jakson 2-2017 puhdistustulokseen (*liite 5*).

Lähtevän jäteveden hygieeninen laatu täytti ympäristöluvan puhdistusvaatimukset kolmen kuukauden keskiarvoina tarkasteltuna (touko–heinäkuu ja elo–lokakuu) ajanjaksolla 1.5.–31.10.2017 (*liite 16*).

VN asetuksen 888/2006 vaatimukset saavutettiin BOD_{7ATU}:n ja COD_{Cr}:n pitoisuuden ja puhdistustehon osalta sekä kiintoaineen puhdistustehon osalta tarkkailukertakohtaisesti tarkasteltuna. Koska pitoisuus ja puhdistustehot ovat vaihtoehtoisia, saavutettiin vaadittu puhdistustulos myös kiintoaineen osalta (*taulukko 20*). Kokonaisfosforin ja kokonaistypen osalta asetuksen 888/2006 vaatimukset saavutettiin vuosikeskiarvoina tarkasteltuna (*taulukko 21*). VN asetuksen 888/2006 mukaan (*taulukko 19 huomautus 7*) enimmäispitoisuus voidaan ylittää tavanomaisissa käyttöolosuhteissa enintään 100 %:lla (BOD_{7ATU}-arvo max 60 mg/l ja COD_{Cr}-arvo max 250 mg/l) ja kiintoaineen osalta 150 %:lla (kiintoainepitoisuus max 88 mg/l). Lähtevä kiintoainepitoisuus ylitti maksimiarvon kerran (1/24) (*kuva 12*).

Puhdistamon Fosforin ja kiintoaineen puhdistus tehostui vuonna 2017 edellisvuoteen nähden. Vaikka tulokuorma laski fosforin 25 % ja kiintoaineen osalta 20 %, vesistöön johdettu fosforikuorma laski 34 % ja kiintoainekuorma laski 38 % edellisvuoteen nähden. Vesistöön johdettu BOD_{7ATU}-kuorma laski 4 % ja COD_{Cr}-kuorma laski 6 %. Vesistöön johdettu typpikuorma kasvoi 6 % ja ammoniumtyppikuorma oli kaksinkertainen edellisvuoteen nähden. Typen ja ammoniumtypen puhdistustulosta heikensi loppuvuodesta 2017 romahtanut nitrifikaatio, mikä kohotti vesistöön johdettua ammoniumtyppikuormaa ja heikensi vuoden keskimääräistä puhdistustulosta ammoniumtypen sekä kokonaistypen osalta.

Pidemmän aikavälin tarkastelussa puhdistamon toiminta on merkittävästi tehostunut muun muassa vähentyneiden ohitusten myötä. Kuntalinjan ohitusta ei ole enää tapahtunut vuoden 2015 jälkeen. Myöskään paperiteollisuuden jätevesien ohitusta ei tapahtunut vuonna 2017. Vuosien 2012–2016 keskimääräiseen vesistöön johdettuun kuormitukseen verrattuna vesistöön johdettu BOD7ATU-kuorma, kokonaistyppikuorma ja kiintoainekuorma olivat noin 60 % pienempiä vuonna 2017. Vesistöön johdettu kokonaisfosforikuorma ja ammoniumtyppikuorma olivat noin 70 % pienempiä. Vesistöön johdettu CODCr-kuorma oli vuonna 2017 noin 50 % pienempi vuosien 2012–2016 keskiarvoon nähden.

Tutkittujen lietenäytteiden raskasmetallipitoisuudet olivat lannoitevalmisteelle sallittuja enimmäispitoisuuksia pienempiä lukuun ottamatta 22.2.2017 kuitusavilietteen kadmiumpitoisuutta, joka oli koholla raja-arvoon nähden (*MMM, asetus lannoitevalmisteita 24/11*). 22.2.2017 myös seoslietteen kadmiumpitoisuus oli tavanomaista korkeampi. Seoslietteen ja kuitusavilietteen kadmiumpitoisuudet tutkittiin ylimääräisellä tutkimuksella 26.4.2017 ja tällöin pitoisuudet alittivat raja-arvot (*kuva 21, liite 15*).

On tärkeää, että teollisuuden esikäsittelyjen toimivuutta ja jätevesiä tarkkaillaan säännöllisesti, jotta lietteen puhtaus ja samalla hyötykäyttömahdollisuudet voidaan varmistaa. Teollisuusjätevesien tarkkailun avulla varmistetaan myös, ettei viemäreihin johdeta viemäriverkostolle sekä jätevedenpuhdistamolle haitallisia jätevesipäästöjä tai muita haitallisia aineita.

Puhdistamon tarkkailukertakohtainen toiminta on tarkemmin kuvattu *kappaleessa 6.3.*

6.2. Tulokuorma

Puhdistamon päästötarkkailussa otetaan yhteisnäyte kuntalinjalta tulevasta jätevedestä, joka koostuu Euran kunnan jätevesistä, HKScan Finland Oy:n jätevesistä ja muiden kunnan viemäriin liittyneiden asumajätevedestä poikkeavaa jätevettä tuottavien liittyjien jätevesistä. Kuntalinjalta tulevan jäteveden näytteessä ovat mukana myös puhdistamolle tuodut sako- ja umpikaivolietteet. Puhdistamon päästötarkkailussa otetaan näyte myös paperiteollisuudesta tulevasta linjasta. Puhdistamolle tuleva kuormitus saadaan laskemalla yhteen kuntalinjalta tuleva ja paperiteollisuudesta tuleva jätevesikuorma.

Puhdistamolle tuleva kuorma laski kokonaisfosforin osalta 25 % ja kiintoaineen osalta 20 % edellisvuoteen nähden. Myös typpikuorma laski 8 % ja COD_{Cr}-kuorma laski 1 % (*taulukko 2*). Puhdistamolle tuleva jätevesi vastasi keskimäärin COD_{Cr}:n ja kiintoaineen osalta väkevää, fosforin osalta laimeaa ja muilta osin keskimääräistä puhdistamatonta yhdyskuntajätevettä.

Puhdistamolle tuleva keskimääräinen kuormitus oli BOD_{7ATU}:n osalta 93 %, fosforin osalta 59 %, typen osalta 61 % ja kiintoaineen osalta 95 % laajennetun puhdistamon mitoitusarvoihin nähden. *Laajennetun puhdistamon mitoitusarvot: keskivirtaama (Q_{kesk}) 8 100 m^3/d, BOD_{7ATU}-kuorma 2 250 kg/d, fosforikuorma 46 kg/d, typpikuorma 540 kg/d, kiintoainekuorma 5 600 kg/d.*

Puhdistamon asukasvastineluku AVL oli keskimääräisen BOD_{7ATU}-kuorman mukaan laskettuna 30 000 asukasta ja maksimi BOD_{7ATU}-kuorman (12.12.2017) mukaan laskettuna noin 45 700 asukasta. Viiden vuoden (2013–2017) tarkkailukertojen BOD_{7ATU}-tulokuormien perusteella puhdistamon AVL_{90} on 41 860 asukasta.

6.2.1. Kuntalinjan jätevedet

Kuntalinjalta johdettiin jätevettä yhteensä 1 007 172 m^3 eli keskimäärin 2 759 m^3/d (sis. tuodut sako- ja umpikaivolietteet). Tämä oli 36 % puhdistamon tulovirtaamasta. Kuntalinjasta tulevasta vesi vastasi laadultaan keskimäärin väkevää puhdistamatonta yhdyskuntajätevettä. Kuntalinjalta tulevan jäteveden kuormitusosuus oli COD_{Cr}:n osalta 44 %, BOD_{7ATU}:n osalta 65 %, fosforin osalta 93 %, typen osalta 95 % sekä kiintoaineen osalta 27 % puhdistamon tulokuormasta (*taulukko 4*).

Kuntalinjalta tuleva kuormitus laski hieman edellisvuoteen nähden. HKScan Finland Oy:n tehtaan tuotannon lopettaminen syyskuussa 2017 on vähentänyt kuntalinjalta tulevaa kuormaa (*taulukko 4*). Toisaalta sateisen loppuvuoden aikana tuli runsaasti Euran kunnan viemäriverkostoon päätyneitä vuotovesiä, jotka kohottivat kuntalinjan virtaamaa etenkin joulukuussa (*kuva 5*). Kuntalinjan jätevedet koostuvat Euran kunnan asumajätevesistä sekä kunnan viemäriin liittyneistä teollisuusjätevesistä. Kuntalinjan jäteveden kuormitusosuuksia on tarkasteltu Euran kunnan ja HKScan Finland Oy:n jätevesien osalta.

Euran kunta

Euran kunnan kuormitusosuuteen sisältyvät kunnan asumajätevedet, tuodut sako- ja umpikaivolietteet ja viemäriin liittyneiden asumajätevedestä poikkeavaa jätevettä tuottavien liittyjien jätevedet, kuten Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan esikäsitellyt prosessijätevedet, Loimi-Hämeen Jätehuolto Oy:n Hallavaaran jätekeskuksen jätevedet ja Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitoksen rejektivedet.

Euran kunnasta johdettiin jätevettä yhteensä 712 398 m^3 eli keskimäärin 1 952 m^3/d. Tämä oli 25 % puhdistamon tulovirtaamasta ja 71 % kuntalinjalta tulevasta jätevesimäärästä.

Euran kunnan osuus kuntalinjalta tulevasta jätevesimäärästä ja kuormituksesta on saatu laskennallisesti vähentämällä HKScan Finland Oy:n kuormitus kuntalinjan kokonaiskuormituksesta (*liitteet 6 ja 10*). Euran kunnan laskennallinen kuormitusosuus puhdistamon tulokuormasta oli COD_{Cr}:n osalta 43 %, BOD_{7ATU}:n osalta 65 %, fosforin osalta 89 %, typen osalta 82 % sekä kiintoaineen osalta 27 %. Kunnan kuormitusosuus oli COD_{Cr}:n osalta 99 %, BOD_{7ATU}:n osalta 99 %, fosforin osalta 95 %, typen osalta 87 % sekä kiintoaineen osalta 98 % kuntalinjalta puhdistamolle tulevasta kuormituksesta.

Euran kunnasta tuleva jätevesi vastasi erittäin väkevää puhdistamatonta yhdyskuntajätevettä etenkin COD_{Cr}:n, typen ja kiintoaineen osalta. Euran kunnan kuormitusosuus (%) kuntalinjan kuormasta kasvoi edellisvuoteen nähden HK:n jätevesien määrän ja kuorman vähentyessä, kun tehtaan tuotanto loppui syyskuussa 2017. Euran kunnan kuormitus kuitenkin laski HK:n tuotannon lakkauttamisen myötä edellisvuoteen nähden fosforin, typen ja kiintoaineen osalta (*taulukko 6*). Mahdollisia muita kuormituslähteitä tulee edelleen selvittää viemäriverkostossa.

HKScan Finland Oy

HKScan Finland Oy:n tehtaalta johdettu jätevesimäärä oli 294 774 m^3 eli keskimäärin 808 m^3/d. Tämä oli 11 % puhdistamon tulovirtaamasta ja 29 % kuntalinjalta tulevasta jätevesimäärästä. HKScan Finland Oy:n teurastustoiminta loppui syksyllä 2017. Loppuvuodesta 2017 tehtaalta on johdettu kunnan viemäriverkostoon pakkaustoiminnan ja henkilökunnan saniteettijätevesiä.

HKScan Finland Oy:n aiheuttama kuormitus oli pääasiassa fosfori- ja typpikuormitusta. Jätevesi vastasi keskimäärin laadultaan melko tehokkaasti puhdistunutta yhdyskuntajätevettä ja typen osalta keskimääräistä puhdistamatonta yhdyskuntajätevettä. Euran kunnan viemäriin johdettu kuormitus oli COD_{Cr}:n ja BOD_{7ATU}:n osalta noin 1 %, fosforin osalta noin 5 %, typen osalta noin 13 % ja kiintoaineen osalta 0,5 % puhdistamon tulokuormasta (*taulukko 7, liite 10*). HK:n kuormitusosuus oli COD_{Cr}:n osalta 2 %, BOD_{7ATU}:n osalta 1 %, fosforin osalta 5 %, typen osalta 13,5 % sekä kiintoaineen osalta 2 % kuntalinjalta puhdistamolle tulevasta kuormituksesta.

HK:lta johdettu keskimääräinen kuormitus laski merkittävästi edellisvuoteen nähden tuotannon vähentyessä ja loppuessa syyskuussa 2017 (*taulukko 8*). HK:n puhdistamon flotaatiolaitteisto oli hajalla elokuussa 2017, mistä johtuen esikäsittelylaitoksen biologinen prosessi oli häiriötilassa. Viemäriverkostoon johdettava jätevesi oli väriltään mustaa, ja HK:lta tuli tavanomaista suurempi kuormitus JVP-Eura Oy:n puhdistamolle 22.8.2017 (*kappale 6.3.*).

6.2.2. Jujo Thermal Oy:n paperitehdas

Jujo Thermal Oy:n paperitehtaalta johdettiin puhdistamolle jätevettä yhteensä 1 761 765 m^3 eli keskimäärin 4 827 m^3/d. Tämä oli 64 % puhdistamon tulovirtaamasta.

Paperitehtaalta tuleva kuormitus oli COD_{Cr}:n osalta 56 %, BOD_{7ATU}:n osalta 35 % ja kiintoaineen osalta 72 % puhdistamon tulokuormasta. Fosfori- ja typpikuormitukset jäivät vähäisiksi vesimäärään nähden (*liite 7*).

Paperitehtaalta tuleva jätevesi vastasi keskimäärin COD_{Cr}:n ja kiintoaineen osalta väkevää puhdistamatonta yhdyskuntajätevettä sekä BOD_{7ATU}:n osalta laimeaa puhdistamatonta yhdyskuntajätevettä. Fosforin ja typen osalta jätevesi vastasi puhdistettua yhdyskuntajätevettä eli jätevedet ovat niukkaravinteisia, mikä on tyypillistä paperiteollisuuden jätevesille.

Paperitehtaalta tulevan jäteveden laimea typpipitoisuus voi aiheuttaa sen, että JVP–Euran puhdistamolle tulevan jäteveden laskennallinen typpipitoisuus jää alhaiseksi (*liite 3*), mikä vaikeuttaa typen puhdistustehovaatimuksen saavuttamista. Toisaalta paperiteollisuudesta tulevan veden korkea lämpötila nostaa esiselkeytyksestä ja ilmastuksesta lähtien prosessilämpötilaa, mikä taas edistää kokonaistypenpoistoa.

6.2.3. Amcor Flexibles Finland Oy Kauttuan paperinjalostustehdas

Amcor Flexibles Finland Oy Kauttuan paperinjalostustehtaan jäteveden esikäsittelylaitokselta puhdistamolle johdettu prosessijätevesimäärä oli 0,03 % koko puhdistamolle tulevasta vesimäärästä ja 0,1 % Euran kunnan osuudesta. Laitos täytti Lounais-Suomen ympäristökeskuksen 5.3.2007 myöntämän ympäristöluvan vaatimukset kuparin, kromin ja kuuden arvoisen kromipitoisuuksien osalta vuosikeskiarvoina laskettuina.

6.2.4. Hallavaaran jätekeskus ja biokaasulaitos

Hallavaaran jätekeskuksen alueen eri toiminnoista muodostuvat valuma- ja suotovedet, saniteettivedet sekä biokaasulaitoksella syntyvät mädätteen kuivauksen rejektivedet johdetaan tasausaltaan kautta Euran kunnan viemäriverkostoon ja edelleen JVP–Eura Oy:n jätevedenpuhdistamolle käsiteltäviksi. Jätevesistä aiheutuu merkittävää typpikuormitusta JVP–Eura Oy:n puhdistamolle.

Tasausaltaalta viemäriverkostoon johdettu jätevesimäärä oli yhteensä 36 290 m^3 eli keskimäärin 99,4 m^3/d, mikä oli 1,3 % puhdistamolle tulevasta vesimäärästä ja 5 % Euran kunnan vesimäärästä (*liite 11*). Kuormitusarvion mukaan Hallavaaran jätevesien osuus puhdistamolle tulevasta typpikuormasta oli 39 % ja osuus Euran kunnan typpikuormituksesta oli 48 %. Typpi oli pääosin ammoniumtyppimuodossa. Vuonna 2017 Hallavaarasta puhdistamolle johdettu kuormitus oli etenkin COD_{Cr}:n, BOD_{7ATU}:n ja typen osalta suurempi kuin edellisvuonna (*taulukko 14*).

6.2.5. Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitos

Länsi-Suomen prosessivesi Oy:n lietteenkäsittelylaitokselta Euran kunnan viemäriverkostoon ja JVP–Eura Oy:n puhdistamolle johdetun jäteveden laatua tutkittiin neljä kertaa vuoden aikana (*taulukko 15, liite 12*).

Jätevesi vastasi laadultaan erittäin laimeaa yhdyskuntajätevettä. Jätevesien kuormitusosuudet olivat pieniä. Kuormitus laski edellisvuoteen nähden merkittävästi, koska myös viemäriverkostoon johdettu jätevesimäärä laski ja jätevedet olivat laadultaan laimeampia. Euran kunnan viemäriverkostoon lähtevästä jätevedestä tulisi kerätä vuorokauden/laitoksen toiminta-ajalta kokoomanäyte automaattisella näytteenottimella (esim. aikaohjatusti 15 min välein otettavat osanäytteet).

6.3. Puhdistamon toiminta tarkkailukerroilla

Vuoden 2017 aikana puhdistamo toimi hyvin 10 tarkkailukerralla, melko hyvin kahdeksalla tarkkailukerralla (6.3., 21.3., 26.4., 10.5., 12.6., 4.7., 5.9., 22.11. ja 19.12.2017), kohtalaisesti viidellä tarkkailukerralla (5.4., 2.8., 22.8., 16.10. ja 12.12.2017) ja melko huonosti tarkkailukerralla 22.5.2017 (*kuvat 6–16, liite 3*). Tarkkailukertojen lukumäärä oli 24.

Jaksolla 1-2017 puhdistamo toimi hyvin ja puhdistusvaatimukset täytettiin tarkkailukerroilla. **Jakson 2-2017** keskimääräistä puhdistustulosta heikensivät tarkkailukerran 5.4.2017 kohtalainen ja tarkkailukerran 22.5.2017 melko huono puhdistustulos. Puhdistamo toimi kohtalaisesti 2.8. ja 22.8.2017 tarkkailukerroilla. Puhdistamolta karkasi kiintoainetta, mikä heikensi puhdistustulosta ko. tarkkailukerroilla ja vaikutti myös **jakson 3-2017** keskimääräiseen puhdistustulokseen etenkin kiintoaineen osalta. **Jakson 4-2017** puhdistustulosta heikensi 16.10.2017 tarkkailukerta, jolloin puhdistamolta karkasi kiintoainetta ja puhdistustulos heikentyi. Lisäksi joulukuun tarkkailukerroilla 12.12. ja 19.12.2017 nitrifikaatio jäi melko heikoksi, mikä heikensi myös jakson keskimääräistä kokonaistypenpoistoa.

Nitrifikaatio vaihteli tarkkailukerroilla melko heikosta täydelliseen (46–100 %) ja lähtevä ammoniumtyppipitoisuus vaihteli 0,1–22 mg/l tarkkailukerroilla. Kokonaistypen puhdistusteho vaihteli 42–96 % välillä. Kokonaistypen keskimääräinen puhdistusteho oli 82 %. Typen puhdistusteho oli vaatimuksen mukainen (ESAVI lupa ≥75 %) 21 tarkkailukerralla (21/24) (*kuva 15, liitteet 3–4*).

Prosessilämpötila vaihteli vuoden aikana välillä 14,7–31°C (*liite 3*). Prosessilämpötila on keskiarvo puhdistamon omista mittauksista uuden ilmastuksen linjoilta 1–3.

Lähtevän jäteveden bisfenoli A:n pitoisuus vaihteli vuoden aikana 0–0,034 mg/l (0–34 µg/l) välillä (*liite 3*).

Tammikuussa 2.1.2017 puhdistamo toimi tarkkailun aikana hyvin ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Vesistöön johdetut kuormitukset olivat pieniä. Nitrifikaatio oli voimakasta.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta tarkkailukerralla.

Kuntalinjasta tuleva jätevesi vastasi fosforin ja typen osalta keskimääräistä ja muilta osin väkevää puhdistamatonta yhdyskuntajätevettä.

16.1.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana hyvin ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Vesistöön johdetut kuormitukset olivat pieniä. Nitrifikaatio oli melko voimakasta.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi oli väkevää etenkin typen, COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta. Puhdistamon automaattisen ammoniumtyppimittarin mukaan kuntalinjalta tuleva ammoniumtyppipitoisuus oli ollut todella korkea viime päivinä.

Helmikuussa 7.2.2017 puhdistamo toimi tarkkailun aikana hyvin ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Vesistöön johdetut kuormitukset olivat pieniä. Nitrifikaatio oli lähes täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta tarkkailukerralla.

Kuntalinjasta tuleva jätevesi vastasi fosforin osalta keskimääräistä ja muilta osin erittäin väkevää puhdistamatonta yhdyskuntajätevettä. Puhdistamon käyttötarkkailumittausten mukaan kuntalinjalta tuleva ammoniumtyppi on ollut viime aikoina erittäin korkea.

Jujolta pääsi viemäriin ja edelleen puhdistamolle 7.2.2017 vaihteistoöljyä, jonka vuoksi lähtevän veden kokoomanäytteestä tutkittiin myös öljyhiilivedyt sekä paperitehtaan esiselkeytetystä jätevedestä otettiin erikseen kaksi öljynäytettä.

Puhdistamolle tullut öljypäästö ei vaikuttanut merkittävästi puhdistamon toimintaan, sillä mm. nitrifikaatio oli täydellistä. Lietteen laskeutuminen oli melko heikkoa, minkä seurauksena kiintoainetta karkasi väliselkeytyksestä flotaatioon. Ko. ilmiö saattoi johtua myös puhdistamolle tulleesta suuresta ammoniumtyppikuormasta, joka on aiemminkin heikentänyt lietteen laskeutuvuutta.

21.2.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana hyvin ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Vesistöön johdetut kuormitukset olivat pieniä. Nitrifikaatio oli lähes täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen tarkkailukerralla.

Kuntalinjasta tuleva jätevesi oli väkevää etenkin typen ja COD_{Cr}:n osalta.

Maaliskuussa 6.3.2017 puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta lähtevän jäteveden kiintoainepitoisuutta, joka oli hieman koholla. Nitrifikaatio oli täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi keskimääräistä puhdistamatonta yhdyskuntajätevettä. Puhdistamon käyttötarkkailumittausten mukaan kuntalinjalta tuleva ammoniumtyppi oli kuitenkin ollut viime aikoina erittäin korkea.

Väliselkeytyksestä karkasi runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi kuitenkin merkittävästi puhdistustulosta.

21.3.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta ammoniumtypen ja nitrifikaatioasteen vaatimuksia. Muilta osin lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Nitrifikaatio oli melko voimakasta ja jäi hieman alle nitrifikaatioasteen vaatimuksen. Lähtevä ammoniumtyppipitoisuus oli hieman yli raja-arvon.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi oli melko väkevää typen osalta. Muilta osin jätevesi oli laimeaa.

Väliselkeytys toimi hyvin eikä flotaatioon karannut kiintoainetta merkittäviä määriä. Väliselkeytykseen syötettiin polymeeria tarkkailun aikana. Flotaatiokäsittely paransi edelleen puhdistustulosta.

Huhtikuussa 5.4.2017 puhdistamo toimi tarkkailun aikana kohtalaisesti. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kokonaistypen puhdistustehojen osalta. Nitrifikaatio oli erittäin voimakasta ja nitrifikaatioasteen vaatimus saavutettiin sekä lähtevän jäteveden ammoniumtyppipitoisuus oli pieni ja alle raja-arvon. Lähtevässä vedessä ei mitattu bisfenoli A:ta. Muilta osin lähtevän jäteveden pitoisuudet olivat koholla raja-arvoihin nähden ja fosforin ja kiintoaineen puhdistustehot jäivät melko heikoiksi.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n ja BOD_{7ATU}:n osalta tarkkailukerralla. Kiintoaineen osalta asetuksen vaatimusta ei saavutettu.

Kuntalinjasta tuleva jätevesi vastasi erittäin väkevää puhdistamatonta yhdyskuntajätevettä. Näytepäivän aikana puhdistamolle tuli hetkellisesti suuria virtaamia, mikä aiheutti kiintoaineen karkaamista väliselkeytyksestä ja edelleen flotaatiosta. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta puhdistustulos jäi silti heikoksi karanneen kiintoaineen vuoksi.

26.4.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta ammoniumtypen ja nitrifikaatioasteen vaatimuksia. Muilta osin lähtevän jäteveden pitoisuudet olivat pieniä ja puhdistustehot korkeita. Nitrifikaatioaste ja jäi hieman alle vaatimuksen ja lähtevä ammoniumtyppipitoisuus oli hieman yli raja-arvon.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi oli melko väkevää COD:n ja typen osalta ja keskimääräistä BOD:n osalta. Muilta osin jätevesi oli laimeaa. Euran kunnan jätevesissä oli arvion mukaan noin 60 % vuotovesiä.

Puhdistamonhoitajan ilmoituksen mukaan ilmastuslinjat 2 ja 3 olivat pois käytöstä 8 h 26.4. klo 23 alkaen. Paperitehtailta oli tullut poikkeavaa kuormitusta, minkä vuoksi ilmastuslinjoja otettiin pois käytöstä.

Toukokuussa 10.5.2017 puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta kokonaistypen puhdistusteho- ja nitrifikaatiovaatimuksia. Nitrifikaatio oli kohtalaista ja nitrifikaatioaste jäi luvan vaatimusta alhaisemmaksi. Lähtevä ammoniumtyppipitoisuus oli koholla raja-arvoon nähden.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi keskimääräistä ja typen osalta väkevää puhdistamatonta yhdyskuntajätevettä. Jäteveden hygienisointi oli päällä tarkkailun aikana ja bakteerimäärät olivat pieniä.

22.5.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana melko huonosti. Melko huono puhdistustulos johtui kuntalinjan kautta tulleiden sammutusjätevesien aiheuttamasta poikkeavasta tulokuormituksesta. Kuntalinjalta tuli viikonloppuna tapahtuneen liikekeskuksen tulipalon myötä sammutusjätevesiä, mikä heikensi biologisen prosessin toimintaa ja lietteen laskeutumista väliselkeytyksessä ja aiheutti edelleen kiintoaineen karkaamista puhdistamolta. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kokonaistypen puhdistustehojen osalta. Muilta osin puhdistusvaatimuksia ei saavutettu. Nitrifikaatio oli kohtalaista ja jäi hieman alle puhdistusvaatimuksen.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n osalta ja BOD_{7ATU}:n puhdistustehon osalta. Kiintoaineen osalta vaatimusta ei saavutettu tarkkailukerralla.

Kuntalinjasta tuleva jätevesi oli erittäin väkevää. Poikkeuksellisesta tilanteesta johtuen liete ei laskeutunut väliselkeytyksestä, vaan lietettä/runsaasti kiintoainetta karkasi flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta puhdistustulos jäi luvan vaatimuksia heikommaksi karanneen kiintoaineen vuoksi.

Jäteveden hygienisointi oli päällä tarkkailun aikana ja syöttö oli tavanomaista suurempi karkaavan kiintoaineen vuoksi. Bakteerimäärät olivat suuresta syöttömäärästä huolimatta tavanomaista korkeampia.

Kuntalinjasta tulevasta jätevedestä ja puhdistamolta lähtevästä jätevedestä teetettiin 22.5.2017 ylimääräisiä haitta-aineanalyysejä sammutusvesipäästön seurauksena. Saatujen tulosten perusteella tutkittujen haitta-aineiden pitoisuudet olivat pieniä, eikä niiden osalta Eurajokeen aiheutunut poikkeuksellista päästöä puhdistamolta.

Kesäkuussa 6.6.2017 puhdistamo toimi tarkkailun aikana hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Nitrifikaatio oli täydellistä ja lähtevä ammoniumtyppipitoisuus oli alle määritysrajan.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi fosforin osalta keskimääräistä ja muilta osin erittäin väkevää puhdistamatonta yhdyskuntajätevettä. Väliselkeytyksestä karkasi kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta ja ympäristöluvan puhdistusvaatimukset täytettiin.

Jäteveden hygienisointi oli päällä tarkkailun aikana ja bakteerimäärät olivat alle raja-arvojen.

Tarkkailukerralla 19.6.2017 puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lähtevän jäteveden kokonaisfosfori- ja kiintoainepitoisuutta lukuun ottamatta. Nitrifikaatio oli erittäin voimakasta.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n ja BOD_{7ATU}:n osalta. Lähtevä kiintoainepitoisuus oli koholla mutta kiintoaineen puhdistustehovaatimus saavutettiin.

Kuntalinjasta tuleva jätevesi oli erittäin väkevää ja kuntalinjalta tuli suuri kuormitus. Väliselkeytyksestä karkasi lietettä/runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta lähtevä fosfori- ja kiintoainepitoisuudet olivat yhä koholla karanneen kiintoaineen vuoksi.

Jäteveden hygienisointi oli päällä tarkkailun aikana ja syöttö oli tavanomaista suurempi karkaavan kiintoaineen vuoksi.

Heinäkuussa 4.7.2017 puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta lähtevää kiintoainepitoisuutta ja nitrifikaatiovaatimuksia. Nitrifikaatio oli melko voimakasta, mikä jäi hieman alle nitrifikaatioasteen vaatimuksen. Lähtevä ammoniumtyppipitoisuus oli hieman koholla raja-arvoon nähden.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi typen osalta erittäin väkevää ja muilta osin keskimääräistä puhdistamatonta yhdyskuntajätevettä. Väliselkeytyksestä karkasi kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta ja lähtevän jäteveden laatu täytti ympäristöluvan vaatimukset hieman koholla ollutta kiintoaine- ja ammoniumtyppipitoisuutta lukuun ottamatta.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä ja alle raja-arvojen.

19.7.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset ja nitrifikaatio oli lähes täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi typen osalta erittäin väkevää ja muilta osin melko laimeaa puhdistamatonta yhdyskuntajätevettä.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Bakteerimäärät olivat pieniä.

Elokuussa 2.8.2017 puhdistamo toimi tarkkailun aikana kohtalaisesti. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta lähtevän jäteveden fosfori- ja kiintoainepitoisuutta, jotka olivat koholla. Myös fosforin puhdistusteho jäi hieman raja-arvoa heikommaksi. Lähtevä ammoniumtyppipitoisuus oli hieman koholla raja-arvoon nähden ja

nitrifikaatioaste jäi hieman alle vaatimuksen. Lähtevän jäteveden bisfenoli A –pitoisuus oli hieman tavoitearvoa suurempi.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Puhdistamolle tuli suuri kuormitus kuntalinjalta. Myös paperiteollisuudesta tuleva jätevesi oli erittäin väkevää COD_{Cr}:n ja kiintoaineen osalta. Ilmastusaltaiden happipitoisuudet olivat alhaiset. Mm. kuormituspiikit lisäävät hapenkulutusta. Alhainen happitilanne vaikuttaa heikentävästi nitrifikaatioon ja lietteen laskeutuvuutta.

Väliselkeytyksestä karkasi runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta lähtevään jäteveteen jäi raja-arvoa enemmän kiintoainetta, mikä kohotti myös kokonaisfosforipitoisuutta.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä ja alle raja-arvojen.

Lähtevän jäteveden näyte oli kerätty manuaalisesti (osanäytteet tietyin aikavälein), koska lähtevä näytteenotin oli huollossa.

22.8.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana kohtalaisesti. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta lähtevän jäteveden fosfori- ja kiintoainepitoisuutta, jotka olivat koholla. Myös fosforin ja kiintoaineen puhdistustehot jäivät hieman raja-arvoa heikommiksi. Nitrifikaatio oli voimakasta ja lähtevä ammoniumtyppipitoisuus oli pieni.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi typen osalta erittäin väkevää ja muilta osin melko väkevää puhdistamatonta yhdyskuntajätevettä. Jätevesi oli väriltään tummaa. Puhdistamolle oli tullut suuri kuormitus kuntalinjalta jo parin viikon ajan, myös jo edellisellä tarkkailukerralla. Muun muassa HK:n tehtaan esikäsittelylaitoksella on ollut ongelmia flotaation hajoamisen vuoksi.

Puhdistamonhoitajan ilmoituksen mukaan suuri kuormitus on heikentänyt lietteen laskeutuvuutta väliselkeytyksessä. Puhdistamolla kuivattiin lietettä tavanomaista enemmän, jotta lietettä saataisiin poistettua prosessista enemmän.

Väliselkeytyksestä karkasi runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta lähtevään jäteveteen jäi raja-arvoa enemmän kiintoainetta, mikä kohotti myös kokonaisfosforipitoisuutta ja heikensi puhdistustehoja.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden suolistoperäisten enterokokkien määrä oli raja-arvoa suurempi. Mm. karkaava kiintoaine kohottaa bakteerimääriä, sillä bakteereista suuri osa on kiintoaineeseen sitoutuneena.

Syyskuussa 5.9.2017 puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lukuun ottamatta lähtevän jäteveden kiintoainepitoisuutta, joka oli koholla raja-arvoon nähden. Myös kiintoaineen puhdistusteho jäi hieman raja-arvoa heikommaksi. Nitrifikaatio oli täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi typen osalta väkevää ja muilta osin keskimääräistä puhdistamatonta yhdyskuntajätevettä.

Väliselkeytyksestä karkasi jonkin verran kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta lähtevään jäteveteen jäi yhä raja-arvoa enemmän kiintoainetta. Kiintoaine ei kuitenkaan heikentänyt merkittävästi lähtevän jäteveden laatua muilta osin.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä ja alle raja-arvojen.

18.9.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Nitrifikaatio oli erittäin voimakasta ja lähtevä ammoniumtyppipitoisuus oli pieni.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta tarkkailukerralla.

Kuntalinjasta tuleva jätevesi vastasi muilta osin väkevää ja fosforin osalta keskimääräistä puhdistamatonta yhdyskuntajätevettä. Väliselkeytyksestä karkasi hieman kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä.

Lokakuussa 2.10.2017 puhdistamo toimi tarkkailun aikana hyvin ja puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Nitrifikaatio oli lähes täydellistä.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi erittäin väkevää puhdistamatonta yhdyskuntajätevettä. Väliselkeytys toimi hyvin ja flotaatioon meni pieni kuorma. Väliselkeytetyn veden laatu täytti puhdistusvaatimukset kiintoainetta ja fosforia lukuun ottamatta. Flotaatiokäsittely paransi edelleen puhdistustulosta.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä ja alle raja-arvojen.

16.10.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana kohtalaisesti. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lähtevän jäteveden BOD_{7ATU}-arvon ja kokonaistypen puhdistustehon osalta. Nitrifikaatio oli lähes täydellistä ja lähtevä ammoniumtyppipitoisuus oli pieni. Lähtevä COD_{Cr}-arvo, kokonaisfosforipitoisuus ja kiintoainepitoisuus olivat kuitenkin raja-arvoja suurempia. Lisäksi COD_{Cr}:n, BOD_{7ATU}:n, fosforin ja kiintoaineen puhdistustehot jäivät heikoiksi.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n pitoisuuksien osalta ja BOD_{7ATU}:n puhdistustehon osalta tarkkailukerralla.

Kuntalinjalta tuli Euran kunnan viemäriverkoston kautta runsaista sateista johtuen vuotovesiä, joiden osuus kunnan jätevesimäärästä oli noin 65 %. Kuntalinjasta tuleva jätevesi vastasi typen ja kiintoaineen osalta keskimääräistä ja muilta laimeaa puhdistamatonta yhdyskuntajätevettä.

HKScan Finland Oy:n tehtaan tuotanto loppui 25.9.2017, mutta tehtaalla oli vielä pakkaustoimintaa. Tehtaalta johdettiin henkilökunnan saniteettivesiä ja pakkaustoiminnan pesuvesiä noin 80 m^3/d.

Väliselkeytyksestä karkasi runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta ympäristöluvan puhdistusvaatimuksiin ei päästy kaikilta osin. Lisäksi kuntalinjalta tulleista vuotovesistä johtuen tuleva jätevesi oli laimeaa, mikä huononsi puhdistustehoja.

Jäteveden hygienisointi oli päällä tarkkailun aikana. Lähtevän jäteveden bakteerimäärät olivat pieniä.

Marraskuussa 8.11.2017 puhdistamo toimi tarkkailun aikana hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset. Nitrifikaatio oli täydellistä ja lähtevä ammoniumtyppipitoisuus oli alle määritysrajan.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi COD_{Cr}:n, BOD_{7ATU}:n, typen ja kiintoaineen osalta erittäin väkevää puhdistamatonta yhdyskuntajätevettä. Kuntalinjalta tulevassa jätevedessä oli runsaasti hyytynyttä rasvaa. Hyytynyttä rasvaa oli myös esiselkeytyksen pinnalla. Rasva kohottaa etenkin jäteveden hapenkulutusarvoja ja kiintoainepitoisuutta.

Väliselkeytyksestä karkasi kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta.

Jäteveden hygienisointi ei ollut päällä tarkkailun aikana. Ympäristölupapäätöksen 23.1.2013 nro 11/2013/1 mukainen hygienisointivelvoite on voimassa 1.5.–31.10. välisenä aikana.

22.11.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lähtevän jäteveden kiintoainepitoisuutta lukuun ottamatta. Nitrifikaatio oli voimakasta.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjalta tuli Euran kunnan viemäriverkoston kautta runsaista sateista johtuen vuotovesiä, joiden osuus kunnan jätevesimäärästä oli noin 50 %. Kuntalinjasta tuleva jätevesi vastasi COD_{Cr}:n BOD_{7ATU}:n ja typen osalta väkevää puhdistamatonta yhdyskuntajätevettä.

Väliselkeytyksestä karkasi runsaasti kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta, mutta kiintoainepitoisuuden puhdistusvaatimusta ei saavutettu.

Joulukuussa 12.12.2017 puhdistamo toimi tarkkailun aikana kohtalaisesti. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset lähtevän jäteveden COD_{Cr}-arvon ja fosforipitoisuuden osalta. Myös COD_{Cr}:n, BOD_{7ATU}:n, fosforin ja kiintoaineen puhdistustehot täyttivät vaatimukset. Lähtevä kokonaistyppi- ja ammoniumtyppipitoisuus ylittivät raja-arvot. Nitrifikaatioaste ja kokonaistypenpoisto jäivät vaatimuksia heikommiksi.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta.

Kuntalinjasta tuleva jätevesi vastasi COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta väkevää puhdistamatonta yhdyskuntajätevettä.

Väliselkeytyksestä karkasi kiintoainetta flotaatioon. Flotaatiokäsittely paransi merkittävästi puhdistustulosta.

19.12.2017 tarkkailukerralla puhdistamo toimi tarkkailun aikana melko hyvin. Puhdistustulos täytti ympäristöluvan puhdistusvaatimukset typenpoistoa ja nitrifikaatiota lukuun ottamatta. Nitrifikaatio jäi puolittaiseksi. Lähtevän jäteveden kokonaistyppi- ja ammoniumtyppipitoisuus olivat koholla tarkkailukerralla.

Puhdistamo saavutti yhdyskuntajätevesiä koskevan VN asetuksen 888/2006 puhdistusvaatimukset COD_{Cr}:n, BOD_{7ATU}:n ja kiintoaineen osalta tarkkailukerralla.

Kuntalinjalta tuli Euran kunnan viemäriverkoston kautta runsaista sateista johtuen vuotovesiä, joiden osuus kunnan jätevesimäärästä oli noin 65 %. Kuntalinjasta tuleva jätevesi vastasi COD_{Cr}:n BOD_{7ATU}:n ja typen osalta väkevää puhdistamatonta yhdyskuntajätevettä.

Väliselkeytys toimi melko hyvin tarkkailun aikana. Flotaatiokäsittely paransi edelleen puhdistustulosta.

Puhdistamon nitrifikaatio oli heikentynyt edelliseen tarkkailukertaan nähden. Heikentyneen nitrifikaation vuoksi myöskään kokonaistypen puhdistusvaatimuksia ei saavutettu tarkkailukerralla. Lähtevä ammoniumtyppipitoisuus oli koholla jo joulukuun ensimmäisellä tarkkailukerralla. Kuntalinjalta tuleva jätevesi oli erittäin kylmää ja myös ilmastusaltaassa jäteveden lämpötila oli laskenut tavanomaiseen nähden.

Nitrifikaatiobakteerien toiminta heikentyy mm. äkillisistä lämpötilan muutoksista. Puhdistamolle oli tullut kuntalinjalta runsaasti kylmiä vuotovesiä marraskuusta lähtien. Romahtaneen nitrifikaation seurauksena puhdistamolla kasvatettiin lieteikää ja lietepitoisuuksia ilmastuksessa nitrifikaation parantamiseksi.

6.4. Hule- ja vuotovedet ja ohitukset

Puhdistamolle tuli Euran kunnan viemäriverkoston kautta sulamisvesiä helmi-maaliskuun aikana. Keväästä syksyyn virtaamat pysyttelivät alhaisella tasolla. HK:n jätevesimäärän vähentyminen syyskuusta 2017 laski kuntalinjalta tulevaa virtaamaa. Sateisen loppuvuoden seurauksena puhdistamolle tuli Euran kunnan viemäriverkostosta runsaasti hule- ja vuotovesiä marras-joulukuun aikana. Hule- ja vuotovesien vaikutus näkyi kuntalinjan jätevesimäärässä sekä etenkin Euran kunnan jätevesimäärässä joulukuussa (*kuva 5, liite 1*). Marras–joulukuun aikana Euran kunnasta johdettu jätevesimäärä oli 29 % Euran kunnan koko vuoden jätevesimäärästä.

Kuntalinjalta tulevan jäteveden määrään vaikuttaa hule- ja vuotovesien lisäksi myös Hallavaaran jätekeskuksesta pumpatut jätevedet. Paperiteollisuudesta tulevat jätevesimäärät vaihtelevat tehtaan tuotannon mukaan.

Verkostoon päätyvät hule- ja vuotovedet aiheuttavat laitoksen hydraulista ylikuormittumista. Hydraulinen ylikuormittuminen aiheutti ajoittain kiintoaineen karkaamista väliselkeytyksestä ja edelleen flotaatiosta. Kylmät hule- ja vuotovedet haittaavat myös nitrifikaatiota. Loppuvuodesta vuotovesien seurauksena jäteveden lämpötila laski äkillisesti marraskuun loppupuolella ja puhdistamon nitrifikaatio heikkeni (*kappale 6.3.).*

Euran kunnan viemäriverkostossa oli ohitusta Sorkkisten pumppaamolla 16.5.2017 250 m^3.

6.5. Kemikaalit, sähkö ja kunnostustoimenpiteet

Flotaatioon menevään jäteveteen syötettiin PAX-XL100 saostuskemikaalia keskimäärin 66,4 g/m^3 käsiteltyä jätevesimäärää kohti laskettuna. Polymeeria syötettiin flotaatioon keskimäärin 0,73 g/m^3. Puhdistamolta lähtevää jätevettä (sis. mahdolliset kuntalinjan ohitukset) hygienisoitiin permuurahaishapolla touko–lokakuun välisellä ajalla.

Puhdistamon kokonaissähkönkulutus oli 1,0 kWh/m^3 käsiteltyä jätevesimäärää kohden laskettuna (*liite 2*).

Puhdistamolla tehtiin altaiden muutostöitä juhannuksen 2017 aikana. Euran kunnan viemäriverkostoa peruskorjattiin Luistarin alueella 800 m ja Sepäntien viemäriä saneerattiin sujuttamalla 1400 m.

6.6. Ympäristölupa

Etelä-Suomen aluehallintovirasto myönsi 23.1.2013 annetulla päätöksellä nro 11/2013/1 (ESAVI/27/04.08/2011) JVP–Eura Oy:lle ympäristönsuojelulain mukaisen ympäristöluvan JVP–Eura Oy:n hakemuksen ja sen täydennysten mukaiselle jätevedenpuhdistamon laajennukselle sekä samalla tarkisti puhdistamon toiminnalle 27.12.2002 annetun ympäristöluvan määräykset.

ESAVI:n päätökseen haettiin muutosta Vaasan hallinto-oikeudelta. VHO antoi 3.11.2015 muutoksen haun myötä päätöksen nro 15/0294/2. VHO:n päätökseen haettiin edelleen muutosta korkeimmalta hallinto-oikeudelta. ESAVI:n päätöksestä ja VHO:n muutospäätöksestä tuli lainvoimaiset 9.1.2017 KHO:n antaman päätöksen nro 17/2017 myötä.

6.7. Muutokset päästötarkkailussa

Puhdistamon päästötarkkailuohjelma päivitetään 23.1.2013 ESAVI:n lupapäätöksen nro 11/2013/1 mukaiseksi. Vanhaa tarkkailuohjelmaa on kuitenkin jo käytännössä päivitetty vastaamaan uuden lupapäätöksen määräyksiä vuodesta 2013 alkaen, kun puhdistamon toimintaa tarkkaillaan 24 krt/a. Lähtevän jäteveden hygieenistä laatua sekä lähtevän jäteveden bisfenoli A:n pitoisuutta seurataan ympärivuotisesti. Tarkkailuohjelma tullaan kuitenkin päivittämään uuden luvan mukaiseksi ja päivitetty tarkkailuohjelma lähetetään Elyyn hyväksyttäväksi.

Vuonna 2014 puhdistamolle laadittiin häiriötilanteiden aikaisen tarkkailun ja häiriötilanteiden tiedotusohjeistus.

JVP-Eura Oy:lle ja Jujo Thermal Oy:lle laaditaan yhteinen E-PRTR yhdisteiden tarkkailuohjelma kesäkuussa 2017 tehdyn E-PRTR tutkimuksen tulosten pohjalta. Viimeksi E-PRTR yhdisteitä tutkittiin laajalla tutkimuksella vuonna 2013.

E-PRTR asetuksen mukaisten yhdisteiden päästötiedot vuodelta 2017 raportoidaan erillisessä vuosiyhteenvedossa.

Turussa 15. maaliskuuta 2018

Nina Leino
prosessi-insinööri, DI

JVP-Eura Oy

PUHDISTAMON JÄTEVESIMÄÄRÄT JA PUHDISTAMO-OHITUKSET
Vuosi 2017

Virallinen virtaamatieto kuormituslaskentaan
Paperitehtaat + kuntalinja + sakokaivolietteet = yhteensä tuleva

kk	Paperitehtaat yhteensä m3	HKScan Finland Oy m3	Kuntalinja tuleva m3 (sis. Euran kunta, HK ja muu teollisuus)	Saostuskaivo-lietteet m3	Tuleva yhteensä m3	Tuleva yhteensä m3 (sis. Sakokaivolietteet)	Kuntalinja ohitus m3	Ohitus väliselk. m3 *	Huom
Tammikuu	133 504	31 048	69 847	66	203 351	203 417			
Helmikuu	121 701	30 136	97 108	6	218 809	218 815			
Maaliskuu	132 801	34 916	100 320	20	239 035	233 141			
Huhtikuu	145 365	31 939	85 521	6	230 886	230 892			
Toukokuu	148 755	31 940	88 452	53	237 207	237 260	250		Kunnan pumppaamon rikkoontuminen
Kesäkuu	128561	35 519	80 572	42	209 133	209 175			
Heinäkuu	155 834	35 519	72 366	60	228 200	228 260			
Elokuu	152 110	35 497	74 138	25	226 248	226 273			
Syyskuu	150 069	13 324	56 231	81	206 300	206 381			
Lokakuu	163 427	13 324	77 542	19	240 969	240 988			
Marraskuu	185 711	1 142	81 136	33	266 847	266 880			
Joulukuu	143 927	470	123 460	68	267 387	267 455			
YHTEENSÄ	**1 761 765**	**294 774**	**1 006 693**	**479**	**2 774 372**	**2 768 937**	**250**		

*** Ohitus väliselkeytyksestä sisältyy käsiteltyyn jätevesimäärään**

LIITE 1

KÄYTTÖTARKKAILUN YHTEENVETOLOMAKE

KUNTA: Eura PUHDISTAMO: JVP-Eura Oy 2017

kk	Käsitelty jätevesi				Jäteveden saostus- ja hygienisointikemikaalit						Lietteen loppusijoitus		Tuotu sakokaivo- ja umpisäiliöliete
					1. tuotenimi:		2. tuotenimi:		3. tuotenimi:		kuitusaviliete, kaatopaikka	kuntalinja-/yljäämä-/ flot.liete seos, biokaasulaitos	
	m^3/d			m^3/kk	PAX-XL100		Permuurahaishappo*		Vetyperoksidi*				
	min.	kesk.	max.	yht.	kg/kk	g/m^3	kg/kk	g/m^3	kg/kk	g/m^3	kg/kk	kg/kk	m^3/kk
Tammi	5 661	7 043	8 929	203 417	17 480	85,9		0		0	276 720	373 240	66,0
Helmi	4 936	6 712	9 595	218 815	14 380	65,7		0		0	210 220	371 250	6,0
Maalis	6 082	7 711	11 107	233 141	15 580	66,8		0		0	240 240	317 280	20,0
Huhti	6 034	8 072	9 484	230 892	18 043	78,1		0		0	194 460	336 000	6,0
Touko	4 445	7 408	8 666	237 260	16 857	71,0	3 000	12,6	3 000	12,6	218 400	340 360	53,0
Kesä	3 577	6 436	8 594	209 175	13 003	62,2	3 000	12,6	3 000	12,6	159 960	367 960	42,0
Heinä	6 148	7 458	8 648	228 260	18 037	79,0	1 000	4,2	1 000	4,2	209 140	298 920	60,0
Elo	6 188	7 497	8 296	226 273	13 117	58,0	2 000	8,4	2 000	8,4	221 240	378 980	24,5
Syys	5 858	7 113	8 371	206 381	13 780	66,8	1 000	4,2	1 000	4,2	229 920	364 480	81,2
Loka	5 595	7 774	9 506	240 988	14 960	62,1		0		0	206 520	347 700	19,0
Marras	5 969	8 896	8 657	266 880	14 620	54,8		0		0	210 790	274 400	33,4
Joulu	3 523	8 628	11 509	267 455	13 940	52,1		0		0	163 200	259 780	67,9
YHTEENSÄ KOKO VUONNA				2 768 937	183 797	66,4	10 000	8,4	10 000	8,4	2 540 810	4 030 350	479
KESKIMÄÄRIN VUOROKAUTTA KOHTI				7 586			* kok. määrä syötetty touko-lokakuussa 2017						

KOKO JAKSO:

	(1-3)KK	(4-6)KK	(7-9)KK	(10-12)KK		
Sähkön kulutus (koko laitos)	721 416	680139	671399	705487		kWh/jakso
Sähkön kulutus (prosessi)	(ei erittelyä)					kWh/jakso
Polymeeri jäteveteen, tuotenimi:	Superfloc C-492 HMW				325 / 775 / 275 / 650	kg/jakso(Q)
Polymeeri lietteeseen, tuotenimi:	Superfloc C-494 HMW				1200/1350/1000/1200	kg/jakso
Alkalointikemikaali, tuotenimi:	-					kg/jakso

Virtausmittarin / mittarien kalibrointipäivämäärät ja todetut virheet:

Juhannuksen aikana tehty mittava altaan muutostyö ja sen aikana virtausmittaria ei ollut mahdollista käyttää.

Puhdistamon toimintaan vaikuttaneet häiriöt ja muut seikat selvitetään kääntöpuolella, tällöin rasti ruutuun [ ]

Ohitustiedot ilmoitettu erillisellä lomakkeella [x]

Ei ohituksia [ ]

Puhdistamonhoitajan yhteystiedot:

nimi:Jukka Valtonen

osoite:

puhnro: 0400983190

@posti:

HUOMAUTUKSET:

Vuoden aikana tehdyt viemäriverkoston kunnostustoimenpiteet:

Vuoden 2017 viemäriverkoston saneeraukset, Euran kunta (Tieto: Kalevi Tuominiemi 25.1.2018):
Luistarin alue viemäreiden peruskorjaus n. 800 m
Sepäntie viemärisujutusta 1400 m.

Vuoden aikana puhdistamolla tehdyt kunnostustoimenpiteet:
Juhannuksen aikana tehty mittava altaan muutostyö.

Muuta:

Adven Oy:lle on toimitettu kuitutlietettä 121,7 tn marraskuusta lähtien.

Päiväys _____ Allekirjoitus _____

Jäte- ja lietetiedot 2017

Kunta	**Eura**
Puhdistamon nimi	**JVP-Eura Oy**
Yhteyshenkilön nimi	Jukka Valtonen
Puhelinnro	0400983190
Sähköpostiosoite	

PUHDISTAMOLLA / JÄTEVEDENKÄSITTELYSSÄ SYNTYVÄT JÄTTEET
(toimitetaan muualle käsiteltäväksi/hyödynnettäväksi)

VÄLPPÄJÄTE (EWC-koodi 190801)

Kok.määrä [t/jakso]	
kuiva-aine %	
Vastaanottaja/sijoitus	Loimi-Hämeen Jätehuolto Oy Oy/Hallavaaran jätekeskus

HIEKANEROTUKSESSA SYNTYVÄ JÄTE, HIEKKAJÄTE (EWC-koodi 190802)

Kok.määrä [t/jakso]	Sisältyy välppäjätteeseen. yhteensä 16,5 t.
kuiva-aine %	
Vastaanottaja/sijoitus	

PUHDISTAMON YLIJÄÄMÄLIETE, KUNTALINJA (EWC-koodi 190805A)

Kok.määrä [t/jakso]	4030,35 t					
kuiva-aine %	19,0 %					
Käsittelytapa	tiivistys		kuivaus		linkokuivaus	x
Vastaanottaja/sijoitus	Gasum Biotehdas Oy/Vambion laitos					

PAPERITEHTAIDEN KUITULIETE (EWC-koodi 030310)

Kok.määrä [t/jakso]	2540,8 t					
kuiva-aine %	35,7 %					
Käsittelytapa	tiivistys		kuivaus		linkokuivaus	x
Vastaanottaja/sijoitus	Loimi-Hämeen Jätehuolto Oy Oy/Hallavaaran jätekeskus					
	Loppuvuodesta alkaen 2017 Adven Oy					

MUU PUHDISTUSPROSESSISSA SYNTYVÄ JÄTE (EWC-koodi 190899)

Jätejakeen kuvaus	
Kok.määrä (t/a, m^3/a)	Hiekka-vesi 16,5t.
kuiva-aine %	Rasvakaivo 10t.
Vastaanottaja/sijoitus	

Jätejakeen kuvaus	
Kok.määrä (t/a, m^3/a)	
kuiva-aine %	
Vastaanottaja/sijoitus	

Lounais-Suomen vesi- ja ympäristötutkimus Oy
Telekatu 16, 20360 TURKU
Puh. (02) 274 0200, fax. (02) 238 1838
FINAS-akkreditoitu testauslaboratorio T101

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			2.1.	16.1.	7.2.	21.2.	6.3.	21.3.	5.4.	26.4.	10.5.	22.5.
Virtaama	Puhd.tuleva	m³/d	8150	7410	6840	7420	7210	8040	9110	10300	8380	8160
	Käsitelty	m³/d	8150	7410	6840	7420	7210	8040	9110	10300	8380	8160
	Ohitus	m³/d	0	0	0	0	0	0	0	0	0	0
	Vesistöön	m³/d	8150	7410	6840	7420	7210	8040	9110	10300	8380	8160
pros.lämpö	Tuleva (vl)	°C										
	Käsitelty	°C	23,0	24,0	20,6	21,7	21,9	20,7	21,6	21,2	23,0	29,1
	Ohitus	°C										
	Vesistöön	°C	23,0	24,0	20,6	21,7	21,9	20,7	21,6	21,2	23,0	29,1
alkal.	Tuleva (vl)	mmol/l										
	Käsitelty	mmol/l	1,6	3,3	3,3	1,9	1,9	1,9	2,2	2,5	3,4	2,6
	Ohitus	mmol/l										
	Vesistöön	mmol/l	1,6	3,3	3,3	1,9	1,9	1,9	2,2	2,5	3,4	2,6
pH	Tuleva (vl)		7,7	7,7	7,6	7,8	7,8	7,6	7,6	7,6	7,8	7,7
	Käsitelty		7,5	7,6	7,6	7,3	7,4	7,5	7,3	7,7	7,7	7,4
	Ohitus											
	Vesistöön		7,5	7,6	7,6	7,3	7,4	7,5	7,3	7,7	7,7	7,4
CODCr	Tuleva (vl)	kg/d	7600	8400	9000	6400	5800	4800	7800	11000	6000	6300
	Käsitelty	kg/d	320	440	400	330	300	140	1000	410	340	980
	Ohitus	kg/d										
	Vesistöön	kg/d	320	440	400	330	300	140	1000	410	340	980
	Tuleva (vl)	mg/l	930	1100	1300	870	800	600	860	1100	710	770
	Käsitelty	mg/l	39	60	59	44	42	18	110	40	40	120
	Ohitus	mg/l										
	Vesistöön	mg/l	39	60	59	44	42	18	110	40	40	120
	Käsittelyteho	%	96	95	96	95	95	97	87	96	94	84
	Kokonaisteho	%	96	95	96	95	95	97	87	96	94	84
BOD7ATU	Tuleva (vl)	kg/d	2400	2600	2900	1600	2000	1400	2500	2400	1200	2500
	Käsitelty	kg/d	43	89	82	61	47	21	190	65	40	260
	Ohitus	kg/d										
	Vesistöön	kg/d	43	89	82	61	47	21	190	65	40	260
	Tuleva (vl)	mg/l	290	350	430	210	270	170	270	230	140	310
	Käsitelty	mg/l	5,3	12	12	8,2	6,5	2,6	21	6,3	4,8	32
	Ohitus	mg/l										
	Vesistöön	mg/l	5,3	12	12	8,2	6,5	2,6	21	6,3	4,8	32
	Käsittelyteho	%	98	97	97	96	98	98	92	97	97	90
	Kokonaisteho	%	98	97	97	96	98	98	92	97	97	90
kok.P	Tuleva (vl)	kg/d	30	31	27	20	22	24	37	27	22	36
	Käsitelty	kg/d	0,43	0,48	0,89	0,28	1,5	0,13	7,8	1,2	0,69	7,6
	Ohitus	kg/d										
	Vesistöön	kg/d	0,43	0,48	0,89	0,28	1,5	0,13	7,8	1,2	0,69	7,6
	Tuleva (vl)	mg/l	3,7	4,2	3,9	2,7	3,0	3,0	4,1	2,6	2,6	4,4
	Käsitelty	mg/l	0,053	0,065	0,13	0,038	0,21	0,016	0,86	0,12	0,082	0,93
	Ohitus	mg/l										
	Vesistöön	mg/l	0,053	0,065	0,13	0,038	0,21	0,016	0,86	0,12	0,082	0,93
	Käsittelyteho	%	99	98	97	99	93	99	79	95	97	79
	Kokonaisteho	%	99	98	97	99	93	99	79	95	97	79
liuk.P	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	0,0080	0,019	0,022	0,011	0,0060	0,0080	0,029	0,019	0,023	0,037
	Ohitus	mg/l										
	Vesistöön	mg/l	0,0080	0,019	0,022	0,011	0,0060	0,0080	0,029	0,019	0,023	0,037
kok.N	Tuleva (vl)	kg/d	240	470	340	370	230	360	410	490	360	360
	Käsitelty	kg/d	20	89	21	34	14	55	45	110	120	90
	Ohitus	kg/d										
	Vesistöön	kg/d	20	89	21	34	14	55	45	110	120	90
	Tuleva (vl)	mg/l	29	64	49	49	31	44	45	47	43	45
	Käsitelty	mg/l	2,5	12	3,0	4,6	2,0	6,9	4,9	11	14	11
	Ohitus	mg/l										
	Vesistöön	mg/l	2,5	12	3,0	4,6	2,0	6,9	4,9	11	14	11

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			6.6.	19.6.	4.7.	19.7.	2.8.	22.8.	5.9.	18.9.	2.10.	16.10.
Virtaama	Puhd.tuleva	m³/d	7990	8250	8630	7000	7650	8090	7690	7220	6400	9070
	Käsitelty	m³/d	7990	8250	8630	7000	7650	8090	7690	7220	6400	9070
	Ohitus	m³/d	0	0	0	0	0	0	0	0	0	0
	Vesistöön	m³/d	7990	8250	8630	7000	7650	8090	7690	7220	6400	9070
pros.lämpö	Tuleva (vl)	°C										
	Käsitelty	°C	27,2	28,5	29,2	29,5	29,9	31,0	28,5	28,6	28,0	23,0
	Ohitus	°C										
	Vesistöön	°C	27,2	28,5	29,2	29,5	29,9	31,0	28,5	28,6	28,0	23,0
alkal.	Tuleva (vl)	mmol/l										
	Käsitelty	mmol/l	1,8	2,9	3,0	1,6	2,5	2,6	2,8	2,2	2,6	1,6
	Ohitus	mmol/l										
	Vesistöön	mmol/l	1,8	2,9	3,0	1,6	2,5	2,6	2,8	2,2	2,6	1,6
pH	Tuleva (vl)		7,7	7,6	7,8	7,8	7,6	7,7	7,9	8,0	7,8	7,6
	Käsitelty		7,4	7,8	7,8	7,1	7,5	7,3	7,5	7,4	7,5	7,4
	Ohitus											
	Vesistöön		7,4	7,8	7,8	7,1	7,5	7,3	7,5	7,4	7,5	7,4
CODCr	Tuleva (vl)	kg/d	5700	9700	6700	4500	7500	6100	4700	4600	5700	4100
	Käsitelty	kg/d	220	400	470	180	440	810	320	370	340	1100
	Ohitus	kg/d										
	Vesistöön	kg/d	220	400	470	180	440	810	320	370	340	1100
	Tuleva (vl)	mg/l	710	1200	780	650	980	750	610	640	890	450
	Käsitelty	mg/l	27	48	55	25	58	100	41	51	53	120
	Ohitus	mg/l										
	Vesistöön	mg/l	27	48	55	25	58	100	41	51	53	120
	Käsittelyteho	%	96	96	93	96	94	87	93	92	94	73
	Kokonaisteho	%	96	96	93	96	94	87	93	92	94	73
BOD7ATU	Tuleva (vl)	kg/d	2300	3000	1500	1300	1900	1600	1600	1500	1400	1300
	Käsitelty	kg/d	58	91	77	21	84	110	75	60	55	140
	Ohitus	kg/d										
	Vesistöön	kg/d	58	91	77	21	84	110	75	60	55	140
	Tuleva (vl)	mg/l	280	370	170	180	250	200	210	210	220	140
	Käsitelty	mg/l	7,2	11	8,9	3,0	11	13	9,8	8,3	8,6	15
	Ohitus	mg/l										
	Vesistöön	mg/l	7,2	11	8,9	3,0	11	13	9,8	8,3	8,6	15
	Käsittelyteho	%	97	97	95	98	96	94	95	96	96	89
	Kokonaisteho	%	97	97	95	98	96	94	95	96	96	89
kok.P	Tuleva (vl)	kg/d	29	48	26	21	31	28	19	21	19	18
	Käsitelty	kg/d	0,96	3,8	2,2	0,32	4,1	4,1	1,5	0,64	0,41	6,3
	Ohitus	kg/d										
	Vesistöön	kg/d	0,96	3,8	2,2	0,32	4,1	4,1	1,5	0,64	0,41	6,3
	Tuleva (vl)	mg/l	3,6	5,8	3,0	3,0	4,0	3,5	2,5	2,9	3,0	2,0
	Käsitelty	mg/l	0,12	0,46	0,26	0,045	0,53	0,51	0,19	0,089	0,064	0,69
	Ohitus	mg/l										
	Vesistöön	mg/l	0,12	0,46	0,26	0,045	0,53	0,51	0,19	0,089	0,064	0,69
	Käsittelyteho	%	97	92	91	98	87	85	92	97	98	66
	Kokonaisteho	%	97	92	91	98	87	85	92	97	98	66
liuk.P	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	0,011	0,018	0,031	0,055	0,048	0,026	0,022	0,024	0,014	0,0090
	Ohitus	mg/l										
	Vesistöön	mg/l	0,011	0,018	0,031	0,055	0,048	0,026	0,022	0,024	0,014	0,0090
kok.N	Tuleva (vl)	kg/d	300	420	350	280	300	390	250	290	240	220
	Käsitelty	kg/d	14	33	85	46	73	38	20	53	28	43
	Ohitus	kg/d										
	Vesistöön	kg/d	14	33	85	46	73	38	20	53	28	43
	Tuleva (vl)	mg/l	38	51	40	40	40	48	33	40	38	24
	Käsitelty	mg/l	1,7	4,0	9,8	6,5	9,5	4,7	2,6	7,4	4,4	4,7
	Ohitus	mg/l										
	Vesistöön	mg/l	1,7	4,0	9,8	6,5	9,5	4,7	2,6	7,4	4,4	4,7

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			8.11.	22.11.	12.12.	19.12.	Jakso	Raja	Tavoite
Virtaama	Puhd.tuleva	m³/d	6620	7100	9400	8090	**7590**		
	Käsitelty	m³/d	6620	7100	9400	8090	**7590**		
	Ohitus	m³/d	0	0	0	0	**0,68**		
	Vesistöön	m³/d	6620	7100	9400	8090	**7590**		
pros.lämpö	Tuleva (vl)	°C							
	Käsitelty	°C	22,6	22,0	14,7	19,8	**24,4**		
	Ohitus	°C							
	Vesistöön	°C	22,6	22,0	14,7	19,8			
alkal.	Tuleva (vl)	mmol/l							
	Käsitelty	mmol/l	2,8	2,4	3,1	3,7	**2,5**		
	Ohitus	mmol/l							
	Vesistöön	mmol/l	2,8	2,4	3,1	3,7			
pH	Tuleva (vl)		7,5	7,8	7,6	7,6			
	Käsitelty		7,5	7,4	7,6	7,6	**7,5**		
	Ohitus								
	Vesistöön		7,5	7,4	7,6	7,6			
CODCr	Tuleva (vl)	kg/d	6700	6100	8300	5500	**6600**		
	Käsitelty	kg/d	380	290	550	420	**430**		
	Ohitus	kg/d					**0,49**		
	Vesistöön	kg/d	380	290	550	420	**430**		
	Tuleva (vl)	mg/l	1000	860	890	670	**870**		
	Käsitelty	mg/l	57	41	59	52	**57**	100	125
	Ohitus	mg/l					**720**		
	Vesistöön	mg/l	57	41	59	52	**57**	100	125
	Käsittelyteho	%	94	95	93	92	**93**	80	75
	Kokonaisteho	%	94	95	93	92	**93**	80	75
BOD7ATU	Tuleva (vl)	kg/d	2500	2300	3200	1900	**2000**		
	Käsitelty	kg/d	52	78	170	70	**83**		
	Ohitus	kg/d					**0,25**		
	Vesistöön	kg/d	52	78	170	70	**83**		
	Tuleva (vl)	mg/l	380	320	340	240	**260**		
	Käsitelty	mg/l	7,8	11	18	8,6	**11**	15	30
	Ohitus	mg/l					**370**		
	Vesistöön	mg/l	7,8	11	18	8,6	**11**	15	30
	Käsittelyteho	%	98	97	95	96	**96**	90	70
	Kokonaisteho	%	98	97	95	96	**96**	90	70
kok.P	Tuleva (vl)	kg/d	21	26	21	32	**27**		
	Käsitelty	kg/d	0,56	0,99	1,3	0,70	**2,0**		
	Ohitus	kg/d					**0,0040**		
	Vesistöön	kg/d	0,56	0,99	1,3	0,70	**2,0**		
	Tuleva (vl)	mg/l	3,2	3,7	2,3	3,9	**3,6**		
	Käsitelty	mg/l	0,085	0,14	0,14	0,086	**0,26**	0,3	
	Ohitus	mg/l					**5,9**		
	Vesistöön	mg/l	0,085	0,14	0,14	0,086	**0,26**	0,3	
	Käsittelyteho	%	97	96	94	98	**93**	90	
	Kokonaisteho	%	97	96	94	98	**93**	90	
liuk.P	Tuleva (vl)	mg/l							
	Käsitelty	mg/l	0,0060	0,015	0,022	0,033	**0,022**		
	Ohitus	mg/l							
	Vesistöön	mg/l	0,0060	0,015	0,022	0,033			
kok.N	Tuleva (vl)	kg/d	250	290	280	340	**330**		
	Käsitelty	kg/d	13	32	150	190	**57**		
	Ohitus	kg/d					**0,075**		
	Vesistöön	kg/d	13	32	150	190	**57**		
	Tuleva (vl)	mg/l	37	40	30	41	**43**		
	Käsitelty	mg/l	2,0	4,5	16	24	**7,5**	15	
	Ohitus	mg/l					**110**		
	Vesistöön	mg/l	2,0	4,5	16	24	**7,5**	15	

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			2.1.	16.1.	7.2.	21.2.	6.3.	21.3.	5.4.	26.4.	10.5.	22.5.
kok.N	Käsittelyteho	%	91	81	94	91	94	84	89	77	67	75
	Kokonaisteho	%	91	81	94	91	94	84	89	77	67	75
NH4-N	Tuleva (vl)	kg/d										
	Käsitelty	kg/d	15	63	2,1	3,0	0,72	43	8,2	87	100	45
	Ohitus	kg/d										
	Vesistöön	kg/d	15	63	2,1	3,0	0,72	43	8,2	87	100	45
	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	1,8	8,5	0,30	0,40	0,10	5,3	0,90	8,5	12	5,5
	Ohitus	mg/l										
	Vesistöön	mg/l	1,8	8,5	0,30	0,40	0,10	5,3	0,90	8,5	12	5,5
	Käsittelyteho	%										
	Kokonaisteho	%										
KA	Tuleva (vl)	kg/d	8500	7200	7200	5000	5400	3500	6200	4200	6400	6000
	Käsitelty	kg/d	64	70	110	43	140	15	770	110	59	760
	Ohitus	kg/d										
	Vesistöön	kg/d	64	70	110	43	140	15	770	110	59	760
	Tuleva (vl)	mg/l	1000	970	1000	680	750	440	680	400	760	730
	Käsitelty	mg/l	7,8	9,5	16	5,8	20	1,9	84	11	7,0	93
	Ohitus	mg/l										
	Vesistöön	mg/l	7,8	9,5	16	5,8	20	1,9	84	11	7,0	93
	Käsittelyteho	%	99	99	98	99	97	100	88	97	99	87
	Kokonaisteho	%	99	99	98	99	97	100	88	97	99	87
Bisfen A	Tuleva (vl)	kg/d										
	Käsitelty	kg/d	0,0031	0,0019	0,0023	0,060				0,35		
	Ohitus	kg/d										
	Vesistöön	kg/d	0,0031	0,0019	0,0023	0,060				0,35		
	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	0,00038	0,00025	0,00033	0,0081		0,0	0,0	0,034	0,0	0,0
	Ohitus	mg/l										
	Vesistöön	mg/l	0,00038	0,00025	0,00033	0,0081		0,0	0,0	0,034	0,0	0,0
	Käsittelyteho	%										
	Kokonaisteho	%										
Nitrif.aste	Käsittelyteho	%	94	87	99	99	100	88	98	82	72	88
	Kokonaisteho	%	94	87	99	99	100	88	98	82	72	88

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			6.6.	19.6.	4.7.	19.7.	2.8.	22.8.	5.9.	18.9.	2.10.	16.10.
kok.N	Käsittelyteho	%	96	92	75	84	76	90	92	82	88	81
	Kokonaisteho	%	96	92	75	84	76	90	92	82	88	81
NH4-N	Tuleva (vl)	kg/d										
	Käsitelty	kg/d	1,6	13	60	3,5	57	14	0,77	8,7	1,9	1,8
	Ohitus	kg/d										
	Vesistöön	kg/d	1,6	13	60	3,5	57	14	0,77	8,7	1,9	1,8
	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	0,20	1,6	6,9	0,50	7,5	1,7	0,10	1,2	0,30	0,20
	Ohitus	mg/l										
	Vesistöön	mg/l	0,20	1,6	6,9	0,50	7,5	1,7	0,10	1,2	0,30	0,20
	Käsittelyteho	%										
	Kokonaisteho	%										
KA	Tuleva (vl)	kg/d	4400	6500	5500	3800	6400	5500	3400	2900	5500	3800
	Käsitelty	kg/d	120	310	160	42	220	380	200	87	90	800
	Ohitus	kg/d										
	Vesistöön	kg/d	120	310	160	42	220	380	200	87	90	800
	Tuleva (vl)	mg/l	550	780	640	540	840	680	440	400	860	410
	Käsitelty	mg/l	15	38	19	6,0	29	47	26	12	14	88
	Ohitus	mg/l										
	Vesistöön	mg/l	15	38	19	6,0	29	47	26	12	14	88
	Käsittelyteho	%	97	95	97	99	97	93	94	97	98	79
	Kokonaisteho	%	97	95	97	99	97	93	94	97	98	79
Bisfen A	Tuleva (vl)	kg/d										
	Käsitelty	kg/d		0,0012	0,27		0,17			0,014		
	Ohitus	kg/d										
	Vesistöön	kg/d		0,0012	0,27		0,17			0,014		
	Tuleva (vl)	mg/l										
	Käsitelty	mg/l	0,0	0,00015	0,031	0,0	0,022		0,0	0,0019	0,0	
	Ohitus	mg/l										
	Vesistöön	mg/l	0,0	0,00015	0,031	0,0	0,022		0,0	0,0019	0,0	
	Käsittelyteho	%										
	Kokonaisteho	%										
Nitrif.aste	Käsittelyteho	%	99	97	83	99	81	96	100	97	99	99
	Kokonaisteho	%	99	97	83	99	81	96	100	97	99	99

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			8.11.	22.11.	12.12.	19.12.	**Jakso**	Raja	Tavoite
kok.N	Käsittelyteho	%	95	89	46	42	**83**	75	
	Kokonaisteho	%	95	89	46	42	**83**	75	
NH4-N	Tuleva (vl)	kg/d							
	Käsitelty	kg/d	0,66	19	130	180	**34**		
	Ohitus	kg/d					**0,064**		
	Vesistöön	kg/d	0,66	19	130	180	**34**		
	Tuleva (vl)	mg/l							
	Käsitelty	mg/l	0,10	2,7	14	22	**4,5**	5	
	Ohitus	mg/l					**94**		
	Vesistöön	mg/l	0,10	2,7	14	22	**4,5**	5	
	Käsittelyteho	%							
	Kokonaisteho	%							
KA	Tuleva (vl)	kg/d	5300	5500	6600	3300	**5300**		
	Käsitelty	kg/d	73	130	160	78	**200**		
	Ohitus	kg/d					**0,26**		
	Vesistöön	kg/d	73	130	160	78	**200**		
	Tuleva (vl)	mg/l	800	780	700	410	**700**		
	Käsitelty	mg/l	11	19	17	9,6	**26**	15	35
	Ohitus	mg/l					**380**		
	Vesistöön	mg/l	11	19	17	9,6	**26**	15	35
	Käsittelyteho	%	99	98	98	98	**96**	95	90
	Kokonaisteho	%	99	98	98	98	**96**	95	90
Bisfen A	Tuleva (vl)	kg/d							
	Käsitelty	kg/d					**0,049**		
	Ohitus	kg/d					**0,0**		
	Vesistöön	kg/d					**0,049**		
	Tuleva (vl)	mg/l							
	Käsitelty	mg/l					**0,0064**		0,02
	Ohitus	mg/l					**0,0**		
	Vesistöön	mg/l					**0,0065**		0,02
	Käsittelyteho	%							
	Kokonaisteho	%							
Nitrif.aste	Käsittelyteho	%	100	93	53	46	**90**	90	
	Kokonaisteho	%	100	93	53	46	**90**	90	

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSOT: **J1 = 1.1.2017 - 31.3.2017**
J2 = 1.4.2017 - 30.6.2017
J3 = 1.7.2017 - 30.9.2017
J4 = 1.10.2017 - 31.12.2017

Tulokset/jaksot			J1	J2	J3	J4	Vuosi	Raja	Tavoite
Virtaama	Käsitelty	m³/d	7280	7440	7180	8430	**7580**		
	Ohitus	m³/d	0,0	2,75	0,0	0,0	**0,688**		
	Vesistöön	m³/d	7280	7440	7180	8430	**7580**		
CODCr	Tuleva vl	kg/d	7000	7800	5700	6100	**6700**		
	Käsitelty	kg/d	310	480	400	560	**440**		
	Ohitus	kg/d	0,0	2,0	0,0	0,0	**0,50**		
	Vesistöön	kg/d	310	480	400	560	**440**		
	Tuleva vl	mg/l	960	1000	790	720	**880**		
	Käsitelty	mg/l	43	64	56	66	**58**	100	125
	Ohitus	mg/l	0,0	730	0,0	0,0	**730**		
	Vesistöön	mg/l	43	65	56	66	**58**	100	125
	Käsittelyteho	%	96	94	93	91	**94**	80	75
	Kokonaisteho	%	96	94	93	91	**94**	80	75
BOD7ATU	Tuleva vl	kg/d	2200	2300	1600	2100	**2100**		
	Käsitelty	kg/d	55	100	65	100	**80**		
	Ohitus	kg/d	0,0	0,99	0,0	0,0	**0,25**		
	Vesistöön	kg/d	55	100	65	100	**80**		
	Tuleva vl	mg/l	300	310	220	250	**280**		
	Käsitelty	mg/l	7,6	14	9,1	12	**11**	15	30
	Ohitus	mg/l	0,0	360	0,0	0,0	**360**		
	Vesistöön	mg/l	7,6	14	9,1	12	**11**	15	30
	Käsittelyteho	%	98	96	96	95	**96**	90	70
	Kokonaisteho	%	98	96	96	95	**96**	90	70
kok.P	Tuleva vl	kg/d	26	33	24	23	**27**		
	Käsitelty	kg/d	0,60	3,1	2,0	1,9	**1,9**		
	Ohitus	kg/d	0,0	0,016	0,0	0,0	**0,0040**		
	Vesistöön	kg/d	0,60	3,1	2,0	1,9	**1,9**		
	Tuleva vl	mg/l	3,6	4,4	3,3	2,7	**3,6**		
	Käsitelty	mg/l	0,083	0,42	0,28	0,22	**0,25**	0,3	
	Ohitus	mg/l	0,0	5,8	0,0	0,0	**5,8**		
	Vesistöön	mg/l	0,082	0,42	0,28	0,23	**0,25**	0,3	
	Käsittelyteho	%	98	91	92	92	**93**	90	
	Kokonaisteho	%	98	91	92	92	**93**	90	
kok.N	Tuleva vl	kg/d	340	390	310	270	**330**		
	Käsitelty	kg/d	38	59	49	83	**57**		
	Ohitus	kg/d	0,0	0,30	0,0	0,0	**0,075**		
	Vesistöön	kg/d	38	59	49	83	**57**		
	Tuleva vl	mg/l	47	52	43	32	**44**		
	Käsitelty	mg/l	5,2	7,9	6,8	9,9	**7,5**	15	
	Ohitus	mg/l	0,0	110	0,0	0,0	**110**		
	Vesistöön	mg/l	5,2	8,0	6,8	9,8	**7,5**	15	
	Käsittelyteho	%	89	85	84	69	**82**	75	
	Kokonaisteho	%	89	85	84	69	**82**	75	
NH4-N	Tuleva vl	kg/d							
	Käsitelty	kg/d	20	36	22	60	**35**		
	Ohitus	kg/d	0,0	0,26	0,0	0,0	**0,065**		
	Vesistöön	kg/d	20	36	22	60	**35**		
	Tuleva vl	mg/l							
	Käsitelty	mg/l	2,8	4,9	3,1	7,1	**4,6**	5	
	Ohitus	mg/l	0,0	95	0,0	0,0	**94**		
	Vesistöön	mg/l	2,7	4,9	3,1	7,1	**4,6**	5	
	Käsittelyteho	%							
	Kokonaisteho	%							

PUHDISTAMO: JVP-Eura Oy:n jätevedenpuhdistamo
LAITOSTUNNUS: 143
TARKKAILUJAKSOT: **J1 = 1.1.2017 - 31.3.2017**
J2 = 1.4.2017 - 30.6.2017
J3 = 1.7.2017 - 30.9.2017
J4 = 1.10.2017 - 31.12.2017

Tulokset/jaksot			J1	J2	J3	J4	**Vuosi**	Raja	Tavoite
KA	Tuleva vl	kg/d	6100	5600	4600	5000	**5300**		
	Käsitelty	kg/d	72	310	170	240	**200**		
	Ohitus	kg/d	0,0	1,0	0,0	0,0	**0,25**		
	Vesistöön	kg/d	72	310	170	240	**200**		
	Tuleva vl	mg/l	840	750	640	590	**700**		
	Käsitelty	mg/l	9,9	41	24	29	**26**	15	35
	Ohitus	mg/l	0,0	360	0,0	0,0	**360**		
	Vesistöön	mg/l	9,9	42	24	28	**26**	15	35
	Käsittelyteho	%	99	94	96	95	**96**	95	90
	Kokonaisteho	%	99	94	96	95	**96**	95	90
Bisfen A	Tuleva vl	kg/d							
	Käsitelty	kg/d	0,013	0,050	0,086	0,0	**0,037**		
	Ohitus	kg/d	0,0	0,0	0,0	0,0	**0,0**		
	Vesistöön	kg/d	0,013	0,050	0,086	0,0	**0,037**		
	Tuleva vl	mg/l							
	Käsitelty	mg/l	0,0018	0,0067	0,012	0,0	**0,0049**		0,02
	Ohitus	mg/l	0,0	0,0	0,0	0,0	**0,0**		
	Vesistöön	mg/l	0,0018	0,0067	0,012	0,0	**0,0049**		0,02
	Käsittelyteho	%							
	Kokonaisteho	%							
Nitrif.aste	Käsittelyteho	%	94	91	93	78	**89**	90	
	Kokonaisteho	%	94	91	93	78	**89**	90	

LIITE 5

PÄIVITTÄISET OHITUKSET

Puhdistamo: JVP-Eura Oy
Laskentajakso: 1.1.-31.21.
Vuosi: 2017

Huomautukset: Väliselkeytetty ohitus sisältyy käsiteltyyn jätevesimäärään

Päivämäärä	Käsitelty vesimäärä m^3/d	Ohitukset verkostossa m^3/d	Ohitukset puhdistamolla			Huom.
			jv m^3/d	Teol. tuleva jv m^3/d	Väliselkeytetty jv m^3/d	
16.5.2017		250				Euran kunnan Sorkkisten pumppaamon ohitus klo 8:40-10:50

JVP-Eura Oy ohituskuormien laskenta vuosi 2017

Ohituskuorma 1-2017
Ei ohituksia.

Ohituskuorma 2-2017

Määrityksen nimi	Yksikkö	kunta/verkosto-ohitus
Virtaama	m3/jakso	250
CODCr	mg/l	710
BOD7ATU	mg/l	360
kokonaisfosfori	mg/l	5,8
kokonaistyppi	mg/l	110
ammoniumtyppi	mg/l	93
kiintoaine	mg/l	380
Bisfenoli A	mg/l	

Määrityksen nimi		kunta/verkosto-ohitus	Yhteensä
CODCr	kg/d	0,49	0,49
BOD7ATU	kg/d	0,25	0,25
kokonaisfosfori	kg/d	0,004	0,004
kokonaistyppi	kg/d	0,075	0,075
ammoniumtyppi	kg/d	0,064	0,064
kiintoaine	kg/d	0,26	0,26
Bisfenoli A	kg/d		0

Ohituskuorma 3-2017
Ei ohituksia.

Ohituskuorma 4-2017
Ei ohituksia.

FINAS Finnish Accreditation Service T101 (EN ISO/IEC 17025)

JVP-Eura Oy
pirjo.patala@jvp-eura.fi

Tilausnro 201484 (EURA8/YLIM), saapunut 16.5.2017, näytteet otettu 16.5.2017

NÄYTTEET

Lab.nro	Näytteen kuvaus
6288	Sorkkisten pmo, ohitettu jv 16.5.2017

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	6288
Vuorokausivirtaama	m3/d	250
COD(Cr) *	mg/l	710
...CODCr-kuorma	kg/d	180
BOD7(ATU) *	mg/l	360
...BOD7ATU-kuorma	kg/d	91
Kokonaisfosfori *	mg/l	5,8
...Fosforikuorma	kg/d	1,5
Kokonaistyppi *	mg/l	110
...Typpikuorma	kg/d	29
Ammoniumtyppi *	mg/l	93
...Ammoniumtyppikuorma	kg/d	23
Kiintoaine (GF/A)*	mg/l	380
...Kiintoainekuorma	kg/d	96

Merkintöjen selityksiä: P = määritys kesken, E = ei tehty, ~ = noin, < = pienempi kuin, « = pienempi tai yhtäsuuri kuin, > = suurempi kuin, » = suurempi tai yhtäsuuri kuin.
* -merkityt analyysit ovat akkreditoituja.

LAUSUNTO

Ohessa Euran kunnan Sorkkisten jätevedenpumppaamon ohituksesta kerätyn jätevesinäytteen tulokset. Ohitetusta jätevedestä kerättiin 3 osanäytettä 16.5.2017 Euran vesihuoltolaitoksen toimesta. Osanäytteet yhdistettiin kokoomanäytteeksi laboratoriossa.

Sorkkisten pumppaamon ohitus tapahtui 16.5.2017 klo 08.40-10.50 välisenä aikana. Ohituspumppauskaluston nimellisestä pumppaustehosta arvioituna Eurajokeen pumpattiin ko. aikana jätevettä noin 250 m3. Tulosten oheen on laskettu ohitetun jäteveden vesistöön aiheuttama kuormitus. Ohituskuorma lasketaan JVP-Eura Oy:n jakson 2-2017 vesistökuormaan mukaan verkosto-ohituksena.

Nina Leino
prosessi-insinööri, DI

TIEDOKSI

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Katuosoite	Postiosoite	Puhelin	Sähköposti	Alv.rek.
Telekatu 16	Telekatu 16			Y 1564941-9
20360 TURKU	20360 TURKU	*(02) 274 0200	nina.leino@lsvsy.fi	Krnro 774822

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
Vuorokausivirtaama	(TL27)
COD(Cr) *	ISO 15705 (TL27)
BOD7(ATU) *	SFS-EN 1899-1 (TL27)
Kokonaisfosfori *	Sis A15, Lachat QuickChem method 10-115-01 (TL27)
Kokonaistyppi *	SFS 5505 (TL27)
Ammoniumtyppi *	Sis A57, Standard Methods... 20th ed. method 4500 NH3 E (TL27)
Kiintoaine (GF/A)*	SFS-EN 872 (TL27)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL27	Lounais-Suomen vesi- ja ympäristötutkimus Oy

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.
COD(Cr) *	2017/6288	±15 %	17.5.2017
BOD7(ATU) *	2017/6288	±15 %	17.5.2017
Kokonaisfosfori *	2017/6288	±15 %	19.5.2017
Kokonaistyppi *	2017/6288	±10 %	19.5.2017
Ammoniumtyppi *	2017/6288	±10 %	17.5.2017
Kiintoaine (GF/A)*	2017/6288	±20 %	17.5.2017

LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Kuntalinjan (Euran kunta, HKScan Finland Oy ja muut teoll.liittyjät) osuus puhdistamolle tulevasta jätevedestä
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	16.1.	7.2.	21.2.	6.3.	21.3.	5.4.	26.4.	11.5.	22.5.	6.6.	19.6.	4.7.	19.7.	2.8.	22.8.	5.9.	19.9.
Virtaama	m^3/d	3195	3157	2670	2736	2828	3857	3569	5405	3140	2659	2994	3113	3392	2608	3171	2474	2474	2346
pH		7,2	7,6	7,4	7,7	7,4	7,5	7,2	7,4	7,6	7,5	7,4	7,2	7,8	7,7	7,4	7,6	7,8	7,9
COD_{Cr}	mg/l	950	1300	1500	690	490	450	1300	790	470	1300	1000	1900	660	540	960	800	640	1100
	kg/d	3035	4104	4005	1888	1386	1736	4640	4270	1476	3457	2994	5915	2239	1408	3044	1979	1583	2581
BOD_{7ATU}	mg/l	490	610	860	250	380	170	540	350	200	700	550	780	220	180	360	340	220	380
	kg/d	1566	1926	2296	684	1075	656	1927	1892	628	1861	1647	2428	746	469	1142	841	544	891
Fosfori	mg/l	8,9	9,5	9,5	6,7	7,2	6	10	4,7	6,2	13	9	15	6,9	7	9,1	8,7	6,9	8,7
	kg/d	28	30	25	18	20	23	36	25	19	35	27	47	23	18	29	22	17	20
Typpi	mg/l	70	140	120	130	74	90	110	87	99	130	95	130	96	100	91	120	95	120
	kg/d	224	442	320	356	209	347	393	470	311	346	284	405	326	261	289	297	235	282
Kiintoaine	mg/l	640	800	960	300	200	160	870	190	190	680	700	1200	320	190	470	350	270	480
	kg/d	2045	2526	2563	821	566	617	3105	1027	597	1808	2096	3736	1085	496	1490	866	668	1126

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Kuntalinjan (Euran kunta, HKScan Finland Oy ja muut teoll.liittyjät) osuus puhdistamolle tulevasta jätevedestä
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.10.	16.10.	8.11.	22.11.	12.12.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	1257	3691	2328	2766	4755	3804	**2971**	**2798**	**2205**	**3068**	**2759**
pH		7,6	7,4	7,3	7,6	7,4	7,5	**7,5**	**7,4**	**7,7**	**7,5**	**7,5**
COD_{Cr}	mg/l	1900	470	1200	840	920	870	**910**	**1360**	**970**	**920**	**1070**
	kg/d	2388	1735	2794	2323	4375	3309	**2692**	**3792**	**2139**	**2821**	**2954**
BOD_{7ATU}	mg/l	780	180	560	400	470	410	**460**	**620**	**350**	**430**	**500**
	kg/d	980	664	1304	1106	2235	1560	**1367**	**1731**	**772**	**1308**	**1374**
Fosfori	mg/l	14	4,7	8,4	7,4	4,1	8,1	**8,2**	**11,2**	**9,8**	**6,8**	**9,1**
	kg/d	18	17	20	20	19	31	**24**	**31**	**22**	**21**	**25**
Typpi	mg/l	170	57	100	100	56	86	**110**	**130**	**130**	**83**	**110**
	kg/d	214	210	233	277	266	327	**316**	**368**	**281**	**254**	**312**
Kiintoaine	mg/l	1100	320	680	270	500	310	**510**	**740**	**430**	**460**	**530**
	kg/d	1383	1181	1583	747	2378	1179	**1523**	**2061**	**955**	**1408**	**1466**

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Jujo Thermal Oy:n paperitehtaan osuus puhdistamolle tulevasta jätevedestä
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	16.1.	7.2.	21.2.	6.3.	21.3.	5.4.	26.4.	11.5.	22.5.	6.6.	19.6.	4.7.	19.7.	2.8.	22.8.	5.9.	19.9.
Virtaama	m^3/d	4957	4256	4171	4687	4380	4181	5545	4877	5241	5505	4999	5137	5240	4395	4483	5211	5211	4869
pH		8	7,8	7,8	7,8	8	7,7	7,8	7,9	7,9	7,8	7,8	7,9	7,8	7,8	7,7	7,7	7,9	8
COD_{Cr}	mg/l	920	1000	1200	970	1000	730	570	1400	860	510	540	730	850	710	1000	720	590	420
	kg/d	4560	4256	5005	4546	4380	3052	3161	6828	4507	2808	2699	3750	4454	3120	4483	3752	3074	2045
BOD_{7ATU}	mg/l	160	150	150	190	200	170	97	100	110	120	120	120	140	180	170	120	210	130
	kg/d	793	638	626	891	876	711	538	488	576,5	661	600	616	734	791	762	625	1094	633
Fosfori	mg/l	0,41	0,29	0,38	0,3	0,36	0,3	0,23	0,33	0,42	0,27	0,34	0,3	0,44	0,57	0,42	0,37	0,35	0,17
	kg/d	2,0	1,2	1,6	1,4	1,6	1,3	1,3	1,6	2,2	1,5	1,7	1,5	2,3	2,5	1,9	1,9	1,8	0,8
Typpi	mg/l	3,0	7,5	4,0	2,1	3,9	2,2	3,4	3,5	9,2	3,4	3,8	3,9	3,7	3,6	3,5	5,0	3,7	2,0
	kg/d	15	32	17	10	17	9	19	17	48	19	19	20	19	16	16	26	19	10
Kiintoaine	mg/l	1300	1100	1100	900	1100	690	550	640	1100	760	460	530	850	750	1100	880	520	360
	kg/d	6444	4682	4588	4218	4818	2885	3050	3121	5765	4184	2300	2723	4454	3296	4931	4586	2710	1753

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Jujo Thermal Oy:n paperitehtaan osuus puhdistamolle tulevasta jätevedestä
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.10.	16.10.	8.11.	22.11.	12.12.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	5144	5382	4288	4330	4646	4287	**4311**	**4645**	**4978**	**5359**	**4827**
pH		7,8	7,7	7,6	7,9	7,8	7,7	**7,9**	**7,9**	**7,8**	**7,8**	**7,8**
COD_{Cr}	mg/l	640	440	900	880	850	500	**1000**	**850**	**700**	**600**	**780**
	kg/d	3292	2368	3859	3810	3949	2144	**4300**	**3959**	**3488**	**3237**	**3746**
BOD_{7ATU}	mg/l	89	110	280	270	210	85	**180**	**120**	**160**	**150**	**150**
	kg/d	458	592	1201	1169	976	364	**756**	**580**	**773**	**793**	**726**
Fosfori	mg/l	0,29	0,17	0,41	1,3	0,37	0,21	**0,35**	**0,35**	**0,38**	**0,39**	**0,37**
	kg/d	1,5	0,9	1,8	5,6	1,7	0,9	**1,5**	**1,6**	**1,9**	**2,1**	**1,8**
Typpi	mg/l	5,3	1,8	3,5	2,4	3,0	2,0	**3,9**	**5,1**	**3,5**	**2,6**	**3,7**
	kg/d	27	10	15	10	14	9	**17**	**24**	**18**	**14**	**18**
Kiintoaine	mg/l	800	480	860	1100	910	500	**1070**	**760**	**730**	**670**	**790**
	kg/d	4115	2583	3688	4763	4228	2144	**4606**	**3524**	**3622**	**3587**	**3834**

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Esiselkeytetty jätevesi, kuntalinjan (Euran kunta, HKScan Finland Oy Eura - kuntalinjan ohitus) jätevedet
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	7.2.	6.3.	5.4.	10.5.	6.6.	4.7.	2.8.	5.9.	2.10.	8.11.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	3195	2670	2828	3569	3140	2994	3392	3171	2474	1257	2328	3804	**2971**	**2798**	**2205**	**3068**	**2759**
BOD_{7ATU}	mg/l	230	460	90	340	140	270	100	180	140	240	290	210	**250**	**290**	**190**	**190**	**230**
	kg/d	735	1228	255	1213	440	808	339	571	346	302	675	799	**739**	**820**	**419**	**592**	**643**
Fosfori	mg/l	6,7	7,0	4,8	6,0	6,2	5,3	5,2	6,7	6,1	10	8,1	5,4	**6,0**	**6,8**	**8,2**	**5,6**	**6,5**
	kg/d	21	19	14	21,4	19,5	16	18	21	15	13	19	21	**18**	**19**	**18**	**17**	**18**
Typpi	mg/l	65	120	61	91	98	71	85	83	84	150	100	80	**79**	**101**	**115**	**79**	**92**
	kg/d	208	320	173	325	308	213	288	263	208	189	233	304	**234**	**282**	**253**	**242**	**253**
Kiintoaine	mg/l	120	250	81	180	80	98	77	85	85	170	170	110	**140**	**141**	**112**	**112**	**130**
	kg/d	383	668	229	642	251	293	261	270	210	214	396	418	**427**	**396**	**247**	**343**	**353**

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Esiselkeytetty jätevesi, paperiteollisuudesta tulevat jätevedet
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	7.2.	6.3.	5.4.	10.5.	6.6.	4.7.	2.8.	5.9.	2.10.	8.11.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	4957	4171	4380	5545	5241	4999	5240	4483	5211	5144	4288	4287	**4311**	**4645**	**4978**	**5359**	**4827**
BOD_{7ATU}	mg/l	47	68	68	41	43	48	34	47	110	36	56	86	**63**	**50**	**64**	**49**	**56**
	kg/d	233	284	298	227	225	240	178	211	573	185	240	369	**271**	**231**	**321**	**265**	**272**
Fosfori	mg/l	0,086	0,22	0,12	0,14	0,19	0,12	0,14	0,11	0,10	0,12	0,08	0,07	**0,14**	**0,17**	**0,12**	**0,078**	**0,13**
	kg/d	0,43	0,92	0,53	0,78	1,0	0,60	0,73	0,49	0,52	0,62	0,34	0,30	**0,62**	**0,79**	**0,58**	**0,42**	**0,60**
Typpi	mg/l	0,5	2,5	2,4	2,8	5,7	1,5	2,6	2,5	2,1	3,5	2,9	1,3	**1,8**	**3,8**	**2,4**	**2,2**	**2,6**
	kg/d	2,5	10	11	16	30	7,5	14	11	11	18	12	5,6	**7,8**	**18**	**12**	**12**	**12**
Kiintoaine	mg/l	220	280	210	200	260	110	160	98	31	290	86	96	**250**	**220**	**100**	**140**	**170**
	kg/d	1091	1168	920	1109	1363	550	838	439	162	1492	369	412	**1059**	**1007**	**480**	**757**	**826**

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Esiselkeytetty jätevesi yhteensä ilmastukseen (paperiteollisuus es + kuntalinja es)
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	7.2.	6.3.	5.4.	10.5.	6.6.	4.7.	2.8.	5.9.	2.10.	8.11.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	8152	6841	7208	9114	8381	7993	8632	7654	7685	6401	6616	8091	**7282**	**7443**	**7184**	**8427**	**7586**
BOD_{7ATU}	mg/l	119	221	77	158	79	131	60	102	120	76	138	144	**140**	**140**	**103**	**102**	**120**
	kg/d	968	1512	552	1441	665	1048	517	781	920	487	915	1168	**1011**	**1051**	**739**	**857**	**915**
Fosfori	mg/l	2,7	2,9	2,0	2,4	2,4	2,1	2,1	2,8	2,0	2,1	2,9	2,6	**2,5**	**2,6**	**2,6**	**2,1**	**2,5**
	kg/d	22	20	14	22	20	16	18	22	16	13	19	21	**19**	**20**	**19**	**18**	**19**
Typpi	mg/l	26	48	25	37	40	28	35	36	28	32	37	38	**33**	**40**	**37**	**30**	**35**
	kg/d	210	331	183	340	338	220	302	274	219	207	245	310	**241**	**299**	**265**	**254**	**265**
Kiintoaine	mg/l	181	268	159	192	193	106	127	93	48	266	116	103	**200**	**190**	**100**	**130**	**160**
	kg/d	1474	1835	1149	1751	1614	843	1100	709	372	1705	765	830	**1486**	**1403**	**727**	**1100**	**1179**

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Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Flotaatioon johdettu väliselkeytetty jätevesi
(Paperitehtaat tuleva + kuntalinja tuleva - kuntalinjan ohitus - väliselkeytetty ohitus)
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.1.	16.1.	7.2.	21.2.	6.3.	21.3.	5.4.	26.4.	10.5.	22.5.	6.6.	19.6.	4.7.	19.7.	2.8.	22.8.	5.9.	18.9.
Virtaama	m^3/d	8152	7413	6841	7423	7208	8038	9114	10282	8381	8164	7993	8250	8632	7003	7654	7685	7685	7215
Alkaliteetti	mmol/l	2,2	4,2	3,8	2,4	2,4	2,4	2,7	2,7	3,9	4,2	2,2	3	3,3	1,7	2,7	3	3,1	2,3
pH		7,4	7,6	7,4	7,3	7,3	7,5	7,2	7,3	7,6	7,2	7,3	7,3	7,5	7,2	7,4	7,2	7,5	7,3
COD_{Cr}	mg/l	69	120	350	120	450	55	520	260	75	1900	380	1600	180	120	350	1200	130	180
	kg/d	562	890	2394	891	3244	442	4739	2673	629	15512	3037	13200	1554	840	2679	9222	999	1299
BOD_{7ATU}	mg/l	14	11	64	16	94	5,5	130	37	11	220	96	530	29	6,2	100	250	14	23
	kg/d	114	82	438	119	678	44	1185	380	92	1796	767	4373	250	43	765	1921	108	166
Fosfori	mg/l	0,29	0,42	2,1	0,58	4,0	0,21	2,4	2,2	0,7	15	2,7	21	2,0	1,2	3,0	11	1,2	1,4
	kg/d	2,4	3,1	14	4,3	29	1,7	22	23	5,9	122	22	173	17	8,4	23	85	9,2	10
Typpi	mg/l	3,2	13	13	7	19	7,4	11	18	16	72	12	45,0	15	8,1	20	54	6,8	12
	kg/d	26	96	89	52	137	59	100	185	134	588	96	371	129	57	153	415	52	87
NH4-N	mg/l	1,4	8,4	0,7	0,1	0,6	5,1	0,9	7,7	11	8,8	0,4	3,7	6,1	0,1	8,6	4,3	0,4	0,5
	kg/d	11	62	4,8	0,74	4,3	41	8,2	79	92	72	3,2	31	53	0,70	66	33	3,1	3,6
Kiintoaine	mg/l	44	90	330	62	440	20	560	210	59	1500	300	1600	120	86	250	1000	100	130
	kg/d	359	667	2258	460	3172	161	5104	2159	494	12246	2398	13200	1036	602	1914	7685	769	938

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LOUNAIS-SUOMEN VESI- JA YMPÄRISTÖTUTKIMUS OY
Julkisen valvonnan alainen vesitutkimuslaitos

JVP-EURA OY:N KESKUSPUHDISTAMON JÄTEVESITARKKAILUN TULOKSET

Flotaatioon johdettu väliselkeytetty jätevesi
(Paperitehtaat tuleva + kuntalinja tuleva - kuntalinjan ohitus - väliselkeytetty ohitus)
Jakso: 1.1.-31.12.2017

Päivämäärä:		2.10.	16.10.	8.11.	22.11.	12.12.	19.12.	**I/2017**	**II/2017**	**III/2017**	**IV/2017**	**Vuosi 2017**
Virtaama	m^3/d	6401	9073	6616	7096	9401	8091	**7282**	**7443**	**7184**	**8427**	**7586**
Alkaliteetti	mmol/l	2,5	1,9	3,0	2,7	3,6	4,0	**2,9**	**3,1**	**2,7**	**3,0**	**2,9**
pH		7,5	7,3	7,4	7,3	7,5	7,6	**7,4**	**7,3**	**7,4**	**7,4**	**7,4**
COD_{Cr}	mg/l	73	370	240	380	310	120	**190**	**890**	**380**	**240**	**420**
	kg/d	467,27	3357	1588	2696	2914,3	970,92	**1404**	**6632**	**2765**	**1999**	**3200**
BOD_{7ATU}	mg/l	7,6	62	120	63	160	13	**34**	**192**	**75**	**68**	**92**
	kg/d	49	563	794	447	1504	105	**246**	**1432**	**542**	**577**	**699**
Fosfori	mg/l	0,39	2,8	0,67	2,1	1,5	0,51	**1,3**	**8,2**	**3,5**	**1,3**	**3,5**
	kg/d	2,5	25	4,4	15	14	4,1	**9,1**	**61**	**25**	**11**	**27**
Typpi	mg/l	5,0	13	4,5	12	21	24	**11**	**33,0**	**21**	**13**	**19**
	kg/d	32	118	30	85	197	194	**77**	**246**	**149**	**109**	**145**
NH4-N	mg/l	0,2	0,7	0,1	2,2	12	21	**2,9**	**6,4**	**3,7**	**6,1**	**4,8**
	kg/d	1,3	6,4	0,7	16	113	170	**21**	**48**	**26**	**51**	**36**
Kiintoaine	mg/l	47	340	210	380	320	63	**160**	**800**	**300**	**220**	**370**
	kg/d	301	3085	1389	2696	3008	510	**1179**	**5934**	**2157**	**1832**	**2775**

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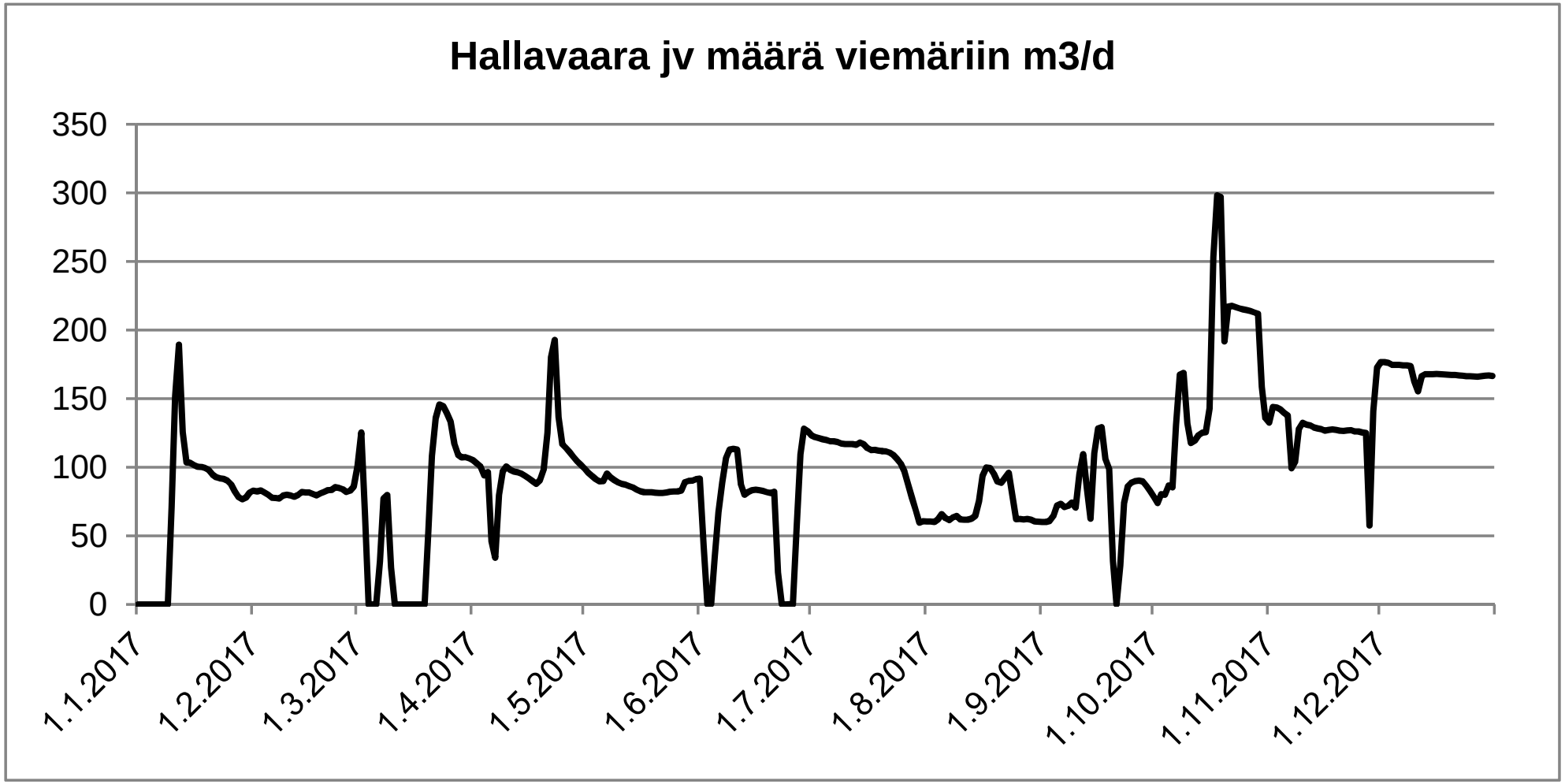
PUHDISTAMO: HKScan Finland Oy Euran jätevesitarkkailu
LAITOSTUNNUS: 1118
TARKKAILUJAKSO: 1.1.2017-31.12.2017

Tulokset/tarkk.kerrat			16.1.	21.2.	21.3.	26.4.	22.5.	19.6.	19.7.	22.8.	18.9.	16.10.	22.11.	12.12.	**Jakso**	Raja	Tavoite
Virtaama	Puhd.tuleva	m³/d	1550	1440	1550	1500	1720	1570	1580	1340	1160	69,0	56,0	78,0	**808**		
	Käsitelty	m³/d	1550	1440	1550	1500	1720	1570	1580	1340	1160	69,0	56,0	78,0	**808**		
	Ohitus	m³/d	0	0	0	0	0	0	0	0	0	0	0	0	**0,0**		
	Vesistöön	m³/d	1550	1440	1550	1500	1720	1570	1580	1340	1160	69,0	56,0	78,0	**808**		
pros.lämpö	Tuleva (vl)	°C															
	Käsitelty	°C	13,7	13,3	14,3	14,5	18,6	19,0	19,9	20,0	17,4	11,6	5,2		**16,7**		
	Ohitus	°C															
	Vesistöön	°C	13,7	13,3	14,3	14,5	18,6	19,0	19,9	20,0	17,4	11,6	5,2				
pH	Tuleva (vl)		6,2			6,1		5,7			4,4						
	Käsitelty		7,2	7,5	7,4	7,8	7,7	5,9	7,4	7,3	7,0	5,5	6,7	6,9	**7,2**		
	Ohitus																
	Vesistöön		7,2	7,5	7,4	7,8	7,7	5,9	7,4	7,3	7,0	5,5	6,7	6,9			
CODCr	Tuleva (vl)	kg/d	700			570		670			750				**670**		
	Käsitelty	kg/d	100	76	140	49	88	96	65	270	260	26	15	11	**71**		
	Ohitus	kg/d													**0,0**		
	Vesistöön	kg/d	100	76	140	49	88	96	65	270	260	26	15	11	**71**		
	Tuleva (vl)	mg/l	450			380		430			650				**830**		
	Käsitelty	mg/l	65	53	92	33	51	61	41	200	220	370	260	140	**88**		
	Ohitus	mg/l													**0,0**		
	Vesistöön	mg/l	65	53	92	33	51	61	41	200	220	370	260	140	**88**		
	Käsittelyteho	%	86			91		86			66				**89**		
	Kokonaisteho	%	86			91		86			66				**89**		
BOD7ATU	Tuleva (vl)	kg/d	340			240		280			370				**310**		
	Käsitelty	kg/d	22	20	54	8,1	15	27	12	64	58	3,7	1,5	1,5	**17**	50	
	Ohitus	kg/d													**0,0**		
	Vesistöön	kg/d	22	20	54	8,1	15	27	12	64	58	3,7	1,5	1,5	**17**	50	
	Tuleva (vl)	mg/l	220			160		180			320				**380**		
	Käsitelty	mg/l	14	14	35	5,4	9,0	17	7,9	48	50	53	26	19	**21**		30
	Ohitus	mg/l													**0,0**		
	Vesistöön	mg/l	14	14	35	5,4	9,0	17	7,9	48	50	53	26	19	**21**		30
	Käsittelyteho	%	94			97		91			84				**95**		
	Kokonaisteho	%	94			97		91			84				**95**		
kok.P	Tuleva (vl)	kg/d	1,5			2,2		3,9			4,2				**3,0**		
	Käsitelty	kg/d	0,39	1,6	5,4	0,36	1,1	1,6	0,71	6,3	3,1	0,43	0,20	0,13	**1,3**	5	
	Ohitus	kg/d													**0,0**		
	Vesistöön	kg/d	0,39	1,6	5,4	0,36	1,1	1,6	0,71	6,3	3,1	0,43	0,20	0,13	**1,3**	5	
	Tuleva (vl)	mg/l	1,0			1,5		2,5			3,6				**3,7**		
	Käsitelty	mg/l	0,25	1,1	3,5	0,24	0,62	1,0	0,45	4,7	2,7	6,3	3,6	1,7	**1,6**		3
	Ohitus	mg/l													**0,0**		
	Vesistöön	mg/l	0,25	1,1	3,5	0,24	0,62	1,0	0,45	4,7	2,7	6,3	3,6	1,7	**1,6**		3
	Käsittelyteho	%	75			84		60			25				**57**		
	Kokonaisteho	%	75			84		60			25				**57**		
kok.N	Tuleva (vl)	kg/d	110			91		110			84				**99**		
	Käsitelty	kg/d	71	89	91	81	120	36	60	100	45	4,0	0,95	2,1	**42**	68	
	Ohitus	kg/d													**0,0**		
	Vesistöön	kg/d	71	89	91	81	120	36	60	100	45	4,0	0,95	2,1	**42**	68	
	Tuleva (vl)	mg/l	74			61		72			72				**120**		
	Käsitelty	mg/l	46	62	59	54	67	23	38	78	39	58	17	27	**52**		40
	Ohitus	mg/l													**0,0**		
	Vesistöön	mg/l	46	62	59	54	67	23	38	78	39	58	17	27	**52**		40
	Käsittelyteho	%	38			11		68			46				**58**		
	Kokonaisteho	%	38			11		68			46				**58**		
KA	Tuleva (vl)	kg/d	98			100		190			210				**150**		
	Käsitelty	kg/d	6,7	27	110	7,8	16	25	21	130	94	14	15	3,8	**28**	200	
	Ohitus	kg/d													**0,0**		
	Vesistöön	kg/d	6,7	27	110	7,8	16	25	21	130	94	14	15	3,8	**28**	200	
	Tuleva (vl)	mg/l	63			68		120			180				**190**		
	Käsitelty	mg/l	4,3	19	71	5,2	9,4	16	13	100	81	210	260	49	**35**		120
	Ohitus	mg/l													**0,0**		
	Vesistöön	mg/l	4,3	19	71	5,2	9,4	16	13	100	81	210	260	49	**35**		120
	Käsittelyteho	%	93			92		87			55				**81**		
	Kokonaisteho	%	93			92		87			55				**81**		

Loimi-Hämeen jätehuolto Oy Hallavaran jätekeskuksen tasausaltaan jätevesi
Euran kunnan viemäriin lähtevän jäteveden tarkkailututkimusten tulokset (jätekeskuksen velvoitetarkkailutulokset, Eurofins Environment Testing Finland Oy)

NäytePvm	Näytteen nimi	Vrkvirt	CODCr	BOD7ATU	Kok.P	Kok.N	NH4-N	Kiintoaine	CODCr	BOD7ATU	Kok.P	Kok.N	NH4-N	Kiintoaine
		m3/d	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d
31.1.2017	viemäriin lähtevä	81,4	5200	2600	17	1800	1700	240	423	212	1	147	138	20
23.2.2017	viemäriin lähtevä	85,4	6100	2900	21	2100	1900	290	521	248	2	179	162	25
21.3.2017	viemäriin lähtevä	108,3	3400	1800	15	980	950	150	368	195	2	106	103	16
24.4.2017	viemäriin lähtevä	136,6	3500	1700	11,0	1200	1100	120	478	232	2	164	150	16
16.5.2017	viemäriin lähtevä	82,9	3600	1700	11	1300	1200	100	298	141	1	108	99	8
13.6.2017	viemäriin lähtevä	85,2	3600	1700	15	1300	1200	95	307	145	1	111	102	8
18.7.2017	viemäriin lähtevä	111,8	3400	1600	15	1200	1100	120	380	179	2	134	123	13
2.8.2017	viemäriin lähtevä	59,6	3900	2100	18	1300	1200	110	232	125	1	77	72	7
6.9.2017	viemäriin lähtevä	70,7	3900	1800	24	1300	1200	250	276	127	2	92	85	18
11.10.2017	viemäriin lähtevä	130,7	3100	1300	19	1300	1200	140	405	170	2	170	157	18
7.11.2017	viemäriin lähtevä	99,2	2600	950	14	1200	1200	290	258	94	1	119	119	29
19.12.2017	viemäriin lähtevä	168,0	3500	2000	3,6	910	850	200	588	336	1	153	143	34
	summa	1219,8							4535	2204	17	1560	1454	212
		m3/a	m3/d					**Laatu**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
	Virtaama	36 290	99,4						**3718**	**1807**	**14**	**1279**	**1192**	**174**
								Kuorma	**kg/d**	**kg/d**	**kg/d**	**kg/d**	**kg/d**	**kg/d**
									370	**180**	**1,4**	**127**	**118**	**17**

Tuloskooste ja kuormituslaskelma: Lounais-Suomen vesi- ja ympäristötutkimus Oy
Eurofins Environment Testing Finland Oy:n tutkimustuloksia, Lähde: Hallavaaran jätekeskuksen velvoitetarkkailututkimukset vuodelta 2017
Pumpatut jätevesimäärät (Jukka Valtonen, JVP-Eura Oy 31.1.2018)


Hallavaara jv määrä viemäriin m3/d
350
300
250
200
150
100
50
0
1.1.2017
1.2.2017
1.3.2017
1.4.2017
1.5.2017
1.6.2017
1.7.2017
1.8.2017
1.9.2017
1.10.2017
1.11.2017
1.12.2017

Länsi-Suomen prosessivesi Oy:n jätevedet

Euran kunnan viemäriin lähtevän jäteveden tarkkailututkimusten tulokset

NäytePvm	TutkOhj	Näytteen nimi	Vrkvirt	pH	Sähk.jv	CODCr	BOD7ATU	Kok.P	Kok.N	Kiintoaine	Rasva,öljy	CODCr	BOD7ATU	Kok.P	Kok.N	Kiintoaine	Rasva,öljy
			m3/d		mS/m	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d
21.2.2017	LSPVES9	viemäriin lähtevä	55	7	65	290	190	0,25	30	30	< 10	16	10,5	0,01	1,65	1,7	0,28
22.5.2017	LSPVES9	viemäriin lähtevä	35	7,2	69	120	72	0,21	12	25	< 10	4	3	0,01	0,4	0,9	0,28
22.8.2017	LSPVES9	viemäriin lähtevä	50	7,2	65	170	78	1,6	29	23	< 10	9	3,9	0,08	1,5	1,2	0,55
20.11.2017	LSPVES9	viemäriin lähtevä	16,5	7,2	57	340	180	1,2	21	29	< 10	6	3	0,02	0,3	0,5	0,28
		summa	**156,5**									**34**	**20**	**0,12**	**3,9**	**4,2**	**1,4**
		keskiarvo	**39,1**														
											Laatu	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**	**mg/l**
												219	**127**	**0,77**	**25**	**27**	**8,8**
	m3/a	m3/d									**Kuorma**	**kg/d**	**kg/d**	**kg/d**	**kg/d**	**kg/d**	**kg/d**
Virtaama*	1 645	4,5										**1,0**	**0,6**	**0,003**	**0,11**	**0,12**	**0,04**

Tuloskooste ja kuormituslaskelma: Lounais-Suomen vesi- ja ympäristötutkimus Oy

* Virtaamatieto, lähde: Juha-Ville Kangas 6.3.2018, Länsi-Suomen Prosessivesi Oy

JVP-Eura Oy:n

JÄTEVEDENPUHDISTAMON VIIKKOVIRTAAMAT VUODELTA 2017

Viikko nro	Kokonais-virtaama m^3/viikko	Qmax m^3/d	Huom.	Viikko nro	Kokonais-virtaama m^3/viikko	Qmax m^3/d	Huom.
1.	47690	8152		27.	53906	8648	
2.	48334	7407		28.	52239	8345	
3.	46392	7413		29.	58252	7637	
4.	45815	7782		30.	45950	8601	
5.	46598	7294		31.	53455	7942	
6.	46803	8120		32.	51043	8296	
7.	50176	8794		33.	52452	8226	
8.	48398	8310		34.	52108	8115	
9.	52244	9595	Korkea typpikurma	35.	52295	8371	
10.	49388	7602		36.	52321	7998	
11.	60337	11107	Hulevesiä	37.	58739	7920	
12.	53091	8622		38.	50022	8018	
13.	52477	8200		39.	43368	6469	HK Lopettanut teurastuksen 24.9, eli tämä viikko on jo kokonaan ilman heidän vesiään. Heiltä tullu vesiä tästä viikosta lähtien noin 80m³/d
14.	71034	5709		40.	49757	7240	
15.	60637	4723		41.	63750	9215	
16.	48459	8397		42.	57919	9506	
17.	64602	9484		43.	55160	8177	
18.	41260	8291		44.	53927	8202	
19.	58526	8666		45.	50288	7179	
20.	69109	8102		46.	56614	8202	
21.	34198	8817		47.	55272	8197	
22.	51996	8028		48.	58594	9254	
23.	53860	8572		49.	63878	8114	Hulevesiä
24.	56899	8594		50.	67687	11509	Hulevesiä
25.	30828	5108	Juhannus. Huolloista johtuen virtausmittari ollut pois käytöstä loppuviikosta.	51.	54415	10830	Hulevesiä
26.	51500	5197	Huolloista johtuen virtausmittari ollut pois käytöstä alkuviikosta.	52.	48155	9048	Paperitehtaan seisakki vähensi virtausta
				2017/1.	2752217	11509	

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.l. g/l
2.1.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,2		950	490	8,9		70				640			
	/teoll/teollisuudesta tuleva		8,0		920	160	0,41		3,0				1300			
	/es1/esiselkeytetty, kunta					230	6,7		65				120			
	/es2/esiselkeytetty, teoll					47	0,086		<1,0				220			
	/vs/väliselkeytetty		7,4	2,2	69	14	0,29		3,2	1,4			44			
	/lähtevä/LÄHTEVÄ	23	7,5	1,6	39	5,3	0,053	0,008	2,5	1,8	0,14	<0,02	7,8	0,075	0,38	
	/IA-1/ilmastus 1-linja															2,6
	/IA-2/ilmastus 2-linja															2,5
	/IA-3/ilmastus 3-linja															2,5
	/Pa-1/palautus 1															6,2
16.1.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,6		1300	610	9,5		140				800			
	/teoll/teollisuudesta tuleva		7,8		1000	150	0,29		7,5				1100			
	/vs/väliselkeytetty		7,6	4,2	120	11	0,42		13	8,4			90			
	/lähtevä/LÄHTEVÄ	24	7,6	3,3	60	12	0,065	0,019	12	8,5	1,1	0,19	9,5	0,053	0,25	
	/IA-1/ilmastus 1-linja															4,2
	/IA-2/ilmastus 2-linja															4,0
	/IA-3/ilmastus 3-linja															4,1
	/Pa-1/palautus 1															5,8
7.2.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		1500	860	9,5		120				960			
	/teoll/teollisuudesta tuleva		7,8		1200	150	0,38		4,0				1100			
	/es1/esiselkeytetty, kunta					460	7,0		120				250			
	/es2/esiselkeytetty, teoll					68	0,22		2,5				280			
	/vs/väliselkeytetty		7,4	3,8	350	64	2,1		13	0,7			330			
	/lähtevä/LÄHTEVÄ	20,6	7,6	3,3	59	12	0,13	0,022	3,0	0,3	0,82	0,057	16	0,057	0,33	
	/IA-1/ilmastus 1-linja															4,2
	/IA-2/ilmastus 2-linja															4,2
	/IA-3/ilmastus 3-linja															4,2
	/Pa-1/palautus 1															5,9
21.2.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,7		690	250	6,7		130				300			
	/teoll/teollisuudesta tuleva		7,8		970	190	0,30		2,1				900			
	/vs/väliselkeytetty		7,3	2,4	120	16	0,58		7,0	<0,2			62			
	/lähtevä/LÄHTEVÄ	21,7	7,3	1,9	44	8,2	0,038	0,011	4,6	0,4	3,6	0,44	5,8	0,043	8,1	
	/IA-1/ilmastus 1-linja															2,9
	/IA-2/ilmastus 2-linja															3,0
	/IA-3/ilmastus 3-linja															2,9
	/Pa-1/palautus 1															5,5

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.I. g/l
6.3.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		490	380	7,2		74				200			
	/teoll/teollisuudesta tuleva		8,0		1000	200	0,36		3,9				1100			
	/es1/esiselkeytetty, kunta					90	4,8		61				81			
	/es2/esiselkeytetty, teoll					68	0,12		2,4				210			
	/vs/väliselkeytetty		7,3	2,4	450	94	4,0		19	0,6			440			
	/lähtevä/LÄHTEVÄ	21,9	7,4	1,9	42	6,5	0,21	0,006	2,0	<0,2	0,33	0,021	20	0,049		
	/IA-1/ilmastus 1-linja															2,3
	/IA-2/ilmastus 2-linja															2,4
	/IA-3/ilmastus 3-linja															2,4
	/Pa-1/palautus 1															4,4
21.3.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,5		450	170	6,0		90				160			
	/teoll/teollisuudesta tuleva		7,7		730	170	0,30		2,2				690			
	/vs/väliselkeytetty		7,5	2,4	55	5,5	0,21		7,4	5,1			20			
	/lähtevä/LÄHTEVÄ	20,7	7,5	1,9	18	2,6	0,016	0,008	6,9	5,3	1,2	0,065	1,9	0,030	0,0	
	/IA-1/ilmastus 1-linja															2,4
	/IA-2/ilmastus 2-linja															2,4
	/IA-3/ilmastus 3-linja															2,4
	/Pa-1/palautus 1															3,4
5.4.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,2		1300	540	10		110				870			
	/teoll/teollisuudesta tuleva		7,8		570	97	0,23		3,4				550			
	/es1/esiselkeytetty, kunta					340	6,0		91				180			
	/es2/esiselkeytetty, teoll					41	0,14		2,8				200			
	/vs/väliselkeytetty		7,2	2,7	520	130	2,4		11	0,9			560			
	/lähtevä/LÄHTEVÄ	21,6	7,3	2,2	110	21	0,86	0,029	4,9	0,9	0,71	0,075	84	0,038	0,0	
	/IA-1/ilmastus 1-linja															2,4
	/IA-2/ilmastus 2-linja															2,6
	/IA-3/ilmastus 3-linja															2,5
	/Pa-1/palautus 1															4,3
26.4.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		790	350	4,7		87				190			
	/teoll/teollisuudesta tuleva		7,9		1400	100	0,33		3,5				640			
	/vs/väliselkeytetty		7,3	2,7	260	37	2,2		18	7,7			210			
	/lähtevä/LÄHTEVÄ	21,2	7,7	2,5	40	6,3	0,12	0,019	11	8,5	1,5	0,031	11	0,077	34	
	/IA-1/ilmastus 1-linja															2,6
	/IA-2/ilmastus 2-linja															2,5
	/IA-3/ilmastus 3-linja															2,5
	/Pa-1/palautus 1															6,0

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.l. g/l
10.5.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,6		470	200	6,2		99				190			
	/teoll/teollisuudesta tuleva		7,9		860	110	0,42		9,2				1100			
	/es1/esiselkeytetty, kunta					140	6,2		98				80			
	/es2/esiselkeytetty, teoll					43	0,19		5,7				260			
	/vs/väliselkeytetty		7,6	3,9	75	11	0,70		16	11			59			
	/lähtevä/LÄHTEVÄ	23,0	7,7	3,4	40	4,8	0,082	0,023	14	12	1,6	0,036	7,0	0,079	0,0	
	/IA-1/ilmastus 1-linja															3,0
	/IA-2/ilmastus 2-linja															3,0
	/IA-3/ilmastus 3-linja															3,1
	/Pa-1/palautus 1															3,6
22.5.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,5		1300	700	13		130				680			
	/teoll/teollisuudesta tuleva		7,8		510	120	0,27		3,4				760			
	/vs/väliselkeytetty		7,2	4,2	1900	220	15		72	8,8			1500			
	/lähtevä/LÄHTEVÄ	29,1	7,4	2,6	120	~32	0,93	0,037	11	5,5	0,63	0,089	93	0,041	0,0	
	/IA-1/ilmastus 1-linja															3,2
	/IA-2/ilmastus 2-linja															3,2
	/IA-3/ilmastus 3-linja															3,1
	/Pa-1/palautus 1															4,0
6.6.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		1000	550	9,0		95				700			
	/teoll/teollisuudesta tuleva		7,8		540	120	0,34		3,8				460			
	/es1/esiselkeytetty, kunta					270	5,3		71				98			
	/es2/esiselkeytetty, teoll					48	0,12		1,5				110			
	/vs/väliselkeytetty		7,3	2,2	380	96	2,7		12	0,4			300			
	/lähtevä/LÄHTEVÄ	27,2	7,4	1,8	27	7,2	0,12	0,011	1,7	0,2	0,17	<0,02	15	0,027	0,0	
	/IA-1/ilmastus 1-linja															3,5
	/IA-2/ilmastus 2-linja															3,5
	/IA-3/ilmastus 3-linja															3,5
	/Pa-1/palautus 1															5,2
19.6.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,2		1900	780	15		130				1200			
	/teoll/teollisuudesta tuleva		7,9		730	120	0,30		3,9				530			
	/vs/väliselkeytetty		7,3	3,0	1600	530	21		45	3,7			1600			
	/lähtevä/LÄHTEVÄ	28,5	7,8	2,9	48	11	0,46	0,018	4,0	1,6	0,50	0,031	38	0,081	0,15	
	/IA-1/ilmastus 1-linja															3,1
	/IA-2/ilmastus 2-linja															3,2
	/IA-3/ilmastus 3-linja															3,2
	/Pa-1/palautus 1															4,4
	/välipumppaus (uusi)															
	/ilm. altailta, kanava															

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.l. g/l
4.7.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,8		660	220	6,9		96				320			
	/teoll/teollisuudesta tuleva		7,8		850	140	0,44		3,7				850			
	/es1/esiselkeytetty, kunta					100	5,2		85				77			
	/es2/esiselkeytetty, teoll					34	0,14		2,6				160			
	/vs/väliselkeytetty		7,5	3,3	180	29	2,0		15	6,1			120			
	/lähtevä/LÄHTEVÄ	29,2	7,8	3,0	55	8,9	0,26	0,031	9,8	6,9	0,70	0,036	19	0,080	31	
	/IA-1/ilmastus 1-linja															3,1
	/IA-2/ilmastus 2-linja															3,2
	/IA-3/ilmastus 3-linja															3,2
	/Pa-1/palautus 1															5,1
19.7.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,7		540	180	7,0		100				190			
	/teoll/teollisuudesta tuleva		7,8		710	180	0,57		3,6				750			
	/vs/väliselkeytetty		7,2	1,7	120	6,2	1,2		8,1	<0,2			86			
	/lähtevä/LÄHTEVÄ	29,5	7,1	1,6	25	3,0	0,045	0,055	6,5	0,5	4,6	0,56	6,0	0,13	0,0	
	/IA-1/ilmastus 1-linja															3,3
	/IA-2/ilmastus 2-linja															3,3
	/IA-3/ilmastus 3-linja															3,1
	/Pa-1/palautus 1															4,0
2.8.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		960	360	9,1		91				470			
	/teoll/teollisuudesta tuleva		7,7		1000	170	0,42		3,5				1100			
	/es1/esiselkeytetty, kunta					180	6,7		83				85			
	/es2/esiselkeytetty, teoll					47	0,11		2,5				98			
	/vs/väliselkeytetty		7,4	2,7	350	100	3,0		20	8,6			250			
	/lähtevä/LÄHTEVÄ	29,9	7,5	2,5	58	11	0,53	0,048	9,5	7,5	0,25	<0,02	29	0,052	22	
	/IA-1/ilmastus 1-linja															3,3
	/IA-2/ilmastus 2-linja															3,2
	/IA-3/ilmastus 3-linja															3,3
	/Pa-1/palautus 1															4,3
22.8.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,6		800	340	8,7		120				350			
	/teoll/teollisuudesta tuleva		7,7		720	120	0,37		5,0				880			
	/vs/väliselkeytetty		7,2	3,0	1200	250	11		54	4,3			1000			
	/lähtevä/LÄHTEVÄ	31,0	7,3	2,6	100	13	0,51	0,026	4,7	1,7	1,0	0,047	47	0,034		
	/IA-1/ilmastus 1-linja															3,2
	/IA-2/ilmastus 2-linja															3,2
	/IA-3/ilmastus 3-linja															3,1
	/Pa-1/palautus 1															5,2

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.I. g/l
5.9.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,8		640	220	6,9		95				270			
	/teoll/teollisuudesta tuleva		7,9		590	210	0,35		3,7				520			
	/es1/esiselkeytetty, kunta					140	6,1		84				85			
	/es2/esiselkeytetty, teoll					110	0,10		2,1				31			
	/vs/väliselkeytetty		7,5	3,1	130	14	1,2		6,8	0,4			100			
	/lähtevä/LÄHTEVÄ	28,5	7,5	2,8	41	9,8	0,19	0,022	2,6	<0,2	0,98	<0,02	26	0,037	0,0	
	/IA-1/ilmastus 1-linja															2,7
	/IA-2/ilmastus 2-linja															2,8
	/IA-3/ilmastus 3-linja															2,8
	/Pa-1/palautus 1															5,2
18.9.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,9		1100	380	8,7		120				480			
	/teoll/teollisuudesta tuleva		8,0		420	130	0,17		2,0				360			
	/vs/väliselkeytetty		7,3	2,3	180	23	1,4		12	0,5			130			
	/lähtevä/LÄHTEVÄ	28,6	7,4	2,2	51	8,3	0,089	0,024	7,4	1,2	4,6	0,62	12	0,042	1,9	
	/IA-1/ilmastus 1-linja															2,7
	/IA-2/ilmastus 2-linja															2,8
	/IA-3/ilmastus 3-linja															2,8
	/Pa-1/palautus 1															4,1
2.10.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,6		1900	780	14		170				1100			
	/teoll/teollisuudesta tuleva		7,8		640	89	0,29		5,3				800			
	/es1/esiselkeytetty, kunta					240	10		150				170			
	/es2/esiselkeytetty, teoll					36	0,12		3,5				290			
	/vs/väliselkeytetty		7,5	2,5	73	7,6	0,39		5,0	0,2			47			
	/lähtevä/LÄHTEVÄ	28,0	7,5	2,6	53	8,6	0,064	0,014	4,4	0,3	2,7	0,20	14	0,047	0,0	
	/IA-1/ilmastus 1-linja															2,7
	/IA-2/ilmastus 2-linja															2,8
	/IA-3/ilmastus 3-linja															2,7
	/Pa-1/palautus 1															4,0
16.10.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		470	180	4,7		57				320			
	/teoll/teollisuudesta tuleva		7,7		440	110	0,17		1,8				480			
	/vs/väliselkeytetty		7,3	1,9	370	62	2,8		13	0,7			340			
	/lähtevä/LÄHTEVÄ	23,0	7,4	1,6	120	15	0,69	0,009	4,7	0,2	1,2	0,077	88	0,029		
	/IA-1/ilmastus 1-linja															3,3
	/IA-2/ilmastus 2-linja															3,3
	/IA-3/ilmastus 3-linja															3,2
	/Pa-1/palautus 1															6,1

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Pros.ltla C-ast	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l	bisFen a µg/l	Kiint.a.l. g/l
8.11.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,3		1200	560	8,4		100				680			
	/teoll/teollisuudesta tuleva		7,6		900	280	0,41		3,5				860			
	/es1/esiselkeytetty, kunta					290	8,1		100				170			
	/es2/esiselkeytetty, teoll					56	0,080		2,9				86			
	/vs/väliselkeytetty		7,4	3,0	240	120	0,67		4,5	<0,2			210			
	/lähtevä/LÄHTEVÄ	22,6	7,5	2,8	57	7,8	0,085	0,006	2,0	<0,2	0,029	<0,02	11	0,039		
	/IA-1/ilmastus 1-linja															2,9
	/IA-2/ilmastus 2-linja															3,0
	/IA-3/ilmastus 3-linja															2,9
	/Pa-1/palautus 1															4,8
22.11.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,6		840	400	7,4		100				270			
	/teoll/teollisuudesta tuleva		7,9		880	270	1,3		2,4				1100			
	/vs/väliselkeytetty		7,3	2,7	380	63	2,1		12	2,2			380			
	/lähtevä/LÄHTEVÄ	22,0	7,4	2,4	41	11	0,14	0,015	4,5	2,7	0,56	0,15	19	0,042		
	/IA-1/ilmastus 1-linja															3,7
	/IA-2/ilmastus 2-linja															3,8
	/IA-3/ilmastus 3-linja															3,8
	/Pa-1/palautus 1															5,4
12.12.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,4		920	470	4,1		56				500			
	/teoll/teollisuudesta tuleva		7,8		850	210	0,37		3,0				910			
	/vs/väliselkeytetty		7,5	3,6	310	160	1,5		21	12			320			
	/lähtevä/LÄHTEVÄ	14,7	7,6	3,1	59	18	0,14	0,022	16	14	0,064	0,021	17	0,053		
	/IA-1/ilmastus 1-linja															5,1
	/IA-2/ilmastus 2-linja															4,7
	/IA-3/ilmastus 3-linja															4,8
	/Pa-1/palautus 1															7,8
19.12.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**															
	/kunta/kunnasta tuleva		7,5		870	410	8,1		86				310			
	/teoll/teollisuudesta tuleva		7,7		500	85	0,21		2,0				500			
	/es1/esiselkeytetty, kunta					210	5,4		80				110			
	/es2/esiselkeytetty, teoll					86	0,070		1,3				96			
	/vs/väliselkeytetty		7,6	4,0	120	13	0,51		24	21			63			
	/lähtevä/LÄHTEVÄ	19,8	7,6	3,7	52	8,6	0,086	0,033	24	22	0,13	0,041	9,6	0,072		
	/IA-1/ilmastus 1-linja															5,5
	/IA-2/ilmastus 2-linja															5,5
	/IA-3/ilmastus 3-linja															5,5
	/Pa-1/palautus 1															7,9

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Kuiva-aine %	Hehk.j. % ka:sta	pH liete	N liete % ka	N lieteliu % ka	P liete % ka	Al % ka	As mg/kg ka	Ca % ka	Cd mg/kg ka	Cr mg/kg ka	Cu mg/kg ka	Hg mg/kg ka	K % ka	Mg % ka	Ni liete mg/kg ka	Pb liete mg/kg ka	Zn, liete mg/kg ka
22.2.2017	**EURA8 / 2 liete**																		
	//#L LIETE KUNTA	21,3		7,3	3,1	0,10	0,63	3,0	2,2	1,5	1,0	6,0	140	0,17	0,11	0,094	15	7,6	180
	//#L LIETE KUITULIETE	38,3		7,8	0,18	0,015	0,023	0,80	0,53	3,2	2,9	4,2	4,9	<0,03	<0,05	0,042	1,6	1,8	100
11.5.2017	**EURA8 / 2 liete**																		
	//#L LIETE KUNTA	18,3		6,9	3,8	0,32	0,82	3,7	1,5	0,55	0,38	8,1	160	0,097	0,15	0,094	9,1	3,5	200
	//#L LIETE KUITULIETE	39,2		7,6	0,39	0,015	0,033	0,99	0,44	7,3	0,84	3,5	7,5	<0,03	<0,05	0,074	1,6	1,5	54
20.7.2017	**EURA8 / 2 liete**																		
	//#L LIETE KUNTA	16,0	42	7,2	3,7		1,2	4,0	2,2		0,39	15	230	0,22			14	7,7	350
	//#L LIETE KUITULIETE	29,5	63	7,8	0,25		0,037	1,2	0,62		0,28	3,8	7,0	<0,03			1,9	1,8	66
17.10.2017	**EURA8 / 2 liete**																		
	//#L LIETE KUNTA	20,2	46	7,7	3,5		0,71	2,2	1,8		0,47	9,1	160	0,16			11	5,9	300
	//#L LIETE KUITULIETE	35,7	58	7,4	0,26		0,034	1,2	0,59		0,49	3,8	6,1	<0,03			1,7	2,1	200

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Ent.kok.v MPN/100 ml	E.coliL MPN/100 ml	Kolib. 44C pmy/100 ml
2.1.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	41	530	400
16.1.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	150	1900	1200
7.2.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	260	4600	3200
21.2.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	>2400	1200	1700
6.3.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	75	340	400
21.3.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	10	470	400
5.4.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	8200	12000	>1000
26.4.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	10	330	350
10.5.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	1	<10	<10
22.5.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	>2400	>24000	5100
6.6.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	190	410	180
19.6.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	310	<100	80
4.7.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	10	<10	<10
19.7.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	<10	<10	1
2.8.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	<10	<10	5
22.8.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	>2400	300	560
5.9.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	10	<10	10
18.9.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	<10	<10	10
2.10.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	20	<10	10
16.10.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	<10	<10	10

JVP-Eura Oy:n jätevedenpuhdistamo (EURA8)

Pvm.	Hav.paikka Näytepaikka	Ent.kok.v MPN/100 ml	E.coliL MPN/100 ml	Kolib. 44C pmy/100 ml
8.11.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	520	3400	2100
22.11.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	770	5800	>1000
12.12.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	98	4600	1500
19.12.2017	**EURA8 / 1 JVP-Eura Oy päästötarkkailu**			
	/purkuk/purkuputk, kerta	1200	10000	3800

Lounais-Suomen
vesi- ja ympäristötutkimus Oy

JÄTEVESI- JA LIETETUTKIMUSTEN MÄÄRITYSMENETELMÄT

TUTKIMUSLAITOSTIEDOT

Tutkimuslaitoksen nimi	Tunnus
Lounais-Suomen vesi- ja ympäristötutkimus Oy, FINAS-akkreditoitu testauslaboratorio T101	TL27

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)	Määritysraja
pH (25 °C) *	SFS 3021:1974 (TL27)	1 yks.
Alkaliteetti *	SFS 3005:1981 (TL 27)	0,1 mmol/l
Sähkönjohtavuus *	SFS-EN 27888:1994 (TL 27)	1 mS/m
BOD7(ATU) *	SFS-EN 1899-1:1998 (TL27)	0,5 mg/l
COD(Cr) *	ISO 15705: 2002 (TL27)	15 mg/l
Kokonaisfosfori, jv *	Sis A15, Lachat QuickChem method 10-115-01 (TL27)	5 µg/l
Liukoinen kokonaisfosfori *	Sis A15, Lachat QuickChem method 10-115-01 (TL27)	5 µg/l
Kokonaistyppi, jv *	SFS 5505:1988 mod. Kjeldahlmenetelmä (TL27)	1000 µg/l
Ammoniumtyppi, jv *	Sis A20, Standard Methods... 20th ed. method 4500 NH3 E (TL27)	200 µg/l
Nitraattityppi, jv *	SFS-EN ISO 13395:1997 (TL27)	100 µg/l
Nitriittityppi, jv *	SFS-EN ISO 13395:1997 (TL27)	30 µg/l
Nitraatti-nitriittitypen summa, jv	SFS-EN ISO 13395:1997 (TL27)	200 µg/l
Kiintoaine (GF/A) *	SFS-EN 872:2005 (TL27)	1 mg/l
Kiintoaine, liete	SFS-EN 872:1996 (TL27)	0,1 g/l
Enterokokit (varmistetut), jv	Enterolert ®Quantitray sis. A51 (TL27)	0 pmy/100 ml
Escherichia Coli, jv	Colilert® Quantitray, sis A43 (TL27)	0 pmy/100 ml
pH liete	Sis A22 ja A01, SFS 3021:1974 (TL27)	1 yks.
Kuiva-aine, % *	SFS 3008:1990 (TL27)	0,1 %
Hehkutusjäännös *	SFS 3008:1990 (TL27)	0,1 % ka:sta
Fosfori, liete	Sis A15 ja A16, Lachat QuickChem method 10-115-01 (TL27)	
Liukoinen fosfori, liete	Sis A15 ja A16, Lachat QuickChem method 10-115-01 (TL27)	
Typpi, liete	Sis A22 ja A21, SFS 5505:1988 (TL27)	
Liukoinen typpi, liete	Sis A22 ja A21, SFS 5505:1988 (TL27)	
Alumiini, Al * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	2 µg/l
Alumiini, Al *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,005 g/kg ka
Liuk. Alumiini, Al suod * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	2 µg/l
Arseeni, As * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 µg/l
Arseeni, As *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Elohopea, Hg * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,01 µg/l
Elohopea, Hg *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,03 mg/kg ka
Kadmium, Cd * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,01 µg/l
Kadmium, Cd *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Kalium, K* (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	50 µg/l
Kalium, K *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,02 g/kg ka
Kalsium, Ca * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 g/kg ka
Kalsium, Ca *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	100 µg/l
Koboltti, Co * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,05 µg/l
Kromi, Cr * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,05 µg/l
Kromi, Cr *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Kupari, Cu * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,3 µg/l
Kupari, Cu *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Magnesium, Mg * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	50 µg/l
Magnesium, Mg * , liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,02 g/kg ka
Rauta, Fe * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	5 µg/l
Rauta, Fe *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,005 g/kg ka
Liuk. rauta, Fe suod * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	5 µg/l
Nikkeli, Ni * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,3 µg/l
Nikkeli, Ni *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Lyijy, Pb * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,05 µg/l
Lyijy, Pb *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,1 mg/kg ka
Sinkki, Zn * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,5 µg/l
Sinkki, Zn *, liete (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,5 mg/kg ka
Vanadiini, V * (ICP-MS)	ISO 17294-1:2005, 17294-2:2003 (TL27)	0,05 µg/l

	Osoite	Puh.	Telekopio/S-posti	ALV rek.
Lounais-Suomen	Telekatu 16		(02) 238 1838	Y 1564941-9
vesi- ja ympäristötutkimus Oy	20360 TURKU	*(02) 274 0200	enimi.snimi@lsvsy.fi	Krnro 774822

Rasvat ja Öljyt **
Öljyhiilivetyindeksi **
Liuottimet, ei halogenoidut/halogenoidut **
Fenolit **

*-merkitty on akkreditoitu menetelmä
**-merkitty tehdään alihankintana

MITTAUSEPÄVARMUUSTIEDOT

Määritys	**Tuloksen epävarmuus**
pH (25 °C)	±0,2 yks.
Alkaliteetti	±10 % (> 0,5 mmol/l) / ±0,05 mmol/l (<0,5 mg/l)
Sähkönjohtavuus	±5 % (> 40 mS/m) / ±2 mS/m (<40 mS/m)
BOD7(ATU)	±15 % (> 3,33 mg/l) / ±0,5 mg/l (<3,33 mg/l)
COD(Cr)	±15 % (> 66,7 mg/l) / ±10 mg/l (<66,7 mg/l)
Kokonaisfosfori	±10 % (>20 µg/l) / ±2 µg/l (<20 µg/l)
Liukoinen kokonaisfosfori	±10 % (>50 µg/l) / ±5 µg/l (<50 µg/l)
Kokonaistyppi	±10 % (>100 µg/l) / ±10 µg/l (<100 µg/l)
Kokonaistyppi, jv	±10 % (>5000 µg/l) / ±500 µg/l (<5000 µg/l)
Ammoniumtyppi, jv	±10 % (>5000 µg/l) / ±500 µg/l (<5000 µg/l)
Nitraattityppi, jv	±10 % (>1000 µg/l) / ±100 µg/l (<1000 µg/l)
Nitriittityppi, jv	±10 % (>250 µg/l) / ±25 µg/l (<250 µg/l)
Nitraatti-nitriittitypen summa, jv	±10 % (>1000 µg/l) / ±100 µg/l (<1000 µg/l)
Kiintoaine (GF/A)	±20 % (> 2,5 mg/l) / ±0,5 mg/l (<2,5 mg/l)
pH liete	±0,2 yks.
Kuiva-aine, %	±10 % (> 3 %) / ±0,3 % (< 3 %)
Hehkutusjäännös	±10 % (> 10 %) / ±1 % (< 10 %)
Alumiini, Al (ICP-MS)	±15 % (>13 µg/l) / ±2 µg/l (<13 µg/l)
Alumiini, Al, liete (ICP-MS)	±30 % (>3 g/kg ka) / ±1 g/kg ka (<3 g/kg ka)
Alumiini suod, Al suod (ICP-MS)	±15 % (>13 µg/l) / ±2 µg/l (<13 µg/l)
Arseeni, As (ICP-MS)	±15 % (>0,3 µg/l) / ±0,05 µg/l (<0,3 µg/l)
Arseeni, As, liete (ICP-MS)	±20 % (>5 mg/kg ka) / ±1 mg/kg ka (<5 mg/kg ka)
Elohopea, Hg (ICP-MS)	±15 % (>0,067 µg/l) / ±0,01 µg/l (<0,067 µg/l)
Elohopea, Hg, liete (ICP-MS)	±20 % (>0,15 mg/kg ka) / ±0,03 mg/kg ka (<0,15 mg/kg ka)
Kadmium, Cd (ICP-MS)	±15 % (>0,067 µg/l) / ±0,01 µg/l (<0,067 µg/l)
Kadmium, Cd, liete (ICP-MS)	±30 % (>2 mg/kg ka) / ±0,5 mg/kg ka (<2 mg/kg ka)
Kalium, K (ICP-MS)	±10 % (>500 µg/l) / ±50 µg/l (<500 µg/l)
Kalium, K, liete (ICP-MS)	±30 % (>2 g/kg ka) / ±0,5 g/kg ka (<2 g/kg ka)
Kalsium, Ca (ICP-MS)	±15 % (>333 µg/l) / ±50 µg/l (<333 µg/l)
Kalsium, Ca, liete (ICP-MS)	±30 % (>2 g/kg ka) / ±0,5 g/kg ka (<2 g/kg ka)
Koboltti, Co (ICP-MS)	±15 % (>0,33 µg/l) / ±0,05 µg/l (<0,33 µg/l)
Kromi, Cr (ICP-MS)	±15 % (>0,33 µg/l) / ±0,05 µg/l (<0,33 µg/l)
Kromi, Cr, liete (ICP-MS)	±20 % (>5 mg/kg ka) / ±1 mg/kg ka (<5 mg/kg ka)
Kupari, Cu (ICP-MS)	±15 % (>2 µg/l) / ±0,3 µg/l (<2 µg/l)
Kupari, Cu, liete (ICP-MS)	±25 % (>4 mg/kg ka) / ±1 mg/kg ka (<4 mg/kg ka)
Magnesium, Mg, (ICP-MS)	±10 % (>500 µg/l) / ±50 µg/l (<500 µg/l)
Magnesium, Mg, liete (ICP-MS)	±20 % (>3 g/kg ka) / ±0,5 g/kg ka (<3 g/kg ka)
Rauta, Fe (ICP-MS)	±15 % (>20 µg/l) / ±3 µg/l (<20 µg/l)
Rauta, Fe, liete (ICP-MS)	±15 % (>7 g/kg ka) / ±1 g/kg ka (<7 g/kg ka)
Rauta suod., Fe suod (ICP-MS)	±15 % (>20 µg/l) / ±3 µg/l (<20 µg/l)
Nikkeli, Ni (ICP-MS)	±15 % (>2 µg/l) / ±0,3 µg/l (<2 µg/l)
Nikkeli, Ni, liete (ICP-MS)	±20 % (>5 mg/kg ka) / ±1 mg/kg ka (<5 mg/kg ka)
Lyijy, Pb (ICP-MS)	±15 % (>0,33 µg/l) / ±0,05 µg/l (<0,33 µg/l)
Lyijy, Pb, liete (ICP-MS)	±20 % (>5 mg/kg ka) / ±1 mg/kg ka (<5 mg/kg ka)
Sinkki, Zn (ICP-MS)	±15 % (>3,33 µg/l) / ±0,5 µg/l (<3,33 µg/l)
Sinkki, Zn, liete (ICP-MS)	±20 % (>5 mg/kg ka) / ±1 mg/kg ka (<5 mg/kg ka)
Vanadiini, V (ICP-MS)	±15 % (>0,33 µg/l) / ±0,05 µg/l (<0,33 µg/l)

EPÄVARMUUKSIEN MÄÄRITYSMENETELMÄ

Mittausepävarmuudet ovat laskettuja

Määritysrajoja ja mittausepävarmuuksia päivitetään tasaisin väliajoin.

JVP-Eura Oy:n jätevedenpuhdistamon tarkkailututkimusten mittausepävarmuudet vuonna 2017

NäytePvm	Näytteen nimi	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l
2.1.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
2.1.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
2.1.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
2.1.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
2.1.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±0,5 mg/l	±0,5 mg/l			±20%	
2.1.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±0,002 mg/l	±20%	±15%
16.1.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
16.1.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
16.1.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
16.1.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±15%
7.2.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
7.2.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
7.2.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
7.2.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
7.2.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
7.2.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±15%
21.2.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
21.2.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
21.2.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
21.2.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±15%
6.3.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
6.3.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
6.3.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
6.3.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
6.3.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
6.3.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
21.3.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
21.3.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
21.3.2017	/vs/väliselkeytetty	±0,2	±10%	±10 mg/l	±15%	±15%		±10%	±10%			±20%	
21.3.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±0,5 mg/l	:0,005 mg/l	±0,005 mg/l	±10%	±10%	±10%	±10%	±0,5 mg/l	±15%
5.4.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
5.4.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
5.4.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
5.4.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
5.4.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
5.4.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±15%	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
26.4.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
26.4.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
26.4.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
26.4.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±20%
10.5.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
10.5.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
10.5.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
10.5.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±10%				±20%	

JVP-Eura Oy:n jätevedenpuhdistamon tarkkailututkimusten mittausepävarmuudet vuonna 2017

NäytePvm	Näytteen nimi	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l
10.5.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
10.5.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±15%
22.5.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
22.5.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
22.5.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
22.5.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±15%	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±15%
6.6.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
6.6.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
6.6.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
6.6.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
6.6.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
6.6.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±0,002 mg/l	±20%	±15%
19.6.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
19.6.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
19.6.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
19.6.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
4.7.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
4.7.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
4.7.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
4.7.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
4.7.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
4.7.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±20%
19.7.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
19.7.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
19.7.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
19.7.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±0,5 mg/l	±15%	±10%	±10%	±0,5 mg/l	±10%	±10%	±20%	±20%
2.8.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
2.8.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
2.8.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
2.8.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
2.8.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
2.8.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±0,002 mg/l	±20%	±20%
22.8.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
22.8.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
22.8.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
22.8.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±15%	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
5.9.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
5.9.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
5.9.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
5.9.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
5.9.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
5.9.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±0,002 mg/l	±20%	±20%
18.9.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
18.9.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	

JVP-Eura Oy:n jätevedenpuhdistamon tarkkailututkimusten mittausepävarmuudet vuonna 2017

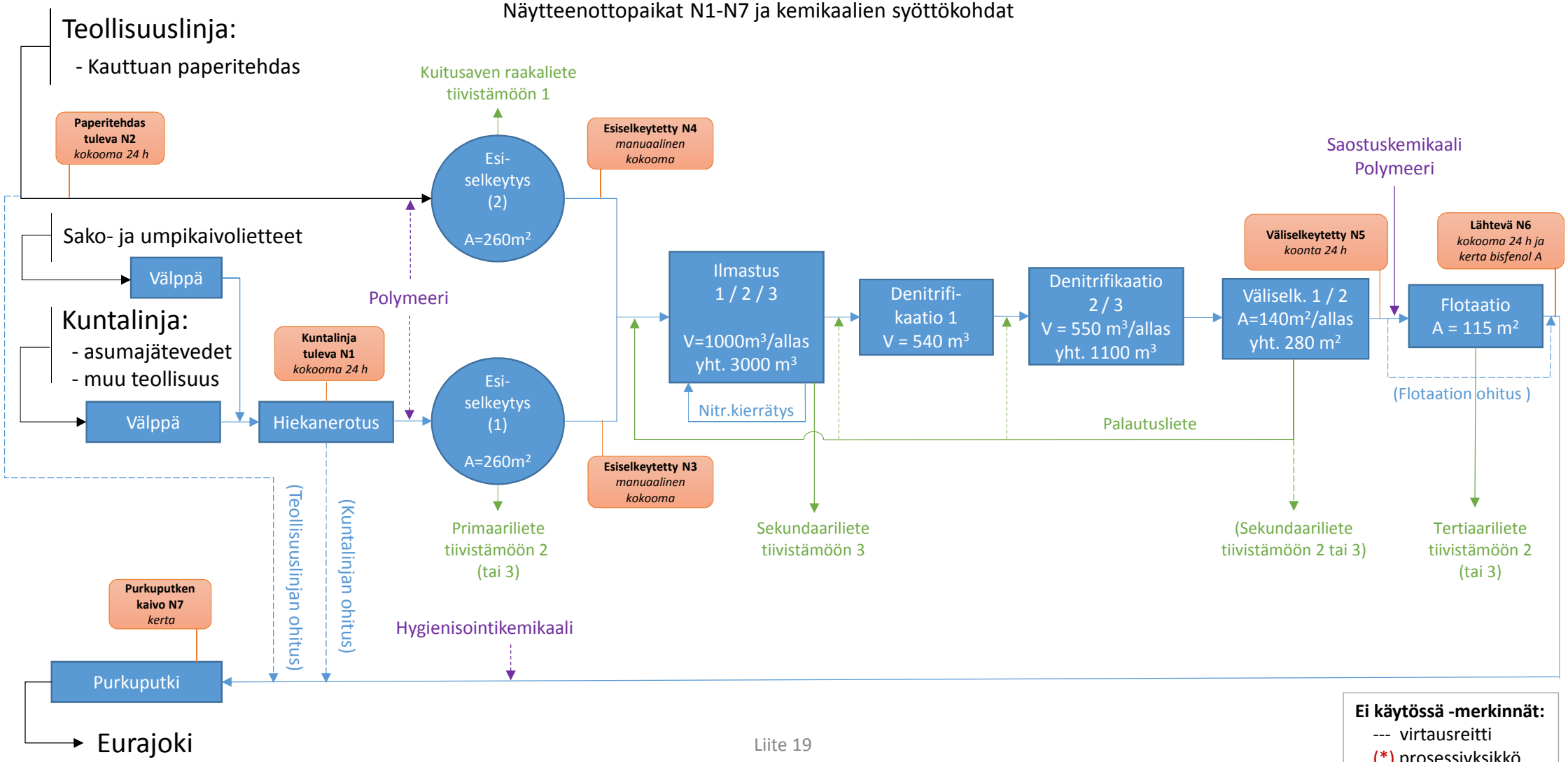
NäytePvm	Näytteen nimi	pH	Alkalit. mmol/l	CODCr mg/l	BOD7ATU mg/l	Kok.P mg/l	Liuk.P KT mg/l	Kok. N mg/l	NH4-N mg/l	L.NO3-N mg/l	L.NO2-N mg/l	Ka GF/A mg/l	Al liuk. mg/l
18.9.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
18.9.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±0,5 mg/l	±10%	±10%	±20%	±20%
2.10.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
2.10.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
2.10.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
2.10.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
2.10.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±0,5 mg/l	±0,5 mg/l			±20%	
2.10.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
16.10.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
16.10.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
16.10.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
16.10.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±15%	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
8.11.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
8.11.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
8.11.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
8.11.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
8.11.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±0,5 mg/l	±0,5 mg/l			±20%	
8.11.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±0,005 mg/l	±0,002 mg/l	±20%	±20%
22.11.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
22.11.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
22.11.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±0,5 mg/l			±20%	
22.11.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±0,5 mg/l	±0,5 mg/l	±10%	±10%	±20%	±20%
12.12.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
12.12.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
12.12.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
12.12.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±20%
19.12.2017	/kunta/kunnasta tuleva	±0,2		±15%	±15%	±15%		±10%				±20%	
19.12.2017	/teoll/teollisuudesta tuleva	±0,2		±15%	±15%	±15%		±0,5 mg/l				±20%	
19.12.2017	/es1/esiselkeytetty, kunta				±15%	±15%		±10%				±20%	
19.12.2017	/es2/esiselkeytetty, teoll				±15%	±15%		±0,5 mg/l				±20%	
19.12.2017	/vs/väliselkeytetty	±0,2	±10%	±15%	±15%	±15%		±10%	±10%			±20%	
19.12.2017	/lähtevä/LÄHTEVÄ	±0,2	±10%	±10 mg/l	±15%	±15%	±0,005 mg/l	±10%	±10%	±10%	±10%	±20%	±20%

JVP-Eura Oy:n jätevedenpuhdistamon lietetutkimusten mittausepävarmuudet vuonna 2017

NäytePvm	Näytteen nimi	pH liete	Kuiva-aine	Hehk.j.	Hg	Cd	Cr	Cu	Ni	Pb	Zn	As	Ca	K	Mg	Al
			%	% ka:sta	mg/kg ka	mg/kg ka	mg/kg ka	mg/kg ka	mg/kg ka	mg/kg ka	mg/kg ka	mg/kg ka	% ka	% ka	% ka	% ka
22.2.2017	//#L LIETE KUNTA	±0,2	±10%		±20%	±20%	±20%	±20%	±20%	±20%	±20%	±20%	±30%	±0,05 % ka	±0,05 % ka	±30%
22.2.2017	//#L LIETE KUITULIETE	±0,2	±10%		±0,03 mg/kg ka	±20%	±1 mg/kg ka	1 mg/kg ka	±20%	±20%	±20%	±20%	±30%	±0,05 % ka	±0,05 % ka	±30%
11.5.2017	//#L LIETE KUNTA	±0,2	±10%		±0,03 mg/kg ka	±20%	±20%	±20%	±20%	±20%	±20%	±20%	±30%	±0,05 % ka	±0,05 % ka	±30%
11.5.2017	//#L LIETE KUITULIETE	±0,2	±10%		±0,03 mg/kg ka	±20%	±1 mg/kg ka	±20%	±20%	±20%	±20%	±20%	±30%	±0,05 % ka	±0,05 % ka	±30%
20.7.2017	//#L LIETE KUNTA	±0,2	±10%	±10%	±20%	±20%	±20%	±20%	±20%	±20%	±20%	±20%				±30%
20.7.2017	//#L LIETE KUITULIETE	±0,2	±10%	±10%	±0,03 mg/kg ka	±20%	±1 mg/kg ka	±20%	±20%	±20%	±20%	±20%				±30%
17.10.2017	//#L LIETE KUNTA	±0,2	±10%	±10%	±20%	±20%	±20%	±20%	±20%	±20%	±20%	±20%				±30%
17.10.2017	//#L LIETE KUITULIETE	±0,2	±10%	±10%	±0,03 mg/kg ka	±20%	±1 mg/kg ka	±20%	±20%	±20%	±20%	±20%				±30%

JVP-Euran jätevesivirtojen lohkokaavio

Näytteenottopaikat N1-N7 ja kemikaalien syöttökohdat



Liite 4.

JVP-EURA OY JA JUJO THERMAL OY

E-PRTR ASETUKSEN MUKAISTEN YHDISTEIDEN PÄÄSTÖT

Tarkkailututkimusten yhteenveto vuosi 2017

12.3.2018
Nro 206-18-1530

Lounais-Suomen
vesi- ja ympäristötutkimus Oy

Sisällys

Liitteet

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1. YLEISTÄ

Euroopan päästö- ja siirtorekisteriä koskeva E-PRTR asetus 166/2006/EY velvoittaa eri teollisuuden aloja sekä asukasvastineluvultaan (AVL) yli 100 000 asukkaan yhdyskunta-jätevedenpuhdistamoita raportoimaan päästöistä vesiin ja ilmaan sekä laitokselta pois kuljetettavien jätteiden määrät. E-PRTR asetuksen soveltamisohjeen liitteessä 5 (*Lähde: Guidance Document for the implementation of the European PRTR, 31.5.2006*) on listattuna toimialoittain aineet, joiden päästöt tulee selvittää ja raportoida. E-PRTR asetuksesta laaditussa ohjeessa yhdyskuntajätevedenpuhdistamoiden osalta on listattu tutkittavaksi yhteensä 43 yhdistettä/yhdisteryhmää jätevedestä (päästölähteen tunnus 5F). Paperiteollisuuden jätevesistä (päästölähteen tunnus 6B) on listattu tutkittavaksi yhteensä 24 yhdistettä/yhdisteryhmää.

Etelä-Suomen aluehallintoviraston 23.1.2013 antaman ympäristölupapäätöksen nro 11/2013/1 määräyksen nro 20 mukaan JVP-Eura Oy:n tulee toimittaa 30.4.2013 mennessä selvitys Varsinais-Suomen ELY-keskukselle E-PRTR -raportointivelvollisuuden piiriin kuuluvista parametreista siten kuin EU:n asetuksessa 166/2006/EY tarkoitetaan. Selvityksen perusteella tulee puhdistamon tarkkailuohjelma päivittää kynnysarvon ylittävien tai mahdollisesti ylittävien parametrien osalta.

Vuonna 2013 tehtiin laaja E-PRTR yhdisteiden tarkkailututkimus. Tutkimus uusittiin vuonna 2017 tutkimalla ne yhdisteet, joita E-PRTR asetuksen soveltamisohjeen liitteessä 5 on mainittu yhdyskuntapuhdistamoille ja paperiteollisuuden jätevesille.

Typen, fosforin, orgaanisen hiilen (TOC tai $COD_{Cr}/3$) ja bisfenoli A:n päästöt vesistöön (kg/a) on raportoitu vuoden 2017 päästötarkkailutulosten mukaisesti.

2. PÄÄSTÖT ILMAAN

JVP-Eura Oy:n jätevedenpuhdistamon ilmapäästöt on laskettu HSY:n ja Vesi- ja viemärilaitosyhdistys ry:n teettämään selvitykseen perustuvan PRTR ilmapäästöt -laskenta-arkin perusteella (*liite 1*). Päästöjen laskenta perustuu HSY:n Viikinmäen puhdistamolla tehtyihin mittauksiin ja niistä luotuun laskentamalliin. JVP-Eura Oy:n jätevedenpuhdistamon ilmapäästöjen laskennan lähtöarvoina on käytetty vuoden 2017 virtaama- ja kuormitustietoja sekä HSY:ltä saatuja päästökertoimia:

Puhdistamolle tuleva vesimäärä	7 586	m^3/d
Tuleva BOD_{7ATU}-kuorma	2 100	kg/d
Metaanikerroin, k_{CH4}	0,0131	kg/kg
Dityppioksidikerroin, k_{N2O}	0,440267	$kg,d/m^3,a$

JVP-Eura Oy:n jätevedenpuhdistamon laskennalliset ilmapäästöt ovat *liitteellä 1*. Vuoden 2017 virtaama- ja kuormitustiedoilla lasketut ilmapäästöt eivät ylittäneet EPRTR raportoinnin kynnysarvoja (*liite 1*).

3. PÄÄSTÖT VESISTÖÖN JA VIEMÄRIIN

JVP-Eura Oy:n jätevedenpuhdistamolla tehtiin E-PRTR yhdisteiden tarkkailututkimukset jätevesistä päästötarkkailukerroilla 19.6. ja 4.7.2017 (*liite 2*).

Puhdistamolle tulevista jätevesijakeista ja puhdistamolta lähtevästä jätevedestä analysoitiin toimialakohtaiset yhdisteet, jotka ovat listattuna E-PRTR asetuksen soveltamisohjeen liitteessä 5 (*Lähde: Guidance Document for the implementation of the European PRTR, 31.5.2006*). Raskasmetallit, kloridit ja fluoridit analysoitiin Lounais-Suomen vesi- ja ympäristötutkimus Oy:n laboratoriossa (FINAS-akkreditoitu laboratorio T101). Muut E-PRTR yhdisteet analysoitiin kahdessa eri alihankintalaboratoriossa (*liite 2*).

Yhdisteet tutkittiin pääosin 24 h kokoomanäytteistä, jotka kerättiin puhdistamon automaattisilla näytteenottimilla virtaamaohjatusti.

Ftalaattiyhdisteet tutkittiin manuaalisesti työpäivän aikana kerätyistä kokoomanäytteistä, koska näytteenkeräyksessä haluttiin välttää kontaminaatiota muoviosiin. Näytteenotossa käytettiin teräksisiä asetonipestyjä ottimia. Näytteenkeräyksestä vastasi puhdistamonhoitaja. Kutakin havaintopaikkaa (kuntalinja tuleva, paperiteollisuus tuleva ja puhdistamolta lähtevä jätevesi) varten oli omat näytteenottovälineet.

Haihtuvuuden vuoksi kertanäytteenä otettiin VOC- yhdisteiden näyte.

3.1. Lähtötiedot

E-PRTR yhdisteiden vesistöpäästöjen (kg/a) kuormitusarvio on laskettu käyttäen vuoden 2017 virtaamatietoja. Vesistöön johdettavassa kuormassa on huomioitu myös ohitukset. Ravinnepäästöt (kokonaistyppi ja kokonaisfosfori) ja orgaanisen hiilen päästöt ($TOC=COD_{Cr}/3$) saatiin puhdistamon päästötarkkailumittauksista vuodelta 2017.

Vuoden 2017 virtaama- ja kuormitustiedot olivat seuraavat (*Lähde: JVP-Eura Oy:n vuosiyhteenveto 2017*):

Kuntalinjalta tuleva jätevesimäärä	1 006 693	m^3/a
Paperiteollisuudesta tuleva jätevesimäärä	1 761 765	m^3/a
Käsitelty jätevesimäärä	2 768 937	m^3/a
Ohitettu jätevesimäärä (kunnan viemäriverkosto)	250	m^3/a
Ohitettu jätevesimäärä (paperiteollisuuden putkilinja)	0	m^3/a
Vesistöön lähtevä COD_{Cr}-kuorma (sis. ohitus)	440,5	kg/d
	160 782	kg/a
Vesistöön lähtevä fosforikuorma (sis. ohitus)	1,904	kg/d
	695	kg/a
Vesistöön lähtevä typpikuorma (sis. ohitus)	57,075	kg/d
	20 832	kg/a

Muiden E-PRTR yhdisteiden osalta vesistöön johdetut päästöt laskettiin 19.6. ja 4.7.2017 tehtyjen tarkkailututkimustuloksista.

3.2. Päästötietojen laskenta

Puhdistamo- ja verkosto-ohitusten aiheuttama kuormitus huomioidaan vesistöön johdetussa kuormituksessa seuraavasti:

> Vesistöön johdettu kuormitus = Puhdistamolta lähtevä kuormitus (käsitelty jätevesi) + ohitusten aiheuttama kuormitus

Jaksokuormitus (kg/jakso) saadaan jakson virtaama (m^3/jakso) * jakson aritmeettinen pitoisuuskeskiarvo (mg/l) tai vaihtoehtoisesti jakson keskimääräinen virtaama (m^3/d) * jakson päivien lukumäärä (d/jakso) * jakson aritmeettinen pitoisuuskeskiarvo (mg/l).

Jos kaikki jakson puhdistamolta lähtevän käsitellyn jäteveden pitoisuusmittaukset ovat alle määritysrajan, jakson lähtevän jäteveden pitoisuudeksi/kuormaksi ilmoitetaan nolla (0).

Jos pitoisuusmittauksen arvo on yli määritysrajan, kuormituslaskennassa käytetään mitattua arvoa. Jos jokin jakson lähtevän jäteveden pitoisuusmittaus on alle määritysrajan, silloin määritysrajan alittavien arvojen osalta käytetään kuormituslaskennassa määritysrajan puolikasta. Em. jakson pitoisuusmittauksista lasketaan aritmeettinen keskiarvo, joka on jakson keskimääräinen pitoisuus. Samaa periaatetta käytetään myös tulevan jäteveden mittausten osalta, mikäli mitattu pitoisuus on alle määritysrajan.

Ohituksista ja ylivuodoista aiheutunut ohituskuorma lasketaan käyttäen tulevan jäteveden pitoisuuksia, mikäli ne ovat tiedossa. Muutoin ohituskuorman laskennassa käytetään käsitellyn eli puhdistamolta lähtevän jäteveden pitoisuutta. Määritysrajan alittavien tulosten osalta ohituskuormien laskennassa käytetään samaa periaatetta kuin puhdistamolta lähtevän jätevesikuorman laskennassa.

Puhdistamolle tuleva kokonaiskuorma on paperiteollisuudesta tulevan kuorman ja kuntalinjalta tulevan kuorman summa. Mikäli vuoden ajalta on vain yksi mittaustulos, vuotuinen tuleva kuorma saadaan käyttämällä tätä mitattua pitoisuutta ja vuotuista jätevesimäärää.

Taulukossa 1 on esitetty ainekohtaisten päästöjen laskentaperiaate, jos päästölaskenta poikkeaa edellä esitetystä.

Dioksiinien ja furaanien, PCDD ja PCDF –yhdisteiden, summaparametri lasketaan käyttämällä toksisuusekvivalenttimenetelmää. Dioksiini- ja furaaniyhdisteiden päästö raportoidaan, jos PCDD- ja PCDF -yhdisteiden TEQ arvosta laskettu päästö ylittää kynnysarvon 0,0001 kg/a (*liite 2, WHO 2005, toksisuusekvivalenttiarvot*).

Fenolit raportoidaan E-PRTR asetuksen mukaan kokonaishiilenä *taulukon 1* mukaisesti. Päästölaskennassa on raportoitu erikseen myös vesistöön johdettu bisfenoli A -kuormitus. Bisfenoli A:n seurannalle on puhdistamon ympäristöluvassa velvoite.

Ilmanpäästöjen osalta asetuksessa 166/2006/EY on lueteltu neljä yhdistettä, joiden summaa pidetään PAH-arvona. Vesipäästöjen osalta ei ole ohjeistettu, mitä yhdisteitä tarkoitetaan. PRTR-ohjeessa puolestaan ei erotella ilmaa, vaan mainitaan yleisesti, että PAH:t sisältävät neljä yhdistettä. Kuormituslaskennassa on käytetty näitä neljää polysyklistä aromaattista hiilivetyä [bentso(a)pyreeni, bentso(b)fluoranteeni, bentso(k)fluoranteeni ja indeno(1,2,3-cd)pyreeni] kuvaamaan PAH-yhdisteitä. E-PRTR asetuksen ainelistassa on erikseen PAH-yhdisteisiin kuuluvat fluoranteeni ja bentso(g,h,i)peryleeni.

TOC on kiintoaineen vuoksi vaikea määrittää jätevesille, joten tiedon tuottamismenetelmänä käytetään COD_{Cr}-arvoa, josta asetuksen mukaan saadaan TOC-tulos kolmella jakamalla.

Bromattujen bifenyylieettereiden kokonaispäästö lasketaan seuraavien yhdisteiden summaparametrina: penta-BDE, octa-BDE ja deca-BDE.

Yksittäisten BTEX -yhdisteiden päästöt raportoidaan, jos BTEX -yhdisteiden (bentseeni, etyylibentseeni, tolueeni, ksyleenit) summaparametrin kynnysarvo 200 kg/a (BTEX) ylittyy.

TAULUKKO 1. Ainekohtaisten päästöjen laskentaperiaatteita.

PRTR Nro 1)	Aine	Kuormituslaskenta ja todennäköinen soveltuva päästötiedon tuottamismenetelmä (mittaus M / laskenta C / arvio E)
47	Dioksiinit ja furaanit	M tai C: PCDD ja PCDF -konregeenien summa raportoidaan TEQ arvona (WHO 2005, toksisuusekvivalenttimenetelmällä)
71	Fenolit (kokonaishiilenä)	M tai C: Summafenolimäärän (SFS 3011) muunto hiileksi kertoimella * 6 * 12,01 / 94,11 eli * 0,77. Tai yksinkertaisesti substituoidut fenolit (=fenoli, kresolit, resorsinolit, kloorifenolit, nitrofenolit) kerrotaan kukin moolimassojen suhteella.
72	Polysykliset aromaattiset hiilivedyt (PAH-yhdisteet)	M tai C: PAH-yhdisteitä kuvaamaan käytetään bentso(a)pyreeniä, bentso(b)fluoranteenia, bentso(k)fluoranteenia ja indeno(1,2,3-cd)pyreeniä
76	Organisen hiilen kokonais-määrä (TOC) (kokonais-hiilenä tai CODCr/3)	M: Päästötarkkailutulokset , TOC= vesistöön johdettu COD_{Cr}-vuosikuorma / 3
63	Bromatut bifenyylieetterit (PBDE)	M tai C: Kokonaispäästö lasketaan seuraavien yhdisteiden summaparametrin arvosta: penta-BDE, octa-BDE ja deca-BDE
62 65 73 78	BTEX-yhdisteet: Bentseeni Etyylibentseeni Tolueeni Ksyleenit	M tai C: yksittäisten BTEX-aineiden päästöt raportoidaan, jos BTEX-yhdisteiden (bentseeni, etyylibentseeni, tolueeni, ksyleenit) summaparametrin kynnysarvo ylittyy

1) E-PRTR asetuksen (166/2006/EY) mukaiset numeroinnit E-PRTR-raportoitaville yhdisteille

3.3. Vesistöön ja viemäriin johdetut päästöt

Liitteelle 4 on laskettu E-PRTR yhdisteiden vesistöön johdetut päästöt (kg/a). Taulukossa on eriteltynä myös puhdistamolle tulevien jätevesijakeiden kuormat eli paperiteollisuudesta tulevan jäteveden ja kuntalinjalta tulevan jäteveden kuormat sekä näistä yhteen laskettu puhdistamolle tuleva kokonaistulokuorma. E-PRTR raportoinnissa paperiteollisuudesta tuleva jätevesikuorma raportoidaan Jujo Thermal Oy:n toimesta viemäriin johdettuna kuormituksena. JVP-Eura Oy raportoi vesistöön johdetut päästöt.

Taulukkoon 2 on koottu puhdistamolle paperiteollisuudesta tuleva kuorma sekä vesistöön johdettu kuormitus (*liite 4*). Kokonaistypen, -fosforin kuormat ja TOC:n laskennassa käytetty CODCr-kuorma ovat puhdistamon kuormitustietoja vuodelta 2017 (*Lähde: JVP-Eura Oy:n puhdistamon vuosiyhteenveto 2017*).

TOC:n päästö (COD_{Cr}/3) vesistöön oli raportoinnin kynnysarvoa suurempi.

Paperiteollisuudesta viemäriin johdettavan jäteveden kuormat sinkin, fenolisten yhdisteiden (kokonaishiileksi muunnettuna) ja TOC:n (COD_{Cr}/3) osalta olivat raportoinnin kynnysarvoja suurempia.

TAULUKKO 2. E-PRTR yhdisteiden päästöt vesistöön ja paperiteollisuudesta viemäriin johdettava jätevesikuorma.

PRTR Nro	Aine	Tulokuorma Paperitehtaat tuleva, kg/a	Lähtevä kuorma kg/a	Ohitus kuorma kg/a	Vesistöön kuorma kg/a	Kynnysarvo 166/2006/EY kg/a
12	Kokonaistyppi	6 570	20 805	27	**20 832**	50 000
13	Kokonaisfosfori	657	693,5	1,46	**695**	5 000
17	Arseeni ja arseeniyhdisteet (arseenina)	1,41	1,94	0,00085	**1,94**	5
18	Kadmium ja kadmiumyhdisteet	0,79	0,11	0,00008	**0,11**	5
19	Kromi ja kromiyhdisteet (kromina)	4,6	4,4	0,0021	**4,4**	50
20	Kupari ja kupariyhdisteet (kuparina)	10,4	9,69	0,053	**9,74**	50
21	Elohopea ja elohopeayhdisteet	0,053	0,055	0,000028	**0,055**	1
22	Nikkeli ja nikkeliyhdisteet (nikkelinä)	5,1	8,6	0,0038	**8,6**	20
23	Lyijy ja lyijy-yhdisteet (lyijynä)	2,6	1,33	0,0025	**1,33**	20
24	Sinkki ja sinkkiyhdisteet (sinkkinä)	247	41,5	0,10	**41,6**	100
27	Atratsiini	0	0	0	**0**	1
34	1,2-dikloorietaani (EDC)	0	0	0	**0**	10
35	Dikloorimetaani (DCM)	0	0	0	**0**	10
37	Diuroni	0	0	0	**0**	1
40	Halogenoidut orgaaniset yhdisteet (AOX)	546	252	0,04	**252**	1 000
42	Heksaklooribentseeni (HCB)	0	0	0	**0**	1
45	Lindaani	0	0	0	**0**	1
47	PCDD+PCDF (dioksiinit ja furaanit, TEQ)*	0,000060	0,0000886	0	**0,0000886**	0,0001
49	Pentakloorifenoli (PCP)	0	0	0	**0**	1
51	Simatsiini	0	0	0	**0**	1
52	Tetrakloorieteeni (PER)	0	0	0,00825	**0,00825**	10
53	Tetraklorimetaani (TCM)	0	0	0	**0**	1
57	Trikloorieteeni	0	0	0,00075	**0,00075**	10
58	Trikloorimetaani (kloroformi)	0	0	0,0020	**0,0020**	10
62	Bentseeni	0	0	0,0095	**0,0095**	200 (BTEX)
63	Bromatut bifenyylieetterit (PBDE)	0	0	0,0000021	**0,0000021**	1
64	Nonyylifenoli ja nonyylifenolietoksylaatit	0	0,25	0	**0,25**	1
67	Isoproturoni	0	0	0	**0**	1
68	Naftaleeni	0,019	0	0,000003	**0,000003**	10
69	Organotinayhdisteet (kok. Sn)	0	0	0,0005	**0,0005**	50
70	Di-2-etyyliheksyyliftalaatti (DEHP)	0	0	0,008	**0,008**	1
71	Fenolit (kokonaishiilenä)	951	0,55	0,85	**1,4**	20
72	Polysykliset aromaattiset hiilivedyt (PAH)**	0	0	0	**0**	5
73	Tolueeni	0	0	0,287	**0,287**	200 (BTEX)
74	Tributyylitina-yhdisteet	0	0	0	**0**	1
75	Trifenyylitina-yhdisteet	0	0	0	**0**	1
76	Kok. Orgaaninen hiili (TOC) tai COD_{Cr} / 3	456 250	53 533	61	**53 594**	50 000
78	Ksyleenit	0	0	0,00075	**0,00075**	200 (BTEX)
79	Kloridit (kokonaiskloorina)	0	332 272	30	**332 302**	2 000 000
82	Syanidi, CN	0	0	0	**0**	50
83	Fluoridit (kokonaisfluorina)	0	719,9	0,15	**720,1**	2 000
87	Oktyylifenolit ja oktyylifenolietoksylaatit	0	0	0	**0**	1
88	Fluoranteeni	0	0	0,0000022	**0,0000022**	1
89	Isodriini	0	0	0	**0**	1
91	Bentso(g,h,i) peryleeni	0	0	0	**0**	1
	Bisfenoli A***	1216	14	0,008	**14**	

* Laskettu käyttäen Middle bound WHO (2005) -TCDD TEQ -arvoa, koska oletettu pitoisuus lower bound ja upperbound -arvojen välillä.

** PAH yhdisteillä tarkoitetaan neljää PAHyhdistettä: bentso(a)pyreeni, bentso(b)fluoranteeni, bentso(k)fluoranteeni ja indeeni(1,2,3cd)pyreeni. EU:n EPER ainelistassa on lisäksi bentso(ghi)peryleeni ja fluoranteeni Lähde: SYKE taustaselvitys.

*** Bisfenoli A: Yhdiste ei sis. E-PRTR raportoitaviin päästöihin

4. TOIMINNASTA SYNTYVÄT JÄTTEET

E-PRTR -raportointi kattaa myös laitokselta pois kuljetettujen jätteiden raportoinnin. E-PRTR -ohjeen mukaan haitattoman jätteen siirron raportointikynnys on 2 000 tn/a ja vaarallisen jätteen siirron raportointikynnys on 1 000 tn/a.

Puhdistamolta vietiin vuoden 2017 aikana yhteensä 4 030,4 tn kuivattua biologisen ja kemiallisen prosessin seoslietettä (EWC-koodi 190802) Gasum Biotehdas Oy:n Vambion biokaasulaitokselle mädätettäväksi (*liite 5*). Paperiteollisuuden kuivattua kuitusavilietettä (EWC-koodi 030310) syntyi vuoden aikana yhteensä 2 540,8 tn ja lietteet toimitettiin Loimi-Hämeen Jätehuolto Oy:n Hallavaaran jätekeskukseen. Puhdistamolla syntyvien lietteiden määrät ylittivät haitattoman jätteen raportointikynnyksen.

Puhdistamolla syntyi vuonna 2017 myös välppäjätettä, hiekka-vesiseosta ja rasvakaivojätettä, jotka määrällisesti eivät ylittäneet raportointikynnystä. Lisäksi puhdistamolla syntyi pieniä määriä energiajätettä ja laboratoriojätettä (*liite 5*).

5. TULOSTEN RAPORTOINTI

E-PRTR asetuksen mukainen päästöraportointi tehdään viranomaisen edellyttämän tavan mukaisesti. Tarkoituksena on raportoida kaikki päästöt kansallisella tasolla eli myös EU:n raportointikynnyksen alittavat päästöt. Viranomainen raportoi edelleen päästöjen kynnysarvot ylittävät päästöt EU:n päästötietorekisteriin.

JVP-Eura Oy raportoi ilmaan ja vesistöön johdetut päästöt sekä toiminnasta syntyneet laitokselta poiskuljetetut jätteet. TOC:n (COD_{Cr} / 3) päästö vesistöön oli raportoinnin kynnysarvoa suurempi (*taulukko 2*).

Jujo Thermal Oy raportoi paperitehtailta viemäriin johdettujen jätevesien E-PRTR päästöt, jolloin päästöpisteenä on viemäri (=paperiteollisuudesta JVP-Eura Oy:n jätevedenpuhdistamolle tuleva kuorma). Paperiteollisuudesta viemäriin johdettavan jäteveden kuormat sinkin, fenolisten yhdisteiden (kokonaishiileksi muunnettuna) ja TOC:n (COD_{Cr}/3) osalta olivat raportoinnin kynnysarvoja suurempia.

Turussa 12. maaliskuuta 2018

Nina Leino
prosessi-insinööri, DI

PRTR ILMAPÄÄSTÖT -LASKENTA-ARKKI

Liite 1

Laitoksen yleistiedot

Puhdistamon nimi	JVP-Eura Oy
Raportointivuosi	2017

Lietteen mädätys K/E?	E
Biokaasun määrä [m3/a]	
Polttoöljyn käyttö K/E?	E
Polttoöljyn käyttömäärä [t/a]	

Vuosikohtaiset tiedot

Puhdistamolle tuleva virtaama	7 586	m³/d
BHK 7 tuleva	2 100	kg/d

Ilmapäästöt

Päästö	kg/a	Ylittyykö raportointi-kynnys ?	Korrelaatio 1	Korrelaatio 2	Korrelaatio 3
Metaani, CH_4	10 041	EI	tuleva BHK 7	biokaasu	
Hiilimonoksidi, CO	0	EI	biokaasu	polttoöljy	
Hiilidioksidi, $CO_{2\ bio}$	672 987	EI	biokaasu	tuleva BHK 7	
Hiilidioksidi, $CO_{2\ fossil}$	0	EI	polttoöljy		
Dityppioksidi, N_2O	3 340	EI	vesimäärä		
Ammoniakki, NH_3	19	EI	tuleva BHK 7		
NMVOC	89	EI	vesimäärä	polttoöljy	
Typen oksidit, NO_X	186	EI	biokaasu	vesimäärä	polttoöljy
Rikin oksidit, SO_X	0	EI	biokaasu	polttoöljy	vesimäärä
1,2-dikloorietaani, EDC	0	EI	vesimäärä		
Dikloorimetaani, DCM	0	EI	vesimäärä		
Heksaklooribentseeni, HCB	0,00023	EI	vesimäärä		
Pentaklooribentseeni, PCB	0,00023	EI	vesimäärä		
Tetrakloorieteeni, PER	0,58	EI	vesimäärä		
Tetrakloorimetaani, TCM	0	EI	vesimäärä		
1,1,1-trikloorietaani	0	EI	vesimäärä		
Trikloorieteeni, TRI	0	EI	vesimäärä		
Trikloorimetaani	0	EI	vesimäärä		
Bentseeni	0	EI	vesimäärä		

Laatinut: Helsingin seudun ympäristöpalvelut -kuntayhtymä / Laura Sundell 1.8.2007
muokattu 25.7.2011 Paula Lindell

HSY

FINAS Finnish Accreditation Service T101 (EN ISO/IEC 17025)

JVP-Eura Oy
pirjo.patala@jvp-eura.fi

Tilausnro 202754 (EURA8/EPRTR), saapunut 20.6.2017, näytteet otettu 19.6.2017
Näytteenottaja: LSVYT Oy, Hannula

NÄYTTEET

Lab.nro	Näytteen kuvaus
8649	Paperiteollisuudesta tuleva jv, 24 h kokoomanäyte 19.6.-20.6.2017
8650	Kuntalinjalta tuleva jv, 24 h kokoomanäyte 19.6.-20.6.2017
8651	Puhdistamolta lähtevä jv, 24 h kokoomanäyte 19.6.-20.6.2017

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	8649	8650	8651
E-PRTR		ks. laus.	ks. laus.	ks. laus.
Kloridi, Cl *	mg/l		120	120
Fluoridi, F *	mg/l		0,61	0,26
Arseeni, As *	mg/l	0,0008	0,0034	0,0007
Kadmium, Cd *	mg/l	0,00045	0,00032	0,00004
Kromi, Cr *	mg/l	0,0026	0,0085	0,0016
Kupari, Cu *	mg/l	0,0059	0,21	0,0035
Elohopea, Hg *	mg/l	0,00003	0,00011	0,00002
Nikkeli, Ni *	mg/l	0,0029	0,015	0,0031
Lyijy, Pb *	mg/l	0,0015	0,0100	0,00048
Tina, Sn	mg/l		0,0020	<0,0002
Sinkki, Zn *	mg/l	0,14	0,40	0,015

Merkintöjen selityksiä: P = määritys kesken, E = ei tehty, ~ = noin, < = pienempi kuin, « = pienempi tai yhtäsuuri kuin, > = suurempi kuin, » = suurempi tai yhtäsuuri kuin.
* -merkityt analyysit ovat akkreditoituja. (a)=laatuvaatimus, (b)=laatusuositus

LAUSUNTO

JVP-Eura Oy:n E-PRTR yhdisteiden tarkkailututkimuksen tulokset. E-PRTR yhdisteiden tutkimus jätevesistä tehtiin päästötarkkailukerran 19.6.2017 kanssa samanaikaisesti.

E-PRTR asetuksen soveltamisohjeen liitteessä 5 (Lähde: Guidance Document for the implementation of the European PRTR, 31.5.2006) on listattuna toimialoittain aineet/yhdisteet, joiden päästöt tulee selvittää ja raportoida. E-PRTR asetuksesta laaditussa ohjeessa yhdyskuntajätevedenpuhdistamoiden osalta on listattu tutkittavaksi yhteensä 43 yhdistettä/yhdisteryhmää jätevedestä (päästölähteen tunnus 5F). Paperiteollisuuden jätevesistä (päästölähteen tunnus 6B) on listattu tutkittavaksi yhteensä 24 yhdistettä/yhdisteryhmää.

Puhdistamolle tulevista jätevesijakeista tutkittiin em. yhdisteryhmät (paperiteollisuus tuleva ja kuntalinja tuleva) ja puhdistamolta lähtevästä jätevedestä em. yhdisteet yhteensä. Lisäksi kuntalinjalta tulevasta ja puhdistamolta lähtevästä jätevedestä tutkittiin bromatut palonestoaineet (PBDE-yhdisteet) vesiympäristölle haitallisten ja vaarallisten aineiden asetuksen 1022/2006 mukaisesti. Ko. yhdisteryhmä kuuluu myös E-PRTR asetuksen mukaisiin yhdisteisiin. Osa yhdisteistä tutkittiin 4.7.2017 päästötarkkailukerralla ja niiden tulokset raportoidaan omalla testausselosteella.

E-PRTR yhdisteiden tarkkailutulosten perusteella lasketaan vuoden 2016 virtaamien (m3/a)

LAUSUNTO (jatkoa edelliseltä sivulta)

perusteella vesistöön johdettavien päästöjen vuosikuormitukset (kg/a) erilliseen raporttiin. Kuormituslaskennassa käytetään vuoden 2016 virtaamatietoja, koska vuoden 2017 toteuma ei ole vielä tiedossa. Lisäksi JVP-Eura Oy:lle laaditaan E-PRTR yhdisteiden tarkkailusuunnitelma.

Nina Leino
prosessi-insinööri, DI

TIEDOKSI

Jujo Thermal Oy/Mari.Ylinen@jujothermal.com
JVP-Eura Oy/tulosten lukuohjelma, 0 kpl.

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
E-PRTR	(TL49)
Kloridi, Cl *	SFS-EN ISO 10304-1 (TL27)
Fluoridi, F *	SFS-EN ISO 10304-1 (TL27)
Arseeni, As *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Kadmium, Cd *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Kromi, Cr *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Kupari, Cu *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Elohopea, Hg *	SFS-EN ISO 17852, muunneltu, SFS-EN ISO 17294-1 ja -2 (TL27)
Nikkeli, Ni *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Lyijy, Pb *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Tina, Sn	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)
Sinkki, Zn *	SFS-EN ISO 17294-1 ja -2, SFS-EN ISO 15587-2 (TL27)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL27	Lounais-Suomen vesi- ja ympäristötutkimus Oy
TL49	Ramboll Finland Oy

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.
Kloridi, Cl *	2017/8650	±10 %	28.6.2017
	2017/8651	±10 %	28.6.2017
Fluoridi, F *	2017/8650	±10 %	28.6.2017
	2017/8651	±50 µg/l	28.6.2017
Arseeni, As *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017
Kadmium, Cd *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±0,01 µg/l	29.6.2017
Kromi, Cr *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017
Kupari, Cu *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017
Elohopea, Hg *	2017/8649	±0,01 µg/l	28.6.2017
	2017/8650	±15 %	28.6.2017
	2017/8651	±0,01 µg/l	28.6.2017
Nikkeli, Ni *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017
Lyijy, Pb *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017
Tina, Sn	2017/8650	±15 %	5.7.2017
	2017/8651	Määritysrajan alitus	28.6.2017
Sinkki, Zn *	2017/8649	±15 %	29.6.2017
	2017/8650	±15 %	29.6.2017
	2017/8651	±15 %	29.6.2017

Tutkimustodistus

Projekti: 1510031319/207

Lounais-Suomen vesi- ja ympäristötutkimus Oy

Telekatu 16
20360 TURKU

Tutkimuksen nimi: LSVSY, Yhdyskunta/teollisuusjätevedenpuhdistamo, haitallisten aineiden tarkkailu

Näytteenottopvm:
Näyte saapui: 21.6.2017
Näytteenottaja:
Analysointi aloitettu: 21.6.2017

Jätevesi

Näytteenottopisteet	Kuntalinja tuleva jätevesi	Paperiteollisuus tuleva jätevesi	Puhdistamolta lähtevä jätevesi	Yksikkö	Menetelmä	
Näytenumero	17JJ 01774	17JJ 01775	17JJ 01776			
MÄÄRITYKSET						
Syanidi (CN), kokonais-	<20		<20	µg/l	RA2081[1]	L
Haihtuvat hiilivedyt, paketti 1+2	tod.	ei tod.	ei tod.	µg/l, mg/l	RA4050[1]	L
Cis-1,2-dikloorieteeni	8			µg/l	RA4050[1]	L
Trikloorieteeni	3			µg/l	RA4050[1]	L
Tetrakloorieteeni	33			µg/l	RA4050[1]	L
Kloroformi (trikloorimetaani)	8			µg/l	RA4050[1]	L
1,4-diklooribentseeni	1			µg/l	RA4050[1]	L
2-klooritolueeni	4			µg/l	RA4050[1]	L
4-klooritolueeni	1			µg/l	RA4050[1]	L
Tolueeni	1100			µg/l	RA4050[1]	L
m+p-ksyleeni	3			µg/l	RA4050[1]	L
1,2-dietyylibentseeni	2			µg/l	RA4050[1]	L
1,3-dietyylibentseeni	3			µg/l	RA4050[1]	L
1,4-dietyylibentseeni	2			µg/l	RA4050[1]	L
n-Propyylibentseeni	3			µg/l	RA4050[1]	L
n-butyylibentseeni	2			µg/l	RA4050[1]	L
Sec.butyylibentseeni	<5			µg/l	RA4050[1]	L
2-etyylitolueeni	5			µg/l	RA4050[1]	L
3-etyylitolueeni	4			µg/l	RA4050[1]	L
4-etyylitolueeni	5			µg/l	RA4050[1]	L
p-isopropyylitolueeni	28			µg/l	RA4050[1]	L
1,2,3-trimetyylibentseeni	4			µg/l	RA4050[1]	L
1,2,4-trimetyylibentseeni	11			µg/l	RA4050[1]	L
1,3,5-trimetyylibentseeni	7			µg/l	RA4050[1]	L
1,2,3,5-tetrametyylibentseeni	2			µg/l	RA4050[1]	L
1,2,4,5-tetrametyylibentseeni	1			µg/l	RA4050[1]	L
Pentaani	<50			µg/l	RA4050[1]	L
Oktaani	120			µg/l	RA4050[1]	L
Nonaani	67			µg/l	RA4050[1]	L
Dekaani	140			µg/l	RA4050[1]	L

	17JJ 01774	17JJ 01775	17JJ 01776	Yksikkö	Menetelmä	
Etanoli	<5			mg/l	RA4050[1]	L
Alfa-pineeni	52			µg/l	RA4050[1]	L
Beta-pineeni	19			µg/l	RA4050[1]	L
Delta-kareeni	33			µg/l	RA4050[1]	L
Limoneeni	84			µg/l	RA4050[1]	L
DMS (dimetyylisulfidi)	25			µg/l	RA4050[1]	L
DMDS (dimetyylidisulfidi)	34			µg/l	RA4050[1]	L
Fenoliset yhdisteet	tod.	tod.			RA4038B[1]	L
Fenoli	1200	9,5		µg/l	RA4038B[1]	L
p-kresoli	3200			µg/l	RA4038B[1]	L
3-etyylifenoli	4,7			µg/l	RA4038B[1]	L
4-etyylifenoli	3,2			µg/l	RA4038B[1]	L
Resorsinoli	3,5			µg/l	RA4038B[1]	L
Pyrokatekoli	7,3			µg/l	RA4038B[1]	L
bisfenoli A	32	690		µg/l	RA4038B[1]	L
Organotinat	tod.		tod.		RA4059[1]	L
Monobutyylitina	0,040		0,004	µg/l	RA4059[1]	L
Dibutyylitina	0,018			µg/l	RA4059[1]	L
Mono-oktyylitina	0,010			µg/l	RA4059[1]	L
Ftalaatit	tod.	ei tod.	tod.	µg/l	RA4010[1]	L
Dietyyliftalaatti (DEP)	0,81		0,11	µg/l	RA4010[1]	L
Di-isobutyyliftalaatti (DiBP)	1,6			µg/l	RA4010[1]	L
Dibutyyliftalaatti (DBP)	1,1			µg/l	RA4010[1]	L
Dipentyyliftalaatti (DPP)	26			µg/l	RA4010[1]	L
Di-2-etyyliheksyyliftalaatti (DEHP)	32			µg/l	RA4010[1]	L
Bentsyylibutyyliftalaatti (BBP)	1,3			µg/l	RA4010[1]	L
Di(n)oktyyliftalaatti (DOP)	0,85			µg/l	RA4010[1]	L
Alkyylifenolit ja alkyylifenolietoksylaatit	ei tod.	ei tod.	tod.		RA4001[1]	L
4-nonyylifenoli, isomeerien seos			0,09	µg/l	RA4001[1]	L
Pestisidit/monij. GC+LC	tod.	tod.	tod.		RA4038A+-4039[1]	L
2,4-dikloorifenoli	<0,50	<0,050	<0,005	µg/l	RA4038A[1]	L
Terbutryyni			<0,005	µg/l	RA4038A[1]	L
Triklosaani			<0,005	µg/l	RA4038A[1]	L
DEET (N,N-dietyyli-m-toluamidi)	1,0		0,23	µg/l	RA4038A[1]	L
Bentatsoni	<0,10			µg/l	RA4039[1]	L
Dalaponi			0,25	µg/l	RA4039[1]	L
Heksatsinoni			0,019	µg/l	RA4039[1]	L
MCPA			<0,010	µg/l	RA4039[1]	L
Mekoproppi + Mekoproppi-P			0,028	µg/l	RA4039[1]	L
Bromatut difenyylieetterit vesi	tod.		tod.		RA4076C[1]	L
BDE 47	0,0029		<0,000125	µg/l	RA4076C[1]	L
BDE 99	0,0037		<0,000125	µg/l	RA4076C[1]	L
BDE 100	0,00071			µg/l	RA4076C[1]	L
BDE 119	<0,0015			µg/l	RA4076C[1]	L
BDE 153	0,00087			µg/l	RA4076C[1]	L
BDE 209	<0,10			µg/l	RA4076C[1]	L
PCDD/F		tod.	tod.		RA4062[1]	L
2,3,7,8-TetraCDD		<20	<20	pg/l	RA4062[1]	L
1,2,3,7,8-PentaCDD		<20	<20	pg/l	RA4062[1]	L
1,2,3,4,7,8-HexaCDD		<20	<20	pg/l	RA4062[1]	L

Tutkimustodistus

Projekti: 1510031319/207

	17JJ 01774	17JJ 01775	17JJ 01776	Yksikkö	Menetelmä	
1,2,3,6,7,8-HexaCDD		<20	<20	pg/l	RA4062[1]	L
1,2,3,4,6,7,8-HeptaCDD		<20	<20	pg/l	RA4062[1]	L
OctaCDD		<20	<20	pg/l	RA4062[1]	L
2,3,7,8-TetraCDF		<20	<20	pg/l	RA4062[1]	L
1,2,3,7,8-PentaCDF		<20	<20	pg/l	RA4062[1]	L
2,3,4,7,8-PentaCDF		<20	<20	pg/l	RA4062[1]	L
1,2,3,4,7,8-HexaCDF		30	<20	pg/l	RA4062[1]	L
1,2,3,6,7,8-HexaCDF		<20	<20	pg/l	RA4062[1]	L
2,3,4,6,7,8-HexaCDF		<20	<20	pg/l	RA4062[1]	L
1,2,3,7,8,9-HexaCDF		<20	<20	pg/l	RA4062[1]	L
1,2,3,4,6,7,8-HeptaCDF		26	<20	pg/l	RA4062[1]	L
1,2,3,4,7,8,9-HeptaCDF		<20	<20	pg/l	RA4062[1]	L
OctaCDF		56	21	pg/l	RA4062[1]	L
Lower bound NATO(1989)-TEQ		3.316	0	pg/l	RA4062[1]	L
Middle bound NATO(1989)-TEQ		31	29	pg/l	RA4062[1]	L
Upper bound NATO(1989)-TEQ		59	58	pg/l	RA4062[1]	L
Lower bound WHO(1998)-TEQ		3.266	0	pg/l	RA4062[1]	L
Middle bound WHO(1998)-TEQ		36	34	pg/l	RA4062[1]	L
Upper bound WHO(1998)-TEQ		69	68	pg/l	RA4062[1]	L
Lower bound WHO(2005)-TCDD TEQ		3.277	0	pg/l	RA4062[1]	L
Middle bound WHO(2005)-TCDD TEQ		34	32	pg/l	RA4062[1]	L
Upper bound WHO(2005)-TCDD TEQ		64	63	pg/l	RA4062[1]	L

[1] FINAS -akkreditoitu menetelmä. Mittausepävarmuus ilmoitetaan tarvittaessa. Akkreditointi ei koske lausuntoa.

Eurofins Environment Testing Finland Oy

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Lisätiedot Näytteen 17JJ01774 määritysrajat ovat normaalia korkeammat näytematriisista johtuen seuraavien analyysien kohdalla:
Ftalaatit.
Bromatut difenyylieetterit.
Pestisidit LC.
Organotinat, Biosidit.
Fenoliset yhdisteet
Haihtuvat hiilivedyt, paketti 1+2.
Alkyylifenolit ja alkyylifenolietoksylaatit

Näytteen 17JJ01775 määritysrajat ovat normaalia korkeammat näytematriisista johtuen seuraavien analyysien kohdalla:
Pestisidit LC.
Fenoliset yhdisteet
Haihtuvat hiilivedyt, paketti 1+2.
Alkyylifenolit ja alkyylifenolietoksylaatit

Näytteen 17JJ01776 määritysrajat ovat normaalia korkeammat näytematriisista johtuen seuraavien analyysien kohdalla:
Pestisidit LC: 2,4-DP, symoksaniili, fluroksipyyri, hymeksatsoli
Haihtuvat hiilivedyt, paketti 1+2.
Alkyylifenolit ja alkyylifenolietoksylaatit

Laboratoriot L Analysoitu Lahdessa

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Menetelmien kuvaukset

RA4001 Alkyylifenolit ja etoksylaatit	Nonyyli- ja oktyylifenolit sekä niiden etoksylaatit (liitteessä) määritettiin käyttäen kiinteäfaasiuuttoa ja UPLC/MS/MS-tekniikkaa (mod. SFS-EN ISO 18857-2) . Menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia. Mittausepävarmuus on 36-47 % yhdisteestä riippuen.
RA4010 Ftalaatit	Ftalaatit (liitteessä) määritettiin liuotinuuton jälkeen käyttäen GC/MS-tekniikkaa (mod. SFS-EN ISO 18856). Menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia. Mittausepävarmuus on 16-40 % yhdisteestä riippuen.
RA4038A Pestisidit/monij. GC	Torjunta-aineet määritettiin käyttäen kiinteäfaasiuuttoa ja GC/MS/MS-tekniikkaa. Mikäli todistuksen liitteenä on lista analysoiduista yhdisteistä, tuloksissa "tutkittu yhdiste <0,005 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu alle määritysrajan oleva pitoisuus. Jos liitettä ei ole, menetelmässä ei vastata totemisrajan ja määritysrajan välissä olevia tuloksia (<0,005 µg/l tarkoittaa määritysrajaa). Mittausepävarmuus on 14-43 % yhdisteestä riippuen.
RA4038A+RA4039 Pestisidit/monij. GC+LC	Torjunta-aineet määritettiin käyttäen kiinteäfaasiuuttoa ja GC/MS/MS- ja UPLC/MS/MS-tekniikkaa. Mikäli todistuksen liitteenä on lista analysoiduista yhdisteistä, tuloksissa "tutkittu yhdiste <0,005 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu alle määritysrajan oleva pitoisuus. Jos liitettä ei ole, menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia (<0,005 µg/l tarkoittaa määritysrajaa). Mittausepävarmuus 14-43 % yhdisteestä riippuen.
RA4038B Fenoliset yhdisteet	Fenoliset yhdisteet (liitteessä) määritettin käyttäen kiinteäfaasiuuttoa ja GC/MS-tekniikkaa. Tuloksissa esim. "analysoitu yhdiste <0,01 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu, mutta pitoisuus on alle määritysrajan. Kloorifenolit tarkoittavat mono-, di-, tri-, tetra- ja pentakloorifenoleja. Mittausepävarmuus on 30%.
RA4039 Pestisidit/monij. LC	Torjunta-aineet määritettiin käyttäen kiinteäfaasiuuttoa ja UPLC/MS/MS-tekniikkaa. Mikäli todistuksen liitteenä on lista analysoiduista yhdisteistä, tuloksissa "tutkittu yhdiste <0,01 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu alle määritysrajan oleva pitoisuus. Jos liitettä ei ole, menetelmässä ei vastata totemisrajan ja määritysrajan välissä olevia tuloksia (<0,01 µg/l tarkoittaa määritysrajaa). Mittausepävarmuus 16-42 % yhdisteestä riippuen.
RA4050 Haihtuvat orgaaniset yhdisteet	Haihtuvat orgaaniset yhdisteet (VOC) määritettiin käyttäen HS/GC/MS-tekniikkaa (mod. ISO 11423-1 ja mod. EN ISO 10301). Mittausepävarmuus 19-44 % yhdisteestä riippuen. Haihtuvat hiilivedyt 1+2 paketit: Näytteestä määritettiin liitteenä olevan listan mukaiset yhdisteet. Tuloksissa esim. "analysoitu yhdiste <0,5 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu alle määritysrajan oleva pitoisuus. TAI VOC PIMA, Aromaattiset hiilivedyt ja oksygenaatit sekä klooratut alifaattiset hiilivedyt (PIMA-paketit): Menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia.
RA4059 Organotinat	Organotinayhdisteet (liitteessä) määritettiin kationina derivatisoinnin ja liuotinuuton jälkeen käyttäen GC/HRMS-tekniikkaa (mod. SFS-EN 17353 ja mod. ISO TC 190/SC 3 N 169). Menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia. Mittausepävarmuus on 20-47 % yhdisteestä riippuen.
RA4062 PCDD/PCDF	PCDD/PCDF:t määritettiin dikloorimetaaniuuton ja pylväspuhdistusten jälkeen käyttäen GC/HRMS-tekniikkaa (mod.EPA method 1613). Menetelmässä ei vastata toteamisrajan ja määritysrajan välissä olevia tuloksia. Menetelmän mittausepävarmuus on 14-27 % yhdisteestä riippuen. Lower bound-TEQ arvossa kongeneerien, joiden pitoisuus ei ylitä määritysrajaa, pitoisuus lasketaan nollana Middle bound-TEQ arvossa kongeneerien, joiden pitoisuus ei ylitä määritysrajaa, pitoisuus lasketaan 0.5 kertaa määritysrajana Upper bound-TEQ arvossa kongeneerien, joiden pitoisuus ei ylitä määritysrajaa, pitoisuus lasketaan määritysrajana

RA4076C PBDE	Bromatut difenyylieetterit (PBDE, liitteessä) määritettiin kiinteäfaasiuutton ja rikkihappopuhdistuksen jälkeen käyttäen GC/MS/MS-tekniikkaa (mod. SFS EN 16694, mod. SFS-EN ISO 22032 ja mod. EPA method 1614). Tuloksissa esim. "analysoitu yhdiste <0,000125 µg/l" tarkoittaa, että kyseistä yhdistettä on havaittu alle määritysrajan oleva pitoisuus. Menetelmän mittausepävarmuus 19-43 % yhdisteestä riippuen.

Eurofins Environment Testing Finland Oy

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14.2.2017

RA4076C BROMATUT DIFENYYLIEETTERIT (BDE)*

Kaasukromatografinen menetelmä, GC/MS/MS

VESI

	CAS	Määritysraja µg/l
BDE 17	147217-75-2	0,000150
BDE 28 **	41318-75-6	0,000050
BDE 47 **	5436-43-1	0,000125
BDE 66	189084-61-5	0,000150
BDE 71	189084-62-6	0,000150
BDE 75	189084-63-7	0,000150
BDE 77	93703-48-1	0,000150
BDE 85	182346-21-0	0,000150
BDE 99 **	60348-60-9	0,000125
BDE 100 **	189084-64-8	0,000050
BDE 119	189084-66-0	0,000150
BDE 153 **	68631-49-2	0,000075
BDE 154 **	207122-15-4	0,000075
BDE 175+BDE 183	446255-22-7+207122-16-5	0,00025
BDE 190	189084-68-2	0,0010
BDE 196	446255-39-6	0,0025
BDE 197	117964-21-3	0,0025
BDE 203	337513-72-1	0,0025
BDE 206	63387-28-0	0,0050
BDE 207	437701-79-6	0,0050
BDE 209	1163-19-5	0,010
BB 153 (heksabromibifenyyli)	59080-40-9	0,000150
PBT (pentabromitolueeni)	87-83-2	0,00050
HBB (heksabromibentseeni)	87-82-1	0,00050
BTBPE (1,2-(bis(2,4,6-tribromifenoksi)etaani)	37853-59-1	0,0025
DBDPE (1.2-bis(pentabromifenyyli)etaani)	84852-53-9	0,025
** BDE-yhdisteet yhteensä		0,0005

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

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14.2.2017

RA4076C BROMATUT DIFENYYLIEETTERIT (BDE)*

Kaasukromatografinen menetelmä, GC/MS/MS

VESI

	CAS	Määritysraja µg/l
BDE 17	147217-75-2	0,00150
BDE 28 **	41318-75-6	0,00050
BDE 47 **	5436-43-1	0,00125
BDE 66	189084-61-5	0,00150
BDE 71	189084-62-6	0,00150
BDE 75	189084-63-7	0,00150
BDE 77	93703-48-1	0,00150
BDE 85	182346-21-0	0,00150
BDE 99 **	60348-60-9	0,00125
BDE 100 **	189084-64-8	0,00050
BDE 119	189084-66-0	0,00150
BDE 153 **	68631-49-2	0,00075
BDE 154 **	207122-15-4	0,00075
BDE 175+BDE 183	446255-22-7+207122-16-5	0,0025
BDE 190	189084-68-2	0,010
BDE 196	446255-39-6	0,025
BDE 197	117964-21-3	0,025
BDE 203	337513-72-1	0,025
BDE 206	63387-28-0	0,050
BDE 207	437701-79-6	0,050
BDE 209	1163-19-5	0,10
BB 153 (heksabromibifenyyli)	59080-40-9	0,00150
PBT (pentabromitolueeni)	87-83-2	0,0050
HBB (heksabromibentseeni)	87-82-1	0,0050
BTBPE (1,2-(bis(2,4,6-tribromifenoksi)etaani)	37853-59-1	0,025
DBDPE (1.2-bis(pentabromifenyyli)etaani)	84852-53-9	0,25
** BDE-yhdisteet yhteensä		0,005

* akkreditoitu menetelmä, mukautuva pätevyysalue

16.2.2017

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RA4059 ORGANOTINAT *

Kaasukromatografinen menetelmä, GC/MS/MS

VESI

	Määritysraja µg/l
Monobutyylitina	0,001
Dibutyylitina	0,001
Tributyylitina	0,0002
Tetrabutyylitina	0,001
Monofenyylitina	0,001
Difenyylitina	0,001
Trifenyylitina	0,001
Mono-oktyylitina	0,001
Dioktyylitina	0,001
Trioktyylitina	0,005
Trisykloheksyylitina	0,005

Yhdisteet analysoidaan kationina.

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

16.2.2017

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RA4059 ORGANOTINAT *

Kaasukromatografinen menetelmä, GC/MS/MS

VESI

	Määritysraja µg/l
Monobutyylitina	0,01
Dibutyylitina	0,01
Tributyylitina	0,002
Tetrabutyylitina	0,01
Monofenyylitina	0,01
Difenyylitina	0,01
Trifenyylitina	0,01
Mono-oktyylitina	0,01
Dioktyylitina	0,01
Trioktyylitina	0,05
Trisykloheksyylitina	0,05

Yhdisteet analysoidaan kationina.

* akkreditoitu menetelmä, mukautuva pätevyysalue

17JJ01774, 17JJ01775, 17JJ01776 28.6.2017

RA4050 VOC (haihtuvat orgaaniset yhdisteet) 1+2 *

VESINÄYTE, HS/GC/MS

HALOGENOIDUT HIILIVEDYT	CAS	Määritysraja µg/l
kloorietaani	75-00-3	1
1,1-dikloorietaani	75-34-3	1
1,2-dikloorietaani	107-06-2	1
1,1,1-trikloorietaani	71-55-6	1
1,1,2-trikloorietaani	79-00-5	5
1,1,1,2-tetrakloorietaani	630-20-6	1
1,1,2,2-tetrakloorietaani	79-34-5	1
heksakloorietaani	67-72-1	5
vinyylikloridi	75-01-4	1
1,1-dikloorieteeni	75-35-4	1
cis-1,2-dikloorieteeni	156-59-2	1
trans-1,2-dikloorieteeni	156-60-5	1
trikloorieteeni	79-01-6	1
tetrakloorieteeni	127-18-4	1
kloorimetaani	74-87-3	10
dikloorimetaani	75-09-2	5
kloroformi (trikloorimetaani)	67-66-3	5
hiilitetrakloridi (tetrakloorimetaani)	56-23-5	5
bromidikloorimetaani	75-27-4	5
dibromikloorimetaani	124-48-1	5
bromoformi (tribromimetaani)	75-25-2	5
bromimetaani	74-83-9	1
dibromimetaani	74-95-3	5
bromikloorimetaani	74-97-5	5
1,2-dibromietaani	106-93-4	5
1,2-diklooripropaani	78-87-5	5
2,2-diklooripropaani	594-20-7	5
1,3-diklooripropaani	142-28-9	5
1,2,3-trikloorипropaani	96-18-4	5
1,1-diklooripropeeni	563-58-6	5
cis-1,3-diklooripropeeni	10061-01-5	5
trans-1,3-diklooripropeeni	10061-02-6	5
1,2-dibromi-3-klooripropaani	96-12-8	5
heksaklooributadieeni	87-68-3	1
trikloorifluorimetaani (CFC-11)	75-69-4	1
diklooridifluorimetaani (CFC-12)	75-71-8	1

TERPEENIT		µg/l
alfa-pineeni	2437-95-8	5
beta-pineeni	127-91-3	5
delta-kareeni	13466-78-9	5
limoneeni	138-86-3	5

ALIFAATTISET HIILIVEDYT		µg/l
pentaani	109-66-0	50
heksaani	110-54-3	50
heptaani	142-82-5	50
oktaani	111-65-9	50
nonaani	111-84-2	50
dekaani	124-18-5	50
sykloheksaani	110-82-7	5
2-metyylipentaani	107-83-5	10
3-metyylipentaani	96-14-0	10
metyyli-syklopentaani	96-37-7	5

KETONIT		mg/l
asetoni	67-64-1	0,5
sykloheksanoni	108-94-1	0,5
2-sykloheksen-1-oni	930-68-7	2,5
metyylietyyliketoni	78-93-3	0,5
metyyli-isobutyyliketoni	108-10-1	0,5
5-metyyli-2-heksanoni (metyyli-isoamyyliketoni)	110-12-3	0,05

AROMAATTISET HIILIVEDYT	CAS	Määritysraja µg/l
bentseeni	71-43-2	1
tolueeni	108-88-3	10
etyylibentseeni	100-41-4	1
m+p-ksyleeni	95-47-6	1
o-ksyleeni	95-47-6	1
styreeni (vinyylibentseeni)	100-42-5	5
1,2-dietyylibentseeni	135-01-3	1
1,3-dietyylibentseeni	141-93-5	1
1,4-dietyylibentseeni	105-05-5	1
propyylibentseeni	103-65-1	1
isopropyylibentseeni	98-82-8	1
n-butyylibentseeni	104-51-8	1
tert.butyylibentseeni	98-06-6	1
sec.butyylibentseeni	135-98-8	5
2-etyylitolueeni	611-14-3	1
3-etyylitolueeni	620-14-4	1
4-etyylitolueeni	622-96-8	1
p-isopropyylitolueeni	99-87-6	1
1,2,3-trimetyylibentseeni	526-73-8	1
1,2,4-trimetyylibentseeni	95-63-6	1
1,3,5-trimetyylibentseeni	108-67-8	1
1,2,3,5-tetrametyylibentseeni	527-53-7	1
1,2,4,5-tetrametyylibentseeni	95-93-2	1
naftaleeni	91-20-3	5
bromibentseeni	75-27-4	1
klooribentseeni	108-90-7	1
1,2-diklooribentseeni	95-50-1	1
1,3-diklooribentseeni	541-73-1	1
1,4-diklooribentseeni	106-46-7	1
1,2,3-trikloorибentseeni	87-61-6	1
1,2,4-trikloorибentseeni	120-82-1	1
1,3,5-trikloorибentseeni	108-70-3	1
2-klooritolueeni	95-49-8	1
4-klooritolueeni	106-43-4	1
nitrobentseeni	98-95-3	50

EETTERIT		µg/l
MTBE (metyyli-tert.butyylieetteri)	1634-04-4	1
TAME (tert.amyylimetyylieetteri)	994-05-8	1
ETBE (etyyli-tert.butyylieetteri)	637-92-3	1
etyylibutyylieetteri	628-81-9	1
TAEE (tert.amyylietyylieetteri)	919-94-8	1
DIPE (di-isopropyylieetteri)	108-20-3	1
dietyylieetteri	60-29-7	50

ALKOHOLIT		mg/l
etanoli	64-17-5	5
propanoli	71-23-8	2
isopropanoli	67-63-0	2
n-butanoli	71-36-3	2
2-butanoli	78-92-2	2
isobutanoli	78-83-1	2
tert.butanoli	75-65-0	0,2
1-pentanoli	30899-19-5	1
2-pentanoli	6032-29-7	1
3-pentanoli	584-02-1	1
1-etoksi-2-propanoli	1569-02-4	20
3-etoksi-1-propanoli	111-35-3	20
1-metoksi-2-propanoli	107-98-2	20
2-etyyli-1-heksanoli	104-76-7	1
2-butoksietanoli (butyyliglykoli)	111-76-2	10

* akkreditoitu menetelmä, mukautuva pätevyysalue

RIKKIYHDISTEET		µg/l
rikkihiili	75-15-0	20
DMS (dimetyylisulfidi)	75-18-3	20
DMDS (dimetyylidisulfidi)	624-92-0	20
tetrahydrotiofeeni	110-01-0	5

MUUT		mg/l
tetrahydrofuraani	109-99-9	0,1
1-hekseeni	592-41-6	0,1
1-okteeni	111-66-0	0,1
		µg/l
akryylinitriili	107-13-1	5
1,4-dioksaani	123-91-1	50
furfuraali	98-01-1	100

ESTERIT		mg/l
metyyliasetaatti	79-20-9	0,1
vinyyliasetaatti	108-05-4	0,1
etyyliasetaatti	141-78-6	0,1
propyyliasetaatti	109-60-4	0,1
isopropyyliasetaatti	108-21-4	0,1
butyyliasetaatti	123-86-4	0,1
isobutyyliasetaatti	110-19-0	0,1
amyyliasetaatti	628-63-7	0,1
isoamyyliasetaatti	123-92-2	0,1

PIIYHDISTEET		µg/l
tetrametyylisilaani	75-76-3	0,5
heksametyylidisiloksaani	107-46-0	1
oktametyylitrisiloksaani	107-51-7	1
dekametyylitetrasiloksaani	141-62-8	5
heksametyylisyklotrisiloksaani D3	541-05-09	5
oktametyylisyklotetrasiloksaani D4	556-67-2	10
dekametyylisyklopentasiloksaani D5	541-02-6	50
dodekametyylisykloheksasiloksaani D6	540-97-6	50

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

5.7.2017

17JJ01776

RA4039 TORJUNTA-AINEET *

Nestekromatografinen monijäämä-menetelmä, UPLC/MS/MS

VESI	CAS	Määritysraja µg/l		CAS	Määritysraja µg/l
2,4,5-T	93-76-5	0,01	Lenasiili	2164-08-1	0,01
2,4-D	94-75-7	0,01	Linuroni	330-55-2	0,01
2,4-DP	3307-39-9	0,1	Malationi	121-75-5	0,01
4,5-dikloori-2-n-oktyyli-4-isotiatsoliini-3-oni (DCOIT; Sea-Nine)	64359-81-5	0,005	Mandipropamidi	374726-62-2	0,01
Aklonifeeni	74070-46-5	0,01	MCPA	94-74-6	0,01
Alakloori	15972-60-8	0,01	MCPB	94-81-5	0,05
Amidosulfuroni	120923-37-7	0,01	Mekoproppi+Mekoproppi-P	7085-19-0 + 16484-77-8	0,01
Aminopyralidi	150114-71-9	0,05	Metabentstiatsuroni	18691-97-9	0,01
Asetamipridi	135410-20-7	0,01	Metalaksyyli	57837-19-1	0,01
Atratsiini	1912-24-9	0,005	Metamitroni	41394-05-2	0,01
Atsoksistrobiini	131860-33-8	0,005	Metamitroni-desamino	36993-94-9	0,01
BAM (2,6-diklooribentsoamidi)	2008-58-4	0,01	Metatsakloori	67129-08-2	0,01
Bentatsoni	25057-89-0	0,01	Metkonatsoli	125116-23-6	0,01
Bitertanoli	55179-31-2	0,1	Metoksuroni	19937-59-8	0,01
Boskalidi	188425-85-6	0,01	Metributsiini	21087-64-9	0,01
Bromasiili	314-40-9	0,01	Metributsiini-desamino	35045-02-4	0,01
Bromoksiniili	1689-84-5	0,01	Metributsiini-desaminodiketo	52236-30-3	0,01
Bronopoli	52-51-7	0,2	Metributsiini-diketo	56507-37-0	0,05
Buprofetsiini	69327-76-0	0,01	Metsulfuroni-metyyli	74223-64-6	0,01
Dalaponi	75-99-0	0,1	Metyyliatsinfossi	86-50-0	0,01
DEA (atratsiini, -desetyyli)	6190-65-4	0,01	Metyyliparationi	298-00-0	0,02
DEDIA (atratsiini, -desetyylidesisopropyyli)	3397-62-4	0,01	Mevinfossi	7786-34-7	0,01
DIA (atratsiini,- desisopropyyli)	1007-28-9	0,01	Napropamidi	15299-99-7	0,01
Difenokonatsoli	119446-68-3	0,01	Nikosulfuroni	111991-09-4	0,01
Diflubentsuroni	3567-38-5	0,01	Ometoaatti	1113-02-6	0,01
Diflufenikaani	83164-33-4	0,01	Pakloputratsoli	76738-62-0	0,01
Dikamba	1918-00-9	0,02	Pendimetaliini	40487-42-1	0,01
Diklofluanidi	1085-98-9	0,01	Penkonatsoli	66246-88-6	0,01
Diklorproppi + Diklorproppi-P	120-36-5 + 15165-67-0	0,01	Pikloraami	1918-02-1	0,02
Diklorvossi	62-73-7	0,0005	Pikoksistrobiini	117428-22-5	0,01
Dimetoaatti	60-51-5	0,01	Pinoksadeeni	243973-20-8	0,01
Dimetomorfi	110488-70-5	0,01	Primisulfuroni-metyyli	86209-51-0	0,01
Dinoseb	88-85-7	0,01	Pronamidi (propytsamili)	23950-58-5	0,005
Dinoterbi	1420-07-1	0,01	Propakloori	1918-16-7	0,01
Diuroni	330-54-1	0,01	Propakvitsafoppi	111479-05-1	0,01
Etyyliparationi	56-38-2	0,02	Propatsiini	139-40-2	0,01
Famoksadoni	131807-57-3	0,01	Propikonatsoli	60207-90-1	0,01
Fenamidoni	161326-34-7	0,01	Prosulfokarbi	52888-80-9	0,01
Fenheksamidi	126833-17-8	0,01	Propoksikarbatsoni	145026-81-9	0,01
Fenitrotioni	122-14-5	0,02	Pyraklostrobiini	175013-18-0	0,01
Fenoksaproppi-P-etyyli	71238-80-2	0,01	Pyretriini 1	121-21-1	0,01
Flamproppi-isopropyyli	52756-22-6	0,01	Pyridaatti	55512-33-9	0,01
Flonikamidi	158062-67-0	0,01	Pyroksulaami	422556-08-9	0,01
Florasulami	145701-23-1	0,01	Rimsulfuroni	122931-48-0	0,01
Fluatsafoppi-P-butyyli	79241-46-6	0,01	Simatsiini	122-34-9	0,01
Fluatsinami	79622-59-6	0,01	Spirodiklofeeni	148477-71-8	0,01
Fludioksoniili	131341-86-1	0,01	Sulfosulfuroni	141776-32-1	0,01
Fluroksipyyri	69377-81-7	0,1	Sulfoteppi	3689-24-5	0,01
Flutolaniili	66332-96-5	0,01	Syanatsiini	21725-46-2	0,005
Furatiokarbi	65907-30-4	0,01	Syatsofamidi	120116-88-3	0,01
Heksatsinoni	51235-04-2	0,01	Symoksaniili	57966-95-7	0,1
Heksytiatsoksi	78587-05-0	0,01	Syprokonatsoli	94361-06-5	0,01
Hiilifuraani	1563-66-2	0,005	Tebukonatsoli	107534-96-3	0,01
Hymeksatsoli	10004-44-1	1,0	Teflubentsuroni	83121-18-0	0,01
Imidaklopridi	138261-41-3	0,05	Tepraloksidiimi	149979-41-9	0,01
Iprodioni	36734-19-7	0,01	Terbasiili	5902-51-2	0,01
Isoksabeeni	82558-50-7	0,01	Terbutylatsiini	5915-41-3	0,005
Isoproturoni	34123-59-6	0,01	Terbutylatsiini-desetyyli	30125-63-4	0,01
Jodosulfuroni-metyyli	144550-36-7	0,01	Thifensulfuroni-metyyli	79277-27-3	0,01
Karfentratsoni-etyyli	128639-02-1	0,01	Tiaklopridi	111988-49-9	0,01
Kinoklamiini	2797-51-5	0,01	Tiametoksaami	153719-23-4	0,01
Kinometionaatti	2439-01-2	0,01	Tolklofossi-metyyli	57018-04-9	0,01
Klopyralidi	1702-17-6	0,05	Tolyylifluanidi	731-27-1	0,01
Klorfenvinfossi	470-90-6	0,01	Tralkoksidiimi	87820-88-0	0,01
Kloridatsoni	1698-60-8	0,01	Triadimefoni	43121-43-3	0,01
Kloroksiuroni	1982-47-4	0,01	Triadimenoli	55219-65-3	0,01
Klorprofaami	101-21-3	0,01	Triallaatti	2303-17-5	0,005
Klorpyrifossi	2921-88-2	0,01	Triasulfuroni	82097-50-5	0,001
Klorsulfuroni	64902-72-3	0,01	Trifloksistrobiini	141517-21-7	0,01
Klotianidiini	210880-92-5	0,01	Triflusulfuroni-metyyli	126535-15-7	0,01
Kresoksimmi-metyyli	143390-89-0	0,01	Triklorfoni	52-68-6	0,01
Kvinmerakki	90717-03-6	0,01	Trineksapakki-etyyli	95266-40-3	0,01
Kvinoksifeeni	124495-18-7	0,01	Tritikonatsoli	131983-72-7	0,01
Kvitsalofoppi-etyyli	76578-14-8	0,01	Tritosulfuroni	142469-14-5	0,01
			Tsoksamidi	156052-68-5	0,02

* akkreditoitu menetelmä, mukautuva pätevyysalue

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RA4039 TORJUNTA-AINEET *

Nestekromatografinen monijäämä-menetelmä, UPLC/MS/MS

VESI	CAS	Määritysraja µg/l		CAS	Määritysraja µg/l
2,4,5-T	93-76-5	0,1	Lenasiili	2164-08-1	0,1
2,4-D	94-75-7	0,1	Linuroni	330-55-2	0,1
2,4-DP	3307-39-9	0,1	Malationi	121-75-5	0,1
4,5-dikloori-2-n-oktyyli-4-isotiatsoliini-3-oni (DCOIT; Sea-Nine)	64359-81-5	0,05	Mandipropamidi	374726-62-2	0,1
Aklonifeeni	74070-46-5	0,1	MCPA	94-74-6	0,1
Alakloori	15972-60-8	0,1	MCPB	94-81-5	0,5
Amidosulfuroni	120923-37-7	0,1	Mekoproppi+Mekoproppi-P	7085-19-0 + 16484-77-8	0,1
Aminopyralidi	150114-71-9	0,5	Metabentstiatsuroni	18691-97-9	0,1
Asetamipridi	135410-20-7	0,1	Metalaksyyli	57837-19-1	0,1
Atratsiini	1912-24-9	0,05	Metamitroni	41394-05-2	0,1
Atsoksistrobiini	131860-33-8	0,05	Metamitroni-desamino	36993-94-9	0,1
BAM (2,6-diklooribentsoamidi)	2008-58-4	0,1	Metatsakloori	67129-08-2	0,1
Bentatsoni	25057-89-0	0,1	Metkonatsoli	125116-23-6	0,1
Bitertanoli	55179-31-2	1	Metoksuroni	19937-59-8	0,1
Boskalidi	188425-85-6	0,1	Metributsiini	21087-64-9	0,1
Bromasiili	314-40-9	0,1	Metributsiini-desamino	35045-02-4	0,1
Bromoksiniili	1689-84-5	0,1	Metributsiini-desaminodiketo	52236-30-3	0,1
Bronopoli	52-51-7	2	Metributsiini-diketo	56507-37-0	0,5
Buprofetsiini	69327-76-0	0,1	Metsulfuroni-metyyli	74223-64-6	0,1
Dalaponi	75-99-0	1	Metyyliatsinfossi	86-50-0	0,1
DEA (atratsiini, -desetyyli)	6190-65-4	0,1	Metyyliparationi	298-00-0	0,2
DEDIA (atratsiini, -desetyylidesisopropyyli)	3397-62-4	0,1	Mevinfossi	7786-34-7	0,1
DIA (atratsiini,- desisopropyyli)	1007-28-9	0,1	Napropamidi	15299-99-7	0,1
Difenokonatsoli	119446-68-3	0,1	Nikosulfuroni	111991-09-4	0,1
Diflubentsuroni	3567-38-5	0,1	Ometoaatti	1113-02-6	0,1
Diflufenikaani	83164-33-4	0,1	Pakloputratsoli	76738-62-0	0,1
Dikamba	1918-00-9	0,2	Pendimetaliini	40487-42-1	0,1
Diklofluanidi	1085-98-9	0,1	Penkonatsoli	66246-88-6	0,1
Diklorproppi + Diklorproppi-P	120-36-5 + 15165-67-0	0,1	Pikloraami	1918-02-1	0,2
Diklorvossi	62-73-7	0,005	Pikoksistrobiini	117428-22-5	0,1
Dimetoaatti	60-51-5	0,1	Pinoksadeeni	243973-20-8	0,1
Dimetomorfi	110488-70-5	0,1	Primisulfuroni-metyyli	86209-51-0	0,1
Dinoseb	88-85-7	0,1	Pronamidi (propytsamili)	23950-58-5	0,05
Dinoterbi	1420-07-1	0,1	Propakloori	1918-16-7	0,1
Diuroni	330-54-1	0,1	Propakvitsafoppi	111479-05-1	0,1
Etyyliparationi	56-38-2	0,2	Propatsiini	139-40-2	0,1
Famoksadoni	131807-57-3	0,1	Propikonatsoli	60207-90-1	0,1
Fenamidoni	161326-34-7	0,1	Prosulfokarbi	52888-80-9	0,1
Fenheksamidi	126833-17-8	0,1	Propoksikarbatsoni	145026-81-9	0,1
Fenitrotioni	122-14-5	0,2	Pyraklostrobiini	175013-18-0	0,1
Fenoksaproppi-P-etyyli	71238-80-2	0,1	Pyretriini 1	121-21-1	0,1
Flamproppi-isopropyyli	52756-22-6	0,1	Pyridaatti	55512-33-9	0,1
Flonikamidi	158062-67-0	0,1	Pyroksulaami	422556-08-9	0,1
Florasulami	145701-23-1	0,1	Rimsulfuroni	122931-48-0	0,1
Fluatsafoppi-P-butyyli	79241-46-6	0,1	Simatsiini	122-34-9	0,1
Fluatsinami	79622-59-6	0,1	Spirodiklofeeni	148477-71-8	0,1
Fludioksoniili	131341-86-1	0,1	Sulfosulfuroni	141776-32-1	0,1
Fluroksipyyri	69377-81-7	0,1	Sulfoteppi	3689-24-5	0,1
Flutolaniili	66332-96-5	0,1	Syanatsiini	21725-46-2	0,05
Furatiokarbi	65907-30-4	0,1	Syatsofamidi	120116-88-3	0,1
Heksatsinoni	51235-04-2	0,1	Symoksaniili	57966-95-7	0,1
Heksytiatsoksi	78587-05-0	0,1	Syprokonatsoli	94361-06-5	0,1
Hiilifuraani	1563-66-2	0,05	Tebukonatsoli	107534-96-3	0,1
Hymeksatsoli	10004-44-1	1	Teflubentsuroni	83121-18-0	0,1
Imidaklopridi	138261-41-3	0,5	Tepraloksidiimi	149979-41-9	0,1
Iprodioni	36734-19-7	0,1	Terbasiili	5902-51-2	0,1
Isoksabeeni	82558-50-7	0,1	Terbutylatsiini	5915-41-3	0,05
Isoproturoni	34123-59-6	0,1	Terbutylatsiini-desetyyli	30125-63-4	0,1
Jodosulfuroni-metyyli	144550-36-7	0,1	Thifensulfuroni-metyyli	79277-27-3	0,1
Karfentratsoni-etyyli	128639-02-1	0,1	Tiaklopridi	111988-49-9	0,1
Kinoklamiini	2797-51-5	0,1	Tiametoksaami	153719-23-4	0,1
Kinometionaatti	2439-01-2	0,1	Tolklofossi-metyyli	57018-04-9	0,1
Klopyralidi	1702-17-6	0,5	Tolyylifluanidi	731-27-1	0,1
Klorfenvinfossi	470-90-6	0,1	Tralkoksidiimi	87820-88-0	0,1
Kloridatsoni	1698-60-8	0,1	Triadimefoni	43121-43-3	0,1
Kloroksiuroni	1982-47-4	0,1	Triadimenoli	55219-65-3	0,1
Klorprofaami	101-21-3	0,1	Triallaatti	2303-17-5	0,05
Klorpyrifossi	2921-88-2	0,1	Triasulfuroni	82097-50-5	0,01
Klorsulfuroni	64902-72-3	0,1	Trifloksistrobiini	141517-21-7	0,1
Klotianidiini	210880-92-5	0,1	Triflusulfuroni-metyyli	126535-15-7	0,1
Kresoksimmi-metyyli	143390-89-0	0,1	Triklorfoni	52-68-6	0,1
Kvinmerakki	90717-03-6	0,1	Trineksapakki-etyyli	95266-40-3	0,1
Kvinoksifeeni	124495-18-7	0,1	Tritikonatsoli	131983-72-7	0,1
Kvitsalofoppi-etyyli	76578-14-8	0,1	Tritosulfuroni	142469-14-5	0,1
			Tsoksamidi	156052-68-5	0,2

* akkreditoitu menetelmä, mukautuva pätevyysalue

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17JJ01774

RA4039 TORJUNTA-AINEET *

Nestekromatografinen monijäämä-menetelmä, UPLC/MS/MS

VESI	CAS	Määritysraja µg/l
2,4,5-T	93-76-5	0,1
2,4-D	94-75-7	0,1
2,4-DP	3307-39-9	0,1
4,5-dikloori-2-n-oktyyli-4-isotiatsoliini-3-oni (DCOIT; Sea-Nine)	64359-81-5	0,05
Aklonifeeni	74070-46-5	0,1
Alakloori	15972-60-8	0,1
Amidosulfuroni	120923-37-7	0,1
Aminopyralidi	150114-71-9	0,5
Asetamipridi	135410-20-7	0,1
Atratsiini	1912-24-9	0,05
Atsoksistrobiini	131860-33-8	0,05
BAM (2,6-diklooribentsoamidi)	2008-58-4	0,1
Bentatsoni	25057-89-0	0,1
Bitertanoli	55179-31-2	1
Boskalidi	188425-85-6	0,1
Bromasiili	314-40-9	0,1
Bromoksiniili	1689-84-5	0,1
Bronopoli	52-51-7	2
Buprofetsiini	69327-76-0	0,1
Dalaponi	75-99-0	1
DEA (atratsiini, -desetyyli)	6190-65-4	0,1
DEDIA (atratsiini, -desetyylidesisopropyyli)	3397-62-4	0,1
DIA (atratsiini,- desisopropyyli)	1007-28-9	0,1
Difenokonatsoli	119446-68-3	0,1
Diflubentsuroni	3567-38-5	0,1
Diflufenikaani	83164-33-4	0,1
Dikamba	1918-00-9	0,2
Diklofluanidi	1085-98-9	1,0
Diklorproppi + Diklorproppi-P	120-36-5 + 15165-67-0	0,1
Diklorvossi	62-73-7	0,005
Dimetoaatti	60-51-5	0,1
Dimetomorfi	110488-70-5	0,1
Dinoseb	88-85-7	0,1
Dinoterbi	1420-07-1	0,1
Diuroni	330-54-1	0,1
Etyyliparationi	56-38-2	0,2
Famoksadoni	131807-57-3	0,1
Fenamidoni	161326-34-7	0,1
Fenheksamidi	126833-17-8	0,1
Fenitrotioni	122-14-5	0,2
Fenoksaproppi-P-etyyli	71238-80-2	0,1
Flamproppi-isopropyyli	52756-22-6	0,1
Flonikamidi	158062-67-0	0,1
Florasulami	145701-23-1	0,1
Fluatsafoppi-P-butyyli	79241-46-6	0,1
Fluatsinami	79622-59-6	0,1
Fludioksoniili	131341-86-1	0,1
Fluroksipyyri	69377-81-7	0,1
Flutolaniili	66332-96-5	0,1
Furatiokarbi	65907-30-4	0,1
Heksatsinoni	51235-04-2	0,1
Heksytiatsoksi	78587-05-0	0,1
Hiilifuraani	1563-66-2	0,05
Hymeksatsoli	10004-44-1	1
Imidaklopridi	138261-41-3	0,5
Iprodioni	36734-19-7	0,1
Isoksabeeni	82558-50-7	0,1
Isoproturoni	34123-59-6	0,1
Jodosulfuroni-metyyli	144550-36-7	0,1
Karfentratsoni-etyyli	128639-02-1	0,1
Kinoklamiini	2797-51-5	0,1
Kinometionaatti	2439-01-2	0,1
Klopyralidi	1702-17-6	0,5
Klorfenvinfossi	470-90-6	0,1
Kloridatsoni	1698-60-8	0,1
Kloroksiuroni	1982-47-4	0,1
Klorprofaami	101-21-3	0,1
Klorpyrifossi	2921-88-2	0,1
Klorsulfuroni	64902-72-3	0,1
Klotianidiini	210880-92-5	0,1
Kresoksimmi-metyyli	143390-89-0	0,1
Kvinmerakki	90717-03-6	0,1
Kvinoksifeeni	124495-18-7	0,1
Kvitsalofoppi-etyyli	76578-14-8	0,1

	CAS	Määritysraja µg/l
Lenasiili	2164-08-1	0,1
Linuroni	330-55-2	0,1
Malationi	121-75-5	0,1
Mandipropamidi	374726-62-2	0,1
MCPA	94-74-6	0,1
MCPB	94-81-5	0,5
Mekoproppi+Mekoproppi-P	7085-19-0 + 16484-77-8	0,1
Metabentstiatsuroni	18691-97-9	0,1
Metalaksyyli	57837-19-1	0,1
Metamitroni	41394-05-2	0,1
Metamitroni-desamino	36993-94-9	0,1
Metatsakloori	67129-08-2	0,1
Metkonatsoli	125116-23-6	0,1
Metoksiuroni	19937-59-8	0,1
Metributsiini	21087-64-9	0,1
Metributsiini-desamino	35045-02-4	0,1
Metributsiini-desaminodiketo	52236-30-3	0,1
Metributsiini-diketo	56507-37-0	0,5
Metsulfuroni-metyyli	74223-64-6	0,1
Metyyliatsinfossi	86-50-0	0,1
Metyyliparationi	298-00-0	0,2
Mevinfossi	7786-34-7	1,0
Napropamidi	15299-99-7	0,1
Nikosulfuroni	111991-09-4	0,1
Ometoaatti	1113-02-6	0,1
Pakloputratsoli	76738-62-0	0,1
Pendimetaliini	40487-42-1	0,1
Penkonatsoli	66246-88-6	0,1
Pikloraami	1918-02-1	0,2
Pikoksistrobiini	117428-22-5	0,1
Pinoksadeeni	243973-20-8	0,1
Primisulfuroni-metyyli	86209-51-0	0,1
Pronamidi (propytsamili)	23950-58-5	0,05
Propakloori	1918-16-7	0,1
Propakvitsafoppi	111479-05-1	0,1
Propatsiini	139-40-2	0,1
Propikonatsoli	60207-90-1	0,1
Prosulfokarbi	52888-80-9	0,1
Propoksikarbatsoni	145026-81-9	0,1
Pyraklostrobiini	175013-18-0	0,1
Pyretriini 1	121-21-1	0,1
Pyridaatti	55512-33-9	0,1
Pyroksulaami	422556-08-9	0,1
Rimsulfuroni	122931-48-0	0,1
Simatsiini	122-34-9	0,1
Spirodiklofeeni	148477-71-8	0,1
Sulfosulfuroni	141776-32-1	0,1
Sulfoteppi	3689-24-5	0,1
Syanatsiini	21725-46-2	0,05
Syatsofamidi	120116-88-3	0,1
Symoksaniili	57966-95-7	0,1
Syprokonatsoli	94361-06-5	0,1
Tebukonatsoli	107534-96-3	0,1
Teflubentsuroni	83121-18-0	0,1
Tepraloksidiimi	149979-41-9	0,1
Terbasiili	5902-51-2	0,1
Terbutylatsiini	5915-41-3	0,05
Terbutylatsiini-desetyyli	30125-63-4	0,1
Thifensulfuroni-metyyli	79277-27-3	0,1
Tiaklopridi	111988-49-9	0,1
Tiametoksaami	153719-23-4	0,1
Tolklofossi-metyyli	57018-04-9	0,1
Tolyylifluanidi	731-27-1	0,1
Tralkoksidiimi	87820-88-0	0,1
Triadimefoni	43121-43-3	0,1
Triadimenoli	55219-65-3	0,1
Triallaatti	2303-17-5	0,05
Triasulfuroni	82097-50-5	0,01
Trifloksistrobiini	141517-21-7	0,1
Triflusulfuroni-metyyli	126535-15-7	0,1
Triklorfoni	52-68-6	0,1
Trineksapakki-etyyli	95266-40-3	0,1
Tritikonatsoli	131983-72-7	0,1
Tritosulfuroni	142469-14-5	0,1
Tsoksamidi	156052-68-5	0,2

* akkreditoitu menetelmä, mukautuva pätevyysalue

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14.7.2017

17JJ01775

RA4038B FENOLISET YHDISTEET*

Kaasukromatografinen menetelmä, GC/MS
VESI

	CAS	Määritysraja µg/l
2-kloorifenoli	95-57-8	0,2
3-kloorifenoli	108-43-0	0,1
4-kloorifenoli	106-48-9	0,1
2,3-dikloorifenoli	576-24-9	0,2
2,4-dikloorifenoli	120-83-2	0,2
2,5 + 2,6-dikloorifenoli	583-78-8 + 87-65-0	0,2
3,4-dikloorifenoli	95-77-2	0,2
3,5-dikloorifenoli	591-35-5	0,2
2,3,4-trikloorifenoli	15950-66-0	0,2
2,3,5-trikloorifenoli	933-78-8	0,2
2,3,6-trikloorifenoli	933-75-5	0,2
2,4,5-trikloorifenoli	95-95-4	0,2
2,4,6-trikloorifenoli	88-06-2	0,2
3,4,5-trikloorifenoli	609-19-8	0,2
2,3,4,5-tetrakloorifenoli	4901-51-3	0,2
2,3,4,6-tetrakloorifenoli	58-90-2	0,2
2,3,5,6-tetrakloorifenoli	935-95-5	0,2
pentakloorifenoli	87-86-5	0,4
4-kloori-2-metyylifenoli	1570-64-5	0,5
4-kloori-3-metyylifenoli	59-50-7	0,5
fenoli	108-95-2	2,5
3-etyylifenoli	620-17-7	0,5
4-etyylifenoli	123-07-9	0,5
3-metyylifenoli (m-kresoli)	108-39-4	2,5
4-metyylifenoli (p-kresoli)	106-44-5	2,5
2-metyylifenoli (o-kresoli)	95-48-7	5,0
2,3-dimetyylifenoli	526-75-0	2,5
2,4 + 3,5-dimetyylifenoli	105-67-9 + 108-68-9	2,5
2,5-dimetyylifenoli	95-87-4	0,5
2,6-dimetyylifenoli	576-26-1	0,5
3,4-dimetyylifenoli	95-65-8	0,5
2,3,5-trimetyylifenoli	697-82-5	0,5
2,3,6-trimetyylifenoli	2416-94-6	2,5
2,4,6-trimetyylifenoli	527-60-6	2,5
3,4,5-trimetyylifenoli	527-54-8	0,5
2,6-di-tert-butyylifenoli	128-39-2	1,0
hydrokinoni	123-31-9	10
pyrokatekoli	120-80-9	2,5
resorsinoli	108-46-3	0,5
1-naftoli	90-15-3	0,2
2-naftoli	135-19-3	0,2
bisfenoli A	80-05-7	1,0
bisfenoli F	620-92-8	0,2
2-nitrofenoli	88-75-5	1,0
3-nitrofenoli	554-84-7	1,0
4-nitrofenoli	100-02-7	2,5
2,3-dinitrofenoli	66-56-8	2,5
2,5-dinitrofenoli	329-71-5	2,5
3,4-dinitrofenoli	577-71-9	2,5

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

14.7.2017

17JJ01774

RA4038B FENOLISET YHDISTEET*

Kaasukromatografinen menetelmä, GC/MS
VESI

	CAS	Määritysraja µg/l
2-kloorifenoli	95-57-8	50
3-kloorifenoli	108-43-0	0,1
4-kloorifenoli	106-48-9	0,1
2,3-dikloorifenoli	576-24-9	0,2
2,4-dikloorifenoli	120-83-2	0,2
2,5 + 2,6-dikloorifenoli	583-78-8 + 87-65-0	0,2
3,4-dikloorifenoli	95-77-2	0,2
3,5-dikloorifenoli	591-35-5	0,2
2,3,4-trikloorifenoli	15950-66-0	5,0
2,3,5-trikloorifenoli	933-78-8	0,2
2,3,6-trikloorifenoli	933-75-5	0,2
2,4,5-trikloorifenoli	95-95-4	0,2
2,4,6-trikloorifenoli	88-06-2	0,2
3,4,5-trikloorifenoli	609-19-8	0,2
2,3,4,5-tetrakloorifenoli	4901-51-3	0,2
2,3,4,6-tetrakloorifenoli	58-90-2	0,2
2,3,5,6-tetrakloorifenoli	935-95-5	0,2
pentakloorifenoli	87-86-5	0,4
4-kloori-2-metyylifenoli	1570-64-5	0,5
4-kloori-3-metyylifenoli	59-50-7	0,5
fenoli	108-95-2	2,5
3-etyylifenoli	620-17-7	0,5
4-etyylifenoli	123-07-9	0,5
3-metyylifenoli (m-kresoli)	108-39-4	2,5
4-metyylifenoli (p-kresoli)	106-44-5	2,5
2-metyylifenoli (o-kresoli)	95-48-7	5,0
2,3-dimetyylifenoli	526-75-0	10
2,4 + 3,5-dimetyylifenoli	105-67-9 + 108-68-9	2,5
2,5-dimetyylifenoli	95-87-4	0,5
2,6-dimetyylifenoli	576-26-1	0,5
3,4-dimetyylifenoli	95-65-8	0,5
2,3,5-trimetyylifenoli	697-82-5	0,5
2,3,6-trimetyylifenoli	2416-94-6	2,5
2,4,6-trimetyylifenoli	527-60-6	2,5
3,4,5-trimetyylifenoli	527-54-8	0,5
2,6-di-tert-butyylifenoli	128-39-2	1,0
hydrokinoni	123-31-9	10
pyrokatekoli	120-80-9	2,5
resorsinoli	108-46-3	0,5
1-naftoli	90-15-3	0,2
2-naftoli	135-19-3	0,2
bisfenoli A	80-05-7	1,0
bisfenoli F	620-92-8	0,2
2-nitrofenoli	88-75-5	1,0
3-nitrofenoli	554-84-7	1,0
4-nitrofenoli	100-02-7	2,5
2,3-dinitrofenoli	66-56-8	2,5
2,5-dinitrofenoli	329-71-5	2,5
3,4-dinitrofenoli	577-71-9	2,5

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

8.2.2017

17JJ01776

RA4038A TORJUNTA-AINEET *

Kaasukromatografinen monijäämä-menetelmä, GC/MS/MS

VESI

	CAS	Määritysraja µg/l		CAS	Määritysraja µg/l
2,4-Dikloorifenoli	120-83-2	0,005	Isodriini	465-73-6	0,0025
4-kloori-2-metyylifenoli	1570-64-5	0,005	Kaptaani	133-06-2	0,02
4-kloori-3-metyylifenoli	59-50-7	0,005	Klooribensidi	103-17-3	0,005
Akrinatriini	101007-06-1	0,005	Klordaani, cis-	5103-71-9	0,005
Aldriini	309-00-2	0,0025	Klordaani, oxy-	27304-13-8	0,005
Alletriini (-D)	584-79-2	0,1	Klordaani, trans-	5103-74-2	0,005
Antrakinoni	84-65-1	0,01	Klordekoni	143-50-0	0,005
Bifenatsaatti	149877-41-8	0,01	Klorfensoni	80-33-1	0,005
Bifenoksi	42576-02-3	0,01	Klormefossi	24934-91-6	0,005
Bifentriini	82657-04-3	0,005	Kloroneb	2675-77-6	0,005
DDD, 2,4´-	53-19-0	0,001	Kloropropylaatti	5836-10-2	0,005
DDD, 4,4´-	72-54-8	0,001	Klorotaloniili	1897-45-6	0,005
DDE, 2,4´-	3424-82-6	0,001	Kvintotseeni	82-68-8	0,005
DDE, 4,4´-	72-55-9	0,001	Mepanipyriimi	110235-47-7	0,005
DDM, 4,4´-	101-76-8	0,005	Metiokarbi	2032-65-7	0,005
DDMU, 4,4´-	1022-22-6	0,005	Metoksikloori, 4,4'-, -olefiini	2132-70-9	0,005
DDT, 2,4´-	789-02-6	0,001	Metoksikloori, o,p'-	30667-99-3	0,005
DDT, 4,4´-	50-29-3	0,001	Metoksikloori, p,p-	72-43-5	0,005
DEET	134-62-3	0,005	Metolakloori-s	87392-12-9	0,005
Deltametriini	52918-63-5	0,01	Mirex	2385-85-5	0,005
Dieldriini	60-57-1	0,0025	Nonakloori, cis-	5103-73-1	0,005
Diklobeniili	1194-65-6	0,005	Nonakloori, trans-	39765-80-5	0,005
Dikofoli	115-32-2	0,001	Oksadiatsoni	19666-30-9	0,005
Endosulfaani, alfa-	959-98-8	0,0025	Pentakloorianisoli	1825-21-4	0,005
Endosulfaani, beta-	33213-65-9	0,0025	Pentaklooribentseeni	608-93-5	0,005
Endosulfaanisulfaatti	1031-07-8	0,005	Permetriini, cis-	61949-76-6	0,005
Endriini	72-20-8	0,0025	Permetriini, trans-	61949-77-7	0,005
Endriinialdehydi	7421-93-4	0,005	Piperonyylibutoksidi	51-03-6	0,005
Endriiniketoni	53494-70-5	0,005	Pirimikarbi	23103-98-2	0,005
Epoksikonatsoli	106325-08-0	0,005	Prokloratsi	67747-09-5	0,2
Esfenvaleraatti	66230-04-4	0,05	Prometryyni	7287-19-6	0,005
Etofumesaatti	26225-79-6	0,005	Pyrimetaniili	53112-28-0	0,005
Etofumesaatti-2-keto	26244-33-7	0,01	Sybutryyni (Irgaroli)	28159-98-0	0,002
Etylaani (etyyli-DDD, Pertaani)	72-56-0	0,005	Syflutriini, beta-	68359-37-5	0,005
Fenotriini (cis- ja trans-)	26002-80-2	0,02	Syhalotriini, lambda-	91465-08-6	0,01
Fenvaleraatti	51630-58-1	0,05	Sypermetriini	52315-07-8	0,005
Flusytrinaatti	70124-77-5	0,005	Syprodiniili	121552-61-2	0,005
Fluvalinaatti, tau-	102851-06-9	0,05	Teflutriini	79538--32-2	0,005
HCH, alfa-	319-84-6	0,005	Teknatseeni	117-18-0	0,005
HCH, beta-	319-85-7	0,005	Terbutryyni	886-50-0	0,005
HCH, delta-	319-86-8	0,005	Tetradifoni	116-29-0	0,005
HCH, gamma- (lindaani)	58-89-9	0,005	Tetrametriini	7696-12-0	0,005
Heksaklooribentseeni	118-74-1	0,01	Transflutriini	118712-89-3	0,005
Heksaklooributadieeni	87-68-3	0,005	Trifluraliini	1582-09-8	0,005
Heptakloori	76-44-8	0,005	Triklosaani	3380-34-5	0,005
Heptaklooriepoksidi, ekso-	1024-57-3	0,005	Triklosaani, metyyli-	4640-01-1	0,005
Heptaklooriepoksidi, endo-	28044-83-9	0,005	Vinklotsoliini	50471-44-8	0,005

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

8.2.2017

17JJ01775

RA4038A TORJUNTA-AINEET *

Kaasukromatografinen monijäämä-menetelmä, GC/MS/MS

VESI

	CAS	Määritysraja µg/l		CAS	Määritysraja µg/l
2,4-Dikloorifenoli	120-83-2	0,05	Isodriini	465-73-6	0,025
4-kloori-2-metyylifenoli	1570-64-5	0,05	Kaptaani	133-06-2	0,2
4-kloori-3-metyylifenoli	59-50-7	0,05	Klooribensidi	103-17-3	0,05
Akrinatriini	101007-06-1	0,05	Klordaani, cis-	5103-71-9	0,05
Aldriini	309-00-2	0,025	Klordaani, oxy-	27304-13-8	0,05
Alletriini (-D)	584-79-2	1,0	Klordaani, trans-	5103-74-2	0,05
Antrakinoni	84-65-1	0,1	Klordekoni	143-50-0	0,05
Bifenatsaatti	149877-41-8	0,1	Klorfensoni	80-33-1	0,05
Bifenoksi	42576-02-3	0,1	Klormefossi	24934-91-6	0,05
Bifentriini	82657-04-3	0,05	Kloroneb	2675-77-6	0,05
DDD, 2,4´-	53-19-0	0,01	Kloropropylaatti	5836-10-2	0,05
DDD, 4,4´-	72-54-8	0,01	Klorotaloniili	1897-45-6	0,05
DDE, 2,4´-	3424-82-6	0,01	Kvintotseeni	82-68-8	0,05
DDE, 4,4´-	72-55-9	0,01	Mepanipyriimi	110235-47-7	0,05
DDM, 4,4´-	101-76-8	0,05	Metiokarbi	2032-65-7	0,05
DDMU, 4,4´-	1022-22-6	0,05	Metoksikloori, 4,4'-, -olefiini	2132-70-9	0,05
DDT, 2,4´-	789-02-6	0,01	Metoksikloori, o,p'-	30667-99-3	0,05
DDT, 4,4´-	50-29-3	0,01	Metoksikloori, p,p-	72-43-5	0,05
DEET	134-62-3	0,05	Metolakloori-s	87392-12-9	0,05
Deltametriini	52918-63-5	0,1	Mirex	2385-85-5	0,05
Dieldriini	60-57-1	0,025	Nonakloori, cis-	5103-73-1	0,05
Diklobeniili	1194-65-6	0,05	Nonakloori, trans-	39765-80-5	0,05
Dikofoli	115-32-2	0,01	Oksadiatsoni	19666-30-9	0,05
Endosulfaani, alfa-	959-98-8	0,025	Pentakloorianisoli	1825-21-4	0,05
Endosulfaani, beta-	33213-65-9	0,025	Pentaklooribentseeni	608-93-5	0,05
Endosulfaanisulfaatti	1031-07-8	0,05	Permetriini, cis-	61949-76-6	0,05
Endriini	72-20-8	0,025	Permetriini, trans-	61949-77-7	0,05
Endriinialdehydi	7421-93-4	0,05	Piperonyylibutoksidi	51-03-6	0,05
Endriiniketoni	53494-70-5	0,05	Pirimikarbi	23103-98-2	0,05
Epoksikonatsoli	106325-08-0	0,05	Prokloratsi	67747-09-5	2,0
Esfenvaleraatti	66230-04-4	0,5	Prometryyni	7287-19-6	0,05
Etofumesaatti	26225-79-6	0,05	Pyrimetaniili	53112-28-0	0,05
Etofumesaatti-2-keto	26244-33-7	0,1	Sybutryyni (Irgaroli)	28159-98-0	0,02
Etylaani (etyyli-DDD, Pertaani)	72-56-0	0,05	Syflutriini, beta-	68359-37-5	0,05
Fenotriini (cis- ja trans-)	26002-80-2	0,2	Syhalotriini, lambda-	91465-08-6	0,1
Fenvaleraatti	51630-58-1	0,5	Sypermetriini	52315-07-8	0,05
Flusytrinaatti	70124-77-5	0,05	Syprodiniili	121552-61-2	0,05
Fluvalinaatti, tau-	102851-06-9	0,5	Teflutriini	79538--32-2	0,05
HCH, alfa-	319-84-6	0,05	Teknatseeni	117-18-0	0,05
HCH, beta-	319-85-7	0,05	Terbutryyni	886-50-0	0,05
HCH, delta-	319-86-8	0,05	Tetradifoni	116-29-0	0,05
HCH, gamma- (lindaani)	58-89-9	0,05	Tetrametriini	7696-12-0	0,05
Heksaklooribentseeni	118-74-1	0,1	Transflutriini	118712-89-3	0,05
Heksaklooributadieeni	87-68-3	0,05	Trifluraliini	1582-09-8	0,05
Heptakloori	76-44-8	0,05	Triklosaani	3380-34-5	0,05
Heptaklooriepoksidi, ekso-	1024-57-3	0,05	Triklosaani, metyyli-	4640-01-1	0,05
Heptaklooriepoksidi, endo-	28044-83-9	0,05	Vinklotsoliini	50471-44-8	0,05

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

8.2.2017

17JJ01774

RA4038A TORJUNTA-AINEET *

Kaasukromatografinen monijäämä-menetelmä, GC/MS/MS

VESI

	CAS	Määritysraja µg/l		CAS	Määritysraja µg/l
2,4-Dikloorifenoli	120-83-2	0,5	Isodriini	465-73-6	0,25
4-kloori-2-metyylifenoli	1570-64-5	0,5	Kaptaani	133-06-2	2
4-kloori-3-metyylifenoli	59-50-7	0,5	Klooribensidi	103-17-3	0,5
Akrinatriini	101007-06-1	0,5	Klordaani, cis-	5103-71-9	0,5
Aldriini	309-00-2	0,25	Klordaani, oxy-	27304-13-8	0,5
Alletriini (-D)	584-79-2	10	Klordaani, trans-	5103-74-2	0,5
Antrakinoni	84-65-1	1	Klordekoni	143-50-0	0,5
Bifenatsaatti	149877-41-8	1	Klorfensoni	80-33-1	0,5
Bifenoksi	42576-02-3	1	Klormefossi	24934-91-6	0,5
Bifentriini	82657-04-3	0,5	Kloroneb	2675-77-6	0,5
DDD, 2,4´-	53-19-0	0,1	Kloropropylaatti	5836-10-2	0,5
DDD, 4,4´-	72-54-8	0,1	Klorotaloniili	1897-45-6	0,5
DDE, 2,4´-	3424-82-6	0,1	Kvintotseeni	82-68-8	0,5
DDE, 4,4´-	72-55-9	0,1	Mepanipyriimi	110235-47-7	0,5
DDM, 4,4´-	101-76-8	0,5	Metiokarbi	2032-65-7	0,5
DDMU, 4,4´-	1022-22-6	0,5	Metoksikloori, 4,4'-, -olefiini	2132-70-9	0,5
DDT, 2,4´-	789-02-6	0,1	Metoksikloori, o,p'-	30667-99-3	0,5
DDT, 4,4´-	50-29-3	0,1	Metoksikloori, p,p-	72-43-5	0,5
DEET	134-62-3	0,5	Metolakloori-s	87392-12-9	0,5
Deltametriini	52918-63-5	1	Mirex	2385-85-5	0,5
Dieldriini	60-57-1	0,25	Nonakloori, cis-	5103-73-1	0,5
Diklobeniili	1194-65-6	0,5	Nonakloori, trans-	39765-80-5	0,5
Dikofoli	115-32-2	0,1	Oksadiatsoni	19666-30-9	0,5
Endosulfaani, alfa-	959-98-8	0,25	Pentakloorianisoli	1825-21-4	0,5
Endosulfaani, beta-	33213-65-9	0,25	Pentaklooribentseeni	608-93-5	0,5
Endosulfaanisulfaatti	1031-07-8	0,5	Permetriini, cis-	61949-76-6	0,5
Endriini	72-20-8	0,25	Permetriini, trans-	61949-77-7	0,5
Endriinialdehydi	7421-93-4	0,5	Piperonyylibutoksidi	51-03-6	0,5
Endriiniketoni	53494-70-5	0,5	Pirimikarbi	23103-98-2	0,5
Epoksikonatsoli	106325-08-0	0,5	Prokloratsi	67747-09-5	20
Esfenvaleraatti	66230-04-4	5	Prometryyni	7287-19-6	0,5
Etofumesaatti	26225-79-6	0,5	Pyrimetaniili	53112-28-0	0,5
Etofumesaatti-2-keto	26244-33-7	1	Sybutryyni (Irgaroli)	28159-98-0	0,2
Etylaani (etyyli-DDD, Pertaani)	72-56-0	0,5	Syflutriini, beta-	68359-37-5	0,5
Fenotriini (cis- ja trans-)	26002-80-2	2	Syhalotriini, lambda-	91465-08-6	1
Fenvaleraatti	51630-58-1	5	Sypermetriini	52315-07-8	0,5
Flusytrinaatti	70124-77-5	0,5	Syprodiniili	121552-61-2	0,5
Fluvalinaatti, tau-	102851-06-9	5	Teflutriini	79538--32-2	0,5
HCH, alfa-	319-84-6	0,5	Teknatseeni	117-18-0	0,5
HCH, beta-	319-85-7	0,5	Terbutryyni	886-50-0	0,5
HCH, delta-	319-86-8	0,5	Tetradifoni	116-29-0	0,5
HCH, gamma- (lindaani)	58-89-9	0,5	Tetrametriini	7696-12-0	0,5
Heksaklooribentseeni	118-74-1	1	Transflutriini	118712-89-3	0,5
Heksaklooributadieeni	87-68-3	0,5	Trifluraliini	1582-09-8	0,5
Heptakloori	76-44-8	0,5	Triklosaani	3380-34-5	0,5
Heptaklooriepoksidi, ekso-	1024-57-3	0,5	Triklosaani, metyyli-	4640-01-1	0,5
Heptaklooriepoksidi, endo-	28044-83-9	0,5	Vinklotsoliini	50471-44-8	0,5

* akkreditoitu menetelmä, mukautuva pätevyysalue

6.11.2014

17JJ01775-17JJ01776

RA4010 FTALAATIT*

Kaasukromatografinen menetelmä, GC/MS

VESI

	CAS	Määritysraja µg/l
Dimetyyliftalaatti (DMP)	131-11-3	0,02
Dietyyliftalaatti (DEP)	84-66-2	0,05
Di-isobutyyliftalaatti (DiBP)	84-69-5	0,05
Dibutyyliftalaatti (DBP)	84-74-2	0,05
Dipentyyliftalaatti (DPP)	131-18-0	0,01
Diheksyyliftalaatti (DHP)	84-75-3	0,01
Bentsyylibutyyliftalaatti (BBP)	85-68-7	0,02
Dietyyliheksyyliftalaatti (DEHP)	117-81-7	0,30
Di(n)oktyyliftalaatti (DOP)	117-84-0	0,01
Di(iso)nonyyliftalaatti (DINP)	68515-48-0 (28553-12-0)	1,0
Di-(iso)dekyyliftalaatti (DIDP)	68515-49-1	1,0

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

5.7.2017

17JJ01774

RA4010 FTALAATIT*

Kaasukromatografinen menetelmä, GC/MS

VESI

	CAS	Määritysraja µg/l
Dimetyyliftalaatti (DMP)	131-11-3	0,5
Dietyyliftalaatti (DEP)	84-66-2	0,5
Di-isobutyyliftalaatti (DiBP)	84-69-5	0,5
Dibutyyliftalaatti (DBP)	84-74-2	0,5
Dipentyyliftalaatti (DPP)	131-18-0	0,1
Diheksyyliftalaatti (DHP)	84-75-3	0,1
Bentsyylibutyyliftalaatti (BBP)	85-68-7	0,2
Dietyyliheksyyliftalaatti (DEHP)	117-81-7	3,0
Di(n)oktyyliftalaatti (DOP)	117-84-0	0,1
Di(iso)nonyyliftalaatti (DINP)	68515-48-0	100
Di-(iso)dekyyliftalaatti (DIDP)	68515-49-1	20

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

4.7.2017

17JJ01776

RA4001 ALKYYLIFENOLIT & -ETOKSYLAATIT*

UPLC/MS/MS

VESI

	CAS	Määritysraja µg/l
4-n-Nonyylifenoli	104-40-5	0,01
4-Nonyylifenoli (isomeerien seos)	84852-15-3	0,05
4-Nonyylifenolimonoetoksylaatti (isomeerien seos)	104-35-8**	0,05
4-Nonyylifenolidietoksylaatti (isomeerien seos)	20427-84-3***	0,01
4-Nonyylifenolitrietoksylaatti (isomeerien seos)	51437-95-7	0,01
4-Nonyylifenolitetraetoksylaatti (isomeerien seos)	7311-27-5	0,05
4-Nonyylifenolipentaetoksylaatti (isomeerien seos)	26264-02-8	0,05
4-Nonyylifenoliheksaetoksylaatti (isomeerien seos)	27177-01-1	0,05
4-tert-Oktyylifenoli	140-66-9	0,1
4-tert-Oktyylifenolimonoetoksylaatti	2315-67-5	0,05
4-tert-Oktyylifenolidietoksylaatti	2315-61-9	0,01
4-tert-Oktyylifenolitrietoksylaatti	2315-62-0	0,05

**CAS numero 4-n-nonyylifenolimonoetoksylaatille
***CAS numero 4-n-nonyylifenolidietoksylaatille

* akkreditoitu menetelmä, mukautuva pätevyysalue

Eurofins Environment Testing Finland Oy

15.2.2017

17JJ01774, 17JJ01775

RA4001 ALKYYLIFENOLIT & -ETOKSYLAATIT*

UPLC/MS/MS

VESI

	CAS	Määritysraja µg/l
4-n-Nonyylifenoli	104-40-5	0,1
4-Nonyylifenoli (isomeerien seos)	84852-15-3	0,5
4-Nonyylifenolimonoetoksylaatti (isomeerien seos)	104-35-8**	0,5
4-Nonyylifenolidietoksylaatti (isomeerien seos)	20427-84-3***	0,1
4-Nonyylifenolitrietoksylaatti (isomeerien seos)	51437-95-7	0,1
4-Nonyylifenolitetraetoksylaatti (isomeerien seos)	7311-27-5	0,5
4-Nonyylifenolipentaetoksylaatti (isomeerien seos)	26264-02-8	0,5
4-Nonyylifenoliheksaetoksylaatti (isomeerien seos)	27177-01-1	0,5
4-tert-Oktyylifenoli	140-66-9	0,1
4-tert-Oktyylifenolimonoetoksylaatti	2315-67-5	0,5
4-tert-Oktyylifenolidietoksylaatti	2315-61-9	0,1
4-tert-Oktyylifenolitrietoksylaatti	2315-62-0	0,5

**CAS numero 4-n-nonyylifenolimonoetoksylaatille
***CAS numero 4-n-nonyylifenolidietoksylaatille

* akkreditoitu menetelmä, mukautuva pätevyysalue

FINAS Finnish Accreditation Service T101 (EN ISO/IEC 17025)

JVP-Eura Oy
pirjo.patala@jvp-eura.fi

Tilausnro 203193 (EURA8/EPRTR), saapunut 5.7.2017, näytteet otettu 4.7.2017 (14:00)
Näytteenottaja: LSVYT Oy, Mattila

NÄYTTEET

Lab.nro	Näytteen kuvaus
9523	Paperiteollisuudesta tuleva jv, 24 h kokoomanäyte 4.7.-5.7.2017
9524	Kuntalinjalta tuleva jv, 24 h kokoomanäyte 4.7.-5.7.2017
9525	Puhdistamolta lähtevä jv, 24 h kokoomanäyte 4.7.-5.7.2017

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	9523	9524	9525
AOX	mg/l	0,310	0,160	0,091
PAH-yhdisteet		ks. laus.	ks. laus.	ks. laus.

Merkintöjen selityksiä: P = määritys kesken, E = ei tehty, ~ = noin, < = pienempi kuin, « = pienempi tai yhtäsuuri kuin, > = suurempi kuin, » = suurempi tai yhtäsuuri kuin.
* -merkityt analyysit ovat akkreditoituja. (a)=laatuvaatimus, (b)=laatusuositus

LAUSUNTO

JVP-Eura Oy:n E-PRTR yhdisteiden tarkkailututkimuksen tulokset AOX- ja PAH-yhdisteiden osalta. Em. yhdisteiden tutkimus jätevesistä tehtiin päästötarkkailukerran 4.7.2017 kanssa samanaikaisesti.

E-PRTR yhdisteiden tarkkailutulosten perusteella lasketaan vuoden 2016 virtaamien (m3/a) perusteella vesistöön johdettavien päästöjen vuosikuormitukset (kg/a) erilliseen raporttiin. Kuormituslaskennassa käytetään vuoden 2016 virtaamatietoja, koska vuoden 2017 toteuma ei ole vielä tiedossa. Lisäksi JVP-Eura Oy:lle laaditaan E-PRTR yhdisteiden tarkkailusuunnitelma.

Nina Leino
prosessi-insinööri, DI

TIEDOKSI

Jujo Thermal Oy/Mari.Ylinen@jujothermal.com
JVP-Eura Oy/tulosten lukuohjelma, 0 kpl.

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Telekatu 16	Telekatu 16			Y 1564941-9
20360 TURKU	20360 TURKU	*(02) 274 0200	nina.leino@lsvsy.fi	Krnro 774822

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
AOX	EN 1485 (TL25)
PAH-yhdisteet	SFS-EN ISO 28540:2011 (TL25)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL25	Kokemäenjoen vesistön vesiensuojeluyhdistys ry

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.

Lounais-Suomen vesi- ja ympäristötutkimus Oy
Puusa Jari
Telekatu 16
20360 TURKU

Tilausnro 296195 (4LOU-SUO/TRE), saapunut 7.7.2017

NÄYTTEET

Lab.nro	Näytteen kuvaus
40390	2017/9523

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	40390
*Adsorboituvat orgaaniset halogeenit,AOX	µg/l	310
*Polyaromaattiset hiilivedyt (PAH)	ng/l	Todettu
*Naftaleeni (PAH)	ng/l	11
*Fluoreeni (PAH)	ng/l	7,2
*Fenantreeni (PAH)	ng/l	12

Merkintöjen selityksiä: P = määritys kesken, E = ei tehty, ~ = noin, < = pienempi kuin, « = pienempi tai yhtäsuuri kuin, > = suurempi kuin, » = suurempi tai yhtäsuuri kuin.
*-merkitty on akkreditoitu menetelmä.

Heli Orakangas
Ymp.asiantuntija(FM)

TIEDOKSI

laboratorio@lsvsy.fi//Lounais-Suomen vesi- ja ympäristö

Tässä tutkimusselosteessa esitetyt testaustulokset pätevät ainoastaan testatulle näytteelle. Akkreditointi ei koske lausuntoa. Tutkimustodistuksen saa kopioida vain kokonaan.

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Alv.rek./enn.pid.rek.
Y 0214391-0

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
*Adsorboituvat orgaaniset halogeenit,AOX	SFS-EN ISO 9562:2004 (TL25)
*Polyaromaattiset hiilivedyt (PAH)	ISO 28540:2011 (TL25)
*Naftaleeni (PAH)	ISO 28540:2011 (TL25)
*Fluoreeni (PAH)	ISO 28540:2011 (TL25)
*Fenantreeni (PAH)	ISO 28540:2011 (TL25)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL25	KVVY/Tampere (FINAS T064)

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.
*Adsorboituvat orgaaniset halogeenit,AOX	2017/40390	±20 %	13.7.2017
*Polyaromaattiset hiilivedyt (PAH)	2017/40390		7.7.2017
*Naftaleeni (PAH)	2017/40390	±50 %	7.7.2017
*Fluoreeni (PAH)	2017/40390	±50 %	7.7.2017
*Fenantreeni (PAH)	2017/40390	±50 %	7.7.2017

Polyaromaattiset hiilivedyt (PAH)

Menetelmä: ISO 28540:2011 (TL25)
Matriisi: Talousvesi, pintavesi, pohjavesi ja jätevesi
Menetelmän kuvaus: GC-MS analyysi, näytteen esikäsittely neste-neste-uutto

Cas-nro	Yhdisteen nimi	Määritysraja (ng/l)
91-20-3	*Naftaleeni	5
83-32-9	*Asenafteeni	5
208-96-8	*Asenaftyleeni	5
86-73-7	*Fluoreeni	5
120-12-7	*Antraseeni	5
85-01-8	*Fenantreeni	5
206-44-0	*Fluoranteeni	5
129-00-0	*Pyreeni	5
56-55-3	*Bentso(a)antraseeni	5
218-01-9	*Kryseeni	5
205-99-2	*Bentso(b)fluoranteeni	5
207-08-9	*Bentso(k)fluoranteeni	5
50-32-8	*Bentso(a)pyreeni	5
193-39-5	*Indeno(1,2,3-cd)pyreeni	5
53-70-3	*Dibentso(a,h)antraseeni	5
191-24-2	*Bentso(g,h,i)peryleeni	5

* Analyysi on akkreditoitu (FINAS akkreditointipalvelun akkreditoima testauslaboratorio T064, akkreditointivaatimus SFS-EN ISO/IEC 17025).

Lounais-Suomen vesi- ja ympäristötutkimus Oy
Puusa Jari
Telekatu 16
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Tilausnro 296195 (4LOU-SUO/TRE), saapunut 7.7.2017

NÄYTTEET

Lab.nro	Näytteen kuvaus
40391	2017/9524

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	40391
*Adsorboituvat orgaaniset halogeenit,AOX	µg/l	160
*Polyaromaattiset hiilivedyt (PAH)	ng/l	Todettu
*Naftaleeni (PAH)	ng/l	12
*Asenafteeni (PAH)	ng/l	21
*Asenaftyleeni (PAH)	ng/l	13
*Fluoreeni (PAH)	ng/l	47
*Antraseeni (PAH)	ng/l	32
*Fenantreeni (PAH)	ng/l	26
*Fluoranteeni (PAH)	ng/l	8,7
*Pyreeni (PAH)	ng/l	17
*Kryseeni (PAH)	ng/l	7,5

Merkintöjen selityksiä: P = määritys kesken, E = ei tehty, ~ = noin, < = pienempi kuin, « = pienempi tai yhtäsuuri kuin, > = suurempi kuin, » = suurempi tai yhtäsuuri kuin.
*-merkitty on akkreditoitu menetelmä.

Heli Orakangas
Ymp.asiantuntija(FM)

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Tässä tutkimusselosteessa esitetyt testaustulokset pätevät ainoastaan testatulle näytteelle. Akkreditointi ei koske lausuntoa. Tutkimustodistuksen saa kopioida vain kokonaan.

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Y 0214391-0

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
*Adsorboituvat orgaaniset halogeenit,AOX	SFS-EN ISO 9562:2004 (TL25)
*Polyaromaattiset hiilivedyt (PAH)	ISO 28540:2011 (TL25)
*Naftaleeni (PAH)	ISO 28540:2011 (TL25)
*Asenafteeni (PAH)	ISO 28540:2011 (TL25)
*Asenaftyleeni (PAH)	ISO 28540:2011 (TL25)
*Fluoreeni (PAH)	ISO 28540:2011 (TL25)
*Antraseeni (PAH)	ISO 28540:2011 (TL25)
*Fenantreeni (PAH)	ISO 28540:2011 (TL25)
*Fluoranteeni (PAH)	ISO 28540:2011 (TL25)
*Pyreeni (PAH)	ISO 28540:2011 (TL25)
*Kryseeni (PAH)	ISO 28540:2011 (TL25)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL25	KVVY/Tampere (FINAS T064)

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.
*Adsorboituvat orgaaniset halogeenit,AOX	2017/40391	±20 %	13.7.2017
*Polyaromaattiset hiilivedyt (PAH)	2017/40391		7.7.2017
*Naftaleeni (PAH)	2017/40391	±50 %	7.7.2017
*Asenafteeni (PAH)	2017/40391	±30 %	7.7.2017
*Asenaftyleeni (PAH)	2017/40391	±50 %	7.7.2017
*Fluoreeni (PAH)	2017/40391	±30 %	7.7.2017
*Antraseeni (PAH)	2017/40391	±30 %	7.7.2017
*Fenantreeni (PAH)	2017/40391	±30 %	7.7.2017
*Fluoranteeni (PAH)	2017/40391	±50 %	7.7.2017
*Pyreeni (PAH)	2017/40391	±50 %	7.7.2017
*Kryseeni (PAH)	2017/40391	±50 %	7.7.2017

Polyaromaattiset hiilivedyt (PAH)

Menetelmä: ISO 28540:2011 (TL25)
Matriisi: Talousvesi, pintavesi, pohjavesi ja jätevesi
Menetelmän kuvaus: GC-MS analyysi, näytteen esikäsittely neste-neste-uutto

Cas-nro	Yhdisteen nimi	Määritysraja (ng/l)
91-20-3	*Naftaleeni	5
83-32-9	*Asenafteeni	5
208-96-8	*Asenaftyleeni	5
86-73-7	*Fluoreeni	5
120-12-7	*Antraseeni	5
85-01-8	*Fenantreeni	5
206-44-0	*Fluoranteeni	5
129-00-0	*Pyreeni	5
56-55-3	*Bentso(a)antraseeni	5
218-01-9	*Kryseeni	5
205-99-2	*Bentso(b)fluoranteeni	5
207-08-9	*Bentso(k)fluoranteeni	5
50-32-8	*Bentso(a)pyreeni	5
193-39-5	*Indeno(1,2,3-cd)pyreeni	5
53-70-3	*Dibentso(a,h)antraseeni	5
191-24-2	*Bentso(g,h,i)peryleeni	5

* Analyysi on akkreditoitu (FINAS akkreditointipalvelun akkreditoima testauslaboratorio T064, akkreditointivaatimus SFS-EN ISO/IEC 17025).

Lounais-Suomen vesi- ja ympäristötutkimus Oy
Puusa Jari
Telekatu 16
20360 TURKU

Tilausnro 296195 (4LOU-SUO/TRE), saapunut 7.7.2017

NÄYTTEET

Lab.nro	Näytteen kuvaus
40392	2017/9525

MÄÄRITYSTULOKSET / NÄYTTEET

Määritys	Yksikkö	40392
*Adsorboituvat orgaaniset halogeenit,AOX	µg/l	91
*Polyaromaattiset hiilivedyt (PAH)	ng/l	Todettu
*Fluoreeni (PAH)	ng/l	7,1
*Fenantreeni (PAH)	ng/l	9,4

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*-merkitty on akkreditoitu menetelmä.

Heli Orakangas
Ymp.asiantuntija(FM)

TIEDOKSI

laboratorio@lsvsy.fi//Lounais-Suomen vesi- ja ympäristö

Tässä tutkimusselosteessa esitetyt testaustulokset pätevät ainoastaan testatulle näytteelle. Akkreditointi ei koske lausuntoa. Tutkimustodistuksen saa kopioida vain kokonaan.

MENETELMÄTIEDOT

Määritys	Menetelmän nimi ja tutkimuslaitos (suluissa)
*Adsorboituvat orgaaniset halogeenit,AOX	SFS-EN ISO 9562:2004 (TL25)
*Polyaromaattiset hiilivedyt (PAH)	ISO 28540:2011 (TL25)
*Fluoreeni (PAH)	ISO 28540:2011 (TL25)
*Fenantreeni (PAH)	ISO 28540:2011 (TL25)

TUTKIMUSLAITOSTIEDOT

Tunnus	Tutkimuslaitoksen nimi
TL25	KVVY/Tampere (FINAS T064)

MITTAUSEPÄVARMUUSTIEDOT

Määritys	Näyte	Tuloksen epävarmuus	Määrityspvm.
*Adsorboituvat orgaaniset halogeenit,AOX	2017/40392	±20 %	13.7.2017
*Polyaromaattiset hiilivedyt (PAH)	2017/40392		7.7.2017
*Fluoreeni (PAH)	2017/40392	±50 %	7.7.2017
*Fenantreeni (PAH)	2017/40392	±50 %	7.7.2017

Polyaromaattiset hiilivedyt (PAH)

Menetelmä: ISO 28540:2011 (TL25)
Matriisi: Talousvesi, pintavesi, pohjavesi ja jätevesi
Menetelmän kuvaus: GC-MS analyysi, näytteen esikäsittely neste-neste-uutto

Cas-nro	Yhdisteen nimi	Määritysraja (ng/l)
91-20-3	*Naftaleeni	5
83-32-9	*Asenafteeni	5
208-96-8	*Asenaftyleeni	5
86-73-7	*Fluoreeni	5
120-12-7	*Antraseeni	5
85-01-8	*Fenantreeni	5
206-44-0	*Fluoranteeni	5
129-00-0	*Pyreeni	5
56-55-3	*Bentso(a)antraseeni	5
218-01-9	*Kryseeni	5
205-99-2	*Bentso(b)fluoranteeni	5
207-08-9	*Bentso(k)fluoranteeni	5
50-32-8	*Bentso(a)pyreeni	5
193-39-5	*Indeno(1,2,3-cd)pyreeni	5
53-70-3	*Dibentso(a,h)antraseeni	5
191-24-2	*Bentso(g,h,i)peryleeni	5

* Analyysi on akkreditoitu (FINAS akkreditointipalvelun akkreditoima testauslaboratorio T064, akkreditointivaatimus SFS-EN ISO/IEC 17025).

JVP Eura Oy E-PRTR yhdisteiden kuormituslaskelma, vuosi 2017

toimialakohtaisesti ei vaadita tutkittavaksi raportointikynnyksen ylitys

PRTR Nro	Aine	Tuleva pit. Kuntalinja mg/l	Tulokuorma Kuntalinja tuleva, kg/a	Tuleva pit. Paperitehtaat mg/l	Tulokuorma Paperitehtaat tuleva, kg/a	Tulokuorma yhteensä kg/a	Lähtevä pitoisuus mg/l	Lähtevä kuorma kg/a	Ohitus kuorma kg/a	Vesistöön kuorma kg/a	Kynnysarvo 166/2006/EY kg/a
12	Kokonaistyppi		113 880		6 570	120 450		20 805	27	**20 832**	50 000
13	Kokonaisfosfori		9 125		657	9 782		693,5	1,46	**695**	5 000
17	Arseeni ja arseeniyhdisteet (arseenina)	0,0034	3,4	0,0008	1,41	4,8	0,0007	1,94	0,00085	**1,94**	5
18	Kadmium ja kadmiumyhdisteet (kadmiumina)	0,00032	0,32	0,00045	0,79	1,1	0,00004	0,11	0,00008	**0,11**	5
19	Kromi ja kromiyhdisteet (kromina)	0,0085	8,6	0,0026	4,6	13	0,0016	4,4	0,0021	**4,4**	50
20	Kupari ja kupariyhdisteet (kuparina)	0,21	211	0,0059	10,4	222	0,0035	9,69	0,053	**9,74**	50
21	Elohopea ja elohopeayhdisteet (elohopeana)	0,0001	0,11	0,00003	0,053	0,16	0,00002	0,055	0,000028	**0,055**	1
22	Nikkeli ja nikkeliyhdisteet (nikkelinä)	0,015	15	0,0029	5,1	20	0,0031	8,6	0,0038	**8,6**	20
23	Lyijy ja lyijy-yhdisteet (lyijynä)	0,010	10	0,0015	2,6	13	0,00048	1,33	0,0025	**1,33**	20
24	Sinkki ja sinkkiyhdisteet (sinkkinä)	0,40	403	0,14	247	649	0,015	41,5	0,10	**41,6**	100
27	Atratsiini	0	0	0	0	0	0	0	0	**0**	1
34	1,2-dikloorietaani (EDC)	0	0		0	0	0	0	0	**0**	10
35	Dikloorimetaani (DCM)	0	0		0	0	0	0	0	**0**	10
37	Diuroni	0	0	0	0	0	0	0	0	**0**	1
40	Halogenoidut orgaaniset yhdisteet (AOX)	0,16	161	0,31	546	707	0,091	252	0,04	**252**	1 000
42	Heksaklooribentseeni (HCB)	0	0	0	0	0	0	0	0	**0**	1
45	Lindaani	0	0	0	0	0	0	0	0	**0**	1
47	PCDD+PCDF (dioksiinit ja furaanit, TEQ)*		0	0,000000034	0,000060	0,000060	0,000000032	0,0000886	0	**0,0000886**	0,0001
49	Pentakloorifenoli (PCP)	0	0	0	0	0	0	0	0	**0**	1
51	Simatsiini	0	0	0	0	0	0	0	0	**0**	1
52	Tetrakloorieteeni (PER)	0,033	33		0	33	0	0	0,00825	**0,00825**	10
53	Tetraklorimetaani (TCM)	0	0		0	0	0	0	0	**0**	1
57	Trikloorieteeni	0,003	3,0		0	3,0	0	0	0,00075	**0,00075**	10
58	Trikloorimetaani (kloroformi)	0,008	8,1		0	8,1	0	0	0,0020	**0,0020**	10
62	Bentseeni	0,038	38		0	38	0	0	0,0095	**0,0095**	200 (BTEX)
63	Bromatut bifenyylieetterit (PBDE)	0,0000082	0,0083		0	0,0083	< 0,000000125	0	0,0000021	**0,0000021**	1
64	Nonyylifenoli ja nonyylifenolietoksylaatit	0	0	0	0	0	0,00009	0,25	0	**0,25**	1
67	Isoproturoni	0	0	0	0	0	0	0	0	**0**	1
68	Naftaleeni	0,000012	0,012	0,000011	0,019	0,031	0	0	0,000003	**0,000003**	10
69	Organotinayhdisteet (kok. Sn)	0,002	2,0		0	2,0	< 0,0002	0	0,0005	**0,0005**	50
70	Di-2-etyyliheksyyliftalaatti (DEHP)	0,032	32	0	0	32	0	0	0,008	**0,008**	1
71	Fenolit (kokonaishiilenä)	3,4	3 423	0,54	951	4374	0,0002	0,55	0,85	**1,4**	20
72	Polysykliset aromaattiset hiilivedyt (PAH)**	0	0	0	0	0	0	0	0	**0**	5
73	Tolueeni	1,15	1 155		0	1155	0	0	0,287	**0,287**	200 (BTEX)
74	Tributyylitina-yhdisteet	0	0		0	0	0	0	0	**0**	1
75	Trifenyylitina-yhdisteet	0	0		0	0	0	0	0	**0**	1
76	Kok. Orgaaninen hiili (TOC) tai COD_{Cr} / 3		358 917		456 250	815 167		53 533	61	**53 594**	50 000
78	Ksyleenit	0,003	3,0		0	3,0	0	0	0,00075	**0,00075**	200 (BTEX)
79	Kloridit (kokonaiskloorina)	120	120 803		0	120 803	120	332 272	30	**332 302**	2 000 000
82	Syanidi, CN	< 0,02	0		0	0	< 0,02	0	0	**0**	50
83	Fluoridit (kokonaisfluorina)	0,61	614		0	614	0,26	719,9	0,15	**720,1**	2 000
87	Oktyylifenolit ja oktyylifenolietoksylaatit	0	0	0	0	0	0	0	0	**0**	1
88	Fluoranteeni	0,0000087	0,0088	0	0	0,0088	0	0	0,0000022	**0,0000022**	1
89	Isodriini	0	0	0	0	0	0	0	0	**0**	1
91	Bentso(g,h,i) peryleeni	0	0	0	0	0	0	0	0	**0**	1
	Bisfenoli A***	0,032	32	0,69	1 216	1248	0,0049	14	0,008	**14**	

* Laskettu käyttäen Middle bound WHO (2005) -TCDD TEQ -arvoa, koska oletettu pitoisuus lower bound ja upperbound -arvojen välillä.

** PAH yhdisteillä tarkoitetaan neljää PAHyhdistettä: bentso(a)pyreeni, bentso(b)fluoranteeni, bentso(k)fluoranteeni ja indeeni(1,2,3cd)pyreeni.

EU:n EPER ainelistassa on lisäksi bentso(ghi)peryleeni ja fluoranteeni Lähde: SYKE taustaselvitys

*** Bisfenoli A: Lähtevä pitoisuus ja kuormitus saatu vuoden 2016 tarkkailutuloksista. Yhdiste ei sis. E-PRTR raportoitaviin päästöihin

Jäte- ja lietetiedot 2017

Kunta	**Eura**
Puhdistamon nimi	**JVP-Eura Oy**
Yhteyshenkilön nimi	Jukka Valtonen
Puhelinnro	0400983190
Sähköpostiosoite	

PUHDISTAMOLLA / JÄTEVEDENKÄSITTELYSSÄ SYNTYVÄT JÄTTEET
(toimitetaan muualle käsiteltäväksi/hyödynnettäväksi)

VÄLPPÄJÄTE (EWC-koodi 190801)

Kok.määrä [t/jakso]	
kuiva-aine %	
Vastaanottaja/sijoitus	Loimi-Hämeen Jätehuolto Oy Oy/Hallavaaran jätekeskus

HIEKANEROTUKSESSA SYNTYVÄ JÄTE, HIEKKAJÄTE (EWC-koodi 190802)

Kok.määrä [t/jakso]	Sisältyy välppäjätteeseen. yhteensä 16,5 t.
kuiva-aine %	
Vastaanottaja/sijoitus	

PUHDISTAMON YLIJÄÄMÄLIETE, KUNTALINJA (EWC-koodi 190805A)

Kok.määrä [t/jakso]	4030,35 t					
kuiva-aine %	19,0 %					
Käsittelytapa	tiivistys		kuivaus		linkokuivaus	x
Vastaanottaja/sijoitus	Gasum Biotehdas Oy/Vambion laitos					

PAPERITEHTAIDEN KUITULIETE (EWC-koodi 030310)

Kok.määrä [t/jakso]	2540,8 t					
kuiva-aine %	35,7 %					
Käsittelytapa	tiivistys		kuivaus		linkokuivaus	x
Vastaanottaja/sijoitus	Loimi-Hämeen Jätehuolto Oy Oy/Hallavaaran jätekeskus					
	Loppuvuodesta alkaen 2017 Adven Oy					

MUU PUHDISTUSPROSESSISSA SYNTYVÄ JÄTE (EWC-koodi 190899)

Jätejakeen kuvaus	
Kok.määrä (t/a, m^3/a)	Hiekka-vesi 16,5t.
kuiva-aine %	Rasvakaivo 10t.
Vastaanottaja/sijoitus	

Jätejakeen kuvaus	
Kok.määrä (t/a, m^3/a)	
kuiva-aine %	
Vastaanottaja/sijoitus	

Lounais-Suomen vesi- ja ympäristötutkimus Oy
Telekatu 16, 20360 TURKU
Puh. (02) 274 0200, fax. (02) 238 1838
FINAS-akkreditoitu testauslaboratorio T101

Liite 5.

JRC Scientific and Technical Reports

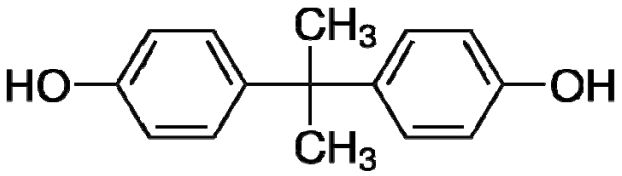
European Union
Risk Assessment Report

CAS: 80-05-7 **EINECS No: 201-245-8**

Environment Addendum of April 2008

(to be read in conjunction with published EU RAR of BPA, 2003)

4,4'-ISOPROPYLIDENEDIPHENOL
(Bisphenol-A)
Part 1 Environment



EUROPEAN COMMISSION

Institute for Health and Consumer Protection

EUR 24588 EN - 2010

The mission of the JRC-IHCP is to protect the interests and health of the consumer in the framework of EU legislation on chemicals, food, and consumer products by providing scientific and technical support including risk-benefit assessment and analysis of traceability.

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Updated European Risk Assessment Report

4,4'-ISOPROPYLIDENEDIPHENOL (BISPHENOL-A)

CAS Number: 80-05-7

EINECS Number: 201-245-8

Environment Addendum of February 2008

(to be read in conjunction with published EU RAR of BPA, 2003 for full details)

Rapporteur for the risk assessment is the United Kingdom.

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The scientific work on the environmental sections was carried out by the Building Research Establishment Ltd (BRE) (with input on the aquatic effects assessment by Watts & Crane Associates), under contract to the rapporteur.

Date of Last Literature Search :	**2007**
Review of report by MS Technical Experts finalised:	**2007**
Final report:	**2008**

Introduction

A risk assessment of bisphenol-A produced in accordance with Council Regulation (EEC) 793/93 has already been published (EC, 2003). The conclusion was that further information was needed about toxic effects in fish and aquatic snails (and potentially terrestrial organisms), and environmental risks were also identified for certain PVC applications and thermal paper recycling (for the aquatic, sediment and terrestrial compartments). The test requirements were published in two Commission Regulations (EC No. 642/2005[1] and 506/2007[2]) with a delivery deadline of November 2006 and November 2007 respectively.

The UK rapporteur began work on a risk reduction strategy for the environment shortly afterwards, and an interim report was prepared (Defra, 2003). Industry was able to provide more detailed information on use pattern and releases for a number of the applications being considered, including measured emissions data. Based on this evidence, the rapporteur considered that the emissions had been over-estimated in the published report, and revised PECs were agreed at EU Technical Meetings in 2003 and 2005. In addition, bisphenol-A may be formed via the degradation of tetrabromobisphenol-A (CAS no. 79-94-7), which is another ESR priority substance. The relevant information has been summarised in the risk assessment report for that substance (ECB, 2007).

The test programme has now concluded, so this report brings together the revised exposure information and an updated review of ecotoxicity data, as an addendum to the original risk assessment report. The opportunity has been taken to include additional industry information and published data that have become available since the original risk assessment was completed[3]. The opinions of the European Commission's former Scientific Committee for Toxicity, Ecotoxicity and the Environment (CSTEE) on the original report have also been considered (CSTEE, 2002). The assessment uses the latest version of the Technical Guidance Document, which was revised after the original report's publication, so marine scenarios and a PBT assessment are included for the first time.

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[1] Official Journal L 107, 28/04/2005 p. 0014 – 0016.

[2] Official Journal L 119, 09/05/2007 p. 0024 – 0026.

[3] EC (2003) was based on a review of all data published up to 2001. For this report, studies were identified independently by Industry (who provided the rapporteur with an updated reference list) and the rapporteur up to March 2007. The abstracts and, where necessary, main text of these papers were reviewed to establish their relevance. Non-relevant papers are listed in Appendix 1, with a reason for their non-inclusion. Relevant papers have been reviewed in detail and are reported in the main text.

The format of the report is broadly in line with that of the published assessment. A brief summary of the original information is given (*the published report should be consulted for full details*), followed by all significant new data and a comment to indicate how these differ from the original report. An exception is the section on aquatic effects, which has been entirely revised (although the original data have not been re-evaluated) and reformatted (the data had previously been divided into 'toxicity test results' and 'endocrine disrupting effects').

To protect commercial confidentiality, site codes are presented in a separate confidential annex. This can be made available to regulatory authorities on request.

CONTENTS

TABLES

0 OVERALL RESULTS OF THE RISK ASSESSMENT

CAS No: 80-05-7
EINECS No: 201-245-8
IUPAC name: 2,2-bis(4-hydroxyphenyl)propane (also known as 4,4'-isopropylidenediphenol or bisphenol-A)

Environment

Conclusion (i) There is a need for further information and/or testing.

This conclusion applies to the freshwater and marine aquatic compartments (including sediment, since the equilibrium partitioning approach has been used). Although no risks are indicated using the freshwater and marine PNEC for any scenario, there are still some uncertainties over the potential effects of bisphenol-A on snails, despite the thorough testing undertaken as part of the conclusion (i) programme. Further work being conducted by the UK Government should be taken into account when results are available in 2008.

Conclusion (ii) There is at present no need for further information and/or testing and no need for risk reduction measures beyond those which are being applied already.

This conclusion applies to the terrestrial and atmospheric compartments, and to secondary poisoning through the aquatic, terrestrial and marine food chains. It also applies to the risks to wastewater treatment plant micro-organisms. For these end points the conclusion applies to all life cycle steps.[4]

[4] Note that the original risk assessment also drew the same conclusion for the water and sediment compartments for five uses that had negligible emissions (i.e. because the processes are either completely dry or any aqueous effluent produced is disposed of through incineration). These have not been reconsidered in this update, and the conclusion remains valid for these applications.

1 GENERAL SUBSTANCE INFORMATION

1.1 IDENTIFICATION OF THE SUBSTANCE

No new information is available. 4,4'-Isopropylidenediphenol (CAS no. 80-05-7) is more commonly known as bisphenol-A, and the common name will be used throughout this report.

1.2 PURITY/IMPURITIES, ADDITIVES

1.2.1 Purity

The purity of bisphenol-A is 99 – 99.8% depending upon the manufacturer (EC, 2003). Impurities typically include phenol (<0.06%), *ortho*- and *para*- isomers of bisphenol-A (<0.2%) and water (<0.2%).

Terasaki *et al.* (2004) reported the results of an analysis of commercial bisphenol-A. This had a purity of 95.3 – 96.8% from the analysis. Fifteen other components were identified, the most abundant of which was the 4,2'-isomer, at 2.95% in one sample. All of the identified components contained phenol groups. [The level of impurity is much higher than is indicated in the risk assessment. The isomer above is indicated as a possible impurity, but at <0.2%.]

1.3 PHYSICO-CHEMICAL PROPERTIES

The key physico-chemical property values are presented in Table 1.1 (EC, 2003). No values have been revised as a result of the updated literature search for this addendum. Shareef *et al.* (2006a) reported the determination of the solubility of bisphenol-A in water at a range of pHs and a range of ionic strengths. The solubility of bisphenol-A in pure water was measured as 300±5 mg/l at 25.0±0.5 °C, with no significant variation over the pH range of 4 to 10, and no change with ionic strength (up to 0.1 moles/litre KNO_3). This further supports the value used in the published assessment.

Table 1.1 Key physico-chemical properties for bisphenol-A

Parameter	Value
Physical state at normal temperature and pressure	White solid flakes or powder
Vapour pressure	5.3 x10^{-9} kPa at 25°C used in environmental models
Solubility in water	300 mg/l used in environmental models
n-Octanol-water partition coefficient (log K_{ow})	3.4 used in environmental models
Flash point	~ 207°C
Autoflammability	~ 532°C
Explosive limits (in air)	Minimum explosive concentration 0.012 g/l with oxygen > 5%
Oxidising properties	Not an oxidising agent

2 GENERAL INFORMATION ON EXPOSURE

Table 2.1 summarises the amount of bisphenol-A used within different applications according to the published risk assessment (EC, 2003). This was based upon submissions made by the bisphenol-A manufacturers and end users to CEFIC.

Table 2.1 Bisphenol-A use pattern data

Use pattern data	Tonnes/year	Percentage of EU consumption
Polycarbonate production	486,880	71.1
Epoxy resin production	171,095	25.0
Phenoplast cast resin processing	8,800	1.3
Unsaturated polyester resin production	3,000	0.4
Can coating manufacture	2,460	0.4
Use PVC production and processing	2,250	0.3
Alkyloxylated bisphenol-A manufacture	2,020	0.3
Thermal paper manufacture	1,400	0.2
Polyols/Polyurethane manufacture	950	0.1
Modified polyamide production	150	<0.1
Tyre manufacture	110	<0.1
Brake fluid	45	<0.1
Minor uses	5,990	0.9
EU Consumption	685,000	

Figures in the table are approximate and based upon industry submissions for the years 1996-1999.
Minor uses include sales to chemical merchants and minor sales. The uses of these minor sales are not expected to be different from those mentioned above

2.1 NEW INFORMATION

2.1.1 Tetrabromobisphenol-A

The published risk assessment included consideration of the use of bisphenol-A in the production of tetrabromobisphenol-A (TBBPA). Production of TBBPA no longer takes place in the EU and so this use of bisphenol-A is not included in this addendum. The possible formation of bisphenol-A from the breakdown of TBBPA under certain circumstances is discussed in detail in the risk assessment of that substance (ECB, 2007). The main routes by which this could lead to bisphenol-A in the environment are through degradation in anaerobic sediments and through the application of anaerobically digested sludge to soil. Information on these processes has been used in Sections 3.1.4.6.2 and 3.1.4.7 to estimate possible concentrations of bisphenol-A in sediments and soil.

2.1.2 PVC

Further more specific information has been provided on the use of bisphenol-A in PVC-related areas; this is presented in Sections 3.1.2.1, 3.1.2.3 and 3.1.2.4.

2.1.3 Thermal paper

Industry has collected additional information on thermal paper recycling and performed monitoring studies at relevant sites. This information is included in Section 3.1.2.5.

2.1.4 Revised EU consumption figures

Industry has provided new production and consumption figures for bisphenol-A for 2005/2006. These are included in Table 2.2. These new values have been taken into account in the estimation of emissions in Section 3.1.2.

Table 2.2 Revised production and use tonnages for Western Europe (2005/2006)

Application	Tonnes/year	% change from published report	Information source
BPA production	1,150,000	+64	PlasticsEurope (1)
BPA uses			
Polycarbonate	865,000	+78	PlasticsEurope (1)
Epoxy resins	191,520	+12	PlasticsEurope (2)
– can coatings	2,755	+12	PlasticsEurope (2)
– ethoxylated BPA	2,260	+12	PlasticsEurope (2)
Phenoplast cast resin processing	8,800		
Unsaturated polyesters	3,600		Cefic (1)
Thermal paper	1,890	+35	ETPA
PVC – polymerisation	0		ECVM
- stabiliser packages	450	-10	ECVM, Cefic (2), (3), EuPC
- phthalate plasticisers	900	-10	ECVM, Cefic (2), (3), EuPC
- direct stabilisation	450	-10	ECVM, Cefic (2), (3), EuPC
Others	7,245		
Net exports	65,000		PlasticsEurope (1)
Total consumption	1,149,870	+68	

Figures for BPA production and polycarbonate use are estimated volumes
Figures for other use categories are calculated from estimated percentage increase/decrease since 2003 figures as provided by relevant industry group.
Information sources:

PlasticsEurope (1)	Polycarbonate / Bisphenol A Group
PlasticsEurope (2)	Epoxy Resins Committee
Cefic (1)	Unsaturated Polyester Resin Committee
Cefic (2)	ESPA European Stabiliser Producers Association
Cefic (3)	European Council for Plasticisers and Intermediates
ETPA	European Thermal Paper Association
ECVM	European Council of Vinyl Manufacturers
EuPC	European Plastics Converters

2.1.5 Other information

Sidhu *et al.* (2005) measured a wide range of substances in diesel particle extracts and in a sample collected from an uncontrolled domestic waste burn in a steel drum. Bisphenol-A was not reported as detected in the diesel particulate extracts, but was found in the sample from waste burning. The estimated emission rate was 9.66 mg bisphenol-A per kg waste burned. The authors used estimates of waste burned in this way in the United States to estimate an emission of 79 tonnes per year from this source in the US. This is of the same order as the industry emissions reported to the Toxic Release Inventory. There is no equivalent information to allow a similar calculation to be made for the EU, but releases as reported by industry make up only a small fraction of the total estimated emissions and so this source seems unlikely to have a significant impact (if any) on the estimated concentrations. This possible source is not considered further in this assessment.

3 ENVIRONMENT

3.1 ENVIRONMENTAL EXPOSURE

3.1.1 Environmental releases – published information

The emission estimates included in the published risk assessment report were based as far as possible on information specific to the production and use of bisphenol-A. Where this was not possible, default emission factors were used, in combination with information on the likely amounts to be used. The regional and continental emissions estimated in the published risk assessment report are summarised in Table 3.1.

Table 3.1 Summary of regional and continental releases from published risk assessment

Process	Air (kg/year)		Emission to wastewater treatment plants (kg/year)		Emission to receiving waters (kg/year)	
	Regional	Continental	Regional	Continental	Regional	Continental
Bisphenol-A production a)	575	410			277	215
Polycarbonate bottle washing b)			0.10	1.0	0.05	0.4
Epoxy resin production a)					216	187
Phenoplast cast resin processing b)			4.2	38	1.8	16
Thermal paper production a)					36	70
Thermal paper recycling c)			35,000	315,000		
PVC – Inhibitor during production process b)			5,810	52,290	2,490	22,410
PVC – Anti-oxidant during processing b)			75	674	32	289
PVC – Preparation of additive packages b)			74	668	32	286
PVC –Use of additive package b)			75	674	32	289
PVC – Anti-oxidant in plasticiser production			81	31		
PVC – Plasticiser use b)			10	88	4	38
Losses from PVC articles in use a)	1,560	14,040			2,250	20,450
Total	2,135	14,450	41,129	369,464	5,371	44,250
Total in kg/day (averaged over 365 days)	5.8	39.6	112.7	1,012.2	14.7	121.2

a) Releases to receiving waters calculated in the text (taking into account any WWTP)
b) Releases to wastewater calculated in the text; these are split 70:30 between WWTP and receiving waters in the table
c) ESD indicates all emissions go to WWTP

In addition to the releases in the table, there are also releases to soil of 2,250 kg/year in the regional environment, and 20,450 kg/year in the continental environment.

3.1.2 Revised emission estimates

The information presented in this section in some cases goes beyond the estimation of emissions and considers exposure situations. The revised PEC values are however presented later in Section 3.1.4.

3.1.2.1 Production of bisphenol-A

Updated information on emissions from production sites has been provided by industry for 2006 (personal communication from PlasticsEurope, 2007). This information is included in Table 3.2.

Table 3.2 Summary of environmental releases from bisphenol-A production sites

Site	Air		Effluent (After wastewater treatment)		Receiving water type and flow rate
	Measured levels	Release	Measured levels	Release	
BPA1	<0.2 mg/Nm^3 (outlet) <0.5 µg/Nm^3 (50 m from site)	<0.012 kg/day <4.4 kg/year	5.6 µg/l	0.06 kg/day 21 kg/year	Estuary 8.64 x 10^6 m^3/day
BPA2	2.9 mg/Nm^3 (outlet discontinuous) 0.1 µg/Nm^3 (outlet)	0.00017 kg/day 0.0605 kg/year	3.13 µg/l	0.07 kg/day 27 kg/year	River 2.068 x 10^8 m^3/day
BPA3	<1 mg/Nm^3 (dust)	<1 kg/day (dust) <365 kg/year (dust)	~0.005 mg/l	0.31 kg/day 113 kg/year	Estuary 8.08 x 10^7 m^3/day
BPA4		0.03 kg/day 9 kg/year		0.096 kg/day 35 kg/year	Estuary 2.49 x 10^7 m^3/day
BPA5		1.58 kg/day (dust) 575 kg/year (dust)	Up to 45 µg/l (average 3.5 µg/l)	0.019 kg/day *6.8* kg/year	Estuary 6.1 x 10^8 m^3/day
BPA 6	10 mg/Nm^3 (dust)	0.08 kg/day (dust) 31.2 kg/year (dust)	Average 10 µg/l	0.072 kg/day 25.8 kg/year	Sea (dilution factor 100)

Values changed from the published risk assessment are underlined. The unit of Nm^3 refers to air at standard temperature and pressure (the measurements may have been made originally with hotter air and so are corrected).

3.1.2.2 Use as an inhibitor in PVC production

The published risk assessment includes the use of bisphenol-A as an inhibitor in PVC production (i.e. the polymerisation of vinyl chloride). This use ceased voluntarily in the EU in 2003 (Defra, 2003), so there are no longer any emissions from this application and it is not considered further.

3.1.2.3 PVC additive formulation

3.1.2.3.1 New information

The PVC additive industry (represented by the European Stabiliser Producers Association, ESPA) has carried out two sampling exercises at sites producing PVC additive packages containing bisphenol-A. In addition, information on other sites has been collected relating to cleaning operations, water handling and treatment, water flows, tonnage used, etc.

A total of 13 sites are involved in the production of these packages in the EU. Measurements have been conducted at seven of these, accounting for 82% of the tonnage used in this area. (The tonnage in this area is now estimated at ~1,400 tonnes, which is an increase from the value used in the original risk assessment.) For the remaining sites, some information on the site is available for all but one, and the tonnage used in 2000 is available for all sites.

3.1.2.3.2 Calculation of emission factors

The sampling exercises were timed to coincide with periods of activity at the sites, in particular in relation to cleaning activities where these were relevant. As a result they can be considered to be representative of conditions when the sites are operating normally. The results of the measurements have been used to estimate the amounts of bisphenol-A released, and hence to derive emission factors. The arrangements on the sites have led to three factors being derived:

- emissions from all sources to an off-site treatment plant;
- emissions from all sources after on-site treatment (so release to surface water); and
- release in rainwater run-off.

The factors and the types of release from which they were derived are in Table 3.3.

Table 3.3 Emission factors derived from the data

Site	Emission factor for water type (kg/tonne)				Notes on combined emissions	External MWWTP
	wash	Rain	process	combined		
1				5.93×10^{-3}	Flow + process + some rain, after internal treatment	n
2					No data	y
3				7.2×10^{-3}	Flow + process after internal treatment	y
4		4.4×10^{-5}		0.037	Process + wash after internal treatment	y
5				4.6×10^{-3}	Cooling + rain + surface after internal treatment	n
6					No data	
7					No data	y
8				0.19	Process + wash + rain after internal treatment	y
9					No data	n

Table 3.3 continued overleaf

Table 3.3 continued Emission factors derived from the data

Site	Emission factor for water type (kg/tonne)				Notes on combined emissions	External MWWTP
	wash	Rain	process	combined		
10				$2.8x10^{-5}$	Process + rain + sewer after internal treatment	n
11		$7x10^{-5}$				n
12					No data	
13					No data	y

Underlined values are the selected emission factors for further calculations.

MWWTP – municipal wastewater treatment plant

3.1.2.4 Anti-oxidant in plasticizer production

Site-specific data for one site were included in the published risk assessment. These were used to estimate the total emissions from this use in the EU. The calculation of the PEC then used the default size for the wastewater treatment plant and the default dilution, resulting in a C_{local} of 1.9 µg/l. It has been pointed out by Industry that a site-specific PEC could be estimated as the size of wastewater treatment plant and river flow for the site were also provided (and in fact included in the original assessment). This calculation has therefore been revised. For the site providing information the actual flows and dilution have been used to estimate the PEC. This site is located on an estuary, and so the concentration relates to marine waters. Further information on the nature of the site, the way in which bisphenol-A is handled and where emissions can arise has also been provided for this site. This indicates that the emission factor used to estimate releases from this site - $1x10^{-4}$ kg/kg - should be applicable to other sites.

Information on the other four sites that use bisphenol-A in this way has also been provided, in the form of the annual quantities used. This has been used to create a generic site to represent the remaining tonnage. The emission factor above has been used to estimate releases from this site, and the TGD default treatment plant and river flows used to estimate the PEC for this generic site. This is used for the freshwater assessment. None of these four sites discharges to marine waters.

3.1.2.5 Thermal paper recycling

The published assessment included a number of assumptions related to recycling, based largely on information provided by the European Thermal Paper Association (ETPA). In reaction to risk management activity, ETPA commissioned a number of additional studies to test these assumptions. In particular, measurements were carried out at three sites that use recovered thermal paper. These include two sites receiving waste from the thermal paper production process (known as 'broke'), and a site receiving a general mixed recovered waste paper stream. These sites include examples with and without a de-inking step in the treatment of the recovered paper.

At the same time, better information has been provided on the specific applications for which thermal paper is now used, and also on the likelihood that paper used in these areas will be found in recovered paper streams.

This new information has been used to revise the calculations of PECs for this life cycle step, and hence the risk characterisation.

3.1.2.5.1 Use pattern

The uses of thermal paper have been changing in recent years. Use for industrial fax paper was once a major application, but this is declining. The European Thermal Paper Association (ETPA) has provided more detailed information on the current use pattern of thermal paper (ETPA, personal communication). The major use area is now for point-of-sale (POS) receipts (e.g. supermarket till receipts), followed by self-adhesive labels. Two smaller uses are in lottery tickets and fax paper. The degree to which each of these types of paper is recycled has also been estimated by ETPA (in consultation with the Institute for Paper Science and Technology, Technical University of Darmstadt) and the results are presented in Table 3.4.

Table 3.4 Use and recycling pattern for thermal paper (ETPA, personal communication)

Use area	Use percentage	Fraction recycled	Percentage of total recycled
Point-of-sale receipts	50	0.3	15
Self-adhesive labels	30	0.1	3
Lottery	10	0.2	2
Fax	10	1	10

The overall estimate is that around 30% of used thermal paper will enter recycling streams.

The different types of paper are also likely to find their way into different waste paper streams. Based on discussions with ETPA and the Institute for Paper Science and Technology, used fax papers and lottery papers are considered likely to be used in making graphic papers, for which a de-inking step is necessary. In contrast, labels and POS receipts are more likely to enter the mixed waste paper stream, which is used for production of packaging, etc., and where a de-inking step will not be used. Hence both of these types of recycling process need to be considered in the assessment of bisphenol-A.

3.1.2.5.2 Amounts of bisphenol-A used in thermal paper

The amount of bisphenol-A used in thermal paper in the EU is 1,890 tonnes (figure for 2005/6). This is used to make 2.4×10^9 m^2 of thermal paper, an area which is estimated to be equivalent to ~168,000 tonnes of paper. Up to 10% of the paper from the production process is waste (due to trimmings, etc.). This waste material is called ‘broke’. It is sent directly to a small number of recycling plants and so never enters actual commercial use. In other words, 190 tonnes of bisphenol-A will be sent for recycling by the thermal paper production sites each year.

The amount of bisphenol-A actually used in thermal paper in the EU is therefore 1,700 tonnes. Around 30% of this paper is estimated to enter recycling streams (see Section 3.1.2.5.1), which is equivalent to 510 tonnes of bisphenol-A. So, in total, around 700 tonnes of bisphenol-A will find its way to paper recycling sites each year.

3.1.2.5.3 Size of paper recycling sites

As already noted in the original risk assessment, a survey indicated that there were 69 paper recycling sites in Germany in 2000. The original risk assessment divided the amount of thermal paper recycled in the EU over ten sites, which would over-estimate the amount recycled on one site. It is now known that there are around 1,000 paper production sites in the EU, of which around half use recovered paper as a source material (RPA, 2003). The total amount of paper recovered in the EU (all types) is around 42 million tonnes/year (CEPI, 2001). On this basis, an average site would use around 84,000 tonnes of recovered paper[5]. This figure will be used in the generic calculations. The use of an average size of site in this instance is appropriate, as the input of bisphenol-A to a site will in general be proportional to the size of the site (in these calculations it will be based on a representative concentration in the recovered paper used). In addition, the water use at a paper recycling site is (in general) related to the amount of paper used or produced, and so it is appropriate to use an average level of water use (and hence waste water treatment plant or WWTP) with an average size of site. ETPA considered that a WWTP size of 4,000 m^3/day was appropriate for this industry. From a study of the UK paper industry (Environment Agency, 2002), typical water consumption rates are in the range 8-16 m^3/tonne of paper produced. The average value, 12 m^3/tonne, has been used in these calculations; this corresponds to a WWTP with a capacity of 2,880 m^3/day for the average site.

There is one area where the available information does not allow a straightforward selection of a representative value to fit the site. This concerns sludge production from the processing of the recovered paper (this does not relate to sludge production in the WWTP). This can vary significantly between plants, and appears to depend much more on the type of paper produced than on the amount of water used. Examples from paper mills in the UK have sludge production rates ranging from 21 kg/tonne to 6.1 tonnes/tonne of paper, although a number are in the range 200-400 kg/tonne (Environment Agency, 2002).

Bisphenol-A measurements have been made at a specific site that takes general waste paper (see Section 3.1.2.5.4). This site has an average sludge production rate of 22.9 kg/tonne paper produced. This is a low figure, related to the lack of a de-inking step in the process, and is consistent with other estimates of losses of 2% of the waste paper used at this stage. This value will be used for the calculations without de-inking. The same value and a value of 200 kg/tonne will be used for calculations with de-inking.

3.1.2.5.4 Information from specific sites

Monitoring studies have been performed at three specific sites (TNO, 2003 & 2004). The information provided consists of:

- flow charts describing the operations carried out,
- quantities handled,
- water flows within the plant, and
- measurements on the levels of bisphenol-A in water within the plant and in the effluent from the final biological treatment.

[5] For comparison, the largest paper recycling site in the UK uses ~400,000 tonnes and the larger of the two thermal paper broke recycling site that provided data uses ~115,000 tonnes.

Details are not included in this report, but the main points relevant for the assessment are presented. An important point common to all of the investigations is that they were carried out at times when the plants were operating under normal conditions.

Sites with de-inking

Two sites were selected as they each receive a high input of bisphenol-A in the form of thermal paper broke from different thermal paper manufacturers. One site is in Germany, the other in Austria. The handling of the thermal paper broke takes place on a batch basis, and the measurements were conducted during the handling of batches of this waste. They can therefore be considered to represent a worst case for each site. The study is reported in TNO (2003).

De-inking rate

De-inking takes place as part of the process to reduce the recovered paper down to fibres. Measurements were carried out on the concentration of bisphenol-A in the waste paper fed to the process and on the fibre produced. These showed a removal efficiency for the process of 95%. (The default value used in the original assessment was 100%.)

Primary treatment

The water from the de-inking process is treated before it is passed to the biological treatment plant. Here the concentrations of bisphenol-A in the water from the de-inking process were compared to the concentration following the primary treatment. This showed a removal of 95.9% from water. (The default value used in the original assessment was 50%.) The bisphenol-A removed is included in the sludge produced from this process (no specific measurements were made on this sludge at these sites).

Biological treatment

The removal rate in the WWTP was estimated by measuring the concentration of bisphenol-A in the influent and in the effluent. The measurements were carried out over a period of time so that any variation in the levels would be observed. The timing of the sampling was arranged so that it covered the expected residence time in the treatment plant where batch paper processes were used. Sampling at regular intervals was employed where the production was continuous. Some variation in the results was seen; as a result the removal rates were calculated from the lowest influent concentrations and the highest effluent[6] concentrations for each site (corrected for recovery). The results indicate a removal level of 99.99% in the WWTP for the two sites.

The results of measurements on mixed samples of effluent (taken over four-hour periods) at both sites showed similar average concentrations of around 20 ng/l. Higher levels were found in a small number of individual spot samples, with maximum concentrations of 170 and 159 ng/l. These higher levels were thought to be due to a release of bisphenol-A when pulping of a batch was completed. These reported levels were not corrected for recovery; this was >95% for the influent samples, but only 33-35% for the effluent samples. Correcting the values for the lower recovery, the maximum effluent concentrations are in fact 500 ng/l and 467 mg/l.

[6] Earlier data reported for these sites in May 2003 were based on a lack of detection in the effluent at a limit of 2 µg/l; further measurements were made with an improved detection limit of 10 ng/l which allowed the actual concentrations in the effluent to be determined.

The process sludges from both sites are incinerated. This is described as standard practice for the countries where the sites are located.

Sites with no de-inking

A site in Germany that uses a representative mixed waste paper stream was chosen for further measurements. It was identified as a representative site by the Institute for Paper Science and Technology, Technical University of Darmstadt. The site produces corrugated packaging materials and does not operate a de-inking process. It operates continuously, and the mixed waste paper stream is checked for consistency. The site also has suitable access to monitoring points, and various internal parameters are routinely monitored. The study is reported in TNO (2004).

Input

The average concentration of bisphenol-A in the waste paper input to the plant was 14.7 mg/kg over the period of the study. This is the equivalent of a level of thermal paper in the waste of 0.1%, and gives a daily input of 15 kg of bisphenol-A. The concentration of bisphenol-A in the waste paper fits the expected level based on the estimate of the amount recycled in Section 3.1.2.5.2 (432 tonnes bisphenol-A in 42,000,000 tonnes of paper is ~10 mg/kg.)

Pulping

This is the equivalent step to de-inking above, where the recovered paper is reduced to fibres. The concentration of bisphenol-A was measured in the input materials (as indicated above) and in the final paper; the difference indicates that only 10% of the bisphenol-A in the waste paper feed was removed at this stage. This shows that without a de-inking step most of the bisphenol-A is retained in the recovered paper products.

Primary treatment

A comparison of the concentrations in water before and after the flotation treatment used as a primary treatment indicates a removal rate from water of 50%. Measurements were also carried out on the sludge produced by this treatment. The concentrations measured in sludge, together with the quantity of sludge produced, indicated that 18% of the input amount was present in the sludge. This leaves 32% of the input amount not accounted for. It is not clear what happens to this. The measurements in water are considered to be reliable, and so a removal rate from water of 50% is assumed for this process. The rest of the substance is assumed to be removed with the solid material for the purposes of this assessment. This leads to a higher concentration in sludge than was actually measured. For comparison, the measured level in the sludge will also be considered in the calculations.

The amount of sludge produced at this stage is 22.68 tonnes per day, which from the pulp production rate is a rate of 22.9 kg/tonne. This is towards the low end of values found for UK mills (Environment Agency, 2002), and reflects the lower sludge production rate for sites with no de-inking.

Biological treatment

The concentrations of bisphenol-A in the influent and effluent of the WWTP were measured. The average values were 193 µg/l and 42.7 ng/l respectively, indicating a removal of 99.98%. Measurements on the sludge produced in the WWTP indicate that this contained 0.98% of the

bisphenol-A entering the WWTP. The fate of bisphenol-A in the WWTP is therefore 0.02% to water, 0.98% to sludge with 99% degraded.

All sludges and rejects from the processes are incinerated at the site. This is described as standard practice in Germany.

Summary of the use of data from the three specific sites

Both monitoring studies appear to be well conducted, and the sampling strategy takes account of site operating conditions. The sites are considered to represent the range of situations in which thermal paper may undergo recycling. At one end of the scale there are two sites that receive high loadings of thermal paper (through the inclusion of thermal paper broke in the recovered paper feedstock). At the other end is a site accepting mixed general 'near household' waste paper containing a low level of thermal paper. Therefore the information from these sites will be used to calculate possible PECs for generic paper recycling sites. These calculations will consider sites taking general waste paper, with or without a de-inking step. The number of sites taking thermal paper broke is limited, and the data for the two sites are considered to be representative for this specific scenario (the results of the surveys are consistent despite the different characteristics of the two sites). However, a calculation based on the high level of bisphenol-A input at these sites is also included for information.

Bisphenol-A input to sites

The concentration of bisphenol-A measured in the recovered paper input to the site producing corrugated packaging (14.7 mg/kg – see above) is assumed to be typical for general paper waste streams. A concentration of 15 mg/kg is therefore used in the following calculations (this represents a bisphenol-A level of around 0.001%). Considering that broke will contain higher levels, a higher figure will also be used for those sites that use broke as part of their recovered paper feed. The maximum input calculated for the two sites receiving thermal paper broke was 0.074% of bisphenol-A in the paper feed.[7]

Removal of bisphenol-A from recovered paper

A removal rate of 95% is assumed for a site with de-inking; a rate of 10% is used for a site with no de-inking.

Fate during primary treatment

For a site with no de-inking, removal of 50% from water will be assumed (Section 5.2). A sludge production rate of 22.9 kg/tonne is assumed for this stage (based on data from the site without deinking described above).

For a de-inking plant, removal of 95.9% from water at this step is assumed. As there are no specific data on paper sludge production at de-inking sites, a figure of 22.9 kg/tonne will also be assumed for calculation purposes. However, a higher value of 200 kg/tonne will also be used for comparison based on UK information from paper mills in general (Environment Agency, 2002).

[7] Around 1,600 tonnes of bisphenol-A was used to make ~140,000 tonnes of thermal paper in 2001, giving a bisphenol-A content of 1.1% by weight. The average bisphenol-A content measured in thermal paper at the two 'broke' recycling sites is 0.7% and 0.88%, which are a similar order of magnitude.

Fate during biological treatment

The values obtained from the WWTP at the corrugated packaging production site (0.02% to water, 0.98% to sludge, from above) will be used for both processing types. This is assumed to represent a worst case, since the data were obtained with a low rate of substance input, and so WWTP microbial populations are less likely to have become adapted. For comparison, SimpleTreat calculations in the original risk assessment predict an overall emission to water of 12% from this step.

Use of sludges

In all three example sites, the sludges from the paper processing steps are incinerated (as are the biological sludges at some sites). This is described as standard practice for the relevant countries (Germany and Austria). It is, however, known that these sludges are applied to land (where they function as a soil improver) in other parts of the EU. Therefore, this route has been considered in the calculations for generic sites. Calculations have been carried out for the application of the paper and biological sludges individually and as a mixture in the proportions in which they are produced.

3.1.2.6 Effect of updated tonnages on local emission estimates

The changes to the tonnages for the various use areas are not considered likely to have a significant impact on the estimates of local emissions, as explained below. The effects on regional and continental emissions are considered later in the addendum.

Bisphenol-A production and polycarbonate production take place together, i.e. there are no polycarbonate production sites at which bisphenol-A is not produced. The emission estimates in the published risk assessment are based on site-specific data. Information from industry is that the emission control measures in place at the sites have been improved such that the emissions are now lower than those reported for the published risk assessment. Some new information is presented in Section 3.1.4.1.

The local emission estimates for epoxy resin use were based on specific information; the relatively small increase in the level of use is considered unlikely to mean significant changes in these values. For can coating and ethoxylated resins, the published risk assessment concludes no emissions to water and so there are no changes.

There is no change to the tonnage used in phenoplast resins. Use in unsaturated polyesters is a dry process according to the published risk assessment and so there are no emissions to change.

The increased tonnage used in thermal paper could mean an increase in the amounts released from paper production sites. There is no specific information on this at the moment. The sites included in the published risk assessment cover a range of sizes (using from 3 to 343 tonnes per year), and these still appear to be realistic within the increased tonnage. Therefore it seems reasonable to continue to use these as representative of this use pattern. For thermal paper recycling, the local estimates are based on a representative paper site using recovered material. The input to the site was based on measured levels in feed. There is no need to change these.

The local estimates for PVC were based on a typical size of site, and this will not change as a result of the reduction in the overall tonnage used in this area, hence the same estimates are retained.

3.1.2.7 Revised regional and continental emissions

3.1.2.7.1 Changes due to revised emission estimates and tonnage

Bisphenol-A production

The new information on releases from production sites, which include polycarbonate production as well, has been used to revise the emissions for this part of the life cycle.

Thermal paper recycling

The regional emissions from thermal paper recycling have been recalculated according to the new information presented above. Recovered thermal paper from fax and lottery use is assumed to be de-inked, whereas recovered POS receipts and labels are assumed not to pass through a de-inking step. Thermal paper broke is assumed to be de-inked. The emission factors described above in Section 3.1.2.5.4 have been used to estimate the annual amounts of bisphenol-A released to surface water, to biological sludges and to paper sludges, as in Table 3.5.[8]

Table 3.5 Calculated emissions of bisphenol-A from thermal paper recycling

	De-inking route	Non-de-inking route	Thermal paper broke
Amount	204 tonnes	306 tonnes	160 tonnes
To paper sludge	187 tonnes	15.3 tonnes	-
To biological sludge	78 kg	150 kg	-
To surface water	1.9 kg	3.5 kg	1.6 kg

Sludges from sites processing thermal paper broke assumed to be incinerated

The total amount to sludge (combined) is therefore 202.5 tonnes per year, and the emissions to surface water are 7 kg/year. The emission scenario document for paper (Environment Agency, 2002) suggests that 80% of sludge from paper recycling may be applied to land, hence the emission of bisphenol-A to land from this route is 162 tonnes. Both the surface water and soil emissions are assumed to be distributed as 10% to the region and 90% to the continental scale.

PVC additive formulation

The total releases from this use have been recalculated from those in the published assessment, using the revised information included in Section 3.1.2.3.[9] The total EU emissions to wastewater treatment are estimated as 81 kg/year, and the releases to surface water as 3.45 kg/year. The regional emissions are taken as those of the largest individual source from the published risk assessment; these are 2.76 kg/year for surface water emissions and 37.1 kg/year for emissions to wastewater treatment. The remainder of the totals is allocated to the continental emissions.

[8] Note that the recalculation presented in the risk assessment update of 2005 has been further modified here to take account of the increased quantity used in thermal paper.

[9] The figures presented in the risk assessment update of 2003 have been modified for this addendum to take account of the reduced use of bisphenol-A in PVC.

3.1.2.7.2 Changes due to revised tonnages only

For the other use areas not included in Section 3.1.2.7.1 the basis for the emission estimates has not changed since the published risk assessment. The regional and continental emissions from that assessment have been adjusted to take account of the changes in quantities produced and used, as follows. Only those areas that gave rise to emissions are considered here.

For polycarbonate bottle washing, it has been assumed that the amount of bottles has increased in line with the increased amount of polycarbonate used, and so the emissions have been increased by 78% from those in the published assessment.

The amount of bisphenol-A used in epoxy resins has increased by 12%, so the regional and continental emissions have been increased by the same factor.

There has been no change to the phenoplast resin use so the emissions remain as in the published assessment.

All PVC-related uses are assumed to have had the same reduction of 10% in quantity, and so the emissions from the published assessment have been reduced by 10% (with the exception of additive packages as described in Section 3.1.2.7.1). No adjustment has been made to the releases from PVC in use during its service lifetime. A lifetime of 30 years was assumed in the published assessment, and so it is assumed that any reduction has not had time to have a significant impact on the emissions from this life cycle step.

3.1.2.7.3 Summary of revised emission estimates

The revised estimates of emissions to the regional and continental scales are presented in Table 3.6. Note that the published risk assessment used a split of 70:30 between releases to waste water treatment and to surface water, as specified in the TGD at the time the assessment was being developed. This has been changed in the current addendum to 80:20 in line with the revised TGD. Also note that for some uses the emissions are estimated after any wastewater treatment and so are presented as emissions to surface water.

Table 3.6 Revised regional and continental emissions

Process	Air (kg/year)		Emission to wastewater treatment plants (kg/year)		Emission to receiving waters (kg/year)	
	Regional	Continental	Regional	Continental	Regional	Continental
Bisphenol-A production	575	409			113	115.6
Polycarbonate bottle washing			0.23	2.05	0.05	0.52
Epoxy resin production					242	209
Phenoplast cast resin processing			4.8	43	1.2	11
Thermal paper production					49	95
Thermal paper recycling					0.68	6.25
PVC – Anti-oxidant during processing			77	693	19	174
PVC – Preparation of additive packages			37	44	2.76	0.79
PVC –Use of additive package			77	693	19	174
PVC – Anti-oxidant in plasticiser production[a]			73	28		
PVC – Plasticiser use			10	91	2.7	23
Losses from PVC articles in use	1,560	14,040			2,250	20,450
Total	2,135	14,449	279	1,594	2,699	21,260
Total in kg/day (Averaged over 365 days)	5.8	39.6	0.76	4.4	7.4	58.2

a - all emissions via WWTP.

In addition there are emissions to agricultural soil from the application of paper sludge: 16.2 tonnes/year (44 kg/day) to the region and 145.8 tonnes per year (400 kg/day) to the continent.

3.1.3 Environmental fate

3.1.3.1 Abiotic degradation

No new information is available. A short atmospheric half-life of 0.2 days is calculated for the reaction of bisphenol-A with hydroxyl radicals (EC, 2003). The physical and chemical properties of bisphenol-A suggest that hydrolysis and photolysis are likely to be negligible.

3.1.3.2 Biodegradation

Results from a number of biodegradation studies were summarised in EC (2003):

- In the OECD 301F manometric respirometry test bisphenol-A meets the criteria for ready biodegradability.
- However in the OECD 301D closed bottle test and OECD 301B modified Sturm test no biodegradation was observed.
- In a modified SCAS procedure bisphenol-A met the criteria for inherently biodegradable substances, although this test can not give any indication of the potential for bisphenol-A to undergo ready biodegradation.

Measured levels of bisphenol-A before and after wastewater treatment at chemical plant and major users of bisphenol-A suggest a high level of removal. It is not possible to say if this is via adsorption to sludge or biodegradation, although based upon its chemical properties biodegradation is likely to be the major removal mechanism.

From the biodegradation studies reported bisphenol-A would appear to be readily biodegradable, possibly with a short period of adaptation. The default rate constant for biodegradation in wastewater treatment plant is $k=1\ h^{-1}$ for a readily biodegradable substance meeting the 10-day window. This value will be used in the assessment. The resulting fate in a wastewater treatment plant as estimated by EUSES is 12% to water and 6.2% to sludge, with 81.9% degraded and a negligible fraction to air.

A number of studies on the degradation of bisphenol-A in natural waters were also summarised (EC, 2003). Removal appears to be rapid once the waters have become acclimatised to bisphenol-A. The reported lag-phases before degradation are between 3-8 days. After the lag phase removal was rapid with 50% removal in 1-2 days and 100% removal in 2 to 17 days. These data would appear to indicate that in natural waters bisphenol-A may be classed as readily biodegradable meeting the 10-day test window. The default rate constant for biodegradation of $4.7 \cdot 10^{-2}\ d^{-1}$ probably under-estimates the removal rate, as it corresponds to a half life of 15 days with 97% removal taking 75 days. However this value has been used in the risk assessment as a conservative approach.

No information was available on the degradation rate of bisphenol-A in soil. Therefore, the degradation rate was estimated from the degradation rate of bisphenol-A in surface water and the soil-water partition coefficient. The half-life for biodegradation of bisphenol-A in soil and the first order rate constant for degradation in soil were calculated by EUSES as 30 days and $0.0231\ d^{-1}$, respectively, based upon bisphenol-A being readily biodegradable in surface waters.

3.1.3.2.1 New information

Aquatic

A further ready biodegradability study is available. CERI (2004) performed a manometric respirometry test (OECD 301F) on bisphenol-A. The average percent removal by BOD was 89%, and no parent compound could be detected by HPLC after 28 days. The 10-day window was met in this test.

A CAS (continuous activated sludge) simulation test has been carried out according to the OECD 303A guideline (TNO, 2001). The guideline was adapted to use a completely closed flow

through system, and radiolabelled substance was used in order to test environmentally relevant concentrations and determine a mass balance. The activated sludge system was acclimated to unlabelled bisphenol-A for four weeks, followed by a three week period when ^{14}C-labelled substance was fed into the system. Bisphenol-A was determined in the influent, effluent, waste sludge and in CO_2 traps. Recovery of the dosed radioactivity was 94-99%. Average removal of ^{14}C-bisphenol-A was 99.1%.

Nakada *et al.* (2006) measured the concentration of bisphenol-A (among a range of substances) in 24-hour composite samples of the influent and effluent from five municipal sewage treatment plants in Tokyo. All five plants used primary and secondary treatment with activated sludge. Bisphenol-A levels in the influent were between 100 and 1000 ng/l; removal of bisphenol-A was >92% on average.

Kang and Kondo (2002) investigated the effect of temperature on the biodegradation of bisphenol-A in river water. Samples of water from fifteen rivers in Japan were spiked with 0.2 mg/l bisphenol-A. At 30°C and 20°C degradation was complete after 10-15 days (half lives from two to seven days depending on the bacterial numbers in the wares samples at the start of the exposures). At 4°C, degradation was slower and had reached 20% after 20 days. Autoclaved water samples showed no removal, demonstrating that the major removal process is biological. The same authors (2002a) isolated specific bacterial strains with a high ability to degrade bisphenol-A. They also demonstrated a lack of degradation of bisphenol A under anaerobic conditions in river water.

Ike *et al.* (2000) studied the degradation of bisphenol-A in three activated sludge microcosms and forty four river water microcosms. The river water microcosms were prepared from water samples from seven rivers, at 15 sites, with conditions ranging from “clean” to “heavily polluted”. Degradation was noted in all of the sludge systems and in forty of the river water systems. Six of the river water systems were able to mineralise the substance completely, and 34 others showed TOC removal of 40-90%. Degradation tended to be greater in microcosms from more polluted waters. In the microcosms with partial removal, common metabolites accumulated, which appeared as two peaks in the HPLC traces. Bacteria isolated from the river water experiments were able to degrade bisphenol-A, and from further work with these the two main metabolites were identified as 2,3-bis(4-hydroxyphenyl)-1,2-propanediol and p-hydroxyphenacyl alcohol.

Suzuki *et al.* (2004a) investigated the biodegradation of bisphenol-A under laboratory conditions, using river water taken from a site on the Tama River in Japan which was influenced by effluent from a sewage treatment plant. After a two or three day lag period, bisphenol-A degraded rapidly, with estimated half lives of 0.4 and 1.1 days at 1 and 10 mg/l respectively. Optical density measurements on the water showed an increase in bacteria after two days of incubation. Metabolites were detected after three days, and correspond to those found in river water at the sampling site. The metabolite in the highest amount was 2,2-bis(4-hydroxyphenyl)propanoic acid (BPA-COOH), at 4.2% of the initial bisphenol-A concentration (1 mg/l). At 10 mg/l bisphenol-A, the metabolite in highest concentration was 2,2-bis(4-hydroxyphenyl)-1-propanol (BPA-OH), which reached a concentration of 679 µg/l after six days, and declined by 14 days. All of the detected metabolites appeared to decrease in concentration over longer exposures.

Kang and Kondo (2005) studied the degradation of bisphenol-A in river water and in seawater. In river water, half-lives of 4 days and 3 days were found at 25°C and 35°C respectively. In autoclaved seawater, no degradation of bisphenol-A was observed over 60 days, indicating no abiotic removal processes. In non-autoclaved seawater samples, no degradation was observed

over the first thirty days of exposure, despite an increase in the number of bacteria over the first three or four days (the numbers of bacteria then declined slowly). Bisphenol-A was degraded after thirty days, with the concentration reducing from 1 mg/l to ~200 µg/l after sixty days at 25-35°C. Some degradation was seen at 4°C, but starting only after 40 days. The concentration had reduced to ~700 µg/l by sixty days.

Ying and Kookana (2003) carried out degradation experiments on seawater and sediments from the coast around Adelaide, South Australia. Seawater samples were spiked with bisphenol-A at a concentration of 5 µg/l. The results showed little or no degradation over the first 35 days of the experiment, followed by rapid degradation over the following seven days. Bisphenol-A was almost completely degraded (>90%) after 56 days. Sediment and water samples (5 g and 5 ml respectively) were spiked with 1 µg/g bisphenol-A and kept under aerobic conditions for seventy days. The half-life of bisphenol-A under these conditions was 14.4 days. Similar sediment and water mixes kept under anaerobic conditions (monitored with resazurin as a redox indicator) showed no degradation of bisphenol-A over 70 days.

Ying *et al.* (2003) carried out biodegradation experiments on aquifer material from South Australia. Limestone sediment samples were taken from a depth of 153-154 m, and native groundwater samples were taken from the same aquifer. The aquifer materials were spiked with bisphenol-A and four other substances (nonylphenol, octylphenol, E2 and EE2), all at 1 µg/g, and incubated at 20°C for 70 days. Aerobic conditions were maintained throughout the experiment. Samples were taken weekly. Autoclaved aquifer materials were used as a control. There was no change in bisphenol-A concentration relative to the controls over the period (there was a slight reduction in concentration in both controls and the exposures).

The same authors carried out similar experiments on the same aquifer materials but under anaerobic conditions. The samples of aquifer material were placed in tubes that were placed in an anaerobic induction chamber under nitrogen for a month, until the redox indicator resazurin indicated that anaerobic conditions had been achieved. Samples were then spiked with the mixed substances. The exposures and sampling were carried out in the anaerobic induction chamber. There were no changes in the bisphenol-A concentration over the exposure period.

Hirooka *et al.* (2005) investigated the ability of green algae *Chlorella fusca* to degrade bisphenol-A. Algae were cultured with bisphenol-A at concentrations from 10 to 160 µM (2.3 to 36 mg/l) over seven days. Removal of bisphenol-A was >95% at concentrations up to 80 µM (18 mg/l), with 70% removal at 180 µM (36 mg/l). Algal growth was promoted over that in the controls at concentrations of 10-20 µM (2.3-4.6 mg/l). The amount of bisphenol-A in the algal cells was measured, and was significantly less than the amount lost from solution; after seven days it was below the limit of detection of the HPLC analysis used. Incubation in the dark resulted in only 27% removal of bisphenol-A. A metabolite, with an additional hydroxy group on one ring, was observed; this increased in concentration up to 72 hours and then decreased. A yeast two-hybrid assay used to assess estrogenic activity showed that this decreased in parallel with the reduction in bisphenol-A concentration.

A *Streptomyces* sp. strain isolated from river water in Japan was able to degrade bisphenol-A. A solution of 1 mg/l of bisphenol-A was degraded by >90% in 10 days at 30°C by a culture of the strain. A half-life of between three and four days was calculated (Kang *et al*, 2004). Zhang *et al.* (2007) isolated a strain of *Achromobacter xylosoxidans* from the compost leachate of municipal solid waste that was able to grow on bisphenol-A. Sasaki *et al.* (2007) isolated a strain (BP-7) of *Sphingomonas* from off-shore seawater samples in Japan which was able to degrade bisphenol-A completely over a period of 40 days alone, or over seven days when combined with a *Pseudomonas* strain.

Impact of new information

The new information supports the conclusion of the published risk assessment that bisphenol-A is readily biodegradable in natural fresh surface waters.

Terrestrial

Fent *et al.* (2003) studied the adsorption and degradation of bisphenol-A in soils from Germany: three soils from North-Rhine Westphalia and one from Rhineland Palatinate. The adsorption-desorption studies were carried out according to the OECD Guideline 106, the soil degradation studies according to a SETAC design.

For the degradation study, twelve test systems were set up for each soil type. Bisphenol-A (uniformly labelled with ^{14}C) was applied at 6 µg/100 g soil. Experiments were continued for 120 days. The test systems were analysed at intervals for the amount of extractable, non-extractable and volatile radioactivity (volatiles captured in soda lime trap for CO_2 and oil-wetted quartz wool for VOCs), as well as how much bisphenol-A remained in the system. Bisphenol-A rapidly formed bound residues in soil. After one hour, 19-59% of the applied radioactivity was non-extractable under normal conditions (methanol plus 5% acetic acid). After three days, 84.7 – 88.6% was not extractable. Following hot flux extraction, only a further 2.8% was removed, so that less than 7.4% was extractable using both techniques combined. At the end of the 120 days exposure, less than 2% of the applied radioactivity was extractable.

Depending on the soil, 13.1 – 19.3% of the label was recovered as CO_2 after the incubation period. No other volatile radioactive species were found. In one soil, after 1-2 hours, 49.2% of the bisphenol-A applied could be recovered, with 33% as other extractable species (up to five different metabolites). After three days the amount was less than the detection limit (1 µg/kg). No significant metabolites could be found after three days.

The authors comment that forming bound residues is common behaviour for phenols and anilines. Rapid transformation to transient metabolites suggests that most of the bound residues are in fact transformation products.

Ying and Kookana (2005) took samples of a sandy loam soil from a depth of 0-15 cm on a farm in South Australia. Bisphenol-A was added to 5 g of soil to give a concentration of 1 µg/g, and incubated at 20°C for 70 days. Degradation was rapid, with a half-life of seven days calculated from the results. Little or no degradation was seen in sterilised soil samples. When the soil was mixed with an equal amount of river water and allowed to attain anaerobic conditions before addition of the bisphenol-A, no degradation was seen.

Oshiman *et al.* (2007) isolated a bacterial strain, identified as belonging to the *Sphingomonas* genus, from soil from a vegetable-growing field in Japan. The strain was able to utilise bisphenol-A as the sole source of carbon and to use it as an energy source under aerobic conditions. The estrogenic activity of Bisphenol-A in the test medium was ultimately reduced by the strain, although the activity increased initially.

Impact of new information

The new information supports the conclusion of the published assessment that bisphenol-A is readily biodegradable in soil.

3.1.3.3 Distribution

Adsorption coefficients for environmental media were estimated using the TGD methods as implemented in EUSES (EC, 2003). The equation used to predict the K_{oc} value is that for hydrophobic chemicals in general as described in the TGD, using a log K_{ow} value of 3.40. The derived partition coefficients are as follows:

K_{oc}	715 l/kg	Organic carbon-water partition coefficient
Kp_{soil}	14.3 l/kg	Solids-water partition coefficient in soil
Kp_{sed}	35.8 l/kg	Solids-water partition coefficient in sediment
Kp_{susp}	71.5 l/kg	Solids-water partition coefficient in suspended matter
$K_{susp\text{-}water}$	18.8 m^3/m^3	Suspended matter-water partition coefficient
$K_{soil\text{-}water}$	21.7 m^3/m^3	Soil-water partition coefficient
$K_{sed\text{-}water}$	18.7 m^3/m^3	Sediment-water partition coefficient

These data suggest that bisphenol-A is likely to be moderately adsorbed to solids upon release to the environment.

Volatilisation is not considered to be a significant removal mechanism for bisphenol-A from water. Removal of bisphenol-A in rainwater is also considered to be negligible.

3.1.3.3.1 New information

Höllrigl-Rosta *et al.* (2003) measured the sorption of radiolabelled bisphenol-A to soil on standard batch equilibrium studies according to OECD Test Guideline 106. The soil was a loamy silt soil with an organic carbon content of 1%. A low water:soil ratio of 1.41:1 was used as resembling natural conditions. The substance was analysed in both phases. The K_{oc} value determined was 890±30 l/kg. Dialysis experiments using solutions of humic and fulvic acids as dissolved organic carbon were also carried out. The distribution coefficient K_{DOC} for humic acids was 860±70 l/kg, very similar to the K_{oc} value and considered to indicate that similar binding mechanisms were operating. No formation of adducts with fulvic acids was observed.

As part of a study on bisphenol-A in German soils (see Section 3.1.3.2.2), Fent *et al.* (2003) measured the adsorption of bisphenol-A in four soils using the OECD 106 Guideline. Degradation as well as binding was seen in the adsorption studies (rapid removal was seen in the degradation studies). In studies to measure the K_{oc} values a biocide was employed to reduce the degree of degradation in the experiments. The mean K_{oc} value obtained was 795.9 (mean Kd value 11.01).

Shareef *et al.* (2006b) looked at the sorption of bisphenol-A to mineral surfaces. Little sorption (<20%) was seen to goethite and kaolinite from a 3 µM (0.7 mg/l) solution, with little effect of pH. Sorption to these two minerals was rapid and completely reversible. When montmorillonite was used, sorption was greater and took longer, and only small amounts were desorbed at pH 7. It was proposed that bisphenol-A intercalated into the inter layer spaces of montmorillonite, whereas sorption to the other two minerals was to the surface.

Ying and Kookana (2005) took samples of soils from a depth of 0-15 cm from locations in South Australia. Sorption of bisphenol-A was measured using a batch equilibrium method, shaking for two hours. The organic carbon content of the soils ranged from 0.85 to 2.9%. The resulting K_{oc} values ranged from 251 to 1507, with a mean value of 962.

Loffredo and Senesi (2006) measured the sorption of bisphenol-A to samples of two acid sandy soils using a batch equilibrium method. Surface (0-30 cm) and deep (30-90 cm) horizons of both soils were used. The organic carbon content of the soils ranged from 1.1 to 9.3 g/kg. Bisphenol-A showed linear sorption to all four soils, with no indication of saturation (up to 40 mg/l with 5 g of soil). The K_{oc} values determined ranged from 335 to 703, average value 375. Sorption was almost completely reversible for three of the four soils, the exception being the surface soil with the highest organic carbon content.

The sorption of bisphenol-A to sediments from an aquifer system in South Australia has been studied (Ying *et al*, 2003). Limestone sediment samples were taken from a depth of 153-154 m. Sorption was measured in batch equilibration experiments at room temperature. The samples were shaken over a 16-hour period and then centrifuged. No loss of bisphenol-A (<3%) was found in controls without sediment. The relation between the sorption coefficient and the bisphenol-A concentration was not linear; the data were fitted to the Freundlich equation, and a coefficient of 3.89 with n=0.85 were obtained. The organic carbon sorption coefficient can only be calculated from these data for the concentration range tests, which was 2.5 – 20 µg/l. The value obtained for the coefficient was 778. The organic carbon content of the sediment was 0.5%.

Zeng *et al.* (2006) sampled sediments from five locations on the Xiangjiang River in China. Three samples were taken from each site, mixed and sieved (88 µm). Batch sorption experiments were carried out with six concentrations of bisphenol-A. Equilibrium was reached rapidly, mostly within the first hour. The organic carbon contents of the sediments were from 2.06 to 6.29% by weight. Three functions were fitted to the data – linear, Freundlich and a dual reactive domain model; all gave a reasonably good fit, with the Freundlich model giving the best fit. The linear model gave an average K_{oc} value of 115 l/kg over the five sediments (calculated from the data in the paper); the Freundlich model gave a value of 305 l/kg. Some irreversible sorption was observed in desorption experiments, but not to a great extent. The pH of the solutions had a small effect on the sorption.

Patrolecco *et al.* (2006) sampled surface water, suspended particulate matter and bed sediments in the River Tiber in Italy, in September 2002 (summer sample) and January 2003 (winter sample). The levels of bisphenol-A measured in water and bed sediments are included in Section 3.1.4.6.3. Bisphenol-A was measured in the suspended matter in two of the four samples taken in summer, and in all four taken in the winter. The levels measured in suspended matter and the corresponding water levels were used to calculate K_{oc} values; the range of results was 11,220 to 17,000.

Hu *et al.* (2006) used the partitioning of bisphenol-A between water and solid phase micro-extractant (SPME) fibres to investigate the effect of water parameters on the availability of bisphenol-A. The measured distribution coefficients are not directly relevant to the environment. Increasing salinity of the water increased the availability of bisphenol-A by around 1.2 times (i.e. the sorption to SPME fibres was reduced). An increase in pH from 5.5 to 8.5 decreased the availability by 1-2 to 1.4 times. The technique was also used to look at the effect of humic acids (commercial form) on the free fraction of bisphenol-A. The distribution coefficients on a dissolved organic carbon basis ranged from 4.03 to 5.60 (as log D_{DOC}). The values are much higher than those reported by Hollrigl-Rosta *et al.* above. Hu *et al.* note that the concentration of DOC in their study is more lower (1-50 mg/l) than that in the Hollrigl-Rosta study (190 mg/l). If the results are extrapolated to higher DOC values then the results are much closer.

Clara *et al.* (2004) looked at the sorption of bisphenol-A to sewage sludge. Activated sludge from a municipal wastewater treatment plant was used. Sludge from the same plant inactivated

by mercury (II) sulphate was also used, to distinguish between pure absorption and biosorption. In the batch sorption tests, bisphenol-A equilibrated with the sludge in around two hours, although all sorption experiments were carried out over 24 hours. There was no significant difference between the activated and inactivated sludge in terms of the sorption of bisphenol-A. The specific adsorption coefficient K_D (and hence the derived organic matter and organic carbon partition coefficients) was concentration dependent, decreasing with increasing free concentration in water, but no saturation was seen (up to 10 mg/l). From the equation given in the paper, the K_D value at 1 mg/l would be 257 l/kg, a similar value to that used in the published assessment (265 l/kg). The authors also investigated the effect of pH on sorption. Increasing the pH above 9 led to the desorption of bisphenol-A from sludge, and the desorption was complete at pH 12. Such high pHs can occur during sludge dewatering processes where limestone is used.

Impact of new information

The new studies provide slightly different results. Batch equilibrium studies in laboratories on both sediment and soil samples give results that are generally similar to the estimated value used in the published risk assessment. There are some indications from field studies where both water and sediment samples were taken that the degree of sorption may be greater (at least sorption to suspended matter). Comments by the CSTEE prior to publication of the original report (CSTEE, 2002) pointed out that measured sediment levels appeared higher than expected from the water levels from the same locations. There is no explanation at present of what might cause this effect. There are always difficulties when comparing measured levels in different compartments to be sure that the samples can be considered to be in steady state with each other. Although there are some indications of enhanced sorption, the majority of the tests, in particular the standard batch equilibrium studies, give results with similar values to those used in the published risk assessment. The values from the published assessment have therefore been retained in the calculations for this addendum.

3.1.3.4 Accumulation and metabolism

The available measured data suggested that bisphenol-A has a low potential for bioaccumulation in fish, in contrast to the moderate potential indicated by the log K_{ow} value. A slightly higher potential was indicated by the measured bioconcentration in freshwater clams (up to 144). Measured data are preferred over calculated values when the studies are valid. A BCF of 67 for fish was therefore used in the published risk assessment, and the accumulation in clams was considered in the risk characterisation (EC, 2003).

A bioconcentration factor for earthworms of 7.9 kg/kg was estimated using QSARs (as implemented in EUSES).

3.1.3.4.1 New information

Bioaccumulation

Lindholst *et al.* (2003) studied the metabolism of bisphenol-A in zebrafish (*Danio rerio*) and rainbow trout (*Oncorhynchus mykiss*). Adult zebrafish were exposed to 100 µg/l bisphenol-A in a flow through system for 168 hours. Exposures took place in a 100 l aquarium, with a flow rate of eight replacement volumes per day, and 150 fish. The bisphenol-A concentration was measured every two days; the actual concentration found was 97.5±5.2 µg/l. Fish were sampled

at 0, 2, 6, 12, 24, 48, 72, 120 and 168 hours. After this time the remaining fish were transferred to a system to which bisphenol-A was not added and kept for the same length of time, with sampling at the same intervals. Zebrafish tissue samples were analysed for bisphenol-A, bisphenol-A glucuronic acid (BPAGA) and bisphenol-A sulphate (BPAS).

Rainbow trout were exposed under similar conditions for eight days to 100 µg/l bisphenol-A (actual concentration from 2-day samples 107.3±6.3 µg/l). After eight days, gall bladder and blood samples were taken, and the bile fluid and blood plasma analysed for the same three substances (bisphenol-A, BPAGA and BPAS).

Uptake and excretion rates for fish were calculated by fitting data to exponential uptake and decay models (much of the data for rainbow trout came from earlier publications). Uptake was fitted to a first order model, excretion to a first or second order model depending on the goodness of fit. Bisphenol-A was detected in zebrafish after two hours' exposure, and steady sate was reached by 24 hours. Steady state concentrations were 569 ng/g for bisphenol-A, 12.6 µg/g for BPAGA and 39.3 ng/g for BPAS. The whole body uptake rate for zebrafish was calculated as 0.23; tissue specific values from rainbow trout plasma, liver and muscle were 0.73, 0.11 and 0.16, so the rates were similar between the two species despite the different matrices.

Elimination from zebrafish was fitted to a second order model; the first compartment had a half life of <1.1 hours, the second compartment half life was 139 hours. The three trout tissues had elimination half-lives of 3.7, 1.8 and 5.8 hours for plasma, liver and muscle respectively, as first order elimination. The authors suggest that in zebrafish bisphenol-A is rapidly removed from tissues, metabolised by the liver and excreted primarily as BPAGA into the gall bladder (compartment 2). Elimination from the tissues in zebrafish is much more rapid than from trout tissues. Zebrafish have a lower sensitivity to bisphenol-A than does trout when considering vitellogenin synthesis. It is suggested that this may be due to the more rapid metabolism resulting in lower bisphenol-A concentrations and a reduced response. Data on specific tissue concentrations in the liver for bisphenol-A and metabolites was needed to confirm this.

Lee *et al.* (2004) measured the accumulation of bisphenol-A in spotted halibut (*Varaspar variegates*) in a seven-day semi-static exposure, with renewal of solutions every twenty four hours. Nonylphenol was also included in the same exposures at similar concentrations. The bioconcentration factor determined at an exposure level of 70 µg/l was 38±21 l/kg, averaged over the seven days.

Killifish (*Oryzias latipes*) were exposed to bisphenol-A at 17 µg/l in a flow-through system for six days (Takino *et al*, 1999). Fish were analysed at intervals, and the results at five and six days showed that steady state had been reached. The mean BCF from these two times was 73.4 l/kg.

Koponen *et al.* (2007) studied the uptake of bisphenol-A in larvae of the common frog *Rana temporaria*. Radiolabelled substance was used at a nominal concentration of 1.84 µg/l in water, the solutions were renewed every day for the three day uptake experiment. The results are based on total radioactivity. The effect of UVB exposure was also considered in the experiments, only the results without UVB are considered here. The steady state BCF value obtained was 140±38; the value derived from uptake and depuration rates was 131. Growth correction was applied, and resulted in a small decrease in the elimination rate estimate; the revised BCF values (with growth correction by two methods) were 147 and 144. As a radiolabelled substance was used the results will include any degradation or metabolism products, hence the results have to be interpreted with caution.

Takahashi *et al.* (2003) measured the concentrations of bisphenol-A in water, periphytons and benthos in the Tama River in Japan. The range of concentrations in water was 0.02-0.15 µg/l.

The concentrations in periphytons were 2.0-8.8 µg/kg and in benthos were 0.3-12 µg/kg, giving bioaccumulation factors for periphytons of 18-650 and for benthos of 8-170.

Metabolism

Kang *et al.* (2006) have reviewed the metabolism and biodegradation of bisphenol-A in organisms – bacteria, fungi, plankton, plants, invertebrates, fish, birds and mammals. There is evidence of metabolism or biodegradation in all of these. The authors conclude that although the metabolites can enhance estrogenicity or toxicity, in general metabolism leads to detoxification of bisphenol-A. This does not mean that the substance does not show effects in organisms.

Metabolism of bisphenol-A by plant tissues has been demonstrated (Nakajima *et al.* 2002). Tobacco BY-2 cells in suspension culture reduced the concentration of added bisphenol-A rapidly after addition, with no bisphenol-A detected 2.5 hours after application. Use of radiolabelled substance allowed four metabolites to be observed, the most abundant being a glucopyranoside derivative (BPAG). When labelled bisphenol-A was administered to the roots of tobacco seedlings, radioactivity was incorporated in BPAG and three other unidentified metabolites that were accumulated in the leaves.

Schmidt and Schupan (2002) demonstrated the metabolism of bisphenol-A in plant cell suspension cultures. The products found were glycosides of bisphenol-A, non-extractable residues and highly polar, presumed polymeric, products. The proportion of each product type varied with plant species. It is possible that bisphenol-A could be liberated from the glycosides, for example under acid conditions, but the other products appeared stable for the most part.

[Note: uptake into plants is not a major route for bisphenol-A. The assumptions in the assessment are that any substance taken up into the plant is available, so metabolism is likely to reduce the level in plants.]

Spivack *et al.* (1994) carried out further work on the metabolic pathways of bisphenol-A in bacterial strain MV1 (details included in EC, 2003). The major pathway was found to account for 85% of the metabolised bisphenol-A, the minor route for the other 15%. Both routes lead to mineralisation, in whole or in part. Similar metabolic pathways with similar degrees of importance were found in a bacterial isolate *Pseudomonas paucimobilis* (Jin *et al*, 1996).

Sasaki *et al.* (2005) purified components of the cytochrome P450 monooxygenase system from a *Sphingomonas* sp. strain A01 (see also soil degradation in Section 3.1.3.2.1), which was able to degrade bisphenol-A. Two degradation products were detected by HPLC analysis and were thought to be 1,2-bis(4-hydroxyphenyl)-2-propanol and 2,2-bis(4-hydroxyphenyl)-1-propanol.

Yim *et al.* (2003) screened 26 species of micro-organisms for ability to degrade bisphenol-A. The species *Aspergillus fumigatus* KCTC 6145 was found to be able to metabolize bisphenol-A. The main product from the metabolism was bisphenol-A-*O*-β-D-glucopyranoside (BPAG). It is not clear from the report whether this was the only species to metabolize bisphenol-A, or whether it was the most successful. The process to obtain sufficient metabolite to allow identification is described as preparative scale biotransformation. Kang *et al.* (2004) isolated a strain of *Streptomyces sp*. from river water in Japan that was able to degrade bisphenol-A, with a half life of three to four days.

<u>Impact of new information</u>

The new BCF values for fish are generally similar to that used in the published risk assessment and so no change is necessary.

3.1.4 Predicted Environmental Concentrations (PECs)

This section presents the PEC values derived from a combination of the new data and that in the published risk assessment. The next four sections present the calculation of Clocal values for uses where the local emissions have been revised based on new information. The calculation of the regional and continental concentration follows. The PEC values for all current uses are then presented for each compartment in turn, together with the results of a survey of monitoring data. PEC values for STP ($PEC_{microorganisms}$) and for air are not included, as there were no risks for either of these compartments in the published risk assessment and the emissions have either reduced or remained the same.

3.1.4.1 Bisphenol-A production

The revised information on releases from production and polycarbonate sites has been used to calculate revised PEC values for the sites. These new values are included in Table 3.9.

3.1.4.2 PVC additive formulation

The factors presented in Table 3.3 were used to estimate emissions from the other sites, using whatever site information was provided for these. Emissions were also estimated for routes of release not covered by the measurements at the seven sites (usually rainwater run-off). Rainwater run-off estimates were only made where it was clear that the rainwater from the site was channelled into a receiving water. The resulting concentrations are presented in Table 3.6.

Table 3.7 C_{local} values for PVC additive sites

Site	C_{local}	Notes
1	0.02 µg/l	Marine.
2	4.2 ng/l	
3	0.074 µg/l	
4	0.012 µg/l	
5	0.013 µg/l	
6	0.01 µg/l	Marine
7	8 ng/l	Marine
8	<0.022 µg/l	
9	0.2 µg/l	
10	<0.32 ng/l	
11	1.1 ng/l	
12	0.065 µg/l	No information on presence of MWWTP – calculations performed for scenarios with and without MWWTP, and higher concentrations included here
13	0.48 ng/l	Marine

MWWTP Municipal wastewater treatment plant

3.1.4.3 Anti-oxidant use in plasticiser formulation

For the specific site, the actual wastewater treatment plant and river flows at the site have been used to calculate a Clocal value of 2 ng/l. For the generic site, the default wastewater treatment plant and dilution have been used to give a Clocal of 0.36 µg/l.

3.1.4.4 Thermal paper recycling

3.1.4.4.1 Site with de-inking

The concentration of bisphenol-A in the waste paper feed is 15 mg/kg. An average site will use of 84,000 tonnes of waste paper per year, over 350 days (ETPA, personal communication). This is equivalent to 240 tonnes of paper/day. The bisphenol-A input to the site is therefore 3.6 kg/day.

De-inking removes 95% from the paper, hence 3.42 kg/day is emitted to water.

At primary treatment, 95.9% is removed to the paper sludge, i.e. 3.28 kg/day. The remainder stays in the water, so 0.14 kg/day is emitted to a WWTP.

In the WWTP: 0.98% to biological sludge, so 1.4 g/day.

0.02% to effluent, so 28 mg/day.

The WWTP flow is 2,880 m^3/day, hence the effluent concentration is 9.7 ng/l. Dilution by 10 (the default factor) gives a Clocal of 0.97 ng/l.

Sites receiving thermal paper broke

An estimated maximum input of 0.074% of bisphenol-A in the paper feed corresponds to an input of 178 kg/day for the generic site. Following the same calculations as above, but using a removal rate in the WWTP of 99.99% (the value obtained from the two specific sites based on corrected concentrations, reflecting the higher level of removal at sites receiving a higher rate of input of bisphenol-A), gives a Clocal of 24 ng/l.

For comparison, the maximum concentration measured in the effluents for these sites (after correction for recovery) was 500 ng/l, giving a Clocal of 50 ng/l based on the default dilution factor. The maximum Clocal estimated from actual receiving water flow rates is 55 ng/l. Since these are maximum values, only the value for the generic site given in the preceding paragraph will be taken through to the risk characterisation section.

Sludges from the thermal paper broke recycling sites are assumed to be incinerated. There are no data on levels in sludge from these sites at the moment.

3.1.4.4.2 Site without de-inking

As above the bisphenol-A input to the site is estimated to be 3.6 kg/day.

Pulping removes 10% from the paper, hence 0.36 kg/day is emitted to water.

At primary treatment, 50% is removed to paper sludge (i.e. 0.18 kg/day). The remainder is emitted to water, so 0.18 kg/day is emitted to a WWTP.

In WWTP: 0.98% to biological sludge, so 1.76 g/day.

0.02% to effluent, so 36 mg/day.

The WWTP flow rate is 2,880 m^3/day, so the effluent concentration is 12.5 ng/l. Dilution by 10 (default factor) gives a Clocal of 1.25 ng/l. The average concentration in the effluent from the actual site measurements was 43 ng/l; assuming a ten-fold dilution gives a Clocal of 4.3 ng/l, which is in good agreement with this generic estimate. Again, only the generic estimate will be taken forward to the risk characterisation section.

3.1.4.5 Regional and continental concentrations

The regional and continental concentrations have been calculated using EUSES 2.0.3. The emissions used are summarised in Table 3.1. The resulting regional PEC values are:

$PECregional_{water}$ = 32 ng/l

$PECregional_{sediment}$ = 0.52 µg/kg wwt

$PECregional_{soil}$ = 0.07 µg/kg wwt

$PECregional_{marine\ water}$ = 2.7 ng/l

$PECregional_{marine\ sed}$ = 0.034 µg/kg wwt

The estimated regional concentration in water is comparable to the concentration of bisphenol-A found in the feed water to the general paper recycling site described in Section 3.1.2.5.4, which was 32 ng/l (average of three samples).

3.1.4.6 PEC values – water (fresh and marine)

3.1.4.6.1 Calculated PEC values

The PEC values calculated using EUSES 2.0.3 are presented in Table 3.8 (for uses where Clocal has not changed from the published assessment) and Table 3.9 (for uses where new Clocal values were calculated in the preceding sections). Values for marine waters and sediments have been added for the generic scenarios, and for specific sites where these discharge to marine or estuarine waters (for these specific sites the marine values replace the freshwater values). For the generic marine scenarios it is assumed that the effluent is not treated in a wastewater treatment plant, and a default dilution of 100 for marine waters has been used. Specific dilution rates have been used for individual sites where this information is available, otherwise the default value of 100 is used with the site-specific information.

3.1.4.6.2 Bisphenol-A from tetrabromobisphenol-A (TBBPA) in sediment

The risk assessment for TBBPA (ECB, 2007) concludes that there is strong evidence that TBBPA can degrade to give bisphenol-A under certain anaerobic conditions. This has been demonstrated conclusively for marine or saline sediments, freshwater sediments and anaerobic sewage sludge, and it is possible that it could also occur in other anaerobic systems. From Section 3.1.3.2 of this addendum, bisphenol-A is expected to be stable under anaerobic

conditions. It is therefore possible that the degradation of TBBPA in sediment could lead to the production of bisphenol-A.

An initial estimation of possible levels can be obtained by assuming that all of the TBBPA present in anaerobic sediment degrades to bisphenol-A. The results of such calculations are presented in Tables 3.10 and 3.11; the concentrations of TBBPA in sediment are taken from the TBBPA risk assessment report (ECB, 2007) and the calculation assumes that 90% of the total sediment concentration is converted (i.e. 100% conversion of TBBPA in the anaerobic part of the sediment which makes up 90% of the total sediment) . Note that only those activities taking place within the EU are included in the table (the risk assessment also has example calculations for other processes but these are not relevant to the EU).

Table 3.8 PEC values for water and sediment (fresh and marine) for uses where Clocal is unchanged from the published risk assessment[a]

	Freshwater		Marine	
	PEC_{water} (µg/l)	PEC_{sed} (µg/kg)	PEC_{marine_water} (µg/l)	PEC_{marine_sed} (µg/kg)
Site specific				
ER 1	0.033	0.53		
ER 2, ER 3, ER 6	0.032	0.52		
ER 4	0.99	16		
ER 5	0.062	1.0		
PAPER 1	0.31	5.1		
PAPER 2	0.14	2.3		
PAPER 3	0.10	1.6		
PAPER 4	1.03	17		
PAPER 5	1.03	17		
PAPER 6	0.97	16		
PAPER 7	0.07	1.1		
Generic scenarios				
Polycarbonate bottle washing	0.032	0.53	0.003	0.046
Phenoplast cast resin processing	1.47	24	*1.2*[a]	*20*[a]
PVC – Anti-oxidant during processing	0.19	3.0	0.13	2.1
PVC – Plasticiser use	0.14	2.3	0.09	1.5

a This scenario is included for completeness, although no relevant sites discharging to marine waters have been identified (see Section 3.3.1.2)

Table 3.9 PEC values for water (fresh and marine) for thermal paper, PVC additives and anti-oxidant use in plasticiser production

	Freshwater		Marine	
	PEC_{water} (µg/l)	PEC_{sed} (µg/kg)	PEC_{marine_water} (µg/l)	PEC_{marine_sed} (µg/kg)
Production				
BPA 1			0.01	0.16
BPA 2	0.032	0.53		
BPA 3			0.008	0.13
BPA 4			0.006	0.11
BPA 5			0.003	0.05
BPA 6			0.10	1.7
PVC additive package				
Site A1			0.023	0.38
Site A2	0.036	0.58		
Site A3	0.11	1.8		
Site A4	0.044	0.71		
Site A5	0.045	0.73		
Site A6			0.013	0.21
Site A7			0.011	0.18
Site A8	0.054	0.88		
Site A9	0.27	4.4		
Site A10	0.032	0.52		
Site A11	0.033	0.54		
Site A12	0.097	1.6		
Site A13			0.009	0.15
Anti-oxidant use in plasticiser production				
Specific site			0.005	0.08
Generic site	0.39	6.4		
Thermal paper recycling				
With deinking	0.033	0.54	0.003	0.045
Without deinking	0.033	0.54	0.003	0.046

Table 3.10 Estimated maximum concentrations of bisphenol-A from anaerobic degradation of TBBPA in sediment

Scenario			Estimated concentration of tetrabromobisphenol-A in sediment (mg/kg wet wt.)	Estimated maximum concentration of bisphenol-A in sediment (mg/kg wet wt.)
Reactive flame retardant use	Manufacture of epoxy and/or polycarbonate resins		0.36-0.44	0.13-0.16
	Processing of epoxy resins		2.7×10^{-3}-4.9×10^{-3}	1.0×10^{-3}-1.9×10^{-3}
Additive flame retardant use	ABS	Compounding	14.6-17.8	5.5-6.7
		Conversion	0.66-0.81	0.25-0.31

The calculations given above make a number of worst case assumptions: all of the TBBPA in aerobic sediment is degraded; the only product is bisphenol-A; there is no degradation or removal of the bisphenol-A formed; degradation of TBBPA is instantaneous. In reality the formation of TBBPA will take place over time and other processes will act on the bisphenol-A formed. A more realistic analysis of the situation has been carried out by EURAS (2006). This approach considers the adsorption/desorption of bisphenol-A and its degradation in water and aerobic sediment, as well as the similar processes for TBBPA. This approach assumes that the bisphenol-A produced is able to desorb to water and be degraded or removed; this would also be necessary for bisphenol-A to be available to have effects. A degradation rate for TBBPA (for conversion to bisphenol-A) equivalent to ready biodegradability was assumed as a worst case (this is four orders of magnitude greater than the degradation rate for TBBPA used in the risk assessment). The concentrations of TBBPA and bisphenol-A estimated using this approach are in Table 3.11. These are considered to be more realistic than the initial estimates and so will be used in the risk characterisation.

Table 3.11 Estimated concentrations of bisphenol-A from anaerobic degradation of TBBPA in sediment (more realistic approach)

Scenario			Estimated concentration of tetrabromobisphenol-A in sediment (mg/kg wet wt.)	Estimated maximum concentration of bisphenol-A in sediment (mg/kg wet wt.)
Reactive flame retardant use	Manufacture of epoxy and/or polycarbonate resins		0.36-0.44	$(1.42\text{-}1.95)\times10^{-4}$
	Processing of epoxy resins		2.7×10^{-3}-4.9×10^{-3}	$(1.23\text{-}1.7)\times10^{-6}$
Additive flame retardant use	ABS	Compounding	14.6-17.8	$(5.75\text{-}7.9)\times10^{-3}$
		Conversion	0.66-0.81	$(2.6\text{-}3.6)\times10^{-4}$

The calculations were only performed for the freshwater environment. The estimated concentrations of TBBPA in marine sediments are approximately one order of magnitude below those in freshwater (with one exception). The marine sediment concentrations of bisphenol-A resulting from TBBPA breakdown are therefore expected to be around one order of magnitude lower than those in Table 3.11.

3.1.4.6.3 Measured concentrations

Industry (PlasticsEurope, 2007) have reviewed the available monitoring studies for bisphenol-A. The studies were reviewed for their quality in two ways. Firstly, the completeness of the information reported in the studied was considered (on methods, locations, quality assurance (QA) procedures, etc.). Secondly the quality of the analytical methods and QA, etc., were assessed. Only studies that were considered as reliable or very reliable in both assessments were included in the further analysis. A total of 99 papers were reviewed initially, with 79 retained for the further analysis. The majority of the samples came from 1998 – 2003.

A number of issues arose in combining the data from different studies to categorise different regions, including high numbers of not detected results and different detection limits. A non–parametric method (Kaplan-Meier) was adopted to address these issues. The results of the evaluation are in Table 3.13 (freshwater), Table 3.14 (freshwater sediments), Table 3.15 (marine waters) and Table 3.16 (marine sediments). A summary of the data is presented in Table 3.12.

Table 3.12 Summary of measured levels data for water and sediment

	Freshwater	Freshwater sediment	Marine water	Marine sediment
Observations:				
Total number of weighted observations	848	249	115	67
Number of weighted observations below detection limit	415	75	58	44
Number of imputed observations[a]	10	65	0	0
Concentrations:	*(µg/l)*	*(ng/g dw)*	*(µg/l)*	*(ng/g dw)*
Median	0.01	16	0.0016	8.5
Mean	0.13	60	0.017	75
SD	1.5	134	0.052	209
5th percentile	0.0005	0.5	0.00005	1.1
95th percentile	0.35	256	0.088	566

a Where individual data points were not available, representative points were imputed from the summary statistics where possible.

Table 3.13 Bisphenol-A concentrations in freshwaters in the EU (all units are µg/l)

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Austria	Sattelberger and Scharf, 1999	1998	34 locations in 15 rivers	34	0.01	9/34 (26%)	Min = <0.01
							Median = <0.01
							95th % = 0.0559
							Max = 0.075
	Paumann and Vetter, 2003; Bursch *et al*., 2004; Hohenblum *et al*., 2004	2001-2002	Monthly samples collected from 24 rivers	272	0.01	72/272 (26%)	Min = <0.005
							Median = <0.005
							95th % = 0.16
							Max = 0.6
Belgium	Loos *et al*., 2007	2003	3 rivers, south of Ghent (Schelde, Molenbeek, Gaverbeek) each sampled upstream and downstream of wastewater discharge	18	NA	16/18 (89%)	Mean of 3 samples at each location, range: 0.003 to 0.055
Czech Republic	Stachel *et al*., 2002; Wiegel *et al*., 2004	1999 & 2000	Elbe River and mouths of its tributaries	17	0.001	15/17 (88)	Min = <0.001
							Median = 0.019
							95th % = 0.089
							Max = 0.114
	Umweltbundesamt, 1999 and 2000; secondary reference to Gandrass, 1999	1998	4 locations (Bilina, Dolni Berkovice, Synthesia, Horenice)	4	0.0003	4/4 (100%)	Min = 0.0015
							Median = 0.0278
							95th % = 1.10
							Max = 1.29
Denmark	Umweltbundesamt, 1999 and 2000; secondary reference to Boutrup, *et al*, 1998	1998	2 locations in Aarhus County	2	0.1	0/2 (0%)	< 0.1
	Christiansen *et al*., 2002; secondary reference for Danish reports by Christiansen and Plesner, 2001 and Boutrup and Plesner, 2001	NA	2 lakes and 3 streams	NA	0.001	NA	Min = < 0.001 Max = 0.44
France	Jeannot *et al*., 2002	NA	Orleans, downstream of wastewater effluent	1	0.0005	0/1 (0%)	< 0.0005

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Germany	Umweltbundesamt, 1999 and 2000; secondary reference for Gandrass, 1999; Voigt, 1999; Koerner, 1998	1998	River Elbe	11	0.0003	11/11 (100%)	Min = 0.0047
							Median = 0.0127
							95th % = 0.0369
							Max = 0.0406
		1999	River Rhine - 7 locations, sampled monthly for 6 months	NA	0.01	NA	Mean ranges from <0.01 to 0.08
	Fries and Puettmann, 2002	2000-2001		NA	0.020	NA	Min = < 0.020
							Mean ranges from 0.051 to 0.084
	Bolz *et al*., 2001	1998-1999	Baden-Wurttemberg - streams and rivers; evaluated the influence of STP discharges on water quality	23	0.050	NA	Min = <0.050
							Max = 0.272
							Median = 0.0721 for water receiving STP discharge; <0.050 with no STP discharge
	Kuch and Ballschmiter, 2001	2000	Southern Germany - Danube River, Blau River, Nau River (upstream and downstream of STP effluent discharge), Iller River, Schussen Creek, Laiblach Creek, Argen Creek	31	0.00004	31/31 (100%)	Min = 0.0005
							Median = 0.0038
							95th % = NA
							Max = 0.014
	Heemken *et al*., 2000	1998	River Elbe (10 locations) and 4 of its tributaries	18	0.00005	18/18 (100)	Min = 0.0089
							Median = 0.0585
							95th % = 0.223
							Max = 0.776
	Stachel *et al*., 2002; Wiegel *et al*., 2004	1999-2000	River Elbe and mouths of its tributaries	35	0.001	35/35 (100)	Min = 0.003
							Median = 0.023
							95th % = 0.093
							Max = 0.100
	Wenzel *et al*., 1998; Fromme *et al*., 2002	1997	North Rhine-Westphalia, Rheinland-Pfalz, Brandenburg & Berlin: rivers, lakes and channels. Used 2 methods of analysis: GC-MS and HPLC.	116	0.0001 (GC-MS); 0.002 (HPLC)	116/116 (100%) (GC--MS); 73/116 (63%) (HPLC)	Min = 0.0005 (GC-MS); <0.002 (HPLC)
							Max = 0.229 (GC-MS); 0.410 (HPLC)
	Fleig, 2000	NA	River Rhine - 3 locations (Karlsruhe, Mainz, Duesseldorf)	NA	NA	NA	Mean at each site: 0.027, 0.028, 0.033
							90th % at each site: 0.052, 0.044, 0.050
Italy	Vigano *et al*., 2006	2005	River Po, upstream and 2 locations downstream of confluence of River Lambro; samples collected every other day for 3 weeks	27	0.00333	27/27 (100%)	Mean of samples at each location: 0.270, 0.302, 0.494

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
	Lagana *et al*., 2004	2002	Rome; Tiber River - downstream of wastewater effluent discharge	7	0.0002	7/7 (100%)	Min = 0.015
							Median = 0.022
							95th % = NA
							Max = 0.029
	Loos *et al*., 2003	2002	8 locations in River Seveso and upstream and downstream of 3 STPs near Como	15	0.002	3/15 (20%)	Min = <0.002
							Median = <0.002
							95th % = 0.040
							Max = 0.043
	Loos *et al*., 2007	2003	2 rivers (Seveso, Lambro) upstream and downstream of wastewater discharge; located in textile industry region	6	0.002	5/6 (83%)	Min = <0.002
							Median = 0.053
							95th % = 0.150
							Max = 0.175
	Patrolecco *et al*., 2004 and 2006	2002 & 2003	Tiber River - upstream and downstream of urban sources, including wastewater from Rome	5 locations, sampled twice	0.030	9/10 (90)	Min = < 0.030
							Median = 0.080
							95th% = 0.122
							Max = 0.140
Netherlands	Umweltbundesamt, 1999 and 2000; secondary reference for Belfroid *et al*., 1999	1997	6 locations (Rhine at Lobith; Maas at Eijsden; Nieuwe Waterweg at Maassluis and Benelux Tunnel; Haringvliet at Haringvlietsluizen; Noordzeekanaal at Ijmuiden)	12	NA	10/12 (83%)	Min = 0.0099
							Median = 0.0355
							95th % = 0.108
							Max = 0.16
	Belfroid *et al*., 2002	1999	River Dommel, River Meuse (Eysden), Bergermeer Lake	7	0.011l	2/7 (29%)	Min = <0.011
							Median = < 0.018
							95th % = 0.16
							Max = 0.17
	Vethaak *et al*., 2002 and 2005	1999	Nationwide monitoring program	97	NA	50/97 (52%)	Min = <0.0088
							Median = 0.018
							95th % = 0.322
							Max = 1.0
Norway	Pettersen and Fjeld, 2005	2005	Drammen waterway	2	0.010	1/2 (50)	Min = <0.010
							Max = 43.0

Portugal	Azevedo *et al*., 2001	1999	National monitoring program; samples collected monthly for three months at 8 locations - rivers and coastal locations	24	0.002	13/24 (54%)	Min = < 0.002
							Median = 0.35
							95th % = 2.0
							Max = 4.0
	Quiros *et al*., 2005	2001-2002	10 rivers (from Ponte Nova Barcelos to Esteiro Seixal), sampled monthly from April 2001 to Dec. 2002; summary statistics calculated using the averages for each location	183	0.09	132/183 (72%)	Min = <0.01
							Median = 0.10
							95th % = 0.88
							Max = 0.92 (individual sample max = 5.03)
Spain	Brossa *et al*., 2005	2001-2002	Catalonia: Ebre River and irrigation canal of Ebre Delta	36	0.002	2/36 (6%)	Min = < 0.002
							Median = < 0.002
							95th % = 0.004
							Max = 0.02
	del Olmo *et al*., 1997	NA	Granada: Santa Maria farm spring water	NA	0.6	NA	< 0.6
	Gonzalez-Casado *et al*., 1998	NA	Granada: Loja - river water	3	0.0012	0/3 (0%)	<0.0012
	Brossa *et al*., 2002	NA	Catalonia: Ebro River	NA	0.01	NA	< 0.01
	Cespedes *et al*., 2006	2001	Ter River and 2 of its tributaries (9 locations) - receive discharge from STPs	9	0.05	0/9 (0%)	< 0.05
	Cespedes *et al*., 2005	2001	Llobregat River Basin - 10 locations, including Anoia and Cardener tributaries	11	0.09	7/11 (64%)	Min = < 0.09
							Median = 0.09
							95th % = 1.91
							Max = 2.97
	Penalver *et al*., 2002	NA	Ebro River	NA	0.06	0%	< 0.06
	Brossa *et al*., 2004	NA	Catalonia: river water	1	0.002	0/1 (0%)	<0.002
	Petrovic and Barcelo, 2001	2000	Anoia and Cardener rivers - 6 sites, upstream and downstream of STPs	6	0.1	0/6 (0%)	<0.1
	Rodriguez-Mozaz, *et al*., 2004 and 2005	2002	Llobregat River - monthly samples tested for 6 months	6	0.0063	6/6 (100%)	Min = 0.065
							Median = 0.138
							95th % = 0.279
							Max = 0.295

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Switzerland	Voutsa *et al*., 2006	2004	Glatt River (10 locations; each sampled 3 times)	30	0.007	30/30 (100%)	Min = 0.009
							Median = 0.026
							95th % = 0.058
							Max = 0.076
	Fleig, 2000	NA	River Rhine at Basel	NA	NA	NA	Mean = 0.010
							90th % = 0.024
UK	Fawell *et al*., 2001	1998	Severn Trent water: Trent, Severn, and Derwent rivers; Tame/Trent confluence	8	5.1	0/8 (0%)	<5.1
	Liu *et al*., 2004b	2003	England, river water - East and West Sussex. Upstream, downstream and near sewage outfall (3 locations)	NA	0.0053	NA	Min = < 0.0053
							Max = 0.024
	Readman *et al*., 2006	2006	Swindon: River Ray upstream of Rodbourne STP	1	0.0104	0/1 (0%)	< 0.0104
			Swindon: River Ray downstream of Rodbourne STP (3 locations; max. 8 km downstream)	3	0.0104	3/3 (100%)	Min = 0.338
							Median = 0.436
							Max = 0.449
			River Ock (reference site)	1	0.0104	0/1 (0%)	< 0.0104
	Environment Agency, 2003	2003	12 locations (each sampled 2 to 5 times); includes Boveney Ditch above Thames; River Aire; River Don; Manchester Ship Canal; River Douglas; River Tame; Sowe River	42	0.013	33/42 (79%)	Min = < 0.01
							Median = 0.092
							95th % = 0.526
							Max = 0.899

NOTE:

NA - Not available

STP - Sewage treatment plant

Table 3.14 Bisphenol-A concentrations in freshwater sediments in the EU (all units are ng/g dw unless otherwise stated)

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Czech Republic	Stachel *et al*., 2005	2002	37 locations along Elbe River and mouths of tributaries after a flood	37	5	NA	Min = < 5
							Median = 30
							Max = 1630
Denmark	Umweltbundesamt, 1999 and 2000; secondary reference to Boutrup, *et al*, 1998	1998	5 locations in Aarhus County, including residential and agricultural areas	36	2	NA	Mean of samples at each location, range: < 10 to 150
Germany	Bolz *et al*., 1999	NA	Baden-Wurttemberg (South Germany): Lake Constance and 2 small streams (Korsch and Sulzbach)	3	10	0/3 (0)	< 10
	Bolz *et al*., 2001	1996-1999	Baden-Wurttemberg – streams and rivers; evaluated the influence of STP discharges on water quality	11	0.5	9/11 (82)	Min = <0.5
							Median = 5
							95th % = 13
							Max = 15
	Heemken *et al*., 2000	1998	Elbe River (8 locations) and 3 of its tributaries	11	0.5	11/11 (100)	Min = 66
							Median = 132
							95th % = 311
							Max = 343
		1998-99	Elbe River – monthly sampling at one location (Schnackenburg)	12	0.5	12/12 (100)	Min = 127
							Median = 211
							95th% = 288
							Max = 322
	Stachel *et al*., 2002; Wiegel *et al*., 2004	2000	Elbe River and mouths of its tributaries	12	NA	12/12 (100)	Min = 10
							Median = 55
							95th % = 300
							Max = 379
		1998	Alster River	2	NA	2/2 (100)	Min = 143
							Max = 192
		1996	Berlin/Brandenburg surface waters	12	0.2	NA	Min = <0.2
							Max = 190
	Wenzel *et al*., 1998; Fromme *et al*., 2002	1997	Brandenburg and Berlin – 35 waterways (rivers, lakes, and channels). Used 2 methods of analysis: GC-MS and HPLC.	35	1 (GC-MS); 5 (HPLC)	30/35 (86%)	Min = 18 (GC-MS); 10 (HPLC)
							Max = 190 (GC-MS); 150 (HPLC)

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Italy	Vigano *et al*., 2006	2005	River Po, upstream and 2 locations downstream of confluence of River Lambro	3	3	0/3 (0%)	< 3
	Patrolecco *et al*., 2004 and 2006	2002 & 2003	Tiber River - upstream and downstream of urban sources, including wastewater from Rome	4 locations, sampled twice	30	0/8 (0%)	< 30
Netherlands	Vethaak *et al*., 2002 and 2005	1999	Nationwide monitoring program	18	NA	14/18 (78%)	Min = 0.5
							Median = 2.35
							95th % = 27
							Max = 43
Norway	Fjeld *et al*., 2004a	2003	Landfills or industrially contaminated sites: leachate ponds	6	NA	6/6 (100)	Min = 7.06
							Median = 108.68
							95th % = 346.33
							Max = 371.16
			Lake Mjosa and Lake Losna	4	NA	4/4 (100)	Min = 10.64
							Median = 37.10
							95th % = 47.88
							Max = 48.04
			Drammens River (industrialized area).	7	NA	7/7 (100)	Min = 6.07
							Median = 25.48
							95th % = 227.65
							Max = 279.8
	Fjeld *et al*., 2004b	2004	Lagen and Vorma Rivers (inlet and outlet of Lake Mjosa)	6	NA	6/6 (100)	Min = 9.27
							Median = 27.79
							95th % = 50.14
							Max = 50.53
		2003	Drammens River (industrialized area)	1	NA	1/1 (100)	53.14
	Pettersen and Fjeld, 2005	2005	Drammen waterway	17	1 to 5	6/17 (35)	Min = <1
							Median = <1
							95th % = 26
							Max = 62
Spain	Petrovic and Barcelo, 2001	2000	Anoia and Cardener rivers - 6 sites, upstream and downstream of STPs	6	10	2/6 (33%)	Min = < 10
							Median = < 10
							95th % = 34
							Max = 40
Sweden	Hedlund *et al*., 2006	2003-2004	Nationwide monitoring program	35	50	3/35 (9%)	Min = <50
							Median = < 50
							95th % = 83

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
							Max = 320
UK	Liu *et al*., 2004a	2003	England, Sussex Rivers: River Uck, River Ouse; upstream and downstream of sewage outfall (7 locations)	15	3.4	8/15 (53%)	Min = <3.4
							Max. not reported; max. ave. = 9; std dev = 2.7
	Centre for Environment, Fisheries and Aquaculture Science (CEFAS)	1999-2000	England - national monitoring program (50 locations, upstream and downstream of STP outfalls)	50	1.07 ng/g wet weight	2/50 (4%)	Min = <1.07 ng/g wet wt
							Median = <1.07 ng/g wet wt
							95th % = <1.07 ng/g wet wt
							Max = 56.8 ng/g wet wt

NOTE:

NA - Not available

STP - Sewage treatment plant

Table 3.15 Bisphenol-A concentrations in marine waters in the EU (all units are µg/l)

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Germany	Heemken *et al*. 2000	1998-1999	North Sea (11 locations, sampled twice)	20	0.00005	10/20 (50%)	Min = <0.00005
							Median = 0.00083
							95th % = 0.0514
							Max = 0.249
	Beck *et al*., 2005	2003-2004	Baltic Sea (5 locations, sampled twice)	29	0.00004	28/29 (97%)	Min = <0.00004
							Max = 0.0057
							Mean at each location: 0.00022 to 0.0054
	Stachel *et al*., 2002; Wiegel *et al*., 2004	2000	Elbe River (mouth)	1	0.001	1/1 (100%)	0.0038
Italy	Famiglini *et al*., 2005	NA	Adriatic Coast (middle-western) - near shore and mouths of rivers and canals	20	0.0032	2/20 (10%)	Min = < 0.0032
							Median = < 0.0032
							95th % = 0.074
							Max = 0.0845
	Pojana *et al*., 2004a	2001-2002	Venice Lagoon - 2 locations near the historical centre and 1 location near the industrial area; bimonthly samples collected for 10 months	15	0.001	14/15 (93%)	Min = <0.001
							Mean at each location: 0.010, 0.0045, 0.0044
							Max = 0.030
	Pojana *et al*., 2004b	2001-2002	Venice Lagoon - 25 locations sampled 4 times	NA	0.001	NA	Min = <0.001
							Max = 0.066
Netherlands	Umweltbundesamt, 1999 and 2000; secondary reference for Belfroid *et al*., 1999	1997	5 locations (Zeehavenkanaal at Delfzijl; Westerschelde at Hansweert and Terneuzen; Kanaal Gent-Terneuzen; Oosterschelde Oesterput)	5	NA	5/5 (100%)	Min = 0.0035
							Median = 0.0038
							95th % = 0.019
							Max = 0.023
	Belfroid *et al*., 2002	1999	Wadden Sea (Bocht van Wattum, Dantziggat, and Den Oever)	10	0.01	5/10 (50%)	Min = <0.01
							Median = 0.016
							95th % = 0.33
							Max = 0.33

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Spain	del Olmo *et al*., 1997	NA	Malaga - sea water	NA	0.6	0%	< 0.6
	Brossa *et al*., 2005	2001-2002	Catalonia: industrial port of Tarragona	12	0.002	2/12 (17%)	Min = < 0.002
							Median = < 0.002
							95th % = 0.015
							Max = 0.02
	Gonzalez-Casado *et al*., 1998	NA	Granada: Motril - sea water	3	0.0012	0/3 (0%)	<0.0012
	Brossa *et al*., 2004	NA	Catalonia: industrial port of Tarragona	1	0.002	0/1 (0%)	<0.002
	Petrovic and Barcelo, 2001	NA	Barcelona, Almeria, Tarragona - 14 sites near outfalls of industrial plants and municipal wastewater discharges	10	0.1	0/10 (0%)	<0.1

NOTE:

NA - Not available

STP - Sewage treatment plant

Table 3.16 Bisphenol-A concentrations in marine sediments in the EU (all units are ng/g dw)

Country	Author	Sample dates(s)	Sample Description	No. of Samples	Minimum Detection Limit	Frequency Detection (%)	Summary Statistics
Denmark	Umweltbundesamt, 1999 and 2000; secondary reference to Boutrup, *et al*, 1998	1998	Aarhus County; 2 locations	10	2	NA	Mean at each location: < 2 and 13 ng/g
Norway	Fjeld *et al*. 2004a	2003	Norwegian coast from near Russian border to the outer Oslofjord	12	NA	12/12 (100%)	Min = 0.01
							Median = 89.13
							95th % = 448.0
							Max = 623.38
	Fjeld *et al*., 2004b	2003	Drammersfjord	1	NA	1/1 (100%)	51.05
Spain	Petrovic and Barcelo, 2001	NA	Barcelona, Almeria, Tarragona - 14 sites near outfalls of industrial plants and municipal wastewater discharges	14	10	0/14 (0%)	< 10
	Morales-Munoz *et al*., 2005a and 2005b	NA	Aguadulce (near Almeria) - composite sample collected near outfall of an urban STP; used 2 different extraction methods	1	0.2	1/1 (100%)	Mean = 19.6
Sweden	Hedlund *et al*., 2006	2003-2004	Nationwide monitoring program; 10 locations	14	50	0/14 (0%)	<50
UK	Kelly *et al*., 2006	NA	National monitoring program; 22 locations near urban or industrial areas (includes Tees River, Tyne River, Belfast Lough, Burbo Bight, River Dee)	22	10	6/22 (27%)	Min = < 10
							Median = < 10
							95th % = 1030
							Max = 1140

NOTE:

NA - Not available

STP - Sewage treatment plant

3.1.4.6.4 Comparison of measured and calculated levels

In general it is not possible to assign the measured values to a corresponding calculated value, either by specific use or by scale. The measured values are considered to provide a good picture of the bisphenol-A levels in industrial/urban areas and can be considered as a mixture of local and regional concentrations. Hence only a general comparison is possible.

For freshwater, the calculated values fall within the range of the 95%ile or maximum values from the measurements. The calculated regional concentration falls toward the lower end of the range of 95%ile values. The calculated regional PEC value of 34 ng/l is higher than the median value from the whole freshwater data set, 10 ng/l, but is just below the 75%ile value from the data set, 42 ng/l.

For freshwater sediment, the measured values are reported as dry weight, so need to be reduced by a factor of 2.6 to be on the same wet weight basis as the calculated values (using the standard water content of sediment in the TGD). The highest of the 95%iles from the measured values are above the range of calculated values. The higher calculated values are similar to the middle of the range of measured levels, 10-20 µg/kg wwt (25-50 ng/g dwt).

The amount of measured data for marine waters is more limited, but covers a similar range to the calculated values, the highest calculated values being a little above the highest measured levels reported. Measured and calculated levels for marine sediment also cover largely similar ranges (after adjusting to the same basis as above). The highest measured values are somewhat above the highest calculated levels, and the lowest calculated level (the regional background) is below the range of measurements.

Overall the calculated and measured values are comparable. There are some exceptions, but these cannot be related to specific situations. Therefore the risk assessment will be based on the calculated values.

3.1.4.7 PEC values - terrestrial

PEC values for the terrestrial compartment have been calculated using EUSES 2.0.3. The only significant route to the terrestrial environment is through the application of sewage sludge. As in the published assessment, values have not been calculated for most of the site-specific scenarios, as the information obtained indicates that disposal of the sludge from many of these is either by incineration or as controlled waste to landfill[10]. Where there is no specific information then a calculation has been performed, but this does not necessarily mean that sludge from the site is actually applied to land. Sites with no on-site biological treatment that do not release to an off-site treatment plant are also excluded.

The resulting PEC values are in Table 3.17.

[10] A calculation for one epoxy resin site (ER4) with sludge application was included in the published assessment. Information provided for this update shows that sludge from this site is no longer applied to land. There is therefore no sludge application related to epoxy resin production and this scenario has been deleted from the terrestrial assessment.

Table 3.17 PEC values for the terrestrial compartment (agricultural soil at 30 days)

	PEC (µg/kg wwt)
Site specific	
PVC additive package: A2	1.43
A3	0.86
A4	1.38
A6	3.46
A8	0.77
A13	0.07
Generic scenarios	
Phenoplast cast resin processing	20
PVC – anti-oxidant during processing	2.2
PVC – plasticiser use	1.6
Anti-oxidant in plasticiser production	5.0
Thermal paper recycling with deinking	633 (p); 1.4 (b); 534 (c)
Thermal paper recycling without deinking	35 (p); 1.7 (b); 29 (c)

p Paper sludge;
b Biological sludge;
c Combined paper and biological sludges (in ratio produced)

Note that these PECs are calculated using the usual TGD method, i.e. sludge is assumed to be applied once per year for 10 years, and the PEC represents the situation 30 days after the final application. In this case, the bisphenol-A concentration is effectively zero after one year, so the PEC is equivalent to the concentration 30 days after an initial application of sludge. However, the $PNEC_{soil}$ is derived from toxicity data based on the initial concentrations of bisphenol-A applied to soil (see Section 3.2.3.1). The concentrations in soil for the risk characterisation must therefore also be expressed on the same basis. This is considered further in Section 3.3.2.

3.1.4.7.1 Thermal paper recycling

Some specific considerations in relation to thermal paper recycling are included here.

Concentrations in sludges from sites with de-inking

From paper treatment, 5.5 tonnes of sludge are produced per day. A total bisphenol-A content of 3.28 kg gives a sludge concentration of 597 mg/kg dry weight (dwt).

From biological treatment, 1,022 kg of sludge are produced per day. A total bisphenol-A content of 1.4 g gives a sludge concentration of 1.4 mg/kg dwt.

If sludges are mixed in the proportions in which they are produced, then the mixed sludge concentration is 504 mg/kg dwt.

The bisphenol-A concentrations in soil at 30 days after application of these sludges[11] (using the TGD method, with input from air neglected) is as follows:

- paper sludge: 633 µg/kg wet weight (wwt)
- biological sludge: 1.5 µg/kg wwt
- combined: 534 µg/kg wwt.

For comparison, if the paper sludge production rate at the site were 200 kg/tonne, then the combined sludge concentration would be 66 mg/kg, and the resulting soil concentration would be 70 mg/kg wwt.

Sludges from the thermal paper broke recycling sites are assumed to be incinerated. There are no data on levels in sludge from these sites at the moment.

Concentrations in sludges from non-deinking sites

From paper treatment, 5.5 tonnes of sludge are produced per day. A total bisphenol-A content of 0.18 kg gives a sludge concentration of 33 mg/kg dwt.

From biological treatment, 1,022 kg of sludge are produced per day. A total bisphenol-A content of 1.76 g gives a sludge concentration of 1.7 mg/kg dwt.

If sludges are mixed in the proportions in which they are produced, then the mixed sludge concentration is 28 mg/kg dwt.

The bisphenol-A concentrations in soil at 30 days after application of these sludges[11] (using the TGD method, with input from air neglected) is as follows:

- paper sludge: 35 µg/kg wwt
- biological sludge: 1.8 µg/kg wwt
- combined: 29 µg/kg wwt.

For comparison the measured concentrations in the paper sludge and biological sludge from the actual site producing corrugated packaging were 12 mg/kg and 5.5 mg/kg respectively. Combining the two sludges gives a calculated concentration of 8.1 mg/kg. The resulting soil concentrations would be 13 µg/kg wwt (paper sludge), 5.9 µg/kg (biological sludge) and 8.6 µg/kg (combined). These figures are broadly in line with the generic calculation, but note that in reality these sludges are incinerated at the site.

3.1.4.7.2 Bisphenol-A in sludge from the degradation of TBBPA

A further possible exposure route for the soil compartment is the degradation of TBBPA during anaerobic wastewater treatment processes, in particular anaerobic sludge digestion[12]. If this did occur, then it is possible that the bisphenol-A formed would be applied to agricultural land with

[11] As bisphenol-A is readily biodegradable there is no residual substance in soil from previous applications.

[12] Anaerobic digestion of sewage sludge is carried out at elevated temperatures (e.g. 35-37°C (mesophilic digestors) or 55°C (thermophilic digesters)) and the residence time of sludge within the system is usually in the range 10-20 days but can be longer).

the digested sludge. The available experimental evidence on this is discussed in the TBBPA risk assessment (ECB, 2007) and is conflicting. A recent study has shown that TBBPA can be degraded to bisphenol-A by anaerobic sewage sludge when incubated at 35°C, but the rate of degradation was relatively slow, for example the half-life for the initial loss of TBBPA from the system was around 19 days, and total yield of bisphenol-A was around 48% after 120 days. However much more rapid disappearance of TBBPA has been demonstrated in a test system using digested sewage sludge (the half-life for degradation of tetrabromobisphenol-A was reported to be 0.59 days) but this study has not yet been fully validated. In contrast to this, a further (unpublished) study has reported little or no degradation of TBBPA in bench-scale reactor systems based on the contact anaerobic process and the conventional aerobic activated sludge process.

A rough estimate has been made of the maximum possible concentration of bisphenol-A that would be present in soil if it was formed from TBBPA during sludge digestion. The concentrations of TBBPA in sludge are taken from the TBBPA risk assessment. The calculation assumes that all the TBBPA present in sludge is converted to bisphenol-A on a molar basis, and that when the sludge is applied to agricultural soil, bisphenol-A will be susceptible to biodegradation in the aerobic conditions present. The resulting concentrations in soil have been estimated with EUSES and are shown in Table 3.18. These figures are speculative, as it is not certain that this reaction occurs during anaerobic sludge digestion, and the calculations do not take into account the rate of the reaction.

3.1.4.7.3 Measured levels

No information on measured levels in soil was available for the published risk assessment and no new information has been located. Limited data on measured levels in sewage sludge were included in the published assessment and showed values which were around three orders of magnitude lower than those calculated; the values calculated for this addendum are similar to those calculated for the published assessment and so are also higher than the available measurements.

3.1.4.8 PEC values - Secondary poisoning

EUSES 2.0.3 has been used to calculate concentrations of bisphenol-A in freshwater fish and earthworms. For the site specific calculations, the site with the highest emission to the appropriate compartment (water or soil) has been used as the basis for the calculations. Concentrations in worms are only calculated for those uses with releases to soil via sludge, as in Section 3.1.4.7. The results are in Table 3.19.

Table 3.18 Estimated maximum concentrations of bisphenol-A in soil that could potentially result from application of sewage sludge from TBBPA processes

Scenario			Estimated concentration of TBBPA in sewage sludge (mg/kg dry weight)	Estimated maximum concentration of bisphenol-A	
				in sewage sludge (mg/kg dry wt.)	in agricultural soil (30-day average) (mg/kg wet wt.)
Reactive flame retardant use	Manufacture of epoxy and/or polycarbonate resins		28-30 (sludge from the eight major brominated epoxy resin companies in the EU is not applied to agricultural land)	12.6	0.013
	Processing of epoxy resins		0.052-0.056	0.024	2.5×10^{-5}
Additive flame retardant use	ABS	Compounding	1.13×10^{3}-1.22×10^{3}	512	0.54
		Conversion	51.6-55.5	23.3	0.025

Table 3.19 PECs for secondary poisoning

	PEC in freshwater fish for predators (µg/kg)	PEC in worms for predators (µg/kg)
Site specific		
Bisphenol-A production (BPA 2)	2.2	-
Epoxy resin (ER 4)	29	-
Thermal paper production (PAPER 6)	28	-
PVC additive package (A6)	8.9	1.6
Generic scenarios		
Polycarbonate bottle washing	2.2	-
Phenoplast cast resin processing	35	7.8
PVC – anti-oxidant during processing	5.7	1.2
PVC – plasticiser use	4.7	0.92
Anti-oxidant use in plasticiser production	11	2.2
Thermal paper recycling with deinking	2.2	237 (p); 0.84 (b); 200 (c)
Thermal paper recycling without deinking	2.2	13 (p); 0.98 (b); 12 (c)

p Paper sludge;
b Biological sludge;
c Combined paper and biological sludges (in ratio produced)

For those scenarios with possible releases to the marine environment, concentrations for exposure of predators and top predators have also been calculated, and are included in Table 3.20. For production, only the highest PEC is presented.

Table 3.20 PECs for secondary poisoning for marine predators

	PEC in food for marine predators (µg/kg)	PEC in food for marine top predators (µg/kg)
Site specific		
Bisphenol-A production (BPA 6)	3.5	0.85
PVC additive package (A1)	0.72	0.29
Generic scenarios		
Polycarbonate bottle washing	0.2	0.2
Phenoplast cast resin processing	*28*[a]	*5.8*[a]
PVC – anti-oxidant during processing	3.2	0.77
PVC – plasticiser use	2.3	0.6
Anti-oxidant use in plasticiser production	7.1	1.6
Thermal paper recycling with deinking	0.2	0.2
Thermal paper recycling without deinking	0.2	0.2

a This scenario is included for completeness, although no relevant sites discharging to marine waters have been identified (see Section 3.3.1.2)

3.1.4.8.1 Measured levels in biota

There is a limited amount of data on levels of bisphenol-A in biota. Belfroid *et al.* (2002) reported levels of bisphenol-A in fish from the Netherlands. Fish were taken from seven locations, both freshwater and marine. The fish species sampled were bream (*Abramis brama*) and flounder (*Platichthys flesus*). The range of concentrations measured was 2 to 75 ng/g dry weight in liver samples, and 1 to 11 ng/g dry weight in muscle samples. These are based on pooled fish samples.

In addition to the fish data reported by Belfroid *et al.* (2002), Vethaak *et al.* (2002) included data on levels in freshwater mussels (*Dreissena polymorpha*) and saltwater mussels (*Mytilus edulis*). These were sampled at locations where higher concentrations of bisphenol-A had been found in the water. In freshwater mussels the concentrations (at two sites) were 0.22 and 0.36 ng/g wet weight; in saltwater mussels (three sites) levels were 0.26 – 1.8 ng/g.

Fjeld *et al.* (2004a) report the results of a screening study in Norway for a range of substances, including bisphenol-A. Sampling for the study took place largely in 2003. Samples were taken from a variety of locations, including lakes and associated rivers, a fjord and its associated river and coastal marine sites (harbours, a contaminated site and open waters). Biota was sampled at a subset of these sampling sites. The bisphenol-A concentration measured in freshwater fish are summarised in Table 3.21.

Table 3.21 Concentrations of bisphenol-A in freshwater fish in Norway

Location	n	Concentration (ng/g)			
		wet weight		Lipid	
		min	max	min	max
Lake Mjøsa (whole fish)	5	1.4	13.7	58	466
Lake Vorma (muscle)	2	6.1	10.4	201	1,350
Lake Øyeren (whole fish)	2	1.0	1.2	32.9	74.5
Inner Drammensfjord (brackish water, muscle)	4	1.9	14.1	24.6	407.8

n Number of samples

In the marine samples (cod liver), bisphenol-A was not detected (at 2-4 ng/g wet weight) in four samples, and was measured at 7 and 62 ng/g wwt in two other samples.

Fjeld *et al.* (2004b) reported further measurements on concentrations in fish from the Drammensfjord, Norway. The levels of bisphenol-A in the fish samples varied between 0.61–13,73 ng/g wwt, lowest in the muscle sample from ide (*Leuciscus idus*) from 1998 and highest in the liver sample from flounder (*Platichthys flesus*) from 2004.

Levels of bisphenol-A in biota from Germany have also been reported (Fraunhofer, 1999). The majority of the samples were collected between 1990 and 1996. The values found in freshwater organisms were: bream (*Abramis brama*) muscle <1-3.3 µg/kg; and zebra mussel (*Dreissena polymorpha*) 1-5.3 µg/kg; and for marine samples: eel pout (*Zoarces viviparus*) muscle <1-3.3 µg/kg; blue mussels (*Mytilus edulis*) <1-1.3 µg/kg; and brown algae (*Fucus vesiculosus*) <1-2.8 µg/kg.

3.1.4.8.2 Comparison with calculated values

The measured values are of the same order of magnitude as the calculated concentrations in fish for the secondary poisoning scenario, and cover a similar range when considering the whole fish values (the calculated values are for whole fish). Individual values are higher, in particular for specific tissues. The data are not extensive, and it is not possible to allocate the measured data directly to either a local or a regional situation. The calculated values are therefore used in the risk characterisation, supported by the measured values.

3.2 ENVIRONMENTAL EFFECTS

3.2.1 Aquatic compartment

This section is a complete reformat and update of the aquatic effects sections presented in EC (2003). Given the rapid biodegradability of bisphenol-A in aquatic systems, studies that do not involve confirmation of exposure concentrations are of limited usefulness for PNEC derivation, especially over longer durations (since the concentration that causes any observed effect cannot be established; this is particularly the case for static tests). Nevertheless, such studies may still be considered qualitatively.

3.2.1.1 Micro-organisms

3.2.1.1.1 Toxicity data

Experiments have been performed with two *Pseudomonas* species, and these are summarised below.

1. Dow (1988) report the determination of an acute bacterial toxicity test carried out using bisphenol-A. The test was performed to good laboratory practice guidelines. Cultures of *Pseudomonas putida* from an agar-solidified medium were added to culture vessels and incubated at 25°C for 18 hours with bisphenol-A. The growth rate of the bacteria was measured by turbidimetry. The highest concentration tested was 320 mg/l, and at this concentration no inhibition of cell growth was observed. (Note that this concentration is slightly above the water solubility of 300 mg/l.)
2. Stone and Watkinson (1983) conducted a growth inhibition test on *P. fluorescens* as part of their studies on bisphenol-A biodegradation. They reported an IC_{50} of 54.5 mg/l for the inhibition of the growth of *P. fluorescens* by bisphenol-A.

Data on micro-organisms are not usually included in a species sensitivity distribution to protect the freshwater compartment. No data were found on the effects of bisphenol-A on saltwater micro-organisms.

3.2.1.1.2 PNEC derivation for WWTP microorganisms

The TGD indicates that tests with *P. fluorescens* should not be used to determine the $PNEC_{WWTP}$ because it uses glucose as a substrate. Results of a cell multiplication test with *Pseudomonas putida* may be used with care. For *P. putida* a NOEC based on cell growth of ≥320 mg/l is reported. This is not a true NOEC since it is the highest concentration used in the test and no effects were observed at this concentration. However, in the absence of any other data this value will be used as the NOEC for the derivation of a PNEC for microorganisms. For a NOEC from a specific population the $PNEC_{WWTP}$ is set equal to the NOEC value. Therefore the $PNEC_{WWTP}$ for bisphenol-A is taken as 320 mg/l.

3.2.1.2 Primary producers

3.2.1.2.1 Freshwater primary producers

Experiments have been performed with one algal and one higher plant species, and these are summarised below.

1. Alexander *et al*. (1985b, 1988) report 96-hour EC_{50} values, based upon cell count and total cell volume of 2.73 mg/l and 3.10 mg/l respectively for the green alga *Pseudokirchneriella subcapitata* (previously known as *Selenastrum capricornutum*). Both of the test results are based upon changes in biomass. In addition to the EC_{50} values reported, the percentage inhibition of cell count and cell volume is reported for the concentrations tested. From these data it is possible to derive an EC_{10} using probit analysis. The calculated 96-hour EC_{10} values

are 1.36 mg/l based upon cell count and 1.68 mg/l based upon cell volume. The test report describes the test methods and test concentrations were measured.

Stephenson (1983) reports a 96-hour EC_{50} of 2.5 mg/l, based upon cell count, for *Ps. subcapitata*. The test report describes the test method used, but does not give details of the test conditions. The test concentration is based upon nominal concentrations. This result supports the data reported by Alexander *et al*. (1985b).

For algae studies it is generally accepted that a 72-hour (or longer) NOEC value can be considered as a chronic result. The TGD indicates that if a long-term NOEC is not available then an EC_{10} obtained by extrapolation using appropriate statistics, such as probit analysis, can be considered as if it were a NOEC.

In summary, the 96-h EC_{10} of 1.36 mg/l for *Ps. subcapitata* is considered valid for use in the PNEC derivation and SSD.

1. Putt (2003) reports a 7-d frond density, biomass and growth rate NOEC of 7.8 mg/l for the duckweed *Lemna gibba*. The static-renewal study was performed to GLP according to OECD Guideline 221 and analytical measurement of bisphenol-A showed that test concentrations remained between 79-100% of nominal. The test report describes the test methods and test concentrations.

The 7-d NOEC of 7.8 mg/l for *L. gibba* is considered valid for use in the PNEC derivation and SSD.

3.2.1.2.2 Saltwater primary producers

Experiments have been performed for two algal species, and these are summarised below.

1. Springborn Bionomics Inc. (1985c) (also published in Alexander *et al*. (1988)) report 96-hour EC_{50} values, based upon cell count and chlorophyll content, of 1.0 mg/l and 1.8 mg/l, respectively for the marine alga *Skeletonema costatum*. The test report describes the test methods and test concentrations were measured. The method used to estimate the effect concentrations was non-linear interpolation. The percentage inhibition of cell count and chlorophyll content is reported for the concentrations tested. These original data have been analysed by the rapporteur using probit analysis in accordance with the OECD Guideline. The resulting EC_{50} for cell count is 1.1 mg/l, and that for chlorophyll content is 1.4 mg/l. It is also possible to derive EC_{10} values using the probit analysis. The calculated 96-hour EC_{10} values are 0.69 mg/l based on chlorophyll content and 0.40 mg/l based upon cell count.

The 96-h EC_{10} of 0.40 mg/l for *S. costatum* is considered valid for use in the derivation of a saltwater PNEC if required.

1. Ishii *et al*. (2003) report a study in which the marine microalga *Nannochloropsis oculata* (ST-3 strain) was exposed to bisphenol-A for more than 15 days. The paper is in Japanese and a translation is currently unavailable, so experimental details could not be determined (and its suitability for PNEC derivation is unknown). However, the abstract, figures and tables are in English and show that there were no effects over 12 days at concentrations up to 3 mg/l, but substantial effects occurred after 1-3 days at concentrations at 6 mg/l and above. Figures in the paper show that exponential growth occurred over a period of about seven days in this study, so the effects occurred during the exponential growth phase.

3.2.1.3 Invertebrates

Many species have been studied, and these are grouped below in taxonomic sequence.

3.2.1.3.1 Freshwater invertebrates

Sponges (Poriferans)

Hill *et al*. (2002) exposed individual gemmules of the freshwater sponges *Heteromyenia* sp. and *Eunapius* sp. to bisphenol-A for nine days in 24-well tissue culture plates with renewal of test medium every 2-3 days. The highest test concentration (160 mg/l) was chemically analysed. The growth of *Heteromyenia* was significantly reduced at 16 mg/l, with no significant effects at 1.6 mg/l. The authors report that there was a similar response in *Eunapius*, but no statistical tests were performed due to small sample sizes. The precise amount of bisphenol-A to which the sponges were exposed for three days between renewals is unknown. However, due to the general robustness of the design (five replicates per treatment, frequent renewal of test solutions), this study is classed as "valid with restriction".

The 9-d growth NOEC of 1.6 mg/l for *Heteromyenia* sp. is considered valid for use in the PNEC derivation and SSD.

Hydra

Experiments have been performed for two *Hydra* species, and these are summarised below.

1. The effects of bisphenol-A on the cnidarian *Hydra vulgaris* have been studied by Pascoe *et al*. (2002). Chemical analysis of test concentrations was performed, and polyp survival, structure, regeneration and mortality were monitored over 96 hours. The 96-h LC_{50} was 6.9 mg/l. The structure and physiology of polyps (considered to be a growth-related end point for the purposes of this assessment) was adversely affected at concentrations greater than 42 µg/l over 6 weeks, and a concentration-dependent inhibition of regeneration was seen above 460 µg/l. The effect levels for 17α-ethinylestradiol were similar to those of bisphenol-A. The authors concluded that the signalling processes responsible for control and regulation of cell movement and differentiation during normal development, regeneration and sexual reproduction were not disrupted by either of the chemicals at low concentrations.

The 6-week polyp structure NOEC of 42 µg/l for *H. vulgaris* is considered valid for use in the PNEC derivation and SSD.

1. The reproductive effects of bisphenol-A on another cnidarian, *H. oligactis*, were studied by Fukuhori *et al*. (2005). Mature polyps were exposed individually in 5 ml of medium for 35 days (males) or 50 days (females) to study effects on sexual reproduction, with renewal of test medium on the 12th, 24th and 36th days. The incidence and number of gonads (testes or eggs) in each polyp were counted at the end of the experiment. Male polyps were also exposed in a separate treatment to examine asexual reproduction, with medium renewal three times a week. The number of buds detached from each parent polyp was recorded at the end of the 35-day asexual study. Concentrations of bisphenol-A were analysed in stock solutions at the start of both experiments only. Testis formation was unaffected at 0.5 mg/l but declined significantly and dose-dependently at 1-4 mg/l in unfed males exposed at $10^{o}C$. However, males that were fed during the study showed significant effects (25-30% reduction) on the number of testes at the lowest test concentrations of 0.5 and 1 mg/l, with no differences at higher test concentrations of 2 and 3 mg/l, but complete inhibition at 4 mg/l. In

starved females, a significant decline in egg production began at 2 mg/l, with a substantial albeit non-significant reduction at 1 mg/l, and no effects at 0.5 mg/l. Results for fed females were not reported in this study. In the group of male polyps used to examine asexual budding, there were no effects at 0.5 mg/l, stimulation of budding occurred at 1 mg/l and a suppression of budding occurred at 2-4 mg/l when animals were exposed at 20°C. When exposure was at 10°C, there was stimulation of budding at both 0.5 and 1 mg/l. These effects at different temperatures could be explained by greater uptake of bisphenol-A at 10°C, which analysis of radiolabelled bisphenol-A showed was 1.4 times higher than at 20°C. The lowest test concentration of 0.5 mg/l elicited a response in some endpoints. Since this response was between 20-30% of the control, a NOEC could be derived by dividing this value by a factor of 3 (i.e., 0.5/3 = 0.17 mg/l), as has been done in some ESR assessments, e.g. for zinc. This study is not used for estimating a PNEC because test solutions were not analysed as frequently, the level of replication was lower, and the final result was less sensitive than in the Pascoe *et al*. (2002) study.

Nematodes

Kohra *et al*. (2002a) exposed young nematode worms *Caenorhabditis elegans* to bisphenol-A in agar plates. On transfer to clean plates the movement of worms to a food source was monitored. Both levels of exposure (10 µM and 0.1 µM) resulted in a reduction in the number of worms reaching the food source after time periods of up to 24 hours. A similar level of effect was seen in both exposures. Kohra *et al*. (2002b) also reported that the respiration of *C. elegans* declined when exposed to 0.1 and 10 µM bisphenol-A in agar. The results cannot be used to derive a no-effect level, and the exposure conditions cannot be easily related to the environment.

Several similar studies with *C. elegans* have been reported in which nematodes were exposed to bisphenol-A incorporated into agar. Ji *et al*. (2004) exposed different strains to 70, 80 and 90 mM of bisphenol-A in agar plates to investigate resistant mutants, and Watanabe *et al*. (2005) reports on studies with a mutant *C. elegans* strain that is particularly sensitive to bisphenol-A and could be used as a sensitive screening assay. Hoshi *et al*. (2003) found a significant increase in the relative percentage of *C. elegans* germ cells when they were exposed to $\geq 10^{-9}$ M bisphenol-A in agar for six days, with no effects at 10^{-10} M. Tominaga *et al*. (2003) exposed *C. elegans* to bisphenol-A on agar plates over four generations and found sublethal effects on fourth generation abundance at 1 nM. Once again, none of these results can be used to derive a no-effect level because the exposure conditions cannot be related to environmental concentrations. However, the results do show that multigenerational effects may occur at concentrations much lower than the LC_{50} from a short-term test.

Rotifers

A 48-hour test was performed with the rotifer *Brachionus calyciflorus* to determine the effects of bisphenol-A on the intrinsic rate of population increase (Springborn Smithers, 2006a). Chemical concentrations were analysed in replicates at the start and end of the exposure period and were in close agreement (95-97%) with nominal concentrations. The NOEC was 1.8 mg/l based on measured concentrations. This study was performed to GLP and is fully reported.

The 48-h reproduction NOEC of 1.8 mg/l for *B. calyciflorus* is considered valid for use in the PNEC derivation and SSD.

Molluscs

Experiments have been performed with two species, and these are summarised below.

1 *Marisa cornuarietis*

Three groups of experiments have been performed on the ramshorn snail *Marisa cornuarietis* (a tropical species of prosobranch snail, not found in Europe).

a) Studies of Oehlmann and co-workers

First test series: Oehlmann *et al*. (2000), Schulte-Oehlmann *et al*. (2001) and Oehlmann *et al*. (2001) report the effect of bisphenol-A on *M. cornuarietis*. Adults were exposed to nominal concentrations of bisphenol-A (1, 5, 25, and 100 µg/l) under semi-static laboratory conditions (with renewal every 24 hours) for five months and in a complete life-cycle test for 12 months. Both experiments included a solvent control, and were carried out at 22ºC. No analysis of the exposure solutions was carried out in these experiments. In both experiments a complex number of alterations referred to as "superfeminisation" occurred. Effects included the enlargement of the accessory pallial sex glands, gross malformations of the pallial oviduct section resulting in an increased female mortality, and a massive stimulation of oocyte and spawning mass production. These effects were statistically significant at each test concentration when compared to the control, and were concentration dependent with the exception of mortality, which was virtually the same in all four bisphenol-A exposure groups (13.3-15.7% compared to control mortality of 3.8%). The cumulative numbers of eggs and the cumulative number of egg masses increased with increasing bisphenol-A concentrations. The hatching success of eggs from the organisms in the five-month experiment (used to start the life cycle test) was not affected by exposure to bisphenol-A.

Second test series: Schulte-Oehlmann *et al*. (2001) and Oehlmann (2001) also report a further experiment using lower bisphenol-A concentrations. The same semi-static exposure system was used, and the duration of exposure was 180 days. The nominal exposure concentrations were 0.05-1.0 µg/l, and the concentrations were checked by analysis following sampling on three occasions. The initial concentrations in the exposures were close to the nominal values. Observations over the 24-hour period between the changes of solution showed that the concentration of bisphenol-A decreased with time. After two months of the experiment, the half-life of bisphenol-A in the exposure solutions was around six hours. After four months the half-life had decreased to two hours and a similar value was found after six months. The concentrations were measured at 2-hour intervals; these were used to calculate average exposure concentrations over a 24-hour period as a time-weighted average. The detection limit was 30 ng/l.

The phenomenon of superfeminisation was again observed in all of the treated groups (with the exception of the 0.05 µg/l (nominal) group). The incidence was at a lower level than in the high concentration experiment (although the level of incidence in the one concentration common to both studies, 1 µg/l, was the same). Mortality was not significantly enhanced in any of the bisphenol-A groups in comparison to the controls. Egg production was also stimulated as in the previous experiment, although the results over the whole 180-day exposure period showed a significant increase only at the two highest concentrations. The authors observe that the exposure period in this second experiment included the season of the year (October to February) when spawning activity in this population of *M. cornuarietis* increases naturally. It was therefore considered that the effect of bisphenol-A might be masked to some degree by the natural increase. (The first experiment took place completely outside this active season.) The experimental results were therefore split into three periods of 60 days, with the middle period containing the season of greatest natural spawning activity. The initial 60-day period showed an increase in the cumulative numbers of eggs and spawning masses in the exposed organisms, with a significant increase over the control for

all but the lowest exposure level. Over the middle period, the animals exposed to bisphenol-A showed a reduction in the cumulative number of spawning masses in all treated groups when compared to the control; in the final 60-day period the pattern was similar to that in the first period. Based on the cumulative egg production over the first 60 days of exposure, the following effect concentrations were obtained: LOEC 48.3 ng/l; NOEC 7.9 ng/l; EC_{10} 13.9 ng/l (all based on the average exposure levels calculated from the measured concentrations).

Third test series: Follow-up studies with *M. cornuarietis* are reported by Oehlmann *et al*. (2006) with the stated objective of resolving identified shortcomings in their earlier studies (see discussion below). Exposures were semi-static, with medium renewal every one or two days. The first of the two experiments reported in this paper is identical to that reported in Oehlmann *et al*. (2000) and Schulte-Oehlmann *et al*. (2001) (i.e., these data are not new).

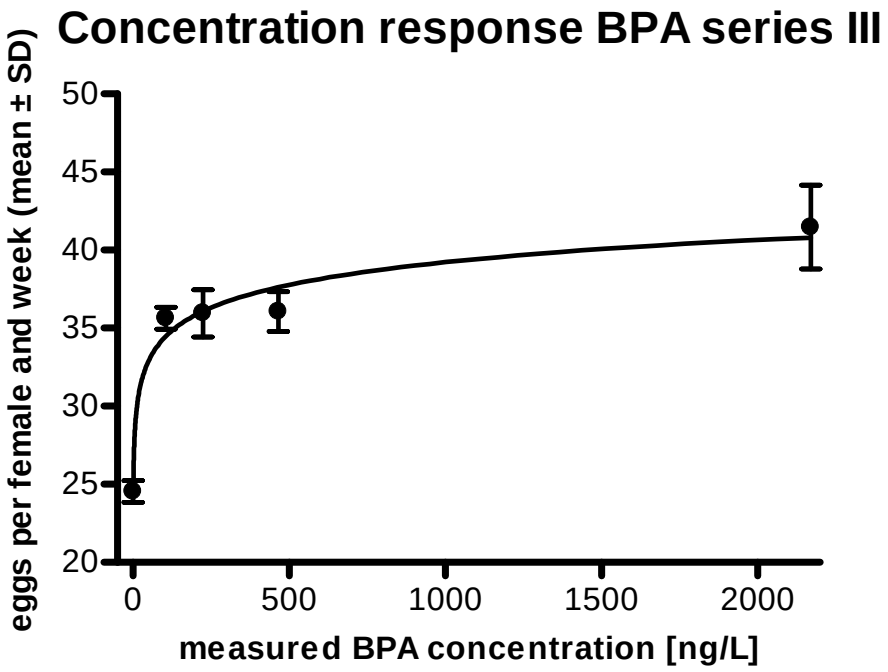
The results of the second experiment have not been published previously. In that study, two replicates, each of 30 sexually mature snails, were exposed to five concentrations of bisphenol-A (0, 0.25, 0.5, 1, and 5 µg/l). Two further treatments of 5 µg/l bisphenol-A with either 3 µg/l of the anti-estrogen ICI 182 780 or 10 µg/l of the anti-estrogen tamoxifen were also used. Exposure was for five months (February-July, which is outside the main spawning period for this population of snails) at two different temperatures (20°C or 27°C) with analysis of all surviving animals at the end of the study. Survival, numbers of eggs and clutches, and numbers of eggs per clutch were recorded daily. Analytical determinations of exposure concentrations over a 24-h period were undertaken in month 1. Measured initial concentrations were very close to nominals, but concentrations declined between renewals. Results were therefore expressed in terms of median (rather than time-weighted) measured concentrations, which were between 39.0% and 48.3% of nominal levels. Bisphenol-A half-lives were slightly lower at 27°C when compared with those at 20°C.

Snails exposed to bisphenol-A at 20°C produced significantly more clutches and eggs compared to controls. A NOEC could not be calculated because there were significant effects (compared to the control) at the lowest test concentration of 106 ng/l. EC_{10} values were estimated to be 14.8 ng/l (95% confidence interval 6.07 – 36.2 ng/l) and 18.0 ng/l (95% confidence interval 6.2-52.5 ng/l) for egg and clutch production, respectively. The dose-response curve derived by Oehlmann *et al*. (2006) is provided in Figure 3.1 (this is a replot of Figure 2C in the original paper provided by the lead author, but the y-axis is the estimate of eggs laid per female per week, rather than the overall egg numbers as in the paper). The curve shown is a fitted Weibull distribution as used by the authors.

At 27°C, none of the treatment groups produced significantly more clutches, or eggs on a per female basis, than the control. A significant increase in egg production could only be detected if measured in terms of cumulative egg number, for the nominal 1 and 5 µg/l exposure groups. Based on measured concentrations, the NOEC for egg production was 205 ng/l (EC_{10} = 998 ng/l; 95% confidence interval 161-6,200 ng/l) and the NOEC for clutch production rose to ≥1,990 ng/l (EC_{10} = 2,090 ng/l; 95% confidence interval 796-5,460 ng/l).

There were no significant differences in egg numbers per female for any of the exposed groups when comparing the output at both temperatures (around 700-800 over the study period), i.e. no dose-response relationship was evident. The temperature-related differences in NOECs are a direct consequence of the lower egg production in controls observed at 20°C (~500 eggs/female over the 5-month period).

Figure 3.1 Dose-response curve for snails exposed to bisphenol-A at 20°C (from Oehlmann *et al*., 2006)



Females with oviduct malformations were only found at 20°C, with an incidence of 4.8%, 8.0%, 14.8% and 11.5% in the groups receiving 0.25, 0.5, 1, and 5 µg/l bisphenol-A respectively. Increased mortality was observed in those groups experiencing oviduct malformation (numbers are not cited, but from Figure 2E in the paper, around 10 deaths were observed in each treatment group at 20°C, compared to 3 in the control – like egg production, there was no clear dose-response).

Some anti-androgenic effects (e.g., a significant concentration-dependent decrease in penis length of males at 20°C) were also observed (neither the magnitude of this change nor a NOEC/EC_{10} for the effect are indicated in the paper).

When snails were simultaneously exposed to bisphenol-A and an anti-estrogen, the stimulatory effect of bisphenol-A on egg production was completely antagonised. Competitive receptor displacement experiments with cytostolic preparations showed the existence of androgen- and estrogen-specific binding sites. Bisphenol-A appeared to have a higher binding affinity for the *M. cornuarietis* estrogen receptor than for fish estrogen receptors.

The first and second test series above were included in the published risk assessment (ECB, 2003). At that time it was concluded that these were not suitable for use in deriving a PNEC for the assessment, and that further work on this species was necessary. A method development and testing programme has been carried out, and the results from this are presented below.

b) Conclusion (i) programme

The conclusion (i) programme was made up of three phases. In the first phase, *Marisa cornuarietis* were obtained from a pristine habitat in the wild[13], and colonies established in three laboratories. The effects of temperature, photoperiod, population density, food, etc., on reproduction, fecundity and juvenile growth were investigated to establish husbandry conditions. It was found in this work that external characteristics of the snails could be used to reliably sex the animals, which allowed a test design based on breeding pairs (Oehlmann *et al*. have reported that reliable sexing based on external characteristics is not possible with the *Marisa* in their laboratory). Partial life cycle tests without chemical exposure were conducted at each of the three laboratories to investigate inter and intra-laboratory variability in endpoints. The main finding was that the primary source of variability was at the level of the breeding pairs. Following the fecundity of adult snails over a 12-month period showed a decrease over the first few months and a plateau thereafter (but no evidence of seasonal variation). This phase of the work is reported in Aufderheide *et al.* (2006) and Selck *et al.* (2006).

The second phase of the work was a preliminary toxicity test to define the range of bisphenol-A concentrations to be used in the definitive test. This was carried out at one laboratory in flow-through apparatus using breeding pairs of snails, with the adult pairs exposed over three months at 25°C. An analytical method to determine bisphenol-A concentrations was developed. This phase investigated the degree of replication and the statistical power needed to identify substance-induced effects. The exposure concentrations used were 0.1, 1, 16, 160 and 640 µg/l. No effects were seen on any of the endpoints studied – reproduction (eggs/female/month), egg hatchability (percent hatch, time to first hatch, time to 50% hatch) and growth rate. There was no increase in fecundity on exposure to bisphenol-A in this phase. This phase of the work is reported in Forbes *et al.* (2007a and 2007b).

The third phase of the work was the definitive toxicity study based on the methodology and results of the earlier phases (Warbritton *et al.*, 2007a). For the adult fecundity trial, replicate exposure aquaria were divided into ten equal size chambers using perforated glass partitioning. Each chamber randomly received a breeding pair of snails. Six replicate exposure aquaria were used for each bisphenol-A exposure concentration, with twelve replicate aquaria for the control. The test temperature was 25°C. Four bisphenol-A concentrations were used: 0.1, 1, 25 and 640 µg/l (nominal), with an intermittent flow-through dosing system, and exposure was for six months. The number of egg masses and the number of eggs per egg mass were counted.

An egg hatchability trial was also conducted. Five females in each of three of the replicate exposure aquaria (and in six of the control aquaria) were randomly selected, and five consecutive egg masses were collected starting at two months after the beginning of the fecundity trial. The egg masses were placed individually in the appropriate test solutions in glass-nylon mesh baskets. The percent hatch, the time to first hatch and the time to 50% hatch were recorded.

A juvenile growth trial was also conducted. One egg clutch was selected randomly from each of five females in each replicate vessel (three replicates per bisphenol-A treatment and six from the controls). The eggs were exposed as in the hatchability trial. At 32 days post hatch five juvenile snails were selected from each female's offspring, giving 25 young per

[13] The snails were taken from a reservoir in Puerto Rico, to which they had been introduced in 1960 (Aufderheide *et al*, 2006).

replicate, and were placed in aquaria (one aquarium for each of the three replicates at each concentration). Snails were individually marked, and were weighed weekly over the three-month exposures. Animal gender was determined for each individual based upon internal examination of the gonads at the termination of the exposure.

An additional fecundity trial was carried out at a lower temperature of 22°C over a twelve-week period, at a single bisphenol-A concentration of 25 µg/l (Warbritton *et al*., 2007b). Four replicates were used for the exposure, along with four controls. The other conditions were the same as those for the main fecundity trial.

The concentrations of bisphenol-A in the exposures were measured on a weekly basis throughout the adult fecundity trials and the juvenile growth trial, and more frequently during the hatchability trials. The mean measured concentrations were 74-135% of the nominal concentrations. No bisphenol-A was detected in the control exposures at a detection limit of 0.06 µg/l. The results are expressed in terms of the nominal concentrations.

There was no significant effect of bisphenol-A exposure on adult egg production at any of the tested concentrations. Statistical tests were carried out on the number of eggs per female per month. Comparisons with the controls were carried out by calculating the mean value for each replicate vessel and then testing the means of the replicates using a two-sided Dunnett's test (looking for either increases or decreases compared to the control). Differences in bisphenol-A concentration explained only 1.6% of the total variation in egg production.

There was no significant effect of bisphenol-A on the percentage of eggs hatching, and no significant difference between the controls and any of the bisphenol-A treatments (based on the mean percentage hatch per treatment). ANOVA suggested a significant effect of bisphenol-A on the time to first hatching, but the two-sided Dunnett's test showed no significant difference between any of the treatments and the control. First hatch occurred over a narrow period of time, generally not much more than 24 hours. The timing of the observations in the lab could have meant just including or just excluding snails from a time period, and so could have affected the result quite strongly. No significant effects on the time to 50% hatch were found.

In the juvenile growth trial, bisphenol-A had a significant effect on female growth rate, female wet weight and male growth rate. Growth rates were calculated by fitting a third degree polynomial curve to the data, and taking the slope of the function at 60 days post hatch as the growth rate. The point on the curve at 60 days was noted as the wet weight at this time. Comparison with the control values (using the mean growth rate or wet weight for each replicate) found a significant reduction in female growth at the highest exposure level. There was also a marginal effect (reduction) on female weight at the same level. A significant increase in male growth rate, and a marginal increase in wet weight, was found for the 1 µg/l treatment group. However, a much greater proportion of the variability in the data was explained by variation between pairs, and between siblings from the same pair, than by bisphenol-A treatment (for example, for male growth rate 42% of the variation was between siblings from the same breeding pair, 24% between breeding pairs, 21% related to bisphenol-A). The effect was not seen in the Phase 2 data when these were re-examined with separated data for males and females. The growth endpoint had a high level of variability, showing the highest difference for an endpoint between the three laboratories in the Phase 1 study. The test facility also noted variation between the growth rates in Phases 2 and 3. The difference in growth rates between Phases 2 and 3 at the test facility was greater than the difference between the growth rates at the BPA exposure levels in Phase 3. Different ages of

the adult snails used to produce the egg masses may account for some of this (between laboratories and/or phases).

There were no significant differences between the fecundity (as eggs/female/month) of the controls and snails exposed to 25 µg/l at 22°C and 25°C. The increase in temperature increased the number of eggs/female/month by 5.1% in the controls and by 11.6% in the exposed snails. Exposure to bisphenol-A increased egg production by 6.6% at 22°C and by 13.2% at 25°C. These differences were not statistically significant.

The overall NOEC from the study was concluded to be 25 µg/l, related to the growth of juvenile female snails. It should be noted that this is a conservative value since the LOEC is significantly higher (i.e. the true NOEC lies somewhere between 25 and 640 µg/l).

c) Studies of Schirling *et al*.

Schirling *et al*. (2006a) reported the development of a test method using eggs of *Marisa cornuarietis* to assess the effects of potential developmental and endocrine disruptors. Eggs were exposed to bisphenol-A in Petri dishes, with 15-20 eggs per dish. Two exposure concentrations were used, 50 and 100 µg/l, with nine replicates for each concentration and the control. Exposure solutions were renewed at least every third day, as was the stock solution. Eggs were observed under a microscope from the day of laying until the hatching of the snail. Endpoints monitored were mortality, formation of eyes, formation of tentacles, hatching (all as percentages of the exposed organisms) and heart rate. The weight of the snails on hatching was also recorded (hatching took place from 9-14 days after laying in the controls.

Bisphenol-A had no effect on the development of eyes or tentacles compared to the controls. There was a significant reduction in the heart rate in the 100 µg/l exposure at nine days. Slightly more animals hatched in the exposed than the control groups at 11 days, but this was reversed at 12 and 13 days, and none of the differences from the controls were statistically significant. The weight of newly hatched snails was significantly higher at 100 µg/l than in the controls. Similar results to those at 100 µg/l bisphenol-A were seen with 17α-ethinylestradiol at 10 µg/l. The study was intended as a development of the method and not for the determination of dose-responses, but a NOEC of 50 µg/l could be tentatively drawn.

2) *Potamopyrgus antipodarum*

As part of studies to investigate the relative sensitivities of fish and molluscs, Jobling *et al*. (2003; corrected version published 2004) exposed *Potamopyrgus antipodarum* (a temperate species of prosobranch snail, common in Europe) to bisphenol-A in water. The exposures lasted up to 90 days, in a semi-static system with 50% of the dosed water being replaced every four days. The exposure levels were nominally 1, 5, 25 and 100 µg/l. No analysis of the exposure solutions was performed. The endpoints monitored were growth and embryo production. Growth was measured by the length of the shell and the width of the shell opening. For embryo production, the number of embryos in the brood pouch was counted, distinguishing between shelled and unshelled embryos. The former are at a much later stage of development, and so the latter gave a measure of new embryo production.

No effects were seen on survival at any concentration of bisphenol-A (or for octylphenol at the same concentrations, or for 17α-ethinylestradiol (EE_2) at concentrations three orders of magnitude lower). Shell height and operculum width were also little affected for the most part, but at nine weeks the shell height in the 5 µg/l exposure were significantly increased over the six week value. There were no significant effects at higher doses. Embryo

production was significantly increased over that in the controls after three weeks at 5 µg/l. At 63 days, the 5 and 25 µg/l exposures had significantly more embryos than the controls, the 1 µg/l exposure had higher numbers but not significantly so, and the numbers at 100 µg/l were lower than in the controls. This indicates an inverted U-shaped response, similar to that seen with EE_2 (at ng/l levels). From the studies reported here and from other studies, the authors concluded that fish appear to be more sensitive to disruption in reproductive output caused by EE_2, but that snails may be more responsive to low concentrations of some xenoestrogens than fish.

This study cannot be used directly for the PNEC derivation or SSD because of the lack of confirmation of exposure concentrations. However, it does suggest that the NOEC for this species might be below that for fish (see Section 3.2.1.4.1), providing additional evidence that snails could be more sensitive than other groups of freshwater organisms. It may be noted that this study was performed in the same German laboratory that has performed a number of tests with *M. cornuarietis* reported above (S Jobling, personal communication to the Environment Agency).

The toxicity of bisphenol-A in sediments to *Po. antipodarum* has also been reported by Duft *et al*. (2003), and this study is discussed in section 3.2.2.1 of this report. In summary, stimulation of embryo production occurred at all test concentrations (i.e., the NOEC was below 1 µg/kg nominal dry weight) after eight weeks' exposure.

Discussion of the mollusc studies

Studies on three species of prosobranch snails (*Po. antipodarum*, *M. cornuarietis* and *Nucella lapillus* - see Section 3.2.1.3.2) – mostly performed in a single laboratory – indicate effects of bisphenol-A on reproductive parameters. The main underlying effect seems to be a stimulation of production of embryos, eggs and/or spawning masses[14]. In the case of *M. cornuarietis,* which appears to be particularly sensitive based on the work of Oehlmann and co-workers, this can lead to a rupture of internal organs and death in a proportion of the snails (this appears to depend on the morphology of the pallial oviduct, and the observation is so far restricted to this one species). Changes to other organs in the animals were also observed. These types of effects were not observed in the extensive conclusion (i) study, which had much greater statistical power (the most sensitive endpoint identified was growth of juvenile females; tissues were not examined for histopathological changes).

There are a number of drawbacks in the experimental methodology of some of the tests performed by Oehlmann and co-workers that makes it difficult to interpret the results with confidence. For example:

- The source of the snails is not well documented. The breeding population was originally established using snails obtained from Dusseldorf Zoo, with occasional inputs of snails from an unnamed source in Florida (J Oehlmann, personal communication).

- In the initial experiments with *M. cornuarietis* (Oehlmann *et al*., 2000; Schulte-Oehlmann *et al*., 2001; Oehlmann *et al*., 2001) two concentration ranges were used, i.e. high (1-100 µg/l) and low (0.05-1 µg/l). Concentrations were not measured in the first (high concentration) experiment. Measurements in the second (low concentration) experiment showed that the

[14] It may be noted that bisphenol-A has also been found to increase egg production in the copepod *Acartia tonsa* – see main text under Section 3.2.1.3.2 (saltwater *Crustacea*).

concentrations of bisphenol-A decreased rapidly over the 24-hour period between renewals of solution. The rate of disappearance was more rapid at later times in the test, despite the renewal of the solutions each day. Bisphenol-A is not susceptible to rapid abiotic degradation in solution, so it would appear that biodegradation or metabolism occurred in the solutions, with some indication of adaptation over the course of the experiment. In view of the rapid disappearance of the substance, the nature of the chemical species present in the exposures is unclear, particularly in the later parts of the experiment. For example, for a half-life of six hours only 6% of the substance would remain after 24 hours; for a half-life of two hours there would be effectively none of the substance left after twelve hours.

- The report of the second (low concentration) experiment also indicates that the control exposure solutions initially contained 30-40 ng/l of bisphenol-A at the first time of sampling for analysis. This was found to be due to leaching of the test compound from the plastic tubes used in the filter systems of the exposure tanks. Following replacement of these tubes with glassware, bisphenol-A could not be detected in the control group in the subsequent sampling.

- As noted in the description of the studies above, the period of the second (low concentration) experiment included the natural spawning season of the snails. This makes it difficult to compare the two studies. Both experiments included a nominal exposure concentration of 1 µg/l. The cumulative egg production over the first 60 days of the second experiment (taken as a period less affected by the natural spawning) was much higher than that seen over the 180 days of the high concentration experiment at the same exposure level, but the incidence of females with malformed oviducts was identical in both 1 µg/l exposure groups. The cumulative egg production in the control of the low concentration experiment was similarly higher than that for the high concentration experiment. These observations presumably relate to the difference in the natural spawning rate, and make it difficult to distinguish the effects due to the substance. The conclusion (i) study found no indications of seasonality in spawning in the *Marisa* used in that study.

- Snail density and volume per snail can both affect the growth, natality rates and calcium uptake rates of aquatic snails. This is due for example to competition for nutrients and food, ammonia formation, and the removal or dilution of beneficial growth factors secreted by the snails (JD Thomas, personal communication). In this case, snail densities were as high as 3.5 snails/litre, and this changed as snails were removed for analysis. Densities above about 1 snail/litre have been shown to have a negative effect on reproductive output of this species even under flow-through conditions (Aufderheide *et al*., 2006). Density-dependent effects may therefore have confounded the results.

- The level of replication should be as high as possible because aquatic snail reproductive traits are generally highly variable (JD Thomas, personal communication). However, only one replicate test chamber was used per exposure concentration. The absence of replication means that inferential statistics cannot be applied, i.e., trends can be observed but they cannot be extrapolated to the 'population' of interest (Leidi, 2005). Further detailed criticisms of the statistical methods are presented in van der Hoeven (2005). In summary, statistical experts consider it invalid to calculate a NOEC from the data or to test the effect of concentration on snail mortality. The main point is that there could be many other factors causing mortality in a given test vessel that have nothing to do with exposure concentration, which is why replicates are needed.

In view of the apparent instability of the substance under the exposure conditions used, statistical uncertainties, issues over snail density and other test conditions, and the possible overlap with natural changes, the effect concentrations from the initial *Marisa* studies are not considered suitable for use in the PNEC derivation.

This led the research group to conduct further studies, which have been reported recently (Oehlmann *et al*., 2006). Despite the criticisms of the original studies, the new study appears to indicate very similar effects, with a 5-month egg production EC_{10} of 14.8 ng/l at 20°C. (This value was inferred since significant effects occurred at the lowest median measured test concentration of 106 ng/l, equivalent to an increase in egg production of ~40% compared to control females.) At 27°C, depending on how the data are interpreted, there are either no effects on egg production (in terms of eggs per female), or a NOEC of 205 ng/l can be derived based on cumulative egg numbers (with an estimated EC_{10} of 998 ng/l or 0.998 µg/l). This paper and the underlying dataset were reviewed by members of an expert group that was set up to guide the conclusion (i) testing programme for snails (as reported above). This review identified a number of issues, as follows:

- Snails were exposed in duplicate tanks at each treatment level. This level of replication permits better statistical analysis than the earlier experiments. However, interpretation of the results from work with groups of snails (rather than paired individuals) remains difficult because it is known from the conclusion (i) test programme that there can be considerable animal-to-animal variability in egg production. By presenting the cumulative egg production per tank and not per female, intra- and inter-female variability is ignored, i.e. apparent differences in egg production among treatments and controls may in fact be related to natural intra- and inter-female variability. The test design still does not allow separation of breeding pairs and analysis of the intra- and inter-female variability in reproductive output. The conclusion (i) study required a very high degree of replication to overcome this problem.

- There are still significant criticisms about the application of the statistical techniques that were used in the paper (van der Hoeven, 2005 and Leidi, 2005 & 2006). For example:
  - The analysis assumed that identical sex ratios were employed in the replicates and exposures, and that mortality did not affect these ratios, nor the fecundity. This influences calculations of egg production per female, and adds uncertainty to the reported results that is not addressed.
  - Van der Hoeven (2005) and Leidi (2005 & 2006) were unable to replicate the derivation of the EC_{10} value from the raw data provided by the authors for this purpose. Whilst the Weibull distribution appears to fit the data very well (r^2 = 0.936), the small number of data points means that this could simply be the result of overfitting (van der Hoeven, 2005). Unfortunately there are no details in the paper about how this curve was calculated to permit independent validation.
  - Several alternative statistical models could have been used. For example, simple linear correlation has been found to be significant (p=0.02), although the fit is not as good (r^2 = 0.718) (van der Hoeven, 2005). This is not necessarily the correct distribution for the data, but it is the simplest. A quadratic relationship was also used, but did not provide a better fit compared with the linear model.

- The authors used the control group repeatedly in their tests of significance, making the results of the individual comparisons dependent on each other. The p-values should have been adjusted accordingly.

- The variability in the data set is surprisingly small. The mean coefficient of variation (CV) for reproductive output is ~3% for all treatment groups. In comparison, van der Hoeven (1998) found that the median CV in a ring test of a highly standardised method with clonal *Daphnia magna* was 14.4%; the median CV in less-standardised tests with *Folsomia candida* and *Eisenia fetida* was about 50%. Leidi (2006) has also pointed out that the observed variability was much lower than expected. This suggests that the dataset is unusual in that the tanks can not be considered to be truly independent replicates: no variability was observed between a few tanks at the same dose. One explanation might be that each individual snail is negatively correlated with the rest (Collett, 2002).

- Some of the experimental issues identified for the original studies still remain, for example:
  - the varying snail density (although this did not vary as much as in the earlier experiments, with an initial density of 1.11 snails/l, dropping to 0.72-1.00 snails/l at the end, depending on the mortality in the different treatment groups); and
  - the very rapid loss of bisphenol-A in the test system, which is a major additional complication. The only analytical measurement of test solution stability occurred after one month, over one test media renewal cycle. The test substance half-life is reported as 3.0-3.9 hours, and in all but the highest dose group, no bisphenol-A was detectable in the media at the end of the renewal period. It is therefore not clear what substance concentration actually caused the apparent effects in each treatment. The authors used the median measured concentrations to derive an EC_{10} value. For example, the lowest nominal concentration of 0.25 µg/l had a median measured concentration of 0.106 µg/l, but the standard deviation for this value is 0.113 µg/l, demonstrating the wide variation observed. Given the lack of information to derive proper time-weighted average concentrations over the whole course of the experiment, the rapporteur considers that this approach is unreliable.

- The paper suggests a possible mode of action in which bisphenol-A binds more strongly to *M. cornuarietis* receptors than to the vertebrate estrogen receptor, which helps to explain why this species is so sensitive. However, some experts have identified experimental drawbacks about this part of the study, which raises some doubt about its reliability (e.g. Dietrich *et al*, 2006). Despite this, the elimination of effects when snails were exposed to a mixture of bisphenol-A and an anti-estrogen lend some support to the hypothesis. In any case, this mechanistic information does not directly affect the interpretation of the bisphenol-A toxicity data themselves.

The Oehlmann *et al*. (2006) study clearly suggests that there are temperature-driven differences in the observed effects[15], and this is linked to an apparently natural increase in egg production at higher temperatures. It should be noted that reproductive traits are more variable in this species at lower temperatures, which could have some influence on the findings due to the test design and method of statistical analysis. Oviduct malformations and associated mortality are not seen

[15] It has been suggested that the lower temperature might not be relevant for this species. However, although mainly tropical in distribution, *M. cornuarietis* is tolerant of a wide range of temperatures, and can exist in Florida (at the edge of its range) at an average temperature of 20-22°C. The snail population used for this experiment was a mixture of laboratory-derived stock and snails obtained from Florida. Control mortality at 20°C was very low during the experiment (5% over a period of 5 months) and even slightly lower than in controls at 27°C of the same experiment (J Oehlmann, personal communication). The lower temperature therefore seems to be appropriate.

at the higher temperature of 27°C (the study authors state that the oviduct becomes widened during natural periods of higher egg production).

Comparison of the studies performed by Oehlmann and co-workers with the conclusion (i) study is not straightforward because the latter was not intended to be an exact replica of the original work. Rather, it was developed to specifically take account of the influence of key husbandry parameters such as water quality, food type, snail density and temperature on snail responses. The findings of the initial phases were used to develop a statistically robust test based on breeding pairs of snails which allowed the intra- and inter-female variability to be investigated, with sufficient replication to detect an increase in fecundity of ~20% under the conditions of the test.

An obvious difference between the two groups of studies is temperature. A temperature of 25°C was chosen for the main test of the conclusion (i) study because:

- of practical considerations such as timing and the laboratory space available to house the required number of aquaria (the snails showed a higher degree of variability (i.e. more control tanks are needed) and grow more slowly at lower temperatures); and
- this is closer to the temperatures that this population of *Marisa* normally encounters in the wild (the original stock of snails was collected from a tropical lake).

There was no increase in egg production at any of the tested concentrations at this temperature. The most sensitive endpoint was growth of female juveniles, which had a NOEC of 25 µg/l.

A trial at 22°C at the same concentration also showed no significant difference in fecundity compared to controls (and only slightly lower egg production than at 25°C). This test concentration and temperature is the same as one in the first test series by Oehlmann and co-workers, when effects on both egg production and mortality were seen.

Another obvious difference is the exposure regime. Bisphenol-A is readily biodegradable, and a flow-through test system is usually preferred for such substances. This was the regime chosen for the conclusion (i) study. The studies of Oehlmann and co-workers used semi-static exposures, and there was rapid disappearance of the parent compound. It is therefore possible that metabolites could have been present at higher concentrations in the semi-static studies. The same metabolites may have been present in the conclusion (i) study, but the actual levels of any metabolites, and their role in the observed effect, is unknown.

Clearly there is a significant difference in the responses of the *Marisa* used in the two major groups of studies. This does not appear to be simply due to temperature differences, because the lower temperature trial in the conclusion (i) study did not result in any effect. Whilst differences in experimental design will obviously have influenced the results, it may be noted that the snails in the studies by Oehlmann and co-workers showed seasonal spawning behaviour, which was not present in the animals used for the conclusion (i) study (no stimulation of egg production was seen in the Oehlmann's snails during their active spawning phase). The fact that these two groups of snails come from different geographical sources has been suggested as a possible contributory factor to this difference, and this demonstrates the difficulties in working with species that have not been properly ring-tested.

In summary, the studies performed by Oehlmann and co-workers have major limitations, which make the numerical results derived from them of questionable reliability. However, whilst preference would normally be given to the fully valid conclusion (i) study, the findings of mortality and morphological changes cannot easily be discounted. This is also supported by the

observation of similar types of effects (in relation to stimulation of aspects of reproduction) in other species such as *Potamopyrgus* and *Nucella*, although none of these other studies provides a value that is suitable for use in the risk assessment (and the tests were performed in the same laboratory and so could be subject to similar drawbacks). In addition, the snails used by Oehlmann and co-workers have a seasonal breeding cycle. It is therefore possible that an effect was missed by using a strain of snails that did not have a seasonal breeding cycle in the conclusion (i) study.

The calculated EC_{10} reported by Oehlmann *et al*. (2006) may be an artefact of the statistical approach and the choice of values used to represent the exposure concentrations. For example, van der Hoeven (2005) calculated an alternative EC_{10} of 2.1 µg/l at 20°C (with a 95% confidence interval from 1.0 to 11 µg/l), based on a simple linear two-parameter model and nominal test concentrations[16]. If the mean measured concentrations were used, the values would be approximately halved, but the rapporteur believes that the lack of proper chemical analysis makes these too unreliable.

One approach to overcome the problem of which value to use for *M. cornuarietis* would be to derive a geometric mean of the available NOECs to take some account of both studies (which would be consistent with the approach used for the *Xenopus* studies reported below). This is not preferred since if seasonality were a key factor in snail sensitivity, the importance of the 'low dose' findings would be diluted. Both studies will therefore be taken into account in the PNEC derivation.

In summary, the 5-month egg production EC_{10} of 0.0148 µg/l at 20°C from Oehlmann *et al.* (2006), the recalculated EC_{10} value of 2.1 µg/l for the same endpoint by van der Hoeven (2005), and the NOEC of 25 µg/l at 25°C for juvenile female growth from the conclusion (i) programme for *M. cornuarietis* are considered in the PNEC derivation and SSD.

Crustacea

Experiments have been performed with three species, and these are summarised below.

1) Four 48-hour EC_{50} values based upon immobilisation of *Daphnia magna* are reported. Stephenson (1983) reports a value of 3.9 mg/l, Chen *et al*. (2002) report a value of 10 mg/l, and Hirano *et al*. (2004) report a value of 12.8 mg/l, all based upon nominal concentrations. Alexander *et al*. (1985c) report a 48-h EC_{50} of 10.2 mg/l based upon measured concentrations. The methods used are documented in all of these studies, but the latter test result based upon measured concentrations is considered to be the most reliable, and is supported by two of the other studies.

   A 21-day $NOEC_{reproduction}$ of ≥3.146 mg/l for *Daphnia magna* is reported by Bayer AG (1996). The method used is fully documented in the test report and the test concentration is measured. At the highest concentration tested (nominal concentration of 3.2 mg/l) no effect on reproduction was observed. The $NOEC_{reproduction}$ is therefore given as ≥3.146 mg/l (measured concentration).

   Caspers (1998) studied the moulting behaviour of parthenogenetic *D. magna* females in what is likely to be the same study as Bayer AG (1996). The author did not observe any change in

16 Other relationships could be used to fit the data. For example, the EC_{10} estimate is 0.38 µg/l using a quadratic relationship. This does not provide a significantly better fit than the linear one (the *p*-value was 5.6%).

moulting behaviour at exposure concentrations of 0.316 and 3.16 mg/l. Moulting behaviour has been claimed to be a toxicological endpoint that is able to reflect effects of endocrine disruption.

Mu *et al*. (2005) report both acute and chronic effects of bisphenol-A on *D. magna* in semi-static test systems with daily renewal. The EC_{50} for juveniles less than 24 hours old was 16 mg/l (95% confidence interval of 15.9-16.4 mg/l). The authors report a chronic toxicity threshold of 1.3 mg/l for effects on female fecundity after a 21-day exposure period. However, this threshold is based upon a second order regression model fitted to the data. Figure 6 in the paper shows that a plausible model could be fitted that would lead to a higher threshold (i.e., a NOEC) of approximately 5 mg/l. At concentrations >5 mg/l there was evidence of an increase in the intermoult period for neonates, and at 10 mg/l there was an increase in neonatal abnormalities. The authors propose that bisphenol-A effects on daphnid reproduction are due to anti-ecdysteroidal activity. There was no chemical analysis of exposure concentrations in this study, so these results are not themselves suitable for inclusion in an SSD but can be used to support the Bayer AG (1996) study.

Brennan *et al.* (2006) carried out acute and chronic tests on *Daphnia magna*. The acute test were carried out over 48 hours, measuring immobilisation at 24 and 48 hours, and the number of discarded carapaces as a measure of the moulting frequency, also at 24 and 48 hours. Three replicates were used at each concentration, with five *Daphnia* in each. The results were EC_{50} (24 hours) 8.57 mg/l (95% confidence limits 8.28 – 8.86 mg/l), and EC_{50} (24 hours) 7.75 (7.65 – 7.85) mg/l. Results are based on nominal concentrations. There were no effects on the moulting frequency from bisphenol-A exposure, up to the highest tested concentration of 10.5 mg/l. This contrasts with the results reported by Mu *et al*. (2005), where a longer time between birth and first moult was found at concentrations above 5 mg/l. The organisms in the Mu *et al.* study were <1 hour old at the start of the exposures; those in the current study were <24 hours old in line with the ISO guideline.

In the chronic studies, single *Daphnia* were exposed to bisphenol-A over 21-day exposures, with ten replicates for each concentration. The test solutions were renewed three times per week. The endpoints monitored were survival, moulting frequency and the number of offspring produced. Again results are based on nominal concentrations. There were no effects on the cumulative number of moults or the cumulative number of offspring per female at concentrations up to 1.0 mg/l, the highest used, in either the first or second generations. The LC_{50} for mortality in the first generation was 0.806 mg/l over the 21 days. (The second generation value is not given, but the exposure at 0.6 mg/l had 50% mortality in the second generation. Probit analysis of the second generation data carried out for this assessment gives an EC_{10} value of 0.2 mg/l.)

Wang *et al.* (2005) developed a short-term assay with Daphnia to screen for endocrine effects. Specifically, the screen was for the ability to stimulate the production of male offspring under conditions when the offspring would normally be all female. This is promoted by juvenoid hormones in crustaceans. Bisphenol-A had no agonistic effect in Daphnia, and no males were produced. When a low level of methyl farnesoate, a potent agonist, was used together with bisphenol-A, the effect was potentiated compared to that of methyl farnesoate alone. The bisphenol-A level used was 10 mg/l. A possible mechanism was suggested in which bisphenol-A inhibits the enzyme that degrades methyl farnesoate. As only a single concentration was used and the endpoints are indicators, the study is not suitable for use in the risk assessment.

In summary, the 21-d reproduction NOEC of 3.146 mg/l (as a limit value) for *D. magna* is considered valid for use in the PNEC derivation and SSD.

2) Watts *et al*. (2001a) exposed the freshwater amphipod *Gammarus pulex* to bisphenol-A and examined toxicity over a 10-day period and precopulatory behaviour over a 24-hour period. Chemical analysis of test concentrations showed good agreement with nominal concentrations. The LC_{50} was 12.8 mg/l after 24 hours, 5.6 mg/l after 48 hours, and plateaued at around 1.5 mg/L after 120 hours. Precopulatory guarding behaviour was only affected at concentrations close to these lethal levels (0.83 mg/l).

   Johnson *et al*. (2005) exposed *G. pulex* to 0, 1, 10, 100 and 1,000 µg/l bisphenol-A for 14 days in a semi-static exposure system. Ten pairs of animals were exposed to each concentration in the form of precopula pairs (i.e., males clasping the females during the pre-mating period) and observed daily to determine whether they had moulted or died, and to count any juveniles produced. There was reduced survival at the highest test concentration (1,000 µg/l), but there were no significant effects on female moulting rate or juvenile production at any concentration. However, the results were variable, so there would have been little statistical power to detect differences. In addition, although the authors state that samples were taken for analysis at the start of the study, no analytical results are reported, so true exposure concentrations are uncertain. Short-term data reported by Johnson *et al*. (2005) also suggest effects on *G. pulex* survival only at higher concentrations, with mortality over 96 hours of 6.7% in controls, 10% in solvent controls and at 1,000 µg/l, 30% at 3,200 µg/l and complete lethality at concentrations above 10,000 µg/l.

   Both of these studies provide information on short-term or lethal effects of bisphenol-A on *G. pulex*, so are unsuitable for inclusion in an SSD.

3) Springborn Smithers (2006b) report the results of a 42-day reproduction test with the amphipod *Hyalella azteca* (known as the scud) during aqueous exposures. Mean measured concentrations during the test were 0.12, 0.22, 0.49, 1 and 2.2 mg/l, which were 63%, 58%, 65%, 67%, and 73% respectively of nominal concentrations. The NOEC for cumulative number of offspring per female was 0.49 mg/l. There were no effects on body length or dry weight up to the highest concentration tested. This study was performed to GLP using US EPA guidelines and a full study report is available.

The 42-d reproduction NOEC of 0.49 mg/l for *H. azteca* is considered valid for use in the PNEC derivation and SSD.

Insects

Experiments have been performed with two *Chironomus* species, and these are summarised below.

1) Sayers (2005) reports a 96-h LC_{50} of 2.7 mg/l (95% confidence interval of 2.1 - 3.2 mg/l) and a 96-h NOEC for survival of 1.4 mg/l for the midge *Chironomus tentans* exposed to bisphenol-A under flow-through conditions. The test was performed according to US EPA guidelines and was GLP compliant, and mean measured concentrations ranged between 84% and 110% of nominal. The test report describes the test methods and test concentrations, but this is only a short-term study.

2) Hahn *et al*. (2002) examined the effect of bisphenol-A on the yolk protein content of *Ch. riparius* and found a significant reduction in vitellogenin in males at all test concentrations of 1, 100 and 3,000 µg/l, and in females at 3,000 µg/l. Test concentrations were not chemically

analysed. These results, which the authors found surprising, may have been influenced by cross-reactivity in the immunoassay that was used, although the authors regarded this as unlikely. This study is not suitable for PNEC derivation because the method is in development and it also lacked confirmation of exposure concentrations.

Watts *et al.* (2003) report the effects of bisphenol-A on larval moulting and mouthpart structure in *Ch. riparius*. Midges were exposed throughout their entire life-cycle, first in repli-dishes when exposed as eggs, and then in glass vials containing 10 ml of test solution when the eggs hatched into larvae. Chironomids require a substrate for normal development and this was provided in the form of a minimal amount of filter paper, previously soaked for 24 hours in the relevant test solution. Test solutions were renewed daily and chemical analysis of the 1 mg/l concentration confirmed that it was within 20% (830 µg/l) of the nominal concentration. Time to first moult and mean wet weights of first instar larvae were only affected at the highest test concentration of 1 mg/l, with no effects at the next lowest concentration of 100 µg/l. There is a substantial difference between the two concentrations, and clearly the actual NOEC could be significantly higher than 100 µg/l. The incidence of mouthpart mentum deformities was significantly higher than controls at lower and intermediate exposure concentrations (10 ng/l and 1 µg/l). There were no significant differences at higher exposure concentrations (or at the intermediate concentration of 100 ng/l), and there were no significant effects on other mouthparts.

Exposure of chironomids in this study could have been via both overlying water and pre-soaked filter paper, but equilibrium partitioning theory suggests that the fugacity of bisphenol-A should be similar from both sources, and the amount of filter paper used in the test was small. In addition to this, analytical confirmation of one exposure concentration plus daily renewal is not an ideal experimental design, but would have been adequate to characterise exposure concentrations sufficiently for use in risk assessment. The ecological consequences of the deformities observed in the study remain unclear, and the lack of a clear linear or U-shaped dose-response makes these data unsuitable for PNEC derivation. However, the data on time to first moult and first instar larval weight are valid.

In summary, the growth NOEC of 100 µg/l (as a limit) for *Ch. riparius* is considered valid for use in the PNEC derivation and SSD.

3.2.1.3.2 Saltwater invertebrates

Annelids

Biggers and Laufer (2004) used a rapid settlement and metamorphosis assay with the polychaete *Capitella* sp. to assess the juvenile hormone activity of bisphenol-A and other phenolic compounds. Two-day old metatrochophore larvae were exposed in 10 ml of artificial seawater (salinity 30 ppt) and the number of larvae that settled and metamorphosed was assessed after 1 hour. The authors reported an EC_{50} of 0.05 µM, equivalent to 11.5 µg/l. There was no chemical analysis of exposure concentrations, and coupled with the short study duration, this means that the study is unsuitable for PNEC derivation.

Molluscs

Experiments have been performed with three species, and these are summarised below.

1) Adult Dogwhelks *Nucella lapillus* (a prosobranch gastropod) from the field were exposed for three months in the laboratory to concentrations of 1, 25 and 100 µg/l, with renewal every 24

hours (Oehlmann *et al*., 2000). Superfeminisation with enlarged pallial sex glands and an enhancement of oocyte production was observed. No oviduct malformations were found (it was noted that there are differences in gross anatomical structure of the pallial oviduct between this species and *M. cornuarietis*). A lower percentage of exposed specimens had ripe sperm stored in their vesicula seminalis and males exhibited a reduced length of penis and prostate gland when compared to the control. Statistically significant effects were observed at all the test concentrations. The authors concluded that the results show that prosobranchs are sensitive to endocrine disruption at the lowest concentrations of bisphenol-A tested (1 µg/l nominal).

The lack of confirmation of exposure concentrations means that these results cannot be used directly for PNEC derivation. However, the study does provide additional evidence of toxicity to prosobranch molluscs in support of the findings for freshwater species.

2) Canesi *et al*. (2005) injected 0.1 and 0.5 µM of bisphenol-A into the mussel *Mytilus galloprovincialis* and examined effects on lysosomal stability and kinase-mediated cell signalling in haemocytes after 6, 12 and 24 hours. Canesi *et al*. (2004) also exposed haematocyte monolayers from the same species to 25 µM of bisphenol-A. These data cannot be used for this assessment because the method of exposure cannot be related to environmental concentrations, and the end points cannot be related to demographically important factors.

3) Blue mussels *Mytilus edulis* were exposed to bisphenol-A, diallylphthalate (DAP) and tetrabromodiphenyl ether (congener 47) for three weeks in filtered seawater at 10-12°C (Ortiz-Zarrogoitia and Cajaraville, 2006). The exposure level for bisphenol-A was 50 ppb. At the end of the exposures 20 animals were sampled. Bisphenol-A exposure did not significantly induce Acyl-CoA oxidase activity in comparison with the controls, and there were no significant changes in the peroxisomal volume density. These two endpoints were used as a measure of exposure to general pollution. Resorption of gametes was observed in 35% of the female and male animals in the bisphenol-A exposure group. Alkali-labile phosphate levels (considered as a measure of vitellogenin-like proteins) were not affected by exposure to bisphenol-A. There were no changes in oocyte athresia after exposure to bisphenol-A. The authors note that the mussels used in this experiment were at the mature gonad stage, and that they may be more sensitive at earlier stages of gonad development. The study appears to have exposed all of the animals in one vessel, hence there were no true replicate exposures. Only one concentration was used, and so no NOEC value can be determined for the one examined endpoint that showed effects. The study is not suitable for use in the risk assessment.

   Aarab *et al.* (2006) exposed blue mussels *Mytilus edulis* to one concentration of bisphenol-A (50 µg/l) for three weeks in a flow through system. Mussels were obtained from a pristine site in Norway. After exposure, mussels were dissected and the gonadal tissue in the mantle was sampled. Histological examination revealed that the control female animals were in a late pre-spawning stage. Mussels exposed to bisphenol-A exhibited two different patterns; half were considered to be in a post-spawning stage, while the other half had atreitic ovocytes, interpreted as relating to spawning delay. Male control mussels showed no evidence of spawning, while mussels exposed to bisphenol-A showed evidence of spawning having taken place. An alkali-labile phosphate assay to determine total phosphate protein was used as an indicator of vitellogenin-like protein levels. Bisphenol-A exposed female mussels had slightly increased levels over the controls, males had similar levels to the controls. The authors comment that this method may not be suitable for assaying VTG levels in mussels. With only one concentration tested the result cannot be used in the risk assessment.

Crustacea

Experiments have been performed with three species, and these are summarised below.

1) Andersen *et al*. (1999) report a 72-hour immobilisation EC_{50} of 0.96 mg/l for the saltwater copepod *Acartia tonsa*. Kusk and Wollenberger (1999) report 24 and 48-hour EC_{50} values of 5.1-6.3 and 3.4-5.0 mg/l, respectively, for the same species.

   Andersen *et al*. (1999, 2001) studied the effects of a range of substances on the development of nauplii of *A. tonsa*. In Andersen *et al*. (1999) semi-static exposures of copepod eggs were performed with nominal bisphenol-A concentrations of 0.2, 2 and 20 µg/l and medium renewal on days 2, 4 and 6. On day 8 hatched juveniles were divided into groups and placed in vessels with new test medium, and egg production was monitored every day for the next three days. Exposure to 20 µg/l bisphenol-A caused a significant increase in egg production on day 10 of the study, but not on days 9 or 11. In Andersen *et al*. (2001) semi-static exposures were also used, with solution renewal after three days; there was no monitoring of test concentration. The exposures were carried out for five days or until at least 50% of the organisms had undergone metamorphosis from the nauplius to copepodite stage, whichever was the longer. The larval development rate was expressed as the ratio of copepodites to the sum of nauplii and copepodites. The EC_{50} value established for this effect was 0.55 mg/l, and the EC_{10} value was 0.10 mg/l. Although this test is of relatively short duration, it assesses what is considered to be a sensitive endpoint.

   None of these studies is considered suitable for the PNEC derivation or SSD, because of the lack of confirmation of exposure concentrations.

2) The effects of bisphenol-A on the harpacticoid copepod *Tigriopus japonicus* have been studied (Marcial *et al*., 2003). This is an intertidal organism, which thrives at a wide range of temperatures and salinities. It has six naupliar and six copepodid stages, of which the last is the adult. Tests were conducted at 2.5% salinity. Stock solutions of bisphenol-A were changed every week. Acute toxicity was determined in 48-hour exposures, the result being an LC_{50} of 4.32 mg/l (95% confidence limits 4.25 – 4.39 mg/l).

   Longer-term exposures were carried out at four concentrations: 0.01, 0.1, 1.0 and 10 µg/l, with three replicates at each concentration. Nominal concentrations are reported, and the test solutions were renewed daily by replacing around 50% of the working volume each time. Twenty nauplii less than 24 hours old were used at each exposure level. The survival and developmental stage of the organisms was assessed at the renewal of the solutions, at which time they were also fed. For the first eight days the exposures were in 24-well plates; after this time the surviving copepodids were transferred to the chambers of 6-well plates, with food and fresh solution, to initiate copulation. After two to three days, six mature females (bearing ovisacs) were randomly selected from the population and transferred individually to new plates. The number of nauplii produced up to the third brood was monitored for each organism. After 21 days, the sex ratio of the copepodids and the percentage survival were determined. The first brood of nauplii were cultured in the same conditions and the same parameters were monitored for 21 days.

   Survival rates were not affected by bisphenol-A exposure in either the parent or the F1 generation. A significant delay in completion of the naupliar stages (compared to the controls) was seen at concentrations of 0.1 µg/l and above in the parent generation, and at all concentrations for the F1 generation. The time to sexual maturity was increased at 1 µg/l in the parent generation, and at all concentrations for the F1 generation. The sex ratios of copepodids were not significantly different from the controls at any concentration, for either

of the generations. There were also no effects on fecundity (as measured by the average number of nauplii per female) at any concentration. The authors concluded that bisphenol-A (and the other chemicals tested, alkylphenols and 17β-estradiol) had no extensive effect on reproductive parameters, and would have little impact on the demographic profile of the copepod. However, the effects on development could be a potential indicator of exposure to estrogens for crustacean species.

This study is not considered to be suitable for the PNEC derivation or SSD because of the lack of confirmation of exposure concentrations.

3) The most sensitive acute result reported for the mysid shrimp *Americamysis bahia* is a 96-hour LC_{50} of 1.1 mg/l (NOEC = 0.51 mg/l) (Springborn Bionomics, 1985b; Alexander *et al*., 1988). The test conditions and methods are fully described in the test report, concentrations were measured and the test is considered to be valid. This value is supported by a 96-hour LC_{50} of 1.03 mg/l reported by Hirano *et al*. (2004) in a study without analytical confirmation of test concentrations. Both of these studies report short-term lethality results, which are not suitable for inclusion in an SSD (but the 96-h LC_{50} of 1.1 mg/l could be used in the derivation of a saltwater PNEC).

Echinoderms

1) Roepke *et al*. (2005) exposed sea urchin *Strongylocentrotus purpuratus* embryos to bisphenol-A for 96 hours post-fertilisation and measured the percentage achieving the pluteus stage when compared to controls. The EC_{50} was 0.227 mg/l (95% confidence interval 0.122 – 0.324 mg/l). The concentration of bisphenol-A in the 20 ml glass vials used to run these tests was not measured. Addition of tamoxifen, an estrogen receptor agonist, substantially reduced these teratogenic effects, while addition of ICI 182 780, a complete estrogen receptor antagonist in mammals, increased developmental abnormalities by 10-20%.

2) Kiyomoto *et al.* (2006) investigated the effect of ethynylestradiol and bisphenol-A on the development of sea urchin embryos and juveniles. Two species of sea urchin were used, *Hemicentrotus pulcherrimus* and *Strongylocentrotus nudus*; both were collected from the wild in Japan. Eggs and sperm were obtained from the collected animals in the laboratory. Exposures were started either with newly fertilised eggs, or with embryos following hatching at 12 hours post fertilisation. In both cases 500 organisms (eggs or embryos) were used. Exposures took place over different durations, up to 48 hours post fertilisation. The exposure levels ranged from 1.25 to 10 µM (0.29 to 2.3 mg/l). The development of the embryos was observed and categorised in five stages.

   The control eggs hatched at 12 hours after fertilisation, and reached stage 5 (pluteus larvae) after 48 hours. In the bisphenol-A exposed animals, this normal development was only affected at the higher concentrations 1.1 and 2.3 mg/l, and only when the exposure began with the eggs. Embryos exposed from 12 hours after fertilisation showed no effects. Ethynylestradiol produced effects at much lower concentrations and in exposures beginning with embryos as well as with eggs. Although the concentrations were not measured the exposures were relatively short (in particular those over 12 hours from fertilisation), and this part of the study indicates a NOEC of 0.71 mg/l for effects on eggs.

   The authors also exposed juvenile sea urchins (*H. pulcherrimus*) following metamorphosis (~45 days after fertilisation) to bisphenol-A at 0.5 µM (0.11 mg/l) for 80 days. The exposure solutions were renewed every week. After 80 days the test diameters of the juveniles were measured. Animals exposed to bisphenol-A had an average test diameter only half that in the

controls. Ethynylestradiol exposure produced animals with a larger diameter than the controls. As only one concentration was tested no NOEC can be derived and so the result cannot be used in the assessment. This part of the study showed effects at lower concentrations than the egg and embryo exposures.

These studies are not considered to be suitable for the PNEC derivation or SSD because of the lack of confirmation of exposure concentration.

3.2.1.4 Vertebrates

3.2.1.4.1 Fish

Given the widespread interest in the effects of endocrine disrupting substances on organisms, it is not surprising that many studies have been performed using fish, including both whole organisms and isolated tissues. For example, Smeets *et al*. (1999) determined the *in vitro* estrogenic potential of bisphenol-A using cultured hepatocytes from the male carp (*Cyprinus carpio*). Estrogenicity was measured as induction of vitellogenin. Bisphenol-A was found to induce vitellogenin production with a relative potency of 1.10^{-4} to 17β-estradiol and a LOEC of 50 µM (11 mg/l). Bisphenol-A was also found to exhibit cytotoxic effects at 100 µM (22 mg/l) the highest concentration of bisphenol-A tested. Pawlowski *et al*. (2000) studied the estrogenic response of bisphenol-A in cells from rainbow trout (*Oncorhynchus mykiss*) and the variation of the response with temperature. Estrogenic response was measured *in vitro* using cultured hepatocytes from male rainbow trout using a non-radioactive dot blot/RNAse protection assay and by RT-PCR. They found that bisphenol-A was estrogenic with a relative potency of 10^{-4} to 10^{-5} of that of 17β-estradiol. They also found that a higher response rate was measured at 18°C than 14°C with a LOEC of 10 µM (2.3 mg/l) after 48 hours exposure at 14°C and a LOEC of 1 µM (0.23 mg/l) after 48 hours exposure at 18°C. The lowest LOEC measured for vitellogenin induction was 0.1 µM (23 µg/l) after 96 hours exposure at 18°C. Jurgella *et al*. (2006) incubated fragments of liver and kidney tissue from immature lake trout (*Salvelinus namaycush*) with bisphenol-A, and found that 100 µM (23 mg/l) inhibited the production of water soluble (conjugated) metabolites of 17β-estradoil. Several other recent papers have also investigated the effects of bisphenol-A on fish hepatocytes or other cells (e.g., Gushiken, 2002; Hassanin *et al*., 2003; Letcher *et al*., 2005; Rouhani Rankouhi *et al*., 2004; Suzuki and Hattori, 2003), or have investigated bisphenol-A binding affinities and interactions with ligands in fish (e.g., Alo' *et al*., 2005; Ohkimoto *et al*., 2003; Tollefsen *et al*., 2004).

Whilst such *in vitro* studies are useful for elucidating mechanisms of action or for developing environmental screening tools, they are not useful for deriving a PNEC for protecting populations of organisms. However, a similar type of study that may be of greater environmental relevance is reported by Thomas and Doughty (2004). They collected sperm from Atlantic croaker (*Micropogonius undulatus*) and treated it with a progestin in the presence or absence of several potential endocrine disrupting chemicals. The lowest concentration of bisphenol-A that significantly reduced upregulation of sperm motility by the progestin was 0.1 µM, which is equivalent to 23 µg/l. This result may be significant for the functioning of fish reproduction, but the authors acknowledge that the environmental relevance of their findings remain unclear. In this case, the lack of confirmation of exposure concentrations also makes the study unsuitable for the PNEC derivation.

The following sections discuss the available *in vivo* studies, grouping the data for individual species together (freshwater first, followed by saltwater).

Freshwater species

1) Carp *Cyprinus carpio*

Bowmer and Gimeno (2001) have studied the effects of bisphenol-A on the development of the male carp reproductive tract when exposed during sexual differentiation (only an extended abstract of this study was available at the time of writing and no published paper has been found subsequently). Males were exposed to nominal concentrations of 10, 32, 100, 320 and 1,000 µg/l bisphenol-A under flow through conditions, during the period of sexual differentiation (from 45 to 55 days post hatch onwards). Two experiments were performed, the first conforming to the OECD principles of GLP. In both experiments nominal concentrations were confirmed by analysis. In the first experiment 28- and 49-day NOECs for growth (wet weight) were >600 and 100 µg/l bisphenol-A; in the second experiment 28- and 56-day NOECs were both 226 µg/l. In the first experiment 28- and 49-day NOECs for oviduct formation were 100 and 16 µg/l bisphenol-A while in the second experiment they were 60 and 17 µg/l. These results should be considered as "valid with restriction" because a full report is not available. The effects on oviduct formation cannot be related directly to demographic parameters such as survival, growth or reproduction, and so are not used in the PNEC derivation directly.

The 49-d growth NOEC of 100 µg/l for *Cy. carpio* is considered suitable for use in the PNEC derivation and SSD.

2) Goldfish *Carassius auratus*

Suzuki *et al*. (2003) exposed immature fish to a single concentration of 10^{-6} M (~230 µg/l) bisphenol-A for 8 days and measured effects on plasma vitellogenin, calcium and calcitonin levels. Vitellogenin was detected in the exposed fish. Calcium concentrations were significantly higher than controls on day 4 and significantly lower on day 8. Plasma calcitonin concentrations were significantly lower than controls on day 8. This shows that bisphenol-A can affect calcium metabolism in teleost fish, but the single dose and lack of confirmation of exposure concentration means that these results are not suitable for use in deriving a PNEC.

3) Zebrafish *Danio rerio*

Bayer AG (1999a) report a 14-day NOEC of 3.2 mg/l and a LOEC of 10.15 mg/l from semi-static tests performed according to OECD guideline 204. The endpoints studied were mortality and visual effects on appearance and behaviour; the specific effect on which the NOEC was defined is not given.

Schäfers *et al*. (2001) studied the estrogenic impact of bisphenol-A in a full life cycle study (only an extended abstract on the work has been seen, but see further references later in this sub-section). They found that bisphenol-A exposure affected juvenile growth, time until first spawning, egg production and fertilisation rate. The EC_{50} and NOEC for fertilisation rate were 1.45 mg/l and 0.76 mg/l, respectively. Bisphenol-A showed a lower estrogenic potency than ethinylestradiol. Similar results were found by Fenske *et al*. (2001) who looked at alterations in vitellogenesis and reproduction in zebra fish exposed to ethinylestradiol and bisphenol-A.

Segner *et al*. (2003a)[17] report a full life cycle study in which zebrafish were exposed to 94-1,500 µg/l bisphenol-A, with analytical confirmation of exposure concentrations. The LOEC for vitellogenin induction and changes in gonad histology was 375 µg/l (the NOEC was 188 µg/l). The LOEC for juvenile growth, time to spawning, mating behaviour, eggs per female and fertilisation success was 1,500 µg/l (the NOEC was 750 µg/l). There was no effect on the hatching rate of offspring. The absence of a considerable number of pertinent experimental design details, lack of discussion on analytical details and sparse presentation of results mean that this study should be classed as "valid with restriction". Nevertheless, it is considered suitable for the PNEC derivation and SSD, even though the most sensitive end points cannot be related directly to demographic parameters such as survival, growth or reproduction.

Lindholst *et al*. (2003) examined the toxicokinetics of bisphenol-A in zebrafish and rainbow trout. It was suggested that zebrafish may be less sensitive than rainbow trout because of more rapid metabolism of bisphenol-A in the zebrafish liver. However Van den Belt *et al*. (2003) compared vitellogenin induction in zebrafish and rainbow trout after a three week semi-static exposure to 40, 200 and 1000 µg/l bisphenol-A and found no evidence for a difference in sensitivity, with significant induction in both species occurring at only the highest concentration.

Drastichová *et al.* (2005) exposed zebrafish (*Danio rerio*) to bisphenol-A in their food. The exposures were begun with 20-day old fry, a stage which is prior to differentiation between males and females. Bisphenol-A in ethanol solution was mixed with decapsulated brine shrimp (*Artemia salina*) eggs at 500, 1000 and 2000 mg/kg. The fish were fed three times a day over the 45 day exposure period, and the water in the exposure vessels was changed three times per week. The sex of each fish was established from the morphology of the gonads at the end of the exposures. The sex ratio in the controls was 1:1. The ratios in the exposures were (female:male) 1.4:1 at 500 mg/kg, 3.8:1 at 1000 mg/kg and 11.5:1 at 2000 mg/kg. The ratios were significantly different from the controls at 1000 and 2000 mg/kg. Fish exposed to 20 mg/kg 17β-estradiol as a positive control all developed as females. The exposure route means that the result is not suitable for use in the risk assessment.

In summary, the NOEC of 750 µg/l for multiple end points from a *D. rerio* full life cycle study is considered suitable for use in the PNEC derivation and SSD. It is noted that vitellogenin induction and changes in gonad histology were observed at this concentration.

4) Rainbow trout *Oncorhynchus mykiss*

Lysak and Marcinek (1972) report a 24-hour LC_{100} of 7 mg/l bisphenol-A and a 48-h NOEC of 5 mg/l for rainbow trout (*Oncorhynchus mykiss*), while Reiff (1979) reports a 96-hour LC_{50} of 3-5 mg/l. Test methods were not stated and concentrations of bisphenol-A were not measured.

Bayer AG (1999b) report the results of a 28-day juvenile growth test on rainbow trout using bisphenol-A. The test followed the proposed OECD guideline 215 for "Fish, Juvenile growth test". The NOEC and LOEC for growth rate were 3.64 and 11.0 mg/l respectively (both

[17] Segner *et al*. (2003b) also report the results of a life cycle test with zebrafish, which is very likely the same test reported in Segner *et al*. (2003a). For example, the exposure concentrations appear to be identical (94, 188, 375, 750 and 1,500 µg/l). This study might also be the same as that reported by Schäfers *et al*. (2001). For example, the reproduction EC_{50} is stated to be 6,140 nM (equivalent to approximately 1.4 mg/l), which is similar to the value reported by Schäfers *et al*. (2001). Schäfers is one of the co-authors of the Segner *et al*. papers.

arithmetic means of analytical values). This chronic study is fully valid, was conducted under full GLP and followed an OECD Guideline.

Lindholst *et al*. (2000) studied the estrogenic response to bisphenol-A in rainbow trout, which were exposed to bisphenol-A via a continuous flow-through system. Vitellogenin concentrations were measured during the exposure period (12 days). A significant induction of vitellogenin synthesis was observed in the 500 µg/l bisphenol-A exposure group over the study period. In lower exposure groups (40 and 70 µg/l) steadily increasing levels of vitellogenin were observed between 6 and 12 days only. Based upon the data the NOEC for vitellogenin production is taken as 40 µg/l. In a further study, Lindholst *et al*. (2001) again exposed rainbow trout to bisphenol-A in a continuous flow-through system (at 100 µg/l), and also through intraperitoneal injection (at a tissue concentration of 35 mg/kg). Both male and female fish showed increased levels of vitellogenin in the injection exposures, with a lag period of 3-5 days for females and 5-7 days for males. Measured levels of bisphenol-A in the livers of the fish had decreased almost to the detection limit before the increase in vitellogenin was noted. Fish in the continuous exposures did not show significantly higher levels of vitellogenin up to the end of the experiment after seven days. Neither of these two studies can be used for the PNEC derivation or SSD since the exposure concentrations were not measured and the end point cannot be related to population effects.

As mentioned above for zebrafish, Lindholst *et al*. (2003) considered that rainbow trout may be more sensitive than zebrafish due to differences in liver metabolism, yet Van den Belt *et al*. (2003) found no evidence for a difference in sensitivity regarding vitellogenin induction (with significant induction only occurring at 1,000 µg/l after a three week semi-static exposure).

In summary, the 28-d NOEC for juvenile growth rate of 3.64 mg/l for *O. mykiss* is considered suitable for use in the PNEC derivation and SSD.

5) Atlantic salmon *Salmo salar* (m. *sebago*)

Honkanen *et al*. (2004) exposed 8-day old yolk-sac fry to nominal concentrations of 10, 100 or 1,000 µg/l bisphenol-A for 42 days. Test media were renewed every 48 hours, but there was no chemical confirmation of exposure concentrations. After 6 days, yolk-sac oedemas and haemorrhages around the gill arches and in the front part of the yolk sac were observed in fry exposed at the highest concentration. After 8 days fry at the highest concentration were lethargic and remained inactive, and by 17 days they were darker in colour than fry at other concentrations. At the end of the experiment fry at the highest concentration remained lethargic, were darker, and some still had yolk-sac oedemas, although others appeared to have recovered. There was also some evidence that fry in the highest concentration weighed significantly more than other fry, although they did not weigh significantly more than those in the solvent control. Histological analysis of fry livers revealed strongly stained fragments in the nuclei of hepatocytes in the 100 and 1,000 µg/l groups, plus a reduction in liver cell storage substances and a difference in the shape of cytoplasmic vacuoles. This study is not considered to be of direct use for the PNEC derivation because of the lack of confirmation of exposure concentration.

6) Brown trout *Salmo trutta*

Lindholst *et al.* (poster presentation; 2002) exposed eggs to 50 µg/l of bisphenol-A from fertilisation through to 64 days post fertilisation, corresponding to the time of first feeding. The concentrations of bisphenol-A and bisphenol-A glucuronic acid (BPAGA) were

measured in the eggs and developing fry. A rapid increase in the concentration of BPAGA was observed at 35 days post fertilisation, on hatching, possibly due to increased uptake of bisphenol-A through the gills at this time. The bioconcentration factor measured in developing eggs was 10, and in the fry it was 14. After hatching, fish were kept for up to 400 days in clean water, and observations were made on the gonads and sex of the fish. No changes were seen in the sex ratio compared to the controls. Generally there were a higher number of males in both exposures and controls, but there was no increase in the percentage of mature males at 400 days. There were no significant differences in the gonadosomatic index of male fish in this study. This study is not considered to be suitable for PNEC derivation because only a single exposure concentration was used, and the actual exposure level was apparently unconfirmed.

7) Japanese medaka *Oryzias latipes*

Several short-term results are available. MITI (1977) report a 48-hour LC_{50} of 15 mg/l, Tabata et al. (2001) report 72-hour LC_{50} values of 5.1 mg/l for embryos and 7.5 mg/l for adults exposed in semi-static systems.

Several longer-term studies have been reported as follows:

a) Shioda and Wakabayashi (2000) exposed male *Or. latipes* to a natural estrogen (17β-estradiol) and three estrogenic substances including bisphenol-A. After 14 days' exposure, one male was kept with two females for spawning. The results indicated that bisphenol-A caused a decrease in the number of hatchlings at a concentration of 2.3 mg/l. No effects were observed at the lower concentrations that were tested (68, 230 and 680 µg/l). This study was designed to look at the effects of endocrine disrupters on reproduction due to *in vivo* exposure. Due to the different study protocols used it is not possible to compare the estimated potency of bisphenol-A with that of 17β-estradiol.

b) Tabata *et al*. (2001) studied the effect of bisphenol-A on mature male *Or. latipes*. No concentration monitoring was undertaken to confirm the exposure levels. After two weeks' exposure to 100 µg/l bisphenol-A, female specific proteins could be detected in the fish, but no effects were observed at 0.1 or 10 µg/l exposure. After five weeks' exposure female specific proteins were found in the 10 µg/l exposure group but not in the 0.1 µg/l exposure group. Abnormalities in the gonad tissue were observed in the 100 µg/l exposure group in one animal of the sixteen exposed. There was no observation of any sex bias towards females in any of the bisphenol-A exposure groups. Tabata *et al*. (2003a&b, 2004) also report results for *Or. latipes* exposed in flow-through systems to bisphenol-A for five weeks in what appear to be different studies to Tabata *et al*. (2001) which produced less sensitive results. Tabata *et al*. (2003a) and Tabata *et al*. (2004) report the same study in which the NOEC for vitellogenin induction was 200 µg/l and the LOEC was 500 µg/l, with significant induction at 500 µg/l beginning on day 3 of the study. Weekly chemical analysis confirmed that test concentrations remained within 77.2 – 102.6% of nominal. Tabata *et al*. (2003b) report a study in which the effect of chlorination on bisphenol-A estrogenicity was assessed when fish were exposed to 100 or 1,000 µg/l for five weeks. Chlorination appeared to remove bisphenol estrogenicity.

c) Na *et al.* (2002) studied the effects of bisphenol-A on sex differentiation and gonadal development in *Or. latipes*. Fish were obtained from a stream in the wild, and breeding fish were cultured for three months. Fertilised eggs were removed and incubated until hatching. Newly hatched larvae were exposed to bisphenol-A in a static renewal system at nominal concentrations of 50, 100 and 200 µg/l (there is no indication that actual

concentrations in the exposures were measured). Solutions were renewed every 72 hours for the first month and then every 48 hours thereafter. The total length of the exposures was 70 days. Fish were sampled at 10, 20, 30 and 70 days. Saggital sections of the gonads of the fish (male and female) were examined and the proportion of the section occupied by each type of germ cell was determined. Length and weight (at 70 days only) were also determined.

No differences of gonadal development in the process of sexual differentiation were observed between any groups until 30 days after exposure began. At 70 days, bisphenol-A exposed female fish had greater proportions of the later stages of oocytes, including mature eggs, which were not present in the controls. In males, the proportions of the later stages of spermatogenesis were reduced; at the highest exposure level there were very few spermatocytes or spermatids.

A chi-square analysis of numbers of females and males showed a 1:1 ratio in the controls and the 200 µg/l exposure, but a 2:1 (female:male) ratio in the other two exposures. However, this section of the paper is unclear. The ratios are based on the sum of the numbers at each time interval and a much larger number was sampled at 30 days, so the ratio is dominated by the numbers then. At 20 days, the control ratio was 3:1 f:m.

The lengths of fish exposed to 50 or 100 µg/l were not significantly different from the controls, but fish exposed to 200 µg/l were longer than those in the other groups after 30 and 70 days exposure. Fish in the high exposure group were also heavier. The NOEC for a growth effect is therefore 100 µg/l (for promoting growth).

The authors conclude that bisphenol-A appears to contribute to the accumulation of vitellogenin in oocytes in females. In males, it inhibits spermatogenesis, and exposed fish had less developed testicular structure. Lack of chemical analysis means that these results are not suitable for direct use in deriving a PNEC.

d) Yokota *et al*. (2000) report a fully valid and thoroughly described extended early life stage study that examined a number of ecologically critical endpoints. *Or. latipes* were exposed to bisphenol-A from fertilised eggs through to 60 days post-hatch. Five concentrations were used: 2.28, 13.0, 71.2, 355 and 1,820 µg/l (as mean measured concentrations, detection limit 2.5 µg/l.) Semi-static exposures were used for the embryos, with flow-through exposures for larvae. The low exposure concentrations were more stable in the semi-static exposures (which is unexpected). The parameters monitored were egg hatchability, time to hatching, cumulative mortality and growth (total length and body weight).

An initial pre-test established a 96-hour LC_{50} of 13.0 mg/l. In the main study, no significant effects were seen on hatchability, time to hatch, or mortality at any exposure. (Hatching of some embryos was significantly delayed in the 13 µg/l exposure, but there was no dose response and higher exposures showed no differences from controls.) Growth was reduced at 60 days - this was a dose-related effect, with only the highest exposure level producing a significant reduction (p=0.005). Sex ratios were determined from external secondary sexual characteristics. Ratios were 1:1 at concentrations of 71 µg/l and below; at 355 µg/l there were more females than males (5:13); and there were no males at the highest concentration. Sex ratios were also determined through gonadal histological investigation (this allowed some of the fish that did not show clear secondary sexual characteristics to be sexed). These results showed a similar pattern, with the ratio at the highest concentration significantly different from that in the controls (which was

2:1 male to female). The sexual characteristic results were not treated statistically as they are not considered reliable indicators of sex. The examination also looked for cases of testis-ova; cases were only found at the highest exposure concentration. The authors concluded that the lowest effect concentration was between 355 and 1,820 µg/l, although they noted that the study did not investigate whether early life exposure would impair reproduction as adults.

e) Kang *et al*. (2002) examined the effects of bisphenol-A on the reproductive capacity (fecundity and fertility) and estrogenic response of adult *Or. latipes* and studied the transgenerational effects (F1 generation growth and sex) of this substance on the F1 offspring. The test methods used are now being recommended by the OECD for elucidation of effects on survival, growth, and reproduction of potential endocrine disrupting compounds (paired breeding assay and extended early life stage test). Sexually mature *Or. latipes* at four months after hatching (300 mg body weight, 33 mm length) were acclimated to flow through conditions for three weeks in 56 breeding pairs in individual 1 litre chambers. The fecundity of each pair was checked daily, and over the last week of the acclimation period eggs were collected daily, a few hours after deposition, counted and assessed for fertility. From these fish, 32 pairs were selected which spawned every day, with ≥15 eggs per day and mean fertility >90%. These fish were exposed to bisphenol-A for three weeks, at nominal concentrations of 0, 1,000, 2,000 and 4,000 µg/l. The concentrations in the exposure chambers were measured twice each week during the exposures. The levels varied, falling as low as 60% of the nominal concentration on one day, but the average concentrations were 78-86% of nominal. The average measured levels were 837, 1,720 and 3,120 µg/l.

Eggs were collected daily and assessed for fecundity and fertility under a light microscope. All fish were sacrificed at day 21, and histological evaluation and determination of vitellogenin were carried out.

Eggs collected on days 18-20 from the exposure and control groups were used to assess trans-generational effects. Eggs were incubated in dechlorinated tap water and hatched larvae were transferred randomly to four test chambers for each treatment. One week after the mean time for hatching across all treatments, 15 larvae from each chamber were selected randomly and kept until day 60 to assess abnormal development and mortality.

There was no decrease in fecundity or fertility in any of the treatments compared to the controls. One male died in the 1,720 µg/l exposure on day 11, and one female fish died in the 837 µg/l exposure on day 17. Neither of these dead fish showed any pathological changes. The gonadosomatic and hepatosomatic indices of both sexes of fish were unaffected by bisphenol-A exposure. Intersex gonads (testis-ova) were observed in males at all three of the exposure levels – one case at 837 µg/l, six at 1,720 µg/l and four at 3,120 µg/l. No instances of testis-ova were observed in the controls. Cells indicative of normal spermatogenesis were also found in all of the gonads examined. No histological abnormalities were noted in the ovaries of any of the female fish exposed, or the controls.

Vitellogenin levels were significantly elevated above the controls in male fish at the highest exposure concentration used. The levels at this concentration were similar to those found in female fish in the controls and at all exposure levels. Levels of vitellogenin in four of the seven male fish examined from the 1,720 µg/l exposure exceeded the detection limit but were not significantly elevated above the controls.

Bisphenol-A had no observable effect on the survival and growth of offspring at 60 days after hatching. Low mortality was seen at all three exposure levels and was not significant. Length and weight were not significantly affected. The sex ratios did not differ significantly between the controls and the exposed fish, although the controls contained more males than females (1.52:1), the 837 µg/l exposure had more females than males (0.71:1) and the two higher exposure levels had approximately equal ratios (1:1). The authors concluded that although bisphenol-A induced hepatic vitellogenin and gonadal intersex in male fish, these effects are not associated directly with effects on reproduction.

f) Metcalfe *et al*. (2001) examined growth and sexual differentiation endpoints over the course of an extended early life stage test. These are ecologically relevant endpoints and the study is well reported. *Or. latipes* fry were exposed to bisphenol-A in a static renewal system from one day after they had hatched until they reached a length of 1.5 cm (approximately 90 days post-hatch). The fry were then examined histologically to determine phenotypic sex and incidence of testis-ova. Exposure concentrations of bisphenol-A were 0, 10, 50, 100 and 200 µg/l, and test medium was replaced every 48 hours; chemical analysis showed that average concentrations over 48 hours were 59.6% of nominal. Fish exposed to the two highest test concentrations had a significantly higher condition factor (weight divided by total length) than fish in the other groups, but there were no significant differences between treatments in either total length or wet weight alone. Sex ratios did not differ after exposure to any of the bisphenol-A concentrations. Testis-ova were observed in only two males from the lowest test concentration, but not in any fish from the higher concentrations. Male fish at the higher concentrations (50, 100 and 200 µg/l) showed several morphological changes in testes, and female fish at the highest concentration had ovaries in advanced stages of oogenesis in comparison to control females.

g) Kashiwada *et al*. (2002) exposed *Or. latipes* eggs, embryos or adults to nominal concentrations of bisphenol-A for three days, with daily medium renewal. 72-hour LC_{50} values were 9 mg/l for eggs (95% confidence interval 7.1-11 mg/l), 5.1 mg/l for embryos (95% confidence interval 4.2-6.7 mg/l), 6.8 mg/l for adult males (95% confidence interval 5.9-7.7 mg/l) and 8.3 mg/l for adult females (95% confidence interval 7.4-9.4 mg/l). Adult males were also exposed for five weeks under flow-through conditions to nominal concentrations of 0.1, 10 or 100 µg/l bisphenol-A, with chemical analysis confirming that measured concentrations remained within 10% of nominals. Fish were sampled at the end of weeks 1, 2, 3 and 5 for analysis of female specific proteins. These proteins were detected in males exposed to 10 µg/l after 4-5 weeks and in males exposed to 100 µg/l after two weeks.

h) Embryos of medaka (*Or. latipes*) were exposed to bisphenol-A in scintillation vials, with five embryos per vial (Pastva *et al*, 2001). Two concentration of bisphenol-A were used, 20 and 200 µg/l, with five replicates per concentration. Solutions were renewed every 24 hours for nine days, and a new standard solution of bisphenol-A was prepared every day. Individual embryos were observed daily and compared to a published atlas of normal medaka development. Abnormalities for each embryo were recorded and a score (severity index) for each test vessel. Larval stages were also exposed to 200 µg/l for 96 hours with a similar solution renewal pattern.

The data for the severity index were analysed using a repeated measures function, to take account of the non-independence of the observations – if a fish had a deformity on day 6 it was likely to have the same one on day 7. No deformities were noted until after day 3.

The severity index in the 200 µg/l exposures was greater than that in the controls for days 5 to 8, but by day 9 it was not significantly different, due to reduced severity of lesions in some individual embryos. Hence the effects were largely transient. Most embryos did not show deformities. There were no mortalities in the exposed larvae.

i) Ishibashi *et al.* (2005) exposed eggs of medaka (*Or. latipes*) from a few hours after fertilisation to bisphenol A at nominal concentrations of 1563, 3125, 6250, 12500, 25000 and 50000 µg/l for 14 days. There were two replicates at each concentration, with 30 eggs per replicate. A semi-static exposure regime was used, with solutions changed every 24 hours. The 14-day LC_{50} value determined in these exposures was 14.8 mg/l. The hatchability of eggs was decreased compared to the controls at concentrations above 12,500 µg/l. The time to hatching was not affected.

The same authors also exposed eggs under similar conditions to MBP (4-methyl-2,4-bis(4-hydroxyphenyl)pent-1-ene, a metabolite). Concentrations used were 313, 625, 1250, 2500 and 5000 µg/l. This study gave a 14-day LC_{50} of 1,730 µg/l; hatchability was affected at concentrations above 1,250 µg/l and the time to hatching increased at all exposure concentrations.

Adult male medaka were exposed from three months old to nominal concentrations of 250, 500, 1000 and 2000 µg/l bisphenol-A for 21 days. Seven males were used per concentration, and the solutions were changed every 24 hours. At the end of the exposures the body weight, and total length were measured. Livers and gonads were sampled, and the HIS and GSI were calculated as the ratios of the organ to body weight. Hepatic vitellogenin levels were measured. Bisphenol-A did not affect growth (weight or length) and there were no effects on survival at 2,000 µg/l. Similarly there were no effects on HIS or GSI over 21 days. Vitellogenin levels in the liver were significantly higher in the 1,000 and 2,000 µg/l exposures.

The metabolite MBP was also tested under similar conditions to the above. The 21-day LC_{50} was estimated as 63.4 µg/l. There were no effects on the GSI up to 1,000 µg/l, but the HIS was significantly higher than in the controls at 37 µg/l. Vitellogenin levels in the liver were significantly increased over the controls at 4.1 µg/l and above.

j) Three other studies on Japanese medaka have recently been completed in Japan. Full details are unavailable, but the text for the results tables is available (Japanese Ministry of the Environment, 2006):

- In one study fish were exposed for 21 days to 0, 58.5, 141, 334, 772 and 1,740 µg/l mean measured concentrations of bisphenol-A. All fish survived at concentrations up to 334 µg/l; there was 3.3% and 13.3% mortality at 772 and 1,740 µg/l, respectively. At 21 days the hepatosomatic index increased significantly at 334 µg/l and vitellogenin concentrations were significantly higher at the same level.
- In a second study (a partial life-cycle test) groups of 20 fish were exposed to 0, 220, 470, 890, 2120 and 4,410 µg/l mean measured bisphenol-A. Hatching rate was unaffected at all concentrations, but time to hatching was significantly greater at the highest concentration. Body length was significantly greater than controls at 470 and 890 µg/l, but not at the two highest concentrations. Body weight was significantly greater than controls at 220 and 470 µg/l, and significantly lower at 4,410 µg/l, with no significant difference at 890 and 2,120 µg/l. The gonadosomatic index was unaffected in this study, but there were significant effects on incidence of testis-ova at 890 µg/l, male hepatosomatic index at 4,410 µg/l, female hepatosomatic index at

2,120 µg/l, male liver vitellogenin at 470 µg/l and female live vitellogenin at 2,120 µg/l.

- In a third study (a full life-cycle test), groups of 20 medaka were exposed to 0, 2, 9.3, 49.7, 247 and 1,179 µg/l mean measured bisphenol-A. There were no effects on F0 hatching rate, days to hatching, body length, body weight, gonadosomatic index, number of eggs, incidence of testis-ova, liver vitellogenin and female hepatosomatic index, but there was a significant increase in mortality at the highest test concentration and in the male hepatosomatic index at 49.7 µg/l. In the F1 generation there were no significant effects on survival, days to hatching, gonadosomatic index or female liver vitellogenin. There were effects in the F1 generation on testis-ova and male liver vitellogenin at the highest concentration. Differences in body length and weight were small and although some were significant there were no linear or U-shaped dose-response relationships. There was a significant reduction in hatching rate at 2 µg/l of about 10%, but no significant reductions at any of the other test concentrations. Taken together, these results suggest that the most sensitive reliable NOEC for *Or. latipes* is 247 µg/l for F0 survival (28% mortality compared with 11-12% in the controls) with a LOEC of 1,179 µg/l. Measured effects below this NOEC are either difficult to interpret or do not appear to have influenced survival, growth or reproduction.

k) Several other authors have also measured vitellogenin induction or gene expression in *Or. latipes* exposed to bisphenol-A. Yamaguchi *et al*. (2005) exposed adults to nominal concentrations of 800 or 8,000 µg/l bisphenol-A for 8 hours and then analysed liver vitellogenin. There was significant induction of vitellogenin II and ERα at 8,000 µg/l, but not at 800 µg/l, and no induction of vitellogenin I at either concentration. Nagae *et al*. (2005) exposed fish to nominal vitellogenin concentrations of 100, 500, 1,000, 5,000 and 10,000 µg/l bisphenol-A for three days, with renewal of test medium every day. Induction of vitellogenin I and II was only apparent at concentrations above 5,000 µg/l. Chikae *et al*. (2003) exposed adult males to 0, 0.02, 0.2, 2, 20 and 40 mg/g bisphenol-A in their diet for 14 days and estimated an EC_{50} for plasma vitellogenin induction of 1.6 mg/g. Lee *et al*. (2002) exposed adult males to nominal concentrations of 5, 50, 100, 200 or 500 µg/l bisphenol-A for 144 hours and found that choriogenin mRNA, which is involved in egg formation in females, began to be expressed in males exposed to ≥50 µg/l.

Many of the studies reported above provide results for secondary supplemental end points (such as vitellogenin, other proteins, histology and other biomarkers) which provide useful information on possible mechanisms of action. However, only long-term end points related to mortality, growth and reproduction (i.e., endpoints of demographic importance) should be used to derive the PNEC. In this regard several of the studies are highly relevant and of high quality, and include measurement of exposure concentrations (particularly Yokota *et al*. (2000), Kang *et al*. (2002), Metcalfe *et al*. (2001) and Japanese Ministry of the Environment (2006)). Inclusion of more than one study for a single species in an SSD would introduce bias, and calculation of a geometric mean for *Or. latipes* is not possible because the study durations differ. After consideration of all of the studies, the new results from the Japanese Ministry of the Environment (2006) are considered to be the most useful for inclusion in an SSD. Although full details are lacking, results are presented for end points of clear demographic importance from a multi-generation study with measured test concentrations.

The NOEC of 247 µg/l for multiple end points in a full life cycle study with *Or. latipes* is considered the most relevant for use in the PNEC derivation and SSD. Effects observed below this NOEC are either difficult to interpret or do not

appear to have influenced survival, growth or reproduction.

8) Fathead minnow *Pimephales promelas*

Two short-term results are available. Alexander et al. (1985a and 1988) report 96-hour LC_{50} values of 4.7 (static) and 4.6 mg/l (flow-through) (nominal concentrations). The test conditions and methods are fully described in the test report, and the studies are considered valid.

Sumpter et al. (2001) (partly published as Sohoni et al., 2001) report a multigenerational study on P promelas that examined effects of bisphenol-A on the F0, F1 and F2 generations. Exposure was to nominal concentrations of bisphenol-A (1 µg/l, 16 µg/l, 160 µg/l, 640 µg/l and 1,280 µg/l) in a flow-through system. Nominal test concentrations were confirmed by measurements of bisphenol-A in the test media. Fish were also exposed to a dilution water control throughout the experiment. The study began with adult fish at 120 days post hatch, with 60 fish per treatment level. At day 42 of the study, eight breeding pairs per treatment were randomly selected and used to assess the fecundity of the F0 generation. Spawnings of 50 embryos from single females were used in hatchability trials. Two cohorts of eggs from these breeding pairs were taken and used in two separate early life stage studies (commencing on days 56 and 155 of the study). Fish larvae from the hatchability trials were discarded at the end of the trials, but those from the early life stage studies were transferred to the progeny tanks to form the F1 generation. The F0 breeding pairs were sacrificed on day 164 of the study. Other adult fish in the F0 generation were sacrificed after 43 and 71 days of the exposure.

Fish of the F1 generation were continuously exposed through to sexual maturity. On day 275 of the study (when the F1 fish were an average of 150 days old) eight breeding pairs were randomly selected and a similar series of tests to those above conducted: fecundity measurements on the F1 generation; hatchability trials on the F2 generation; and an early life stage test on the F2 generation. Adults from the F1 generation not selected for breeding were sacrificed on day 295 of the study. The study was terminated at 431 days from the start with the sacrifice of the F1 breeding pairs.

During the experiment information was recorded on fish survival, fecundity and hatchability of eggs. Upon sacrifice, intact fish, dissected gonads and blood plasma of the F0 and F1 fish were analysed for vitellogenin, gonad growth and histology of the gonads. For male fish, the gonad histology included a scoring of the various testicular cell types in order to assess the progression of spermatogenesis. The study concluded that bisphenol-A acts as a weak estrogen in vivo to fathead minnow exposed to bisphenol-A via water. The overall NOEC for conventional endpoints of survival, growth and reproduction based on the hatchability of the F2 generation is 16 µg/l. For vitellogenin production a NOEC of 16 µg/l is determined. Some growth endpoints, including gonad size, show NOEC values of <16 µg/l at individual monitoring points, but not consistently over the course of the experiment.

The observations on the testes of the male fish showed that exposure to bisphenol-A had a significant effect on the development of sex cell types compared to the controls. Measurements were made on the relative proportions of each cell type in the tissue, not the absolute numbers of cells. The cells develop from spermatogonia through spermatocytes and spermatids to spermatozoa. For the F0 generation, regression analysis showed that there were dose-related effects of bisphenol-A on the proportion of different cell types. The lowest effective concentration for these responses was 640 µg/l (spermatogonia) and 16 µg/l (spermatozoa). The highest exposure concentration (1,280 µg/l) caused a five-fold decrease

in the relative occurrence of mature spermatozoa while spermatocytes, spermatids and other cell types varied by up to 10%. The relative proportion of spermatogonia increased from ~12% in the controls to 83% at the highest concentration. The NOEC for a reduced proportion of spermatozoa is 1 µg/l. For the F1 generation, there was a positive dose-related effect of bisphenol-A on the proportion of spermatogonia, and an inhibitory effect on the proportion of the testes occupied by spermatozoa. The lowest effect concentration for these responses was 1 µg/l for both spermatogonia and spermatozoa. (This aspect of the study has since been questioned, see comments below following the study conclusions.)

From the data it is not possible to say that inter-generational sensitivity increased or decreased because the F0 generation fish were introduced to the test system as sub-adults, whereas the F1 generation was exposed to bisphenol-A throughout their lives.

From the data the report derived the following conclusions:

- LOEC (survival, 60 days) 640 µg/l (for F1, LOEC>640 µg/l for F0 and F2)
- NOEC (growth, 164 days) 160 µg/l.
- The size of the gonads of female F0 fish, were significantly greater than that of the controls at 1 µg/l on day 43. However, no significant effects were seen at 16 µg/l and subsequently the NOEC rose to 1,280 µg/l (day 71) and 160 µg/l (day 164). In males the NOEC for effects on gonad size was <1 µg/l on day 43 but subsequently rose to 1,280 µg/l (day 71) and 160 µg/l (day 164). Therefore, the NOEC for consistent or dose-related effects is taken as 160 µg/l.
- NOEC (egg production) 160 µg/l for the F1 generation and 640 µg/l for the F0 generation. This is based upon the number of eggs produced per female per day.
- NOEC (hatchability of eggs) 160 µg/l for the F1 generation and 16 µg/l for the F2 generation.
- NOEC (vitellogenin production) 16 µg/l, for F0 males and F1 generation males and females.
- Effects on the different stages of male spermatozoa development were seen at lower concentrations, with a NOEC value for the proportion of spermatogonia and spermatozoa of 1 µg/l for the F0 generation and a LOEC of 1 µg/l for the F1 generation. The hatchability of eggs was affected only at 160 µg/l or greater.

Overall, effects based upon the survival, and reproductive fitness of fathead minnows exposed to bisphenol-A from F0 breeding adults to F2 offspring occurred at concentrations of 640 µg/l bisphenol-A and higher, with hatchability of F2 eggs slightly but significantly reduced at 160 µg/l.

Two independent experts in fish histopathology subsequently reviewed the parts of this study relating to spermatogenesis (D Dietrich, personal communication). It was noted that the study was designed to look for effects on reproduction, hatching and growth. The sampling and examination of gonad tissues for sperm cell types was added after the study design had been implemented, and so the experimental design was not optimised to look at these effects. Some short-comings of this part of the study were identified in relation to the number of fish sampled from each exposure level, the taking of tissue samples from the testes and their preparation for counting, and the number of cells counted in each sample. In addition, the statistical methods used to compare the proportions of cell types in the controls and exposed fish were not appropriate, as the relative proportions of each cell type are not independent of

each other. While these short-comings and general test design are not considered to make the study invalid for population effects in terms of reproduction, hatchability and growth, the experts concluded that the weaknesses in the spermatogenesis data make them unsuitable as the basis for deriving a PNEC. This view was supported by one of the main authors of the study.

The published risk assessment for bisphenol-A (EC, 2003) concluded that further work was needed on this endpoint. As a result a series of studies has been carried out on fathead minnows to investigate further the possible effects on sperm cells and on ovarian cells (Rhodes *et al*, 2007). The initial phase of the work was to develop the methods necessary to visualise and quantify the individual gonadal cell types (Wolf *et al*., 2004). In this phase of the work the fish were exposed to 17β-estradiol. Techniques were developed for the optimal preparation, preservation and processing of gonadal tissues. These tissue samples were used to develop manual tagging procedures for the identification and quantification of gonadal cell types. The developed method allows for a permanent record of all cells identified and counted and therefore facilitates peer review of gonadal cell type assessment.

The second phase of the studies (Caunter *et al*., 2006) was a 42-day range finding study exposing fathead minnows to bisphenol-A in order to demonstrate the above methods. This part of the work also looked at the natural variability of the distribution of cell types, and the consequences for the number of replicates needed in the final study to allow determination of statistically significant effects on gonadal cell type distribution as a result of treatment.

The third phase of the studies was a partial life cycle test over 164 days, with a similar duration and similar bisphenol-A concentrations to those in the P (F0) and F1 parts of the Sumpter *et al.* (2001) study (Rhodes *et al*., 2007). In addition to the cell types, endpoints covered included survival, growth, reproduction, gonadosomatic index and vitellogenin levels. The study involved flow-through exposures to nominal concentrations of 1.0, 16, 64, 160 and 640 µg/l, together with controls. Concentrations were measured regularly during the exposures, and the mean measured levels were 1.19, 13.4, 52.8, 130 and 567 µg/l. These were 81-89% of nominal with the exception of the lowest concentration which was higher than nominal; all exposure levels were reasonably consistent throughout the test. Concentrations in this summary refer to the nominal. The concentration of bisphenol-A in the controls was less than 0.293 µg/l (the analytical limit of quantitation). Other environmental properties were also monitored routinely – dissolved oxygen, temperature, pH, conductivity, alkalinity and hardness – with no notable deviations from the required values.

Testes were fixed, embedded, sectioned and stained according to the methods developed in the earlier phases of the work. Four digital images of each testis (left and right) were obtained at 40X magnification (hence eight images per fish). A grid with 400 intersection points was superimposed on the images, and the intersection points were manually identified as a cell type. The cell types included were spermatozoa, spermatid, spermatocyte, spermatogonium, vacuolated cell (VC), apoptic body cell (ABC), interstitial (Leydig) cell, Sertoli cell, interstitial tissue or unknown cell (ITUC), or empty space. A total of 3,200 points were counted per male fish. The relative frequency of each sperm cell type was expressed as the number of cells of a given type as a proportion of the number of cells that were equally or less mature – the sequence runs from more mature to less mature above, from spermatozoa to spermatogonium. The median frequencies of the other cell types (VC, ABC, Leydig, Sertoli, ITUC) were also determined.

Ovaries were fixed, embedded, sectioned and stained according to the methods developed in the earlier phases of the work. Two digital images were obtained from each of the left and

right ovary sections at 4X magnification (hence four images per fish). All ovarian follicles in the images were identified and tagged as one of six types from least to most mature – perinuclear, cortical alveolar, early vitellogenic, late vitellogenic, mature/spawning and atretic. An average of 408.5 follicles from both left and right ovaries combined were counted from the four images per fish. The relative frequency of each oocyte type was expressed as the number of a given type as a proportion of those equally or less mature.

The gonadal tissue slides were examined microscopically for morphological abnormalities and potential exposure-related changes. These were graded on a severity scale from 1 (minimal) to 5 (severe/high). Gross observations were also made during necropsy and sample preparations, and were related to microscopic observations where possible.

Statistical assessments were carried out on 37 variables for males and 27 for females, using a variety of statistical techniques (for most variables several techniques were employed). Variable-wise comparisons with the control values were carried out for each variable at a significance level of 5%. At this level of significance, on average one in twenty comparisons will show a difference by chance, i.e. a false positive will be detected. To address this, simultaneous significance tests were also carried out, where the level of significance was distributed across the number of endpoints addressed. This was done by initially grouping the variables into five types – size variables (weight, length etc), histopathological tissue lesions, gonad cell type frequencies, reproduction variables (e.g. fecundity, egg production), and others (survival, vitellogenin etc). The significance level was split equally between the five groups, and then further divided between the variables within each group. Splitting the significance level between groups of similar endpoints, such as size or histopathology endpoints, maintains an equal importance or power to detect an effect for each group so that a group with more variables (e.g. histopathology) does not dilute the significance of anther group of endpoints. An effect was considered to be statistically significant if it was significant in both the variable-wise and the simultaneous tests. If an effect was only significant in a variable-wise comparison this was considered an indication of an effect, but not sufficient to conclude an effect at the 5% significance level[18].

For studies with similar methodology and replication, one possible consequence of splitting the significance across the variables in this way is a reduction in the power of the tests to identify a real effect, i.e. an increased possibility of a false negative. A comparison of the statistical power available in the Phase 3 study with the power available in the Sumpter *et al.* study clearly demonstrates a much higher power (lower minimum significant difference which can be detected) in the Phase 3 study. This is due to the improved methodology used for gonadal cell determinations as well as a result of the high replication employed. Thus in the Sumpter *et al*. study, up to eight fish were available for assessment per treatment, compared to up to 32 fish of the same sex in the Phase 3 study. The minimum significant difference of the one-sided Dunnett test in logit units ranged from 1 to 1.2 for the male gonadal cell types in the Sumpter *et al*. study, compared with 0.5 to 0.8 for the same endpoints in the Phase 3 study (calculated on the assumption that the fish were independent of each other). Consequently, even with the splitting of the significance level the Phase 3 study had a much higher likelihood of finding a treatment related effect than the original Sumpter *et al.* study.

[18] Variable-wise significant effects which were not simultaneously significant in any statistical test were observed for male wet-weight at 640 µg/l, for the effects on the number of spawns and the time of first spawning at 640 µg/l, the VTG level in males at 16 µg/l and in females at 16 and 1 µg/l, for the lesion testicular cysts in testis at 640 µg/l, the lesion cellular infiltrates, mononuclear cells in ovaries at 640, 160 and 64 µg/l, and the frequency of VC in the group of VC and ABC in testis at 640 µg/l.

The survival of male fish was significantly reduced at 640 µg/l; no effect was seen on survival of females at any concentration. No statistically significant effects on growth were seen in either males or females, or on gonad weight or gonadosomatic index. Among the breeding pairs of fish there were no significant differences from controls at any concentration in the mean numbers of eggs, the mean number of spawns and the mean number of eggs per spawn. There were no statistically significant effects on hatching, with no significant trend with concentration and no significant differences between treatments.

The levels of vitellogenin were significantly elevated above those in the control fish in both males and females at concentrations of 64 µg/l and above.

The incidence and severity of the histopathological lesions observed increased in male fish at 160 and 640 µg/l, and in female fish at 640 µg/l. The main observation was proteinaceous fluid in the testes and ovaries. These observations may be related to the induction of vitellogenin. In male fish the bisphenol-A concentration accounts for 65% of the variance in the results. In the majority of male fish exposed to BPA at 640 µg/l, and to a lesser extent at 160 µg/l, macroscopic enlargement of the kidneys was associated with a variety of degenerative changes that are considered to be consistent with chronic protein (vitellogenin) overload. Other histopathological observations were not considered to be related to bisphenol-A exposure (no dose responses, occurrence in the controls, historical incidence).

For the sperm cells, the relative proportions of cell types to those of an equal or lesser stage of development were calculated as indicated above. A comparison of these relative frequencies between the controls and treatments is not the best way to express the size of a treatment effect. Small changes in the relative frequency are more important when the relative frequency is very small or very large – so in the margins - compared to when the relative frequency is intermediate. To address this, the relative frequency values for each gonad were converted to logit values, the logit values for the left and right gonads were averaged, and the comparisons between controls and treatments carried out on these values. From these comparisons, there was a statistically significant shift to less mature cell types at 160 and 640 µg/l in male fish (for spermatocytes as a proportion of equally and less developed cells at both concentrations, for spermatids as a proportion of equally and less developed cells at 640 µg/l). There was also a decrease in the proportion of Leydig cells relative to the ITUC at the same concentrations. In female fish, a shift to less mature cell types in the ovaries was observed at 640 µg/l.

From this study, the lowest effect concentration for a "conventional" endpoint was 640 µg/l for survival in male fish, giving a NOEC of 160 µg/l. The gonadal cell distribution was significantly affected at concentrations of 160 and 640 µg/l in male fish, hence a NOEC of 64 µg/l, and vitellogenin induction was significant at 64 µg/l, giving a NOEC of 16 µg/l.

The results from the two long-term studies on fathead minnow are compared in Table 3.22.

The Phase 3 study is comparable to that on the F0 generation in the Sumpter *et al.* study in terms of the concentration range used and the duration of exposure. The concentrations used in the comparison are nominal values as in most cases the same nominal levels were used. The overall effect levels for survival are the same for both studies, though for different generations. Growth was not significantly affected in the Phase 3 study, whereas effects were seen at 160 µg/l in the earlier study. Both studies reported a NOEC of 16 µg/l (nominal) for the production of vitellogenin[19]. The results for egg production are similar for the F0

[19] The levels of vitellogenin in the control fish in the Phase 2 and 3 studies were notably higher than those in the Sumpter *et al.* study. Work by the OECD and others has shown that there can be considerable variation between

generation. There is a difference in the results for hatchability. No effects were seen in the new study at 640 µg/l, whereas effects were seen at 640 µg/l in the F1 eggs and at 160 µg/l in the F2 eggs in the earlier study. The F2 eggs in the Sumpter *et al.* study come from fish which had been exposed to bisphenol-A throughout their lifetime up to egg laying, and so had a longer exposure than those in either of the two F0 cases. Although the replication was not as great in the Sumpter *et al.* study, and hence the possibility of a false positive finding is greater, the original study is considered to be suitable for use in the assessment for this endpoint, and so the NOEC of 16 µg/l for hatchability will be taken.

VTG levels in control fish in different studies, even when similar assays are used. As a result, comparisons within studies are considered relevant but comparisons between studies are not.

Table 3.22 Comparison of results from Phase 3 study with original Sumpter *et al.* study

	NOEC values (µg/l)			LOEC values (µg/l)		
Endpoint	**Phase 3 (F0)**	**Sumpter F0**	**Sumpter F1**	**Phase 3 (F0)**	**Sumpter F0**	**Sumpter F1**
Survival	160 (m)	NA	160, 640[d]	640 (m)	NA	640, >640[d]
Growth (length, weight)	>640	160 (m)	160 (m)	>640	640 (m)	640 (m)
Gonad weight	>640	160	NA	>640	640	NA
GSI	>640	160 (m)	NA	>640	640 (m)	NA
Egg production	>640 (f)	640 (f)	160 (f)	>640 (f)	1280 (f)	640 (f)
Hatchability	>640[a]	160[a]	16[b]	>640[a]	640[a]	160[b]
Vitellogenin	16	16 (m)	16	64	160 (m)	160
Histopathological lesions	64 (m)	NA	NA	160 (m)	NA	NA
Gonad cell distribution	64 (m)	c	c	160 (m)	c	c

Notes: m, f – male, female, if neither included then value applies to both
>: no effect at highest concentration tested
<: effect at lowest concentration tested
NA: not assessed
a: relates to F1 eggs
b: relates to F2 eggs
c: figures for this endpoint not considered reliable
d: results from two separate early life stage studies at 60 days. No results for F0 survival reported. F2 ELS studies had LOEC >640 µg/l.

Brian *et al*. (2005) exposed *Pi. promelas* to bisphenol-A in a study designed to assess the effects of mixtures of endocrine disrupters on plasma vitellogenin induction. The individual dose-response curves for vitellogenin induction were fully characterised for bisphenol-A, estradiol, ethinylestradiol, nonylphenol and octylphenol by exposing adult fish under flow-through conditions for two weeks, with chemical analysis of test concentrations. There were problems with the analysis of test concentrations during this phase of the study, resolved later for the mixture stage, so nominal concentrations were used to report the single substance studies. The EC_{50} for vitellogenin induction by bisphenol-A was 158 µg/l (95% confidence interval 119-205 µg/l).

Prediction of the overall effect on vitellogenin induction of a mixture of the five chemicals, based on concentration addition, was supported by the empirical results. This shows that the co-occurrence of several estrogenic chemicals in the environment may lead to greater biological effects than individual substance risk assessments might suggest.

The NOEC of 16 µg/l for F2 generation egg hatchability in a full life cycle study with *Pi. promelas* is considered suitable for use in the PNEC derivation and SSD.

9) Guppy *Poecilia reticulata*

Haubruge et al. (2000) exposed adult males to bisphenol-A at 274 and 549 µg/l. The exposure solutions were renewed every 48 hours. After 21 days a significant decline on total sperm count was noted, by 40-75%. It was considered that the short-term decline in sperm count was unlikely to be due to endocrine mediated alteration of the germ line, and no change was found in testis size or sperm length. The authors speculate that the effect may be due to interference with the function of Sertoli cells, which facilitate the transport of maturing sperm. These cells are directly sensitive to the action of xenobiotics.

Kinnberg and Toft (2003) exposed groups of 30 sexually mature males for 30 days to nominal concentrations of 5, 50, 500 and 5,000 µg/l bisphenol-A in a flow-through system. Concentrations were analysed and were all higher than nominals, with a maximum difference of 21%, except for one sample which was 129% higher. During the first 21 days of exposure 77% of the fish in the highest concentration died and this treatment was terminated. No fish died in any of the other treatments. The gonad histology of fish in the highest treatment showed pronounced effects, with testes filled with spermatozeugmata, some of which had ruptured resulting in free spermatozoa, and virtually no spermatogenic cysts. No effects were reported at the other treatment levels.

The 30-d survival NOEC of 500 µg/l for *Po. reticulata* is considered suitable for use in the PNEC derivation and SSD.

10) Swordtail *Xiphophorus helleri*

Kwak et al. (2001) conducted short-term tests (72 hours) to determine the effect of bisphenol-A on vitellogenesis and damage to testes, and long-term tests (60 days) to examine the effect on sword (tail) length (a secondary sexual characteristic in males). Semi-static exposure conditions were used, but no concentration monitoring was undertaken. Vitellogenin expression was noted in a dose dependant manner with no induction at 0.4 mg/l bisphenol-A, but induction was observed at 2 and 10 mg/l. Binding studies to detect cell damage (apoptosis or necrosis) showed a reduction in the proportion of healthy cells at all three exposure concentrations. However, histological examination of testis tissue taken from

fish exposed to 0.4 or 2 mg/l bisphenol-A failed to show any apoptotic cells. Apoptotic cell masses and other injured cells were observed at 10 mg/l bisphenol-A though no lesions were observed. In tests on swordtail length, a significant reduction in length was observed at 0.002 and 0.02 mg/l bisphenol-A but not at 0.0002 mg/l bisphenol-A. The authors also determined a 96-hour LC_{50} of 17.93 mg/l, based upon OECD guideline 204 and semi-static exposure.

The significance of the changes in sword length is not understood, but it is thought that the length of the sword has an influence on mating success, with female fish preferring males with longer swords. It is not clear what degree of change should be considered to be significant. The separation between exposure levels was an order of magnitude, and there was no measurement of concentration during the exposures. The study is therefore not considered suitable for use in PNEC derivation, but it is noted that the LOEC from this study is higher than the NOEC from the full life cycle test with Pi. promelas.

Summary of freshwater fish studies

Toxicity data are now available for ten species of freshwater fish. Whilst some of these are warmwater or even tropical species, most are 'standard' species for ecotoxicological assessment. Bisphenol-A is estrogenic to fish as shown by the concentration-related increase in the plasma vitellogenin concentration observed in the fathead minnow (Sumpter *et al*., 2001), rainbow trout (Lindholst *et al*., 2000), male carp (Smeets *et al*., 1999), and other studies reported above. Vitellogenin synthesis in fish is widely considered to be a reliable and sensitive indicator of exposure to estrogenic chemicals (Sumpter and Jobling, 1995). Sumpter *et al*. (2001) report a LOEC of 160 µg/l and a NOEC of 16 µg/l for vitellogenin production. The conclusion (i) test programme also found a NOEC of 16 µg/l for the same endpoint. These values fit with the LOECs of 23 µg/l and 40 µg/l for vitellogenin production reported by Pawlowski *et al*. (2000) and Lindholst *et al*. (2000). While both of these studies did not test concentrations low enough to derive NOEC values they did measure the relative potency of bisphenol-A to 17β-estradiol. All of the studies showed a similar relative potency of bisphenol-A to that of 17β-estradiol of around 10^{-4}. This and the similar concentration for LOEC values between the studies suggests that the NOEC values from these other studies should be in a similar concentration range to the NOEC of 16 µg/l. Based upon the available data a NOEC of 16 µg/l can be assumed for vitellogenin production in fish.

Bisphenol-A can also bind to the estrogen receptor of fish (Kloas *et al*., 2000) though with a lower affinity than estradiol has for the receptor.

Although vitellogenin is a biomarker for exposure to estrogenic substances, the ecological significance of its presence is not yet known - the relationship between biomarkers for endocrine disruption and ecological effects is currently being investigated by a number of workers. The most sensitive end point for population-relevant effects from the existing fish studies is the NOEC for egg hatchability for the F2 generation of 16 µg/l reported by Sumpter *et al*. (2001). This is the same as the NOEC for vitellogenin production from the same study.

Other parameters can be sensitive to both estrogens and xenoestrogens. These include inhibition of testis growth by natural and synthetic estrogens and xenoestrogens (Panter *et al*., 1998; Jobling *et al*., 1996). Estrogens are also known to inhibit spermatogenesis in male fish (Billard *et al*., 1981) and exposure of fish to estradiol and nonylphenol has been shown to affect testicular structure (Miles-Richardson *et al*., 1999; Flammarion *et al*., 2000; Jobling *et al*., 1996). High concentrations of both estrogens and xenoestrogens can induce the development of ovotestes in male fish or cause complete feminisation (Hartley *et al*., 1998; Gary and Metcalfe, 1997).

Bowmer and Gimeno (2001) observed a NOEC for oviduct formation in male carp of 16 µg/l. It is noted that this is the same as the NOEC for egg hatchability observed by Sumpter *et al*. (2001).

The study on swordtail fish (Kwak *et al*., 2001) largely showed responses at similar concentrations to other studies and support these data. As noted above, this study is not considered suitable for use in defining the PNEC, but it is noted that the LOEC from this study is higher than the NOEC from the full life cycle test with fathead minnow *Pi. promelas*.

To summarise, the results from many tests indicate that bisphenol-A acts as a weak estrogen in fish, though it is a lot less active than either estradiol or ethinylestradiol. The NOEC for egg hatchability in fathead minnows (16 µg/l) will be taken forward for further discussion in the PNEC derivation as the most sensitive measure of fish toxicity. Long-term results for a further five fish species may also be considered for the derivation of an SSD:

- *Cyprinus carpio* 49-d growth NOEC of 100 µg/l,
- *Danio rerio* NOEC of 750 µg/l for multiple end points (full life cycle study),
- *Oncorhynchus mykiss* 28-d juvenile growth rate NOEC of 3,640 µg/l,
- *Oryzias latipes* NOEC of 247 µg/l for multiple end points (full life cycle study), and
- *Poecilia reticulata* 30-d survival NOEC of 500 µg/l.

Saltwater species

1) Sheepshead minnow *Cyprinodon variegatus*

   Emmitte (1978) reports a 96-hour LC_{50} of 7.5 mg/l (measured concentration) in a flow-through exposure. The test method used appears to be acceptable, although no information is given on temperature, pH or dissolved oxygen during the test. Whilst apparently reliable, this test only considers short-term lethality.

2) Atlantic silverside *Menidia menidia*

   Springborn Bionomics (1985a) and Alexander *et al*. (1988) report a 96-hour LC_{50} of 9.4 mg/l measured bisphenol-A in a flow-through test. Whilst valid, this study only considers short-term lethality.

3) Japanese common goby *Acanthogobius flavimanus*

   Mochida *et al*. (2004) exposed *A. flavimanus* to 0.2, 1, 5 or 25 µg/l bisphenol-A for three weeks in a flow-through system. Chemical analysis at least once per week showed that mean concentrations were 0.28, 0.79, 3.02 and 19.1 µg/l. Exposure had no effect on histology, serum vitellogenin or the expression of ubiquitin C-terminal hydrolase mRNA in either the testis or brain. This study is not considered to be suitable for PNEC derivation because the measured parameters cannot be directly related to demographically important end points.

4) Killifish *Fundulus heteroclitus*

   Pait and Nelson (2003) investigated the production of vitellogenin in males following injection with bisphenol-A. The injection levels used were 0, 10, 50, 100 and 150 mg/kg body weight fish. They compared the results obtained for fish from “clean” stocks with fish taken from contaminated areas (general contamination, not specifically with bisphenol-A). In

the clean fish there were significant increases in vitellogenin levels at 50, 100 and 150 mg/kg doses. In fish from contaminated areas the production of vitellogenin was reduced compared to that in the clean fish, although only significantly so at the middle two doses. The administration route makes this study unsuitable for use in the risk assessment, and the measured parameters cannot be related directly to demographically important end points either.

1) Turbot *Psetta maxima*

Labadie and Budzinski (2006) exposed juvenile turbot (Psetta maxima) to bisphenol-A for three weeks under flow through conditions in natural seawater. The one exposure concentration was confirmed by GC-MS as 59±11 µg/l. The levels of sex steroids in the fish were measured at the end of the exposure. Bisphenol-A had no effect on androgen levels. It increased levels of E1 (estrone), which the authors suggested was due to up-regulation of aromatase activity.

2) Korean rockfish *Sebastes schlegeli*

Lee et al. (2003) exposed fry of the Korean rockfish (Sebastes schlegeli) to bisphenol-A in their diet. Food was prepared by adding a solution of bisphenol-A in ethanol to powdered fish diet at the appropriate level, drying at room temperature and storing in a refrigerator until used. Exposure levels were 0.05, 0.5, 5, 50 and 100 µg/g. Fish were fed 2.52 g of food per day. Three replicates for each exposure were used, with 70 fry in each, with exposures over 29 days. The fry were exposed from 51 days old, a time at which they have undifferentiated gonads. The study found no difference in the male to female ratio between the controls and any of the exposure levels. No effects on fry length were noted. The exposure route means that the result is not suitable for use in the risk assessment.

In summary, the limited data available for saltwater species does not suggest any significant difference in sensitivity compared to freshwater species during short-term exposures.

3.2.1.4.2 Amphibians

Experiments have been conducted with five species.

1) European common frog *Rana temporaria*

Koponen and Kukkonen (2002) investigated the effect of bisphenol-A alone and together with artificial UVB radiation. Eggs and larvae were exposed for 20 days in Pyrex dishes, 30 embryos to a dish. The exposures were ended after 20 days because by this time almost all of the UVB-exposed larvae had died. Control larvae were at Gosner stage 25-27 at this time. In the exposures without UVB, bisphenol-A had no effects on survival at concentrations up to 100 µg/l, with significant reduction in survival at 1,000 µg/l. The UVB exposures showed mortality with or without bisphenol-A. The authors concluded that the combined effect at the highest bisphenol-A concentration was greater than that from UVB alone. This study is not considered to be suitable for PNEC derivation because there was no chemical analysis of exposure concentrations.

Rouhani Rankouhi *et al*. (2005) found that bisphenol-A did not induce estrogen-receptor mediated vitellogenesis in *R. temporaria* primary hepatocytes at concentrations up to 100 µM.

2) African clawed frog *Xenopus laevis*

Several studies have been performed with this species, and these are summarised below.

a) Kloas *et al*. (1999) reported the development of a model for the investigation of endocrine-disrupting chemicals using this species. As part of this work tadpoles at 2-3 days post-hatch were exposed to nominal concentrations of bisphenol-A. Solutions were renewed three times per week, and exposure continued until metamorphosis occurred in approximately 90% of all animals - this took around 12 weeks. The two exposure concentrations used were 10^{-7} M (23 µg/l) and 10^{-8} M (2.3 µg/l). After exposure the animals were examined for differentiation into males and females. The higher exposure concentration produced a statistically significant increase in the number of female phenotypes in relation to the controls. The ratio of the sexes in the control exposures was 60:40 male:female and in the 23 µg/l exposure group was 36:64 male:female. A decreased male:female ratio was also observed in the 2.3 µg/l test group though the result was not significant comparable to the controls.

   It should be noted that this was only a method development study, which was not optimally designed to establish a NOEC (e.g., only two exposure concentrations were used, separated by an order of magnitude). The lack of information on test conditions (e.g., temperature, water quality), limited test vessel replication and lack of analytical confirmation of test concentrations means that this study cannot be used directly in the PNEC derivation or SSD.

b) Pickford *et al*. (2000; published in Pickford *et al*., 2003) reported the results of a study investigating the effects of bisphenol-A on larval growth, development and sexual differentiation on *X. laevis*. This study was conducted in an attempt to repeat the original findings by Kloas *et al*. (1999) and establish a dose-response relationship. The test was initiated with 4-day-old larvae. Hatching of larvae occurred principally on day 2 post-fertilisation; exposure to the test substance therefore commenced approximately 2 days post-hatching. A dynamic flow-through test system was used with four replicate test vessels for each test concentration, dilution water and positive control. In the experiments 17β-estradiol was used as a positive control. Larvae were exposed to 1, 2.3, 10, 23, 100 and 500 µg/l nominal concentrations of bisphenol-A. The larvae were observed daily for mortality, behaviour and appearance. Test conditions were monitored throughout the study. Growth and development assessments were performed on all larvae from one replicate per treatment group on exposure days 32 and 62. Larvae were sacrificed upon reaching the froglet stage of development for analysis. The test was terminated at day 90, which corresponds to 94 days after fertilisation.

   The NOEC for larval survival was calculated as 500 µg/l based upon pooled data results. At 32 days and 62 days post fertilisation there were no significant differences in growth or development between the test concentrations, the positive control or the dilution water control. The sex ratios were assessed pre- and post- fixation to allow comparison with the method used by Kloas *et al*. (1999), with statistical analysis being undertaken on the post-fixation results only. No significant difference from the expected 50:50 sex ratio were observed in any of the test concentrations or the dilution water control, while a significant feminisation was observed in the positive control group. The exposure of larvae to bisphenol-A did not result in an increase in gross gonadal abnormalities in stage 66 froglets. There was no significant difference in time to metamorphosis in any of the test concentrations of bisphenol-A compared to the dilution water control. There was no significant difference in total lengths in any of the test concentrations compared to the dilution water control. There were no significant differences in weight between any of the test concentrations of bisphenol-A, and the dilution water control.

This 90-d study was conducted under full GLP and was thoroughly reported, so is considered fully valid.

c) Kloas and co-workers (Levy *et al*. 2004) carried out a further study on *X. laevis* as a follow-up to their original 1999 study. The bisphenol-A used in the experiments was 99% pure. Tadpoles were raised in tanks to development stage 42/43, in deionised distilled water with 2.5 g/l added sea salt. They were then randomly assigned to groups of forty tadpoles. Two experiments were then conducted with different exposure regimes.

Experiment 1: This consisted of exposures to 10^{-7} and 10^{-8} M bisphenol-A (23 µg/l and 2.3 µg/l respectively) in duplicate. The test medium was changed three times per week, on Monday, Wednesday and Friday, and food and test substance were added at the same time to give a semi-static exposure regime. Exposures at the same molar concentrations were also conducted with 17β-estradiol (E2). After metamorphosis was complete, the froglets were sacrificed, and their gonads fixed *in situ*. Sex determination was based on gross morphology. The same procedure was applied to tadpoles that had not completed metamorphosis by 120 days after the first chemical application.

There were no signs of general toxicity at either of the applied concentrations. An average of 75% of the surviving animals reached metamorphosis in the experiment, with mortality at 20-30%. There were no significant differences between the replicates in terms of mortality, time to metamorphosis, and other end points so the groups were pooled. The control organisms had 56% male and 44% female froglets. The organisms from the 23 µg/l nominal exposure were 69% female (significantly different from controls at $P<0.005$), and at 2.3 µg/l nominal 65% were female (not statistically significant). For comparison, E2 produced 81% and 84% females respectively.

Experiment 2: Three exposure levels were used (10^{-6}, 10^{-7} and 10^{-8} M, or 230, 23 and 2.3 µg/l), in duplicate, with 10^{-7} M E2 as a positive control. A different food was used in this experiment. After metamorphosis, the froglets were weighed, and sex determined by gross morphology. The gonads and kidneys were removed completely and fixed. Tadpoles not completing metamorphosis after 120 days were treated in the same way, but without weighing. Testes from this experiment were examined to confirm the identification as males, and to look for possible cellular irregularities. Only a random sub sample of ovaries was examined, as bisphenol-A is not expected to produce effects on ovaries.

The content of bisphenol-A in the water from all vessels from experiment 2 was analysed. Samples were taken immediately after the application of the nominal concentration and at six-hour intervals over the 48 hours between solution changes. Samples were taken from the experimental solutions, solutions without tadpoles, and from test medium with only bisphenol-A. Water samples were sterilised with mercuric chloride after collection and stored at -20°C before analysis, which was by solid phase extraction and HPLC determination. The concentration of bisphenol-A in the controls and the pure test medium was below the limit of detection, which was 0.2 µg/l (9×10^{-9} M). The measured concentrations in the exposures at time zero (immediately after the solution change) were 90-105% of nominal levels. Samples from the actual exposures (containing medium, food and tadpoles) decreased to 15-30% of nominal over the 48-hour period between solution changes. Samples of the medium with food, and the medium alone, remained at 70% or higher of nominal (with one exception, the 10^{-8} M solution with food dropping to 50% nominal).

An average of 80% of the surviving animals reached metamorphosis, and the mortality in the exposures was 10-20%. As for experiment 1, the data for the duplicate exposures were pooled. The mean body weight of the organisms increased at all three bisphenol-A exposure levels, with a possible trend of higher weights at lower concentrations, but the changes were not statistically significant. Animals exposed to E2 had a similar mean weight to the controls. The middle bisphenol-A nominal concentration of 23 µg/l resulted in a statistically increased proportion of females (70%) compared to the controls (48% in this experiment). The other two bisphenol-A exposures resulted in ratios not significantly different from the controls (51% female at 2.3 µg/l; 53% female at 230 µg/l). No morphological irregularities were noted in the gonads from any of the bisphenol-A exposure groups (nor from the E2 exposure) following examination of gross morphology. None of the developed testes were affected by bisphenol-A or E2 exposure. The incidence of testis-ova was only 1.1%.

The paper gives no information on metabolism, but studies on mRNA also reported in this paper suggest that bisphenol-A may bind effectively to the endocrine receptor *in vivo*. The authors conclude that bisphenol-A is responsible for sex reversal in this species.

It is not entirely straightforward to derive a NOEC from this study. In the first experiment, the 10^{-8} M exposure affected sex ratio (although the effect was not statistically significant), while the same concentration had no effect in the second experiment. The 10^{-7} M exposure showed effects in both experiments, so could be considered to be the LOEC. If the lower concentration were taken as showing no effect, then the NOEC would be 10^{-8} M, or 2.3 µg/l. There is a large gap between the concentrations (one order of magnitude), so the geometric mean will be taken to indicate a NOEC of 7.3 µg/l (and it is noted that it could be higher still). The validity of this study is discussed at the end of this section.

d) Iwamuro *et al*. (2003) carried out studies on embryos and larvae of *X. laevis*. Adult frogs were mated and eggs were removed the next morning and kept for sixteen hours in dechlorinated water. Fertilised embryos were transferred to containers with the experimental solutions, or kept in dechlorinated water for experiments at more advanced stages of development. Embryos from different parents were well mixed when larger numbers of individuals were needed for the experiments.

Embryos (60-100, development stage 7) were exposed for 72 hours to concentrations of bisphenol-A of 10^{-5}, 2 x 10^{-5}, 2.5 x 10^{-5}, 3 x 10^{-5}, 5 x 10^{-5} and 1 x 10^{-4} M (i.e., 2.3 – 23 mg/l). They were transferred to dechlorinated water, and the number of surviving embryos counted at 48, 96 and 120 hours. The survival rates at 96 and 120 hours were expressed as a percentage of those alive after 48 hours. The number of tadpoles showing morphological abnormalities was recorded at 5-7 days after fertilisation.

Tadpoles developed to stage 52 were immersed in 2.5 x 10^{-5} M bisphenol-A for 22 days, with the exposure solution being changed every two days. Development was monitored every three days under a microscope. *In vitro* studies were also carried out on tails removed from stage 52-54 tadpoles.

The survival rate of embryos exposed to bisphenol-A was reduced at 2.5 x 10^{-5} M, with no significant effect at 2 x 10^{-5} M. The median lethal dose was calculated as 2.1 x 10^{-5} M (4.8 mg/l). No apparent abnormalities were seen in embryos immersed in 10^{-5} M bisphenol-A for seven days. At 2.5 x 10^{-5} M, most of the abnormalities were seen in dead

tadpoles. The abnormalities seen were winding vertebrae (scoliosis) or malformation of the head region (reduced distance between the eyes).

Stage 52 embryos kept in bisphenol-A solution (10^{-5} M or above) showed a retardation of metamorphosis by 1-2 stages compared to the controls, and the effect was dose-dependent. The hormone T_4 (L-thyroxine) promoted metamorphosis by four stages from the controls; in combination with bisphenol-A this was retarded by 2-4 stages, again dependent on concentration. The hormone T_3 promoted the reduction of the length of tail sections taken from stage 52-54 larvae; 10^{-5} and 10^{-4} M bisphenol-A blocked this shortening in a concentration dependent manner.

The parameters measured in this study cannot be readily related to demographic effects, so are unsuitable for use in PNEC derivation. In any case, the test concentrations were significantly higher than the NOECs derived in the other studies reported above.

e) Oka *et al*. (2003) exposed *X. laevis* embryos to 10-100 µM bisphenol-A until the early tadpole stage, when they had reached stage 6 or late stage 10. Developmental abnormalities were absent at 10 µM (2.3 mg/l) but began to occur at 20 µM (4.6 mg/l), with crooked vertebrae and development defects of the head and abdomen. At 40-100 µM embryos died rapidly during the gastrula stage. When embryos were exposed to similar molar concentrations of ethinylestradiol different abnormalities were induced, suggesting to the authors that the effects of bisphenol-A were due to non-estrogenic effects on developmental processes. The paper does not report whether the test medium was renewed and there does not appear to have been any chemical analysis of test concentrations, so it cannot be used for PNEC derivation.

f) Trudeau *et al*. (2005) exposed *X. laevis* tadpoles for 48-hours to nominal concentrations of 50 nM bisphenol-A (11.5 µg/l). They then injected an estrogen response element-thymidine-kinase-luciferase (ERE-TK-LUC) construct into the tadpoles' brains before returning them to fresh test medium for a further 48 hours before sacrifice and determination of total brain luciferase activity. Bisphenol-A increased luciferase activity 1.5-fold over controls. This study showed that exposure to bisphenol-A can modulate tadpole brain activity. However, the individual or demographic consequences remain unknown, so the study cannot be used for PNEC derivation.

g) Several papers evaluate the ability of receptors of *X. laevis* and other amphibians to bind bisphenol-A *in vitro* or *in vivo*. Kudo and Yamauchi (2005) suggest that bisphenol-A could interfere with the *X. laevis* thyroid system at environmentally realistic concentrations. However, this conclusion was based solely on results from *in vitro* transthyretin and thyroid hormone receptor β binding assays with bisphenol-A, and the relevance of this *in vivo* remains uncertain. Suzuki *et al*. (2004b) developed an *in vitro* estrogen binding assay and found a relative binding affinity of bisphenol-A of 0.957% when compared with diethylstilbestrol. This is rather a low value, but greater than the binding affinity of bisphenol-A to quail ERα. Lutz *et al.* (2005) studied the time course of free estrogen receptor (ER) in cultures of primary cultured hepatocytes of *X. laevis*. Bisphenol-A, nonylphenol and E2 all led to immediate drops in the free ER levels, followed by significant increases. Bisphenol-A produced a significant increase at 10^{-7} M (~23 µg/l).These studies provide useful information on possible mechanisms of action but are not relevant for PNEC derivation.

3) Wrinkled frog *Rana rugosa*

Goto *et al.* (2006) carried out a number of studies on the effects of bisphenol-A on the T_3-induced tadpole tail regression in *Rana rugosa* (the wrinkled frog). Tadpoles were exposed to bisphenol-A (2.3, 23 and 230 µg/l) for five days with a chlorine-free water control. After five days, T_3 ($5x10^{-8}$ M) was added to half of the vessels in the treatment and control groups for one day. This addition resulted in induced metamorphosis (measured by tail shortening) in the treated tadpoles not exposed to bisphenol-A. Tadpoles in the untreated water controls and the untreated bisphenol-A exposures did not exhibit tail shortening. Tadpoles in the treated bisphenol-A exposures showed a lesser degree of tail shortening, significantly less than the T_3-treated tadpoles at 23 and 230 µg/l.

DNA fragmentation in the tails of the tadpoles was also investigated. T_3-treated tadpoles showed marked fragmentation and the development of a ladder-like profile. This was not seen in untreated controls (tadpoles kept in water), those treated with bisphenol-A alone (230 µg/l) and those treated with both T_3 and bisphenol-A (230 µg/l).

These results were interpreted as showing possible competition between bisphenol-A and T_3 for the thyroid hormone receptor. The study is not suitable for use in the risk assessment as the metamorphosis was artificially induced.

4) Tropical clawed frog *Silurana tropicalis*

Goto *et al.* (2006) investigated the effects of bisphenol-A exposure on spontaneous metamorphosis, tail shortening and hindlimb elongation in tropical clawed frog *Silurana tropicalis* tadpoles. Stage 57 tadpoles were exposed to either 230 µg/l bisphenol-A or a 1 mM solution of methimazole (thyroid hormone synthesis inhibitor) for up to ten days. Tadpoles raised in chlorine-free tap water acted as the control population. At various times during the test, the stage of metamorphosis, tail length and hind limb length was determined. Exposure to bisphenol-A at 230 µg/l elicited a similar response as methimazole, and resulted in suppressed spontaneous metamorphosis, tadpole tail length shortening and hindlimb elongation compared with the control population. As only one concentration was used this result cannot be used in the risk assessment but will be considered in the discussion.

5) Black spotted pond frog *Rana nigromaculata*

Yang *et al.* (2005) exposed tadpoles of the black spotted pond frog *Rana nigromaculata* to bisphenol A from five days after hatching. Embryos were collected from the field. Concentrations of 2, 20 and 200 µg/l were used, and half of the exposure solution in each vessel (one vessel per concentration) was replaced every three days. Five tadpoles were sampled from each vessel on days 15, 30 45 and 60 of the exposures. These were weighted individually, then pooled for analysis. The samples were analysed for testosterone, total thryoxin (TT4) and plasma vitellogenin (as alkaline-labile phosphate). (Note: the paper indicates that the five tadpoles were pooled for analysis, but the results are presented as the average for five tadpoles, so the basis of the results is not clear.)

Malformations of tail flexure were noted in the highest exposure concentration at a level of 10%. These animals grew into young frogs. Inhibition of TT4 compared to the controls at 60 days was noted, but not significant. Testosterone levels were not different from those in the controls. Alkaline-labile phosphate levels were increased at all concentrations, but again not significantly. The lack of clarity in what the results represent and the lack of measurement of concentrations means this study is not suitable for the risk assessment.

Discussion of amphibian toxicity data

It is not clear why the three experiments by Kloas *et al*. (1999), Pickford *et al*. (2000 & 2003) and Levy *et al*. (2004) on the same species of amphibian produced such different results. The original study by Kloas *et al*. (1999) was aimed at developing a method to investigate endocrine effects rather than to determine a no-effect level, and can be disregarded given the other two studies now available.

Differences in experimental design might be an important factor. The range of concentrations in the Pickford *et al*. study covers the range of nominal concentrations used by Levy *et al*. (2004), as well as the actual range based on measurements (with the exception of the lowest concentration towards the end of the period between changes). The only clear difference between Levy *et al*. (2004) and Pickford *et al*. (2000 & 2003) is the exposure regime, with semi-static renewal used in the former instead of a flow-through design. As the bisphenol-A concentration declined significantly during the period between solution changes, it is likely that degradation was occurring. It is noted that this did not appear to occur in solutions unless tadpoles were present. However, this does not necessarily suggest that tadpole metabolism was the cause: the tadpoles have a microbial flora on their skin, and in any case, uptake would have occurred in both studies, so metabolism should also have been the same.

Pickford (2003) identified a number of other issues from a pre-publication manuscript of the Levy *et al*. (2004) study, as follows:

- There were two replicate vessels per test concentration, but pooling the data effectively reduced the number of replicates to one. The experimental error associated with the sex ratio end point therefore cannot be estimated.
- The most appropriate statistical method for analysis of sex ratio data is a test based on a binomial distribution of frequency data (e.g., Chi-squared test). In contrast, Levy *et al*. reduced the sex ratio of the duplicate tanks to one average numeric value for per cent males, and compared this by a non-parametric method to the solvent control value (as in Kloas *et al*., 1999). Since the solvent control sex ratio is slightly skewed in favour of males, this could have introduced a statistical bias.
- No concentration-response relationship is apparent. The experiments were not conducted with sufficient replication and statistical rigour to infer that a non-monotonic (i.e., inverted-U) response was involved.
- The absence of significant incidences of gonadal abnormalities at the histological level does not seem to be consistent with the presumed effect of bisphenol-A on gonadal development. Evidence of intersex condition in some larvae would be expected.
- Given the generally lower estrogen receptor binding affinity of bisphenol-A compared to estradiol, the similarity in level of mRNA induction at the same concentration is rather surprising. As there are no complementary protein expression data (e.g., immunohistochemistry), it is not clear whether this level of upregulation has any biological significance. It is not even clear whether the upregulation was in the presumptive (gonad) target tissue. Consequently it is not possible to relate the apparent mRNA upregulation mechanistically to the apparent effect on the sex ratio.

The Pickford *et al*. (2000 & 2003) study is of high quality and was specifically designed to establish a no-effect level for a range of effects. The Levy *et al*. (2004) study suggests a lower NOEC, but there were some drawbacks to the methodology used, and the apparent effect could

be an artefact. The true NOEC value is also uncertain given the wide separation of test concentrations. However, given that an effect on sex ratio is a potentially important finding, and the results cannot be rejected as invalid, the study is still considered in the PNEC derivation, though classed as 'valid with restriction'.

This means that two NOEC values are considered for this species. Since there is a large gap between them (two orders of magnitude), the geometric mean NOEC of 60.4 µg/l is used as the preferred value for PNEC derivation. It should be noted that the highest NOEC of 500 µg/l was in fact the highest concentration tested in the study, so the true NOEC could be higher. The geometric mean is therefore considered to be a conservative value. Finally, there are also still questions in relation to the use of a parameter such as the sex ratio in risk assessment: for example, what other factors influence the ratio, and what is the normal range of values for the ratio in healthy populations? The geometric mean value is below the concentration which retarded metamorphosis in *Silurana tropicalis*.

In summary, the geometric mean chronic sex ratio NOEC of 60.4 µg/l for *X. laevis* is considered in the PNEC derivation and SSD. This is derived from two significantly different NOECs, i.e., 7.3 and 500 µg/l.

3.2.1.4.3 Reptiles

Stoker *et al*. (2003) studied the effect of topical administration of bisphenol-A to eggs of the broad snouted caiman *Caiman latirostris* (a member of the *Crocodylidae* family). Sex determination in this species is temperature dependent. Bisphenol-A was applied to the eggs at doses of 1.4 and 140 ppm, and exposures were at two temperatures, i.e., 30°C (female producing temperature) and 33°C (male producing temperature).

No effects were seen on animals exposed to bisphenol-A at 30°C. At 33°C, all animals hatched as females at a bisphenol-A dose of 140 ppm. The same result was observed with 17β-estradiol at a dose of 1.4 ppm at this temperature. At the lower bisphenol-A dose of 1.4 ppm, all of the animals hatched as males, but significant disruption of the seminiferous tubule histoarchitecture was observed.

The topical method of application of bisphenol-A in this study means that these results are not suitable for derivation of a PNEC, although it does provide additional evidence of an endocrine effect.

3.2.1.4.4 Mesocosm studies

One stream mesocosm study is available in which the effect on aufwuchs biomass was examined (Licht *et al*., 2004) ("aufwuchs" is a term used to describe the organisms and detritus that coat rock and plant surfaces in aquatic systems). In this study the aufwuchs were collected from a German river and allowed to colonise unglazed ceramic tiles. These tiles were then placed in unreplicated artificial streams (3.7 m long x 0.5 m wide) located in a greenhouse. The bisphenol-A was added at nominal concentrations of 5, 50 and 500 µg/l as weekly pulses and analysis of concentrations showed that nominal concentrations were achieved initially, with rapid degradation (DT50 ~1 day) leading to almost complete disappearance of the substance between doses. The authors converted nominal concentrations into what they termed 'effective concentrations' by using the geometric mean of the initial concentration and the concentration after 7 days (or the limit of detection). Three of the aufwuchs-colonised tiles were removed from

each stream at 14-day intervals and the ash-free dry weight of the aufwuchs was determined. The overall exposure period was 103 days.

There was some evidence that exposure of aufwuchs to 500 µg/l bisphenol-A was associated with significantly lower ash-free dry weights, but there was little evidence of effects at 50 or 5 µg/l. However, the authors report an EC_{10} of 11 µg/l and EC_{50} of 46 µg/l for the area under the aufwuchs biomass/time curve, or an EC_{10} of 20 µg/l and EC_{50} of 73 µg/l when these values were normalised to the percentage of initial biomass in each treatment. These low values result from the calculation of exposure concentrations as the geometric means of initial and 7-day concentrations. If nominal concentrations are used then the EC_{10} and EC_{50} for the area under the aufwuchs biomass/time curve are 38 and 450 µg/l respectively, or 239 and 806 µg/l, respectively, if normalised to the percentage of initial biomass.

This study is not suitable for derivation of a PNEC because treatments were not replicated, and the relationship between exposure and effects on aufwuchs is difficult to interpret because of the pulsed dosing design.

The same artificial streams were used for exposures of the crustacean *Gammarus fossarum* to bisphenol-A at the same nominal concentrations (Schirling *et al*, 2006b). The effects noted in the study were an accelerated maturation of oocytes in females and a reduction in the size and number of early vitellogenic oocytes. The pulsed dosing system again makes the actual exposures difficult to estimate, and this and the lack of replication mean that the results are not suitable for the risk assessment.

3.2.1.4.5 Field studies

Vethaak *et al*. (2005) report a field monitoring study in which concentrations of several xenoestrogens, including bisphenol-A were measured at several freshwater and saltwater sites across the Netherlands. The *in vitro* reporter assay ER-CALUX was used to assess the estrogenic activity of the water samples, and samples of flounder (*Platichthys flesus*) and bream (*Abramis brama*) were also collected from selected sites for assessment of blood vitellogenin and ovotestis in males, and muscle concentrations of xenoestrogens. Two case studies were also performed as part of this study in which caged rainbow trout (*Oncorhynchus mykiss*) and carp (*Cyprinus carpio*) were exposed on-site to sewage effluent. Multivariate statistical techniques were then used to relate measured concentrations of xenoestrogens to estrogenic activity and effects on fish. Steroid hormones (particularly ethinylestradiol), alkylphenols and alkylphenol ethoxylate concentrations were associated with estrogenic effects, but the authors state that 'Estrogenic effects of [bisphenol-A] can be more or less ruled out.'

This study is not suitable for either deriving a PNEC or for assessing the environmental realism of the PNEC based on laboratory-derived data, since a mixture of substances was present, and only fish were analysed.

3.2.1.5 PNEC derivation for fresh surface water

3.2.1.5.1 Assessment factor approach

In deriving the $PNEC_{water}$ consideration needs to be given to short-term and chronic toxicity studies for fish, amphibians, aquatic invertebrates and algae. The guidelines given in the TGD

are based upon population effects (e.g. effects on ability to reproduce and species mortality) and do not directly cover endocrine disruption as an endpoint. Ideally, the data used to derive the $PNEC_{water}$ should be obtained from studies conducted to standard guideline methods that have been adequately ring tested, and performed to appropriate quality assurance standards. In this case, data are available for many species but most do not involve standardised methods. Nevertheless, these studies can still be relevant provided that the methods and results are sufficiently described.

A number of acute toxicity studies are available for fresh and saltwater fish, invertebrates and algae. No group appears to be significantly more sensitive than the others, and $L(E)C_{50}$ values are typically in the range 1-10 mg/l. There are no new acute studies with $L(E)C_{50}$ values below 1 mg/l, so the environmental classification proposal is unaffected.

For bisphenol-A the most sensitive effect that has a clear ecological relevance is egg hatchability in the fathead minnow, with a NOEC of 16 µg/l. This is also the NOEC for vitellogenin production in males of the same species (seen as an indicator of endocrine effects) and oviduct formation in male carp, and the study is of high quality and is considered reliable.

As there are long-term NOEC values available for fish, invertebrates and algae a factor of 10 can be used on the NOEC in accordance with the usual TGD method to give a **$PNEC_{water}$ of 1.6 µg/l**.[20]

This leaves out the consideration of effects on snails, in particular *Marisa cornuarietis*. The (conservative) NOEC from the most reliable study is 25 µg/l, and so is covered by the derivation above. The other, less reliable, values identified in Section 3.2.1.3.1 relate to the stimulation of egg production during a period of non-spawning. Such an effect is clearly important for seasonally breeding species, when chemical stimulation of breeding could effectively be forcing the organism to use energy reserves at a time of sexual repose, with a consequent possible reduction in fecundity during the following normal breeding season. There may also be an impact on offspring survival since eggs may hatch during periods of low natural food availability. Finally, the female-specific mortality caused by oviduct malformations might have an impact on sex ratio. Therefore this is a potentially important adverse effect, although ideally a full life cycle study would help clarify the actual relevance of each of these considerations. If the lowest EC_{10} value of 0.0148 µg/l[21] from Oehlmann *et al.* (2006) were used with an assessment factor of 10, the $PNEC_{water}$ would be 1.48 ng/l, which is extremely low. The derivation of this value is not clear in the paper and could not be duplicated (e.g. van der Hoeven, 2005). An alternative value of 2.1 µg/l was derived from the same raw data; this would give a $PNEC_{water}$ of 0.21 µg/l with an assessment factor of 10. It should be noted that this study is not considered to be as reliable as the conclusion (i) study, but this is discussed further in the risk characterisation section.

[20] For the majority of industrial chemicals, the $PNEC_{water}$ can be derived from just five tests perhaps involving only three species – one algal test (providing both acute and chronic data), an acute and a chronic *Daphnia* test, and an acute and a chronic fish test. For bisphenol-A, chronic NOECs for fish, *Daphnia* and algae are 3,640 (from the juvenile fish growth test), >3,146 and 1,360 µg/l respectively. If these were the only data available, the $PNEC_{water}$ would be 136 µg/l based on an assessment factor of 10 (with algae being the most sensitive trophic level). This shows the importance of measuring reproductive effects for suspected endocrine disrupters.

[21] The German competent authority believes that this value is reliable enough for the PNEC derivation.

3.2.1.5.2 Statistical approach

The TGD allows the use of statistical extrapolation to derive a $PNEC_{water}$ if there are sufficient data. The suggested minimum data requirements are that there should be at least 10 NOECs from at least 8 taxonomic groups, including:

- Fish
- A second family in the phylum Chordata (fish, amphibian, etc.);
- A crustacean (e.g., cladoceran, copepod, ostracod, isopod, amphipod, crayfish etc.);
- An insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge, etc.);
- A family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca);
- A family in any order of insect or any phylum not already represented;
- Algae; and
- Higher plants.

Suitable data (including some from studies that are classed as valid with restriction) are listed in Table 3.20, and these show that the above requirements are met. With the exception of molluscs, the data are the most reliable long-term values for each of the species, and the reasons for their selection are discussed in Sections 3.2.1.2 to 3.2.1.4. Fish provide around one third of the chronic data points. It could be argued that only data from full life cycle tests should be used, since these should cover all relevant life stages. It should also be noted that this table only considers data for freshwater organisms. At least one marine species has a chronic value that could be suitable for inclusion (*Skeletonema costatum*).

The data in Table 3.20 were used to construct species sensitivity distributions (SSDs) using the software program ETX 2.0, available from RIVM in the Netherlands. The value selected for *Marisa* snails is open to challenge since it is not from the most reliable study, and represents a recalculated value. Therefore, calculations have also been performed with the 5-month egg production EC_{10} as derived by the original study authors (for illustrative purposes only, given the low reliability of the actual value), as well as the result of the fully valid conclusion (i) study, to illustrate how the SSD would be affected. Plots of the resulting SSDs are shown in Figure 3.2 to Figure 3.4, and the resulting HC5 values are presented in Table 3.24. The table also contains the results of the estimation of the goodness of fit to a normal distribution using three different measures.

Table 3.23 Freshwater toxicity data used to construct a species sensitivity distribution for bisphenol-A

Taxonomic group	Species	Common name	Endpoint	Result (µg/l)	Reference
Fish	*Cyprinus carpio*	Common carp	49-d growth NOEC	100 [a]	Bowmer & Gimeno (2001)
	Danio rerio	Zebrafish	Full life-cycle multiple end point NOEC	750	Segner *et al.* (2003a)
	Oncorhynchus mykiss	Rainbow trout	28-d juvenile growth NOEC	3,640	Bayer AG (1999)

Taxonomic group	Species	Common name	Endpoint	Result (µg/l)	Reference
	Pimephales promelas	Fathead minnow	Multi-generation F2 egg hatchability NOEC	16	Sumpter *et al*. (2001)
	Oryzias latipes	Japanese medaka	Multi-generation multiple end point NOEC	247 [a]	Japanese Ministry of the Environment (2006)
	Poecilia reticulata	Guppy	30-d survival NOEC	500	Kinnberg & Toft (2003)
Amphibia	*Xenopus laevis*	African clawed frog	12-week sex ratio NOEC	60.4	Geometric mean of 500 (Pickford *et al*., 2000 & 2003) and 7.3 (Levy *et al*., 2004)
Crustacea	*Daphnia magna*	Water flea	21-d reproduction NOEC	3,146	Bayer AG (1996)
	Hyalella azteca	Scud	42-d reproduction NOEC	490	Springborn Smithers (2006b)
Insects	*Chironomus riparius*	Midge	Life-cycle time to moult & growth NOEC	100	Watts *et al*. (2003)
Rotifers	*Brachionus calyciflorus*	Rotifer	48-h intrinsic rate of increase NOEC	1,800	Springborn Smithers (2006a)
Molluscs	*Marisa cornuarietis*	Ramshorn (apple) snail	5-month egg production EC_{10}	2.1	Van der Hoeven (2005), recalculated from Oehlmann *et al*. (2006)
Cnidarians	*Hydra vulgaris*	Hydra	6-week polyp structure NOEC	42	Pascoe *et al*. (2002)
Poriferans	*Heteromyenia sp.*	Sponge	9-d growth NOEC	1,600	Hill *et al*. (2002)
Algae	*Pseudo-kirchneriella subcapitata*	Alga	96-h cell count EC_{10}	1,360	Alexander *et al*. (1985b & 1988)
Macrophytes	*Lemna gibba*	Duckweed	7-d growth NOEC	7,800	Putt (2003)

a) A full study report is not currently available, but the data are considered adequate based on abstract information

Figure 3.2 Species sensitivity distribution using whole data set with mollusc value of 0.0148 µg/l

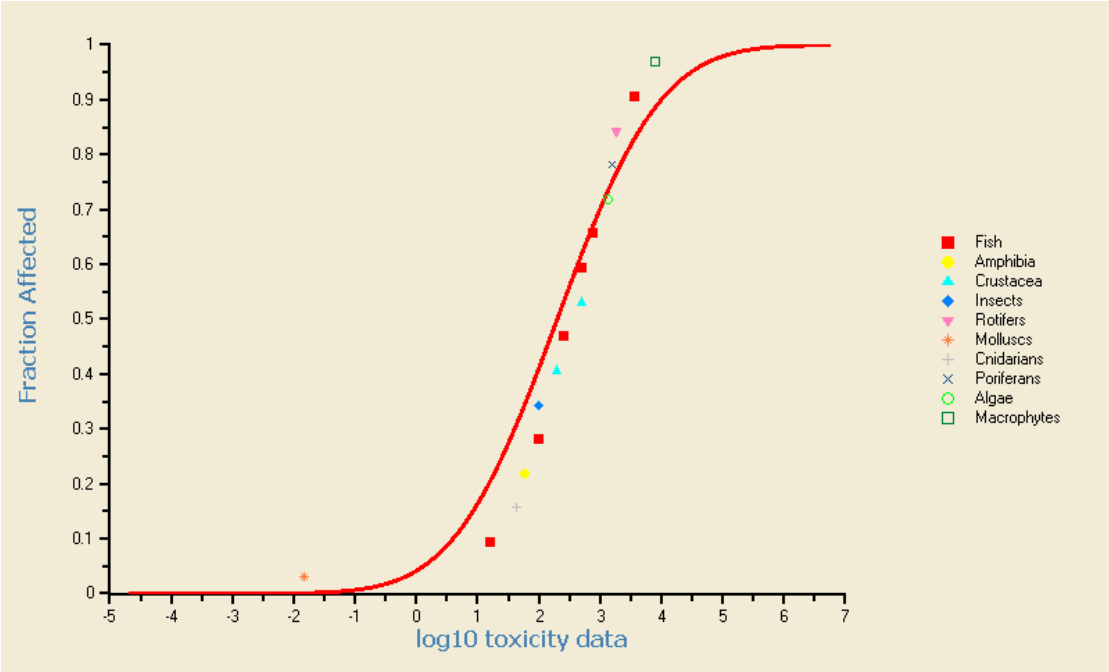


Figure 3.3 Species sensitivity distribution using whole data set with mollusc value of 2.1 µg/l

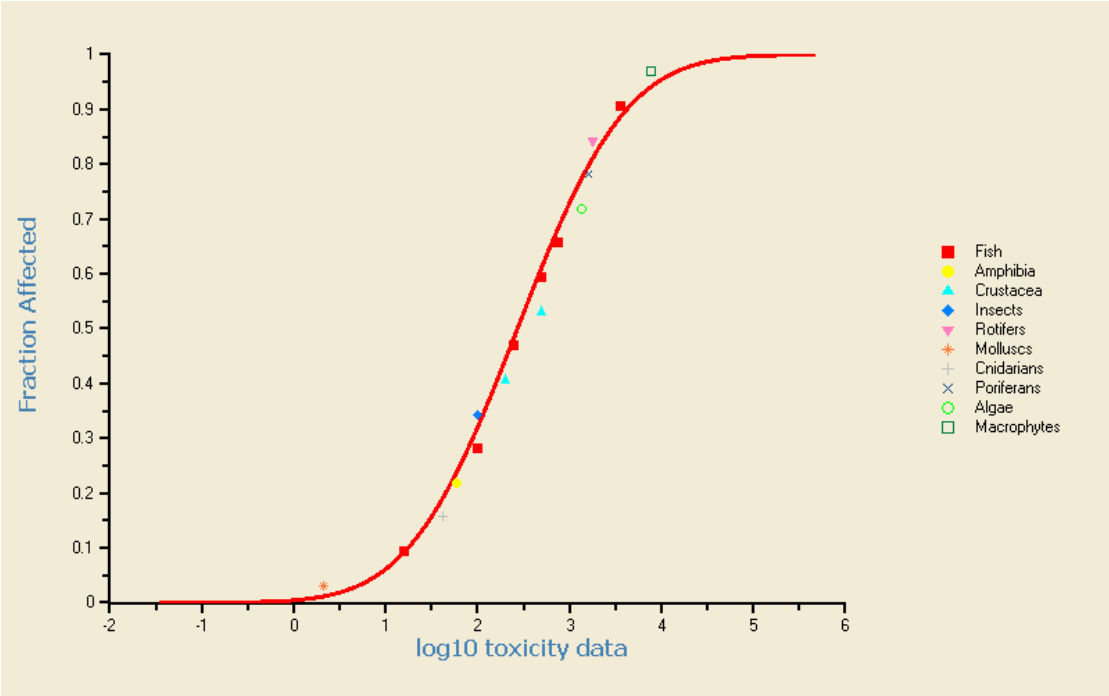
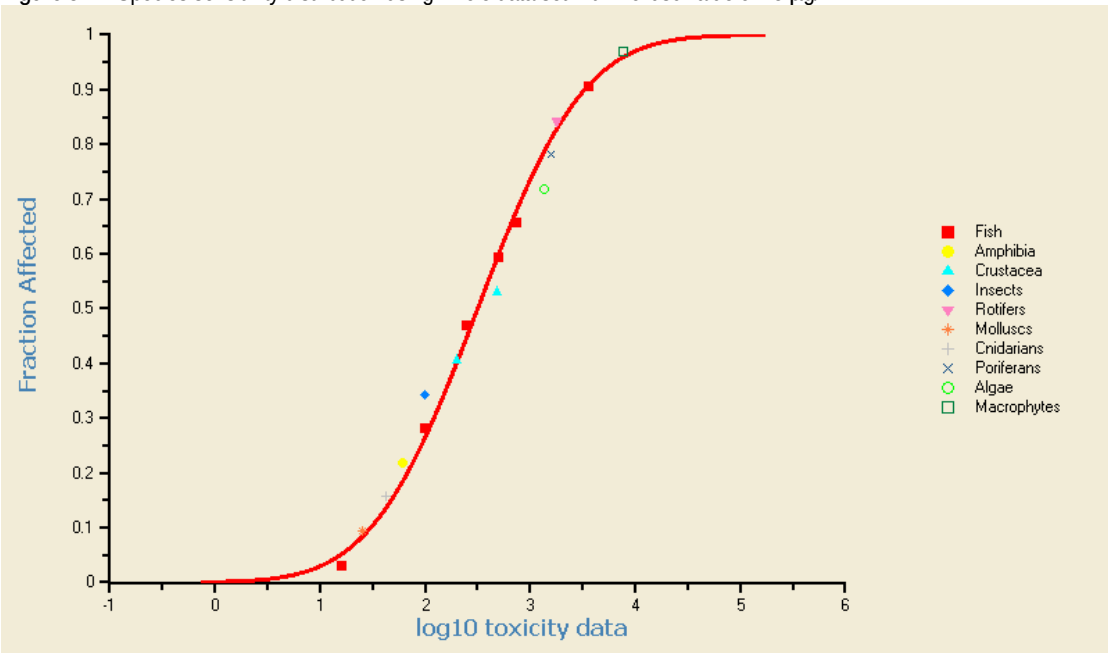


Figure 3.4 Species sensitivity distribution using whole data set with mollusc value of 25 µg/l



There are indications (not necessarily in relation to bisphenol-A) that many invertebrates have physiological systems that could potentially be affected by endocrine-disrupting substances. Fish are known to be affected by such compounds, so it is considered valid to combine the data for the invertebrates and fish in the SSD. It might be expected that algae and plants could respond differently to bisphenol-A. The results of leaving the data for these out of the data set are therefore also shown in Table 3.21 (plots are not shown).

Table 3.24 HC5 values

Data set	HC5	90% interval	Goodness of fit
Mollusc 2.1 µg/l	7.5	1.23 – 24.3	All accepted
Mollusc 2.1 µg/l Algae and macrophytes removed	6.36	0.97 – 20.7	All accepted
Mollusc 25 µg/l	14.7	3.12 40.2	All accepted
Mollusc 25 µg/l Algae and macrophytes removed	13.6	2.87 – 36.2	All accepted
The following results are included for comparative purposes			
Mollusc 0.0148 µg/l	1.19	0.09 – 6.4	A-D rejected at 0.025 K-S all accepted CvM rejected at 0.1
Mollusc 0.0148 µg/l Algae and macrophytes removed	0.79	0.046 – 4.7	A-D rejected at 0.025 K-S rejected at 0.1 CvM rejected at 0.05

A-D Anderson-Darling;
K-S Kolmogorov-Smirnov;
CvM Cramer von Mies

The choice of value for *Marisa* has a large influence on the HC5 resulting from the calculation, the difference between the highest and the lowest being over an order of magnitude. In contrast, removing the algal and macrophytes values produced a change of only 35% at most. The complete data set has therefore been used.

If the *Marisa* EC_{10} of 2.1 µg/l is used, the data pass all three tests for normality at the p=0.1 level; this value is also the lowest in the data set. Using the conclusion (i) programme NOEC of 25 µg/l, the data also pass all three tests at the p=0.01 level, but fish are more sensitive.

The lowest EC_{10} value of 0.0148 µg/l for *Marisa* is considered to be the least reliable value for a variety of reasons, as outlined in Section 3.2.1.3.1. When it is included in the data set for the SSD, the data pass the Kolmogorov-Smirnov test for normality at the p=0.1 significance level, but only pass the Anderson-Darling test at the p=0.01 level and the Cramer von Mies test at the p=0.05 level. These latter two tests focus on the fit in the tails of the distribution, and this *Marisa* result is inconsistent with a normal distribution of data. Regardless of the validity of the numerical value of this EC_{10}, the HC5 from this SSD would have to be treated with caution because the assumptions of normality are likely to be violated and the value therefore has a high level of uncertainty. It is therefore not considered further in this assessment.

The TGD proposes the use of an assessment factor of between one and five on the HC5 value to arrive at the $PNEC_{water}$. The choice of assessment factor depends on the quality and extent of the data. The data set meets the minimum requirements of 10 NOEC values for eight taxonomic groups, there are in fact 16 values for 10 groups. The main group is fish, with six values, and hence fish could be considered to have too large an influence on the result; however, the individual values for fish are spread out through the data set fairly evenly. There are no valid mesocosm or field data to use to support or confirm the result of the SSD. The data set overall is smaller than that used for some metals where a low factor of one or two has been proposed. There is also the remaining uncertainty over the appropriate value to use for molluscs. It is therefore proposed to use an assessment factor of five.

Applying a factor of five to the HC5 from the data set including the conclusion (i) programme result would give a $PNEC_{water}$ of 3.0 µg/l. Using the recalculated result of 2.1 µg/l in the data set and an assessment factor of five gives a $PNEC_{water}$ of 1.5 µg/l. This lower value is preferred for the risk characterisation given the possibility that the conclusion (i) study might have missed an effect because the snails did not exhibit a seasonal breeding pattern. It is very similar to the $PNEC_{water}$ derived using the assessment factor approach without consideration of the snail data, and is also close to the lower limit of the 90th percentile confidence interval on the HC5 value.

3.2.1.6 PNEC for marine waters

Information is available on a number of tests with marine organisms. None of these tests provide results that are suitable for direct use in the risk assessment. The results for fish appear to show effects at similar levels to those in freshwater fish and no indication of increased sensitivity in the marine species. The most sensitive organisms appear to be molluscs, with effects at similar levels to those with *Marisa* in freshwater (with the same reservations about the limitations of the studies). There is no specific guidance on adapting an SSD-based PNEC from freshwater organisms to the marine environment. For the assessment factor approach, an additional factor of 10 would be used on a PNEC from freshwater data only, to take account of the wider range of species in the marine environment. The same approach will be adopted here, giving a $PNEC_{marine\ water}$ of 0.15 µg/l.

3.2.2 Sediment compartment (fresh and saltwater)

3.2.2.1 Invertebrate toxicity data

3.2.2.1.1 Molluscs

The freshwater snail *Potamopyrgus antipodarum* was exposed to bisphenol-A in artificial sediments for up to eight weeks (Duft *et al*., 2003). The sediment was composed of 95% quartz sand and 5% ground beech leaves. Bisphenol-A was added to the sediment dissolved in ethanol and the sediment left for one day for the solvent to evaporate. Water was added and the sediment allowed to equilibrate for five days with aeration. Exposure concentrations were 1, 10, 30, 100 and 300 µg/kg dry weight. Experiments were carried out at 15±1°C.

Eighty snails were added to the flasks containing sediment at the start of the exposures, and twenty were removed after 0, 2, 4 and 8 weeks. Embryos were removed from the brood pouch and the number of 'grown up' embryos (with shells) and 'new' embryos (without shells) were counted. The occurrence of egg cells in the oviduct and the maturity of the ovary were noted, as was any mortality in the treatments.

Two weeks' exposure to bisphenol-A concentrations of 30 µg/kg and above resulted in the increased production of unshelled embryos. A similar result was found for the total number of embryos, but not for the number of shelled embryos. At eight weeks, the stimulation of embryo production was significant at all concentrations tested in comparison to the controls. The total number of embryos and the number of shelled embryos varied very little in the controls; the number of unshelled embryos showed a slight but not significant decrease over the eight weeks. (Non-linear regression was used to fit the results and to derive concentrations giving 10% and 50% stimulation. For embryo production at two weeks the values were 0.22 and 24.5 µg/kg, at eight weeks they were 0.001 and 0.004 µg/kg. Note that these latter values are extrapolated by three orders of magnitude below the lowest concentration tested, and so have a very high degree of uncertainty.)

No analysis of the sediment was undertaken because of the reported short half-life of bisphenol-A in sediment. In addition, all of the exposure concentrations were below the reported detection limit for bisphenol-A in sediment of 5 mg/kg. Attempts were made to analyse the soft tissues of the snails to obtain a measure of the levels in the organisms, but insufficient tissue was recovered to allow the analysis to be performed.

The lack of confirmation of exposure concentrations means that these data cannot be used directly in the $PNEC_{sediment}$ derivation. However, given the apparent sensitivity of snail species to aqueous exposures, it is notable that effects were observed, and it should also be recalled that a NOEC of 1 µg/l (nominal) was obtained for stimulation of embryo production with this species via water phase exposure (Jobling *et al*., 2004; discussed in Section 3.2.1.3.1).

3.2.2.1.2 Crustacea

Whale *et al*. (1999) studied the acute toxicity of bisphenol-A to the saltwater benthic amphipod *Corophium volutator*. Artificial sediment was prepared following guidelines in the OECD (1984) earthworm acute toxicity test. Bisphenol-A with 98% purity was added to the sediment by a spiking procedure with and without the presence of acetone as a carrier solvent. Animals were

added to the test system and exposed to bisphenol-A for 10 days. The condition of the organisms was assessed daily as active, immobilised or dead. The resultant LC_{50} (based on mortality) and EC_{50} (based on total adverse effects) values were calculated using probit analysis. The concentration of bisphenol-A in sediment was measured using solvent extraction and liquid chromatography. The pore-water concentration of bisphenol-A was estimated from the sediment concentration using the equilibrium partitioning model approach. The 10-day LC_{50} values calculated for acetone and direct spiked tests based on bulk sediment concentrations were 46 and 60 mg/kg dry weight, respectively. The corresponding 10-day EC_{50} values were 31 and 36 mg/kg dry weight for acetone and direct spiked tests, respectively. The endpoints of the toxicity tests based upon interstitial water concentrations were also determined; the 10-day LC_{50} values were 1.4 and 1.6 mg/l for acetone and direct spiked tests, respectively and the 10-day EC_{50} values were 1.1 and 1.3 mg/l for acetone and direct spiked tests, respectively.

3.2.2.1.3 Insects

Watts *et al*. (2001b) studied the effect of bisphenol-A on development and reproduction in the freshwater midge *Chironomus riparius*. Larvae were exposed to a range of sediment concentrations and raised until the adults emerged. The time to emergence, sex ratio, number of adults, egg production and egg viability were all measured. The sediments in the experiment were spiked with stock solutions of bisphenol-A, and the concentrations of bisphenol-A in the stock solution were confirmed by analysis. The sediment was artificial, containing 15% organic matter; the resultant bisphenol-A concentrations were not measured in the sediment or the exposure water. The authors found that emergence of male and female adults were significantly delayed in the second generation of adults at bisphenol-A concentrations of 78 ng/l to 0.75 mg/l (these are stock solution concentrations and not the actual exposure concentrations in sediment). There was no observable effect on the first generation adults, and no effect on sex ratio or total number of adults produced in either generation. The authors noted that although time of emergence of adults was affected, the results in general do not suggest that the criteria examined, although validated as indicators of general sediment toxicity, could be used to detect oestrogenic effects. In this experiment it is not possible to estimate the actual level of exposure in the test system which may be substantially different from the stock solution concentrations due to adsorption and degradation of bisphenol-A. This study is not considered valid for further use in the risk assessment.

3.2.2.2 PNEC derivation for sediment

For bisphenol-A there are limited data on the toxic effects of bisphenol-A to benthic organisms. Based upon a 10-day EC_{50} for *Corophium volutator* of 36 mg/kg dry weight (lowest value for direct spiked tests) and using an assessment factor of 1,000 a $PNEC_{sediment}$ of 36 µg/kg dry weight is calculated. It should be noted that this result is from a test on a saltwater organism carried out in a saltwater sediment medium. As the data set is very limited a $PNEC_{sediment}$ derived from the PNECwater using the equilibrium partitioning method has also been calculated for comparison. The calculated $PNEC_{sediment}$ value is 24 µg/kg wet weight (63 µg/kg dry weight) using the $PNEC_{water}$ of 1.5 µg/l.

The PNECs derived by the two methods are reasonably similar. The equilibrium partitioning approach should be suitable for a substance such as bisphenol-A. The database for aquatic organisms is much more extensive than that for sediment organisms, and so more confidence can be placed in the result. In addition, the sediment study also derived acute toxicity values based

on the measured interstitial water concentrations in the test. The resulting $L(E)C_{50}$ values (1.1-1.4 mg/l) are the same as the lower end of the values for aquatic invertebrates. There are indications from one study that snails may also be more sensitive when exposed to bisphenol-A in sediment. This also supports the importance of developing a result or results for molluscs that can be used with confidence. Whether the snail data are confirmed or not, taking all the evidence together the assessment for aquatic organisms can be considered to be protective for the sediment compartment.

For the marine compartment, there are no additional specific data to that used above, so the equilibrium partition method is used on the marine aquatic PNEC of 0.15 µg/l, giving a $PNEC_{marine\ sediment}$ of 2.4 µg/kg wet weight (6.3 µg/kg dry weight).

3.2.3 Terrestrial compartment

3.2.3.1 Terrestrial toxicity data

There were no terrestrial toxicity results available at the time the original risk assessment was developed, and so the PNEC for the terrestrial compartment was derived using the equilibrium partition method. A testing programme for the terrestrial compartment was developed following the publication of the original risk assessment. The degradability of bisphenol-A leads to difficulties in maintaining a constant concentration in all media, but especially in soils where renewal of the soil is both difficult and unrealistic. It was agreed by the Technical Committee for New and Existing Substances that these tests should be performed with a single addition of bisphenol-A to the soil at the start of the exposures. This approach would mimic the only likely route of exposure for soil, which is through the application of sewage sludge containing the substance. Deposition from air is estimated to be negligible in comparison. Effect concentrations would be expressed in terms of the initially added concentration.

3.2.3.1.1 Springtails

The toxicity of bisphenol-A to the collembolan *Folsomia candida* in a test according to ISO 11267 has been reported (ECT, 2007a)[22]. The test was conducted using an artificial soil, composition based on the OECD Guideline 207 (10% sphagnum peat, 20% kaolin clay, 68-69% quartz sand, 1% calcium carbonate). A mixture of radiolabelled (^{14}C ring-labelled) and non-labelled bisphenol-A was used. Solutions of bisphenol-A in acetone were applied to portions of the quartz sand and the solvent allowed to evaporate; the treated sand was then incorporated into the rest of the artificial soil. The soil was wetted to 40-60% of its maximum water holding capacity at the start; the weight was checked once per week, and water added if the weight loss was greater than 2% of the water content. Samples of the treated soil were taken for analysis before the organisms were added. The recovery of the radiolabel from the initially treated soils (expressed as dpm in soil/dpm in dosage solution, where dpm is disintegrations per minute) ranged from 101-109%, so the actual concentrations at the start corresponded to the nominal concentrations.

[22] The rapporteur originally proposed a test on *Folsomia fimetaria* as this is a sexually reproducing species of collembolan. Information from the literature on the toxicity of nonylphenol to *F. fimetaria* and *F. candida* shows them to have similar sensitivities in terms of effects following exposure to a weakly estrogenic substance (nonylphenol). It is therefore considered that the test on *F. candida* is appropriate for the purpose of the risk assessment.

Five exposure concentrations were used, with solvent and deionised water controls, with five replicate vessels for each treatment and control. Collembolans were introduced to the treated soil after the soil was added to the test vessels; ten animals were added to each vessel. The animals were 10-12 days old (juveniles), from a synchronised culture. They were fed with ~30 mg of granulated dry yeast at the start of the exposures, and again after 14 days. The exposures lasted for 28 days.

At the end of the exposures, the soil from each vessel was mixed with water and the collembolans floated to the surface. The appearance and behaviour of the adults was observed, and the number of adults counted directly. Digital photos of the test vessels were taken, and the number of juveniles on these images was counted.

Mortality among the adults in the solvent and water controls was 12%, that in the exposures was 2-12%, so there was no effect on survival at any exposure level. (The test guidelines performance criterion for survival is less that 20% mortality in the controls.) The number of juveniles was reduced at the highest exposure level of 1,000 mg/kg dw, down to 61% of the number in the solvent control. The NOEC for this endpoint is therefore 500 mg/kg dw.

3.2.3.1.2 Earthworms

a) Eisenia andrei

As part of a project to investigate endocrine disruption in key invertebrate taxonomic groups, Johnson *et al*. (2005) carried out tests on the earthworm *Eisenia andrei* exposed to a number of substances (individually), including bisphenol-A. Both short-term (14-day) screening tests and longer-term (56-day) reproduction studies were conducted. For both types of test a stock solution of bisphenol-A was prepared in acetone, and the appropriate amount added to OECD earthworm soil. After spiking with the substance, 0.5 kg amounts of soil were added to replicate test vessels, which were left to stand overnight to allow the acetone to evaporate. Ten animals were added to each replicate and allowed to burrow; dried ground rabbit droppings (5 g) were placed on the surface for the worms to feed on. The weight of the test vessels was recorded at this stage; twice a week distilled water was added to restore the weight to the starting value to compensate for water lost by evaporation. The control and solvent controls contained twenty animals each. All worms used in the study were sexually mature with clitella. The environmental conditions were 25±2°C and a photoperiod of 16 hours light and eight hours dark. The test procedures are not described in detail in the report, but for the most part there appear to be only minor variations from the OECD guideline, and these would not be expected to affect the test. A possible exception is the feeding of the worms; the test report indicates this was done once at the start of the exposures, whereas the OECD guideline indicates weekly additions of food.

The nominal concentrations used in the short-term test were 1.0, 3.2, 10, 32, 100, 320, 1,000, 3,200 and 10,000 mg/kg, with two replicates. After 14 days, the live and dead worms were removed from the test vessels by sieving the soil. The numbers of live and dead worms were recorded and the live worms were snap frozen in liquid nitrogen and stored at -80°C for analysis[23]. Concentration-dependent mortality was observed in the study; the responses were 10% at 10 mg/kg, 20% at 32 mg/kg, 90% at 100 mg/kg, 40% at 320 mg/kg, and 100% at 1,000 mg/kg and above. Given the 10% mortality observed in the solvent control (which is within the validity criteria for the OECD guideline), a NOEC of 32 mg/kg and a LOEC of 100 mg/kg are

[23] The report comments that analysis was carried out on samples where significant effects on toxicity indices were recorded, but no analytical results are included in the report

presented in the report. A probit analysis of the data for this paper gives an LC_{50} of 61 mg/kg. No comment is given on the high mortality at the 100 mg/kg dose level, but this may just reflect the natural variation in such tests; it does mean the result will be more uncertain.

The long-term test used nominal concentrations of 1.0, 3.2, 10, 32 and 100 mg/kg, with four replicates at each concentration. Exposures were started in the same way as for the short-term studies; after 28 days the soil was sieved and the adult worms were removed, snap frozen in liquid nitrogen and stored at -80°C. The sieved soil containing cocoons was returned to the test vessels and left for a further 28 days to allow the cocoons to hatch. The number of juvenile worms in each vessel was determined at 56 days after wet sieving the soil. The report notes that soil samples were taken for analysis at the start of the test and at 28 days (when the soil was sieved) and stored at -20°C. Analyses were to be carried out on those samples from vessels where significant effects on toxicity indices or biomarkers were seen. No statistically significant effects were seen on the numbers of hatched cocoons, unhatched cocoons or live worms at any of the exposure levels. In the absence of any significant effects, no soil analyses were conducted. The number of worms in the controls was below the value of 30 set as a validity criterion in the OECD test guideline. Similar low numbers of worms were recorded for three of the other substances. For the other two substances tested the control responses met the validity criteria. The report notes that the production of cocoons varied in a seasonal manner, and that two of the experiments had to be repeated due to the low numbers of cocoons in the original tests. These repeats were the two tests that met the OECD criterion. It is not clear whether the limited addition of food in this study would have an influence on cocoon production. These observations are not considered to affect the overall conclusion of the study.

The study also investigated possible biomarkers for endocrine effects. A robust assay was developed for the gene expression of annetocin, a protein involved in the release of cocoons. No significant effects on the expression of this protein were observed in either the short- or long-term exposures with bisphenol-A. Long-term experiments under the same conditions with oestradiol, ethinylestradiol, testosterone, nonylphenol and propoxur also showed no effect on the gene expression. All but propoxur had no effect on the numbers of cocoons or live young worms; the effects caused by propoxur were not considered to be endocrine related.

The report concludes that earthworms may not be the most appropriate terrestrial species with which to assess the effects of endocrine disrupting chemicals. Earthworms are hermaphroditic, and they appear to have inherent homeostatic mechanisms to compensate for internal fluctuations in the levels of oestrogen and androgen that may result from exposure to chemicals.

Discussion

Although earthworms may not be suitable to demonstrate effects arising from endocrine disruption, they are still susceptible to “classical” toxicity, and effects on reproduction were seen with one of the test substances. No effects were seen with bisphenol-A at the highest concentration tested of 100 mg/kg in the long-term study. However, in the short-term study lethality was observed, beginning at a lower concentration than this, with significant lethality being seen at 100 mg/kg.

This apparent discrepancy may be due to degradation of bisphenol-A in the soil during the course of the exposures. Bisphenol-A is considered to be readily biodegradable in aquatic tests (the corresponding half-life in soil from the Technical Guidance Document is 30 days, although it should be noted that this is only a very approximate guide for modelling purposes). It is therefore likely that some degradation occurred over the 14-day study. However, as the soils were dosed in the same way for both the short- and longer-term studies, the extent of degradation

would be expected to be similar at the same times, and hence similar effects would be expected at the same time points. Since no concentrations were measured there is no information to indicate whether the test substance degraded at different rates in the two studies.

It should also be noted that the results obtained with nonylphenol in the same study follow a similar pattern to those with bisphenol-A, in that effects were seen at 14 days in the 100 mg/kg exposure, but not in the long-term study at the same level. The short-term effects for nonylphenol agree fairly well with other results available for that substance (Enviroment Agency, 2005). However, the long-term result for nonylphenol is not consistent with other data, which suggests that there may have been a problem with the longer test.

b) Enchytraeus crypticus

As a consequence of the unclear results with *Eisenia andrei*, a study on the effects of bisphenol-A on the enchytraeid species *Enchytraeus crypticus* has been conducted following OECD Guideline 220 (ECT, 2007b). The same artificial soil was used as in the collembolan study above, and the test soil samples were prepared in the same way. Samples were again taken for analysis at the start of the exposures. The recovery (as dpm in soil/dpm in dosage solution) ranged from 110 to 148% of the nominal levels. These were considered to be in reasonable agreement with the nominal levels, and the results are presented in terms of the nominal values.

Six concentrations of bisphenol-A were used, together with a solvent and a deionised water control. Four replicates were used for each treatment level and for the water control, with eight replicates for the solvent control. Ten adult enchytraeids were added to each test vessel. The animals were fed ~50 mg of ground oats at the start of the exposures, and once a week for the 28-day duration.

At the end of the exposures each soil sample was transferred to a shallow plastic tray and ethanol added to fix the juveniles. Water and Bengal red stain were added, the components mixed and left for 12 hours, after which the worms were stained red and lying on the surface where they were counted.

The mortality in the water control was 5% and in the solvent control 7.5% (the test guideline specifies a maximum mortality for validity of 20%). Mortality in the bisphenol-A treatments was 5-12.5%, hence there was no effect on survival. There were no significant differences between the numbers of juveniles in the controls and any of the bisphenol-A exposures (the controls met the validity criterion of >50 per vessel). Hence the NOEC for the study is ≥100 mg/kg dw (the top dose).

3.2.3.1.3 Plants

The effect of bisphenol-A on the emergence and growth of six species of plant has been determined using a protocol meeting the requirements of OECD Test Guideline 208 (Springborn Smithers, 2007). The plant species tested were three monocotyledons: corn (Zea mays); oats (Avena sativa); and wheat (Triticum aestivum); and three dicotyledons: cabbage (Brassica oleracea); soybean (Glycine max); and tomato (Lycopersicum esculentum).

The sandy loam used for the test came from Fairhaven, Massachusetts, and contained 85% sand, 12% silt and 3% clay, with an organic carbon content of 1.1% (1.9% organic matter). The soil was heat sterilised before use.

A master stock solution of bisphenol-A was prepared in acetone, and a series of dilutions was prepared from this, also in acetone. The appropriate volume of each dilution was applied to silica sand and the acetone allowed to evaporate. Once dried, the sand was mixed with soil (0.5 kg sand to 11.5 kg soil for all except wheat, where 6 kg of soil were used). Different exposure levels were used for each plant species based on range finding tests. Solvent controls were prepared in the same way without addition of bisphenol-A to the acetone; controls without the addition of acetone were also used.

Approximately 1.2 kg of treated soil was placed in each pot. Seeds were planted in each pot at the start of the test. The number of seeds per pot was based on the seed and expected plant size (see table headings). Pots were placed on saucers, and well water or nutrient solution was added to the saucer at regular intervals. The tests were conducted in a greenhouse, with a 16-hour light period (sunlight augmented by sodium vapour lights as necessary). The temperature was monitored and ranged from 24 to 42°C; the relative humidity range was 18-100%. Although these exceed the recommended ranges in OECD 208, the same conditions have been used by the laboratory in the past with no negative impact on plants.

The control pots were observed daily until 50% emergence or greater was seen. At 7, 14 and 21 days after this, the number of emerged plants, mortalities and morphological abnormalities (e.g. chlorosis of leaves) were recorded. After 21 days from 50% control emergence, all exposures were terminated, and the above ground portions of living plants were removed and dried to determine dry shoot weights.

Each dosing solution was analysed prior to application to sand. An earlier range finding study using radiolabelled bisphenol-A added to soil in the same way as above demonstrated that the concentration after application ranged from 78-152% of nominal. This range was considered to be within the expected range for mixing a solid substance (sand) into soil, and therefore the nominal concentrations are taken as representative of the initial concentration in soil.

The results for each species are presented in Table 3.25 to Table 3.30. The derived effect levels are summarised in Table 3.32 and Table 3.31.

Table 3.25 Cabbage (10 replicates, 4 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	0.2964	0.0862	59
20	0.2165[a]	0.0915	70
50	0.3058	0.0457	88
130	0.1622[b]	0.0570	50
320	0.0251[c]	NA[c]	2.5[b]
800	NA[c]	NA[c]	0[b]

a) Significantly reduced compared to control, but not considered treatment related as next concentration is not reduced

b) Significantly reduced compared to control

c) Statistics not calculated due to lack of emerged plants.

Table 3.26 Corn (10 replicates, 2 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	2.2619	1.0197	80
3.8	1.6899	0.4695	90
10	1.7635	0.1831	95
20	1.9959	0.7395	80
50	1.8348	0.4213	90
130	1.1461	1.0883	65
320	0.7472[a]	0.1563	80

a) Significantly reduced compared to control

Table 3.27 Oat (10 replicates, 8 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	0.2889	0.0513	76
9.4	0.2802	0.0247	86
19	0.3133	0.0269	98
47	0.2736	0.0532	68
120	0.0894[a]	0.0775	18[b]
300	0.0530[a]	0.0230	84
800	0.0100[a]	0.0026	64

a) Significantly reduced compared to control

b) Significantly reduced compared to control, but not considered treatment related as next two concentrations are not reduced.

Table 3.28 Soybean (10 replicates, 2 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	2.1009	0.6438	100
20	1.4529	0.7335	100
50	2.0287	0.4238	100
130	1.7787	0.7694	90
320	1.4084	0.3400	90
800	0.1869[a]	0.1250	75

a) Significantly reduced compared to control

Table 3.29 Tomato (10 replicates, 2 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	1.1308	0.2914	85
4.0	1.0774	0.3001	85
10	0.9528	0.0994	85
20	0.8137	0.1208	95
50	0.6790[a]	0.1390	90
130	0.1568[a]	0.0753	90
320	0.0206[a]	0.0288	25[a]

a) Significantly reduced compared to control

Table 3.30 Wheat (5 replicates, 8 seeds per replicate)

Concentration (mg/kg dw)	21 day shoot dry weight (g)	SD	Percent emergence at 21 days
Control	0.1609	0.0178	99
3.8	0.1685	0.0206	98
9.4	0.1541	0.0046	100
20	0.1858	0.0085	98
47	0.1678	0.0161	100
120	0.1230[a]	0.0176	98
300	0.0297[a]	0.0101	98

a) Significantly reduced compared to control

Table 3.31 Results based on dry shoot weight (mg/kg nominal)

Species	EC25[a]	EC50[a]	LOEC	NOEC
Cabbage	82 (52-120)	>130 NA[b]	130	50
Corn	83 (14-180)	160 (80-280)	320	130
Oat	69 (57-81)	100 (87-130)	120	47
Soybean	220 (72-360)	460 (370-520)	800	320
Tomato	19 (9.8-32)	67 (52-79)	50	20
Wheat	120 (98-140)	200 (180-210)	120	47

a) 95% confidence limits in parentheses

b) NA = not applicable; EC25 and EC50 values were estimated empirically, so 95% confidence limits could not be calculated.

Table 3.32 Results based on percent emergence (mg/kg nominal)

Species	EC25[a]	EC50[a]	LOEC	NOEC
Cabbage	130 (83-180)	190 (120-230)	320	130
Corn	>320 NA[b]	>320 NA[b]	>320	320
Oat	>800 NA[b]	>800 NA[b]	>800	800
Soybean	650 (370-800)	>800 NA[b]	>800	800
Tomato	190 (160-210)	260 (230-300)	320	130
Wheat	>300 NA[b]	>300 NA[b]	>300	300

a) 95% confidence limits in parentheses

b) NA = not applicable; EC25 and EC50 values were estimated empirically, so 95% confidence limits could not be calculated.

The lowest EC_{25} value from the study is 19 mg/kg dw, for dry shoot weight in tomato plants. This endpoint also has a NOEC value of 20 mg/kg dw. The value of 20 mg/kg will be used in the derivation of the PNEC.

Ferrera *et al.* (2006) exposed seeds and seedlings of four plant species (broad beans, *Vicia faba* L., var. maior; tomato, *Lycopersicum esculentum* Mill.; lettuce, *Lactuca sativa* L.; and durum wheat, *Triticum durum* Desf.) to bisphenol-A in solution (not in soils). Seeds were exposed on filter paper in Petri dishes, and germination and early growth were evaluated. Seedlings from these exposures were inserted into holes in aluminium lids on glass jars filled with nutrient medium containing bisphenol-A or medium alone for 21 days. The length and weight (wet and dry) of the roots and shoots of the seedlings were measured. The exposure concentrations were 10 and 50 mg/l.

Germination of seeds and root and shoot lengths of seedlings up to six days (Petri dish exposures) were not affected by bisphenol-A, with the exception of the root length of tomato seedlings which was reduced by over 50% at 50 mg/l. The root and shoot lengths and weights (wet and dry) were reduced at both bisphenol-A levels in the 21-day growth tests for tomato, durum wheat and lettuce, but not for broad bean. The bisphenol-A concentration reduced in the nutrient medium over the 21-day exposure by ~90% at the lower concentration and by between 80% and 96% at the higher concentration. Solutions stored under the same conditions with no seedlings showed only limited decreases. Analysis of broad been and tomato seedlings for bisphenol-A was carried out. The tomato seedlings contained measurable levels in both shoots and roots; broad bean seedlings had lower levels that the tomatoes in the roots, and bisphenol-A was not detected in the shoots.

These exposures are through water only, and no NOEC can be determined, so they are not suitable for use in the assessment.

3.2.3.2 Terrestrial PNEC

As discussed in Section 3.2.1.3.1, aquatic snail species might be sensitive to bisphenol-A, and so terrestrial molluscs could be an important group to protect. However, no relevant data are available, and a standardised reproductive toxicity test method is not available either. Unlike the aquatic environment, terrestrial exposures are intermittent, and since bisphenol-A is readily biodegradable, there is no potential for continuous exposure. It is therefore recommended that the standard soil assessment scheme is followed, which is consistent with the approach taken for other endocrine active chemicals, e.g. nonylphenol (EC, 2002).

The results of long-term tests with earthworms, springtails and plants are available, with NOEC values of >100, 500 and 20 mg/kg dw respectively. The first two values were obtained in soils with an organic matter content of 10%. Normalising these values to the standard TGD soil organic matter content of 3.4% gives NOEC values of >34 and 170 mg/kg dw. The value for plants was obtained from a soil with 1.82% organic matter[24]. Normalising the value to the standard TGD soil organic matter content gives a NOEC value of 37 mg/kg dw.

As three NOEC values are available covering a suitable range of organisms[25], an assessment factor of 10 is appropriate, giving a $PNEC_{soil}$ of 3.7 mg/kg dw. For comparison with the calculated concentrations in soil, which are presented on a wet weight basis, this corresponds to a value of 3.2 mg/kg wet weight using the standard TGD. A NOEC of 32 mg/kg has also been reported for mortality in *Eisenia* in a short-term test. As no effects were seen with the same species in a longer-term test with the same test conditions, this short-term result is not considered to have a high reliability. As the $PNEC_{soil}$ derived here is well below the reported value, it is considered to be suitably protective.

3.2.4 Secondary poisoning

The $PNEC_{oral}$ was based on the mammalian data reviewed in the human health risk assessment. A NOAEL of 50 mg/kg bw/day was used (related to reduction in litter size in a three-generation feeding study with rats).

3.2.4.1 New information

The effects of bisphenol-A on fertility and reproductive performance in CD-1 mice have been investigated in a two-generation study, conducted in response to the published risk assessment conclusions (Tyl *et al*, 2007). This study has been reviewed for the human health assessment. Overall, the study NOAEL for both general and reproductive toxicity is 50 mg/kg bw/day.

No avian toxicity data were previously available. Male White Leghorn *Gallus domesticus* chicks were administered bisphenol-A orally from two weeks of age to 25 weeks (Furuya *et al*, 2006). The doses used were 2 µg/kg bw to 200 mg/kg bw with administration every two days. The weights of the comb, wattle and testes were examined; cell counts on testes sections were used to monitor spermatogenesis.

[24] The OM content of the test soil as collected was 1.9%. The test medium as used was made up by mixing 11.5 kg of soil with 0.5 kg of sand, hence the final OM content was 1.82%.

[25] Although no data are available for soil micro-organisms, this is considered to be acceptable since bisphenol-A is readily biodegradable and possible endocrine effects are of more importance.

There were no differences in the body weights of birds between the control animals and those exposed to bisphenol-A. No pathological lesions were observed in the liver or kidneys of exposed birds. Decreases in the weight of the comb and wattle were seen in birds exposed to 2 µg/kg bw at ten weeks, but not at other times. At 20 µg/kg bw, similar effects were seen at ten weeks, and at 15 weeks reduced weights in the combs and testes were observed. These had recovered to control levels at 20 and 25 weeks. Higher concentrations tended to show greater effects, although only the 200 mg/kg bw exposure did not recover back to levels not statistically significantly different from the controls after 15 weeks.

The counts of spermatogonia per lumen were reduced in birds exposed to 20 µg/kg bw and above at ten weeks and longer exposures. Spermatocytes per lumen were reduced after 15 weeks and longer at 20 µg/kg and above, and the counts of spermatids per lumen were reduced from ten weeks on at 20 µg/kg bw and above.

The variation in effects over time makes the interpretation of the results difficult. There appears to be a delaying effect on the development of the comb, wattle and testes at most of the exposure levels, but this is temporary in all but the highest exposure. Spermatogenesis was affected at all but the lowest exposure level, but the effect of this on ability to reproduce was not investigated in the study and is not clear. If the highest dose was considered as a LOAEL then the NOAEL for the effects on the comb, wattle and testes weights would be 20 mg/kg bw. As this appears to have been given every two days, the daily dose should be taken as 10 mg/kg bw.

3.2.4.2 PNEC for secondary poisoning

The $PNEC_{oral}$ derived in the published risk assessment was 33 mg/kg food, based on a NOAEL of 50 mg/kg bw/day from a three-generation rat study with a conversion factor of 20 and an assessment factor of 30.

The new two-generation study on mice also has a NOAEL of 50 mg/kg bw/day. However, the conversion factor for mice is 8.3, giving a NOEC of 415 mg/kg; applying the same assessment factor of 30 gives a $PNEC_{oral}$ of 13.8 mg/kg food.

The NOAEL from the study on chickens is 10 mg/kg bw/day. The conversion factor is 8, giving a NOEC of 80 mg/kg; applying an assessment factor of 30 gives a $PNEC_{oral}$ of 2.67 mg/kg food.

The lowest $PNEC_{oral}$ value of 2.67 mg/kg food will be used in the risk characterisation.

3.3 RISK CHARACTERISATION

3.3.1 Aquatic compartment

3.3.1.1 Surface water

The PNEC for surface water derived in Section 3.2.1.5 is 1.5 µg/l. The PEC/PNEC ratios obtained using this value are presented in Table 3.33 and a) This scenario is included for completeness, but see the main text for further discussion

Table 3.34. Values above 1 are highlighted in bold.

Table 3.33 Risk characterisation ratios for freshwater and marine water – part 1

	Freshwater		Marine	
	PEC_{water} (µg/l)	PEC/PNEC	$PEC_{marine\ water}$ (µg/l)	PEC/PNEC
Site specific				
BPA 1			0.01	0.07
BPA 2	0.032	0.02		
BPA 3			0.008	0.05
BPA 4			0.007	0.05
BPA 5			0.003	0.02
BPA 6			0.10	0.67
ER 1	0.033	0.02		
ER 2, ER 3, ER 6	0.032	0.02		
ER 4	0.99	0.66		
ER 5	0.062	0.04		
PAPER 1	0.31	0.2		
PAPER 2	0.14	0.09		
PAPER 3	0.10	0.07		
PAPER 4	1.03	0.67		
PAPER 5	1.03	0.67		
PAPER 6	0.97	0.65		
PAPER 7	0.07	0.05		
Generic scenarios				
Polycarbonate bottle washing	0.032	0.02	0.003	0.02
Phenoplast cast resin processing	1.47	0.98	*1.2*[a]	***7.74***[a]
PVC – Anti-oxidant during processing	0.19	0.12	0.13	0.87
PVC – Plasticiser use	0.14	0.09	0.09	0.61

a) This scenario is included for completeness, but see the main text for further discussion

Table 3.34 Risk characterisation ratios for freshwater and marine water – part 2

	Freshwater		Marine	
	PEC_{water} (µg/l)	PEC/PNEC	$PEC_{marine\ water}$ (µg/l)	PEC/PNEC
PVC additive package				
Site A1			0.023	0.15
Site A2	0.036	0.02		
Site A3	0.11	0.07		
Site A4	0.044	0.03		
Site A5	0.045	0.03		
Site A6			0.013	0.08
Site A7			0.011	0.07
Site A8	0.054	0.04		
Site A9	0.27	0.18		
Site A10	0.032	0.02		
Site A11	0.033	0.02		
Site A12	0.097	0.06		
Site A13			0.009	0.06
Anti-oxidant use in plasticiser production				
Specific site			0.005	0.03
Generic site	0.39	0.26		
Thermal paper recycling				
With deinking	0.033	0.02	0.003	0.02
Without deinking	0.033	0.02	0.003	0.02

No PEC/PNEC ratio is above one for the freshwater compartment for any life cycle stage. The $PNEC_{water}$ of 1.5 µg/l is also above the 95%ile value of 0.35 µg/l from the whole freshwater monitoring data set as presented in Section 3.1.4.6.3.

Nevertheless, there remains a possibility that the $PNEC_{water}$ does not take full account of the potential effects of bisphenol-A on snails. The UK Government funded some additional research with native European[26] gastropod mollusc species in 2006 (the pulmonate snail *Planorbarius corneus* and the prosobranch snails *Bithynia tentaculata* and *Viviparus viviparus*). Much of this work has involved method development, since the selected species are not typically cultured in laboratories (and *V. viviparus* could not be cultured successfully). Initial results (unpublished) are as follows:

[26] The original work on snails involved a tropical species – it was decided early in the development of the conclusion (i) programme that the same species should be tested since:
- there was little experience in testing European freshwater snails at the time, and
- if a test with a different species failed to show any effect, there would still have been an open question about the original findings.

- Adult *P. corneus* were exposed to estradiol over an 8-week period in a semi-static system. At exposure concentrations of 1, 10 and 100 ng/l there was evidence of an increase in egg production relative to the controls at 15°C, whilst at 20°C there appeared to be a small decrease.
- A preliminary experiment exposed adult *P. corneus* to bisphenol-A at concentrations of 0.2, 2 and 20 µg/l at 15°C. Compared to the estradiol study, a much lower egg production rate was obtained for both exposed and control snails, which might have been caused by operational problems. The results were inconclusive as to whether the bisphenol-A exposure resulted in a change in egg production rate, although the mean egg productivity of the control groups was below all the bisphenol-A exposed groups.

There is therefore a residual concern that the $PNEC_{water}$ might be too high, despite the thorough testing conducted under the conclusion (i) programme. The following conclusion is therefore drawn for the freshwater compartment:

Conclusion (i) There is a need for further information and/or testing.

The rapporteur has commissioned an additional study that will expose adult *P. corneus* over a 6-month period using a more robust test design than that used for the original trial. If an effect is indeed apparent, further work will need to be considered (such as a life-cycle test). The implications for other priority substances will need to be considered at the same time.

3.3.1.2 Marine water

The $PNEC_{marine\ water}$ derived in Section 3.2.1.5 is 0.15 µg/l, although this should also be considered provisional for the same reasons as for freshwater (it is noted that effects of bisphenol-A on marine molluscs have been recorded).

The resulting risk characterisation ratios are presented in Table 3.33 and a)This scenario is included for completeness, but see the main text for further discussion

Table 3.34. The generic scenario for phenoplast resins is the only scenario to give a potential risk for marine discharges; however, consultation with the European Phenolic Resins Association has confirmed that the sites previously identified as having marine discharges no longer use bisphenol-A for this purpose. Hence this scenario is not relevant for the marine environment.

The marine PNEC is above the 95%ile value from the measured levels in marine waters reviewed in Section 3.1.4.6.3.

The considerations with regard to toxicity to snails described in the freshwater assessment are also relevant for the marine assessment. Therefore the conclusion is:

Conclusion (i) There is a need for further information and/or testing.

No scenarios pose a potential risk using the current $PNEC_{marine\ water}$, but this should be reconsidered once the results of further toxicity testing with freshwater snails are available.

3.3.1.3 Sediment

The sediment PNEC and the sediment PEC values are obtained through the equilibrium partition method, and so the risk characterisation ratios are the same as for the freshwater and marine compartments and the same conclusions apply.

There are also additional scenarios related to the possible degradation of TBBPA in anaerobic sediments to give bisphenol-A. The PEC values estimated for the relevant freshwater TBBPA scenarios and the risk characterisation ratios (using a PNEC of 24 µg/kg wwt) are provided in Table 3.35 (marine sediment concentrations are expected to be around one order of magnitude lower). All ratios are below 1.

Table 3.35 Risk characterisation ratios for sediment (scenarios for TBBPA degradation)

Scenario			PEC (mg/kg wwt)	PEC/PNEC
Reactive flame retardant use	Manufacture of epoxy and/or polycarbonate resins		$(1.42\text{-}1.95)\times10^{-4}$	<0.01
	Processing of epoxy resins		$(1.23\text{-}1.7)\times10^{-6}$	<0.01
Additive flame retardant use	ABS	Compounding	$(5.75\text{-}7.9)\times10^{-3}$	0.24-0.32
		Conversion	$(2.6\text{-}3.6)\times10^{-4}$	0.01-0.02

3.3.2 Terrestrial compartment

The PNEC for the terrestrial compartment is 3.2 mg/kg wwt. This is derived from the initial concentrations of bisphenol-A applied to the soils as described in Section 3.2.3.1. The concentrations in soil for the comparison therefore also need to be on the same basis. The values presented in Section 3.1.4.7 are on the standard TGD basis at a time 30 days after application. From the calculation method in the TGD, the ratio between the initial concentration and the 30-day value is 1.39:1, and so the calculated concentrations have been increased by a factor of 1.39. These revised concentrations and the resulting risk characterisation ratios are in Table 3.36 for bisphenol-A uses and Table 3.37 for possible formation of bisphenol-A through the degradation of TBBPA during sludge digestion. All of the ratios are below one.

Conclusion (ii) There is at present no need for further information and/or testing and no need for risk reduction measures beyond those which are being applied already.

There are no risks for the terrestrial compartment from the current production and use of bisphenol-A, nor from the possible degradation of TBBPA to bisphenol-A during sludge digestion.

Table 3.36 Risk characterisation ratios for soil from bisphenol-A uses

	PEC (µg/kg wwt)	Revised PEC	PEC/PNEC
Site specific			
Epoxy resin ER4	13.3	18.5	<0.01
PVC additive package: A2	1.43	2.0	<0.01
A3	0.86	1.2	<0.01
A4	1.38	1.9	<0.01
A6	3.46	4.8	<0.01
A8	0.77	1.1	<0.01
A13	0.07	0.1	<0.01
Generic scenarios			
Phenoplast cast resin processing	20	28	0.01
PVC – anti-oxidant during processing	2.2	3.1	<0.01
PVC – plasticiser use	1.6	2.2	<0.01
Anti-oxidant in plasticiser production	5.0	7.0	<0.01
Thermal paper recycling with deinking	633 (p); 1.5 (b); 534 (c)	880 (p); 2.1 (b); 742 (c)	0.28 (p); <0.01 (b); 0.23 (c)
Thermal paper recycling without deinking	35 (p); 1.8 (b); 29 (c)	49 (p); 2.5 (b); 40 (c)	0.02 (p); <0.01 (b); 0.01 (c)

p Paper sludge;
b Biological sludge;
c Combined paper and biological sludges (in ratio produced)

Table 3.37 Risk characterisation ratios for soil from TBBPA uses

Scenario			PEC	PEC/PNEC
Reactive flame retardant use	Manufacture of epoxy and/or polycarbonate resins		0.013	<0.01
	Processing of epoxy resins		2.5×10^{-5}	<0.01
Additive flame retardant use	ABS	Compounding	0.54	<0.01
		Conversion	0.025	<0.01

3.3.3 Secondary poisoning

The PNEC for secondary poisoning is 2.67 mg/kg food based on a non-standard test with birds (Section 3.2.4.2). The resulting risk characterisation ratios for freshwater and terrestrial predators are in Table 3.38 and for marine predators are in Table 3.39. All of the ratios are below one, the majority below 0.01. This would be the case even if the slightly higher BCF for clams were used for the aquatic food chain.

Table 3.38 Risk characterisation ratios for secondary poisoning – freshwater and soil

	PEC fish (µg/kg)	PEC/PNEC	PEC worms (µg/kg)	PEC/PNEC
Site specific				
Bisphenol-A production (BPA 2)	2.2	<0.01	-	
Epoxy resin (ER 4)	29	<0.01	5.3	<0.01
Thermal paper production (PAPER 6)	28	<0.01	-	
PVC additive package (A6)	21	<0.01	1.6	<0.01
Generic scenarios				
Polycarbonate bottle washing	2.3	<0.01	-	
Phenoplast cast resin processing	36	<0.01	7.8	<0.01
PVC – anti-oxidant during processing	5.8	<0.01	1.2	<0.01
PVC – plasticiser use	4.8	<0.01	0.92	<0.01
Anti-oxidant use in plasticiser production	11	<0.01	2.2	<0.01
Thermal paper recycling with deinking	2.3	<0.01	237 (p); 0.84 (b); 200 (c)	0.09 (p); <0.01 (b); 0.07 (c)
Thermal paper recycling without deinking	2.3	<0.01	13 (p); 0.98 (b); 12 (c)	<0.01 (p); <0.01 (b); <0.01 (c)

p Paper sludge;
b Biological sludge;
c Combined paper and biological sludges (in ratio produced)

Information on avian reproductive toxicity is important for endocrine disrupting chemicals, since mammalian toxicity data are of limited predictive value (birds are fundamentally different in certain aspects of their physiology, e.g. the control of sexual differentiation, egg laying, etc.). In this case a standard test guideline study is not available. However, it is not considered appropriate to request a further multi-generational study with birds because:

- bisphenol-A is readily biodegradable and has a low bioaccumulation potential,
- the existing study addressed several relevant end points, and
- the PEC/PNEC ratios are all significantly below 1.

Table 3.39 Risk characterisation ratios for secondary poisoning - marine

	PECpredators (µg/kg)	PEC/PNEC	PEC top predators (µg/kg)	PEC/PNEC
Site specific				
Bisphenol-A production (BPA 6)	3.5	<0.01	0.85	<0.01
PVC additive package (A1)	0.73	<0.01	0.3	<0.01
Generic scenarios				
Polycarbonate bottle washing	0.2	<0.01	0.2	<0.01
Phenoplast cast resin processing	28	<0.01	5.8	<0.01
PVC – anti-oxidant during processing	3.2	<0.01	0.78	<0.01
PVC – plasticiser use	2.3	<0.01	0.61	<0.01
Anti-oxidant use in plasticiser production	7.1	<0.01	1.6	<0.01
Thermal paper recycling with deinking	0.2	<0.01	0.2	<0.01
Thermal paper recycling without deinking	0.2	<0.01	0.2	<0.01

Conclusion (ii) There is at present no need for further information and/or testing and no need for risk reduction measures beyond those which are being applied already.

There are no risks for secondary poisoning from the current production and uses of bisphenol-A

3.3.4 PBT assessment

Persistence: Bisphenol-A is readily biodegradable, and so does not meet the P criterion.

Bioaccumulation: The measured BCF values in fish for bisphenol-A are in the range 30-75, with slightly higher values for other aquatic organisms (tadpoles, clams). These values are well below the threshold, and so bisphenol-A does not meet the B criterion.

Toxicity: There are no reliable chronic NOEC values below 0.01 mg/l, although there are some less reliable values and indications of possible effects at this level. Bisphenol-A has been shown to have effects on the endocrine systems of a number of organisms. It is therefore considered to meet the T criterion.

Conclusion: Bisphenol-A is not a PBT or vPvB substance; it meets the T criterion but not the P or B criteria.

3.3.5 Uncertainties

The exposure assessment is based on data provided by Industry, much of which is based on site-specific considerations. It is possible that some suppliers or users exist outside of the main trade associations, particularly in those Member States that joined the EU in recent years. For example, the rapporteur has been informed that there is a producer in Poland that is not part of the Industry consortium (no data have been supplied from this site). Competent Authorities may therefore need to check that the scenarios presented in this report are appropriate for their national situation.

As discussed in Section 3.2.1.5, the $PNEC_{water}$ can be derived in several ways, depending on how the *Marisa cornuarietis* data are viewed. The conclusion (i) study is reliable, and has not confirmed the original findings of Oehlmann and co-workers. Nevertheless, there are certainly strain differences in the snail stocks used in the different laboratories, and it is possible that the role of seasonality was not sufficiently investigated. Differences in exposure regimes might also have an influence if metabolites are more potent than the parent substance (though there is no evidence for this).

It is also apparent that reproductive effects have been observed at apparently low concentrations in more than one aquatic snail species (*Nucella lapillus* and *Potamopyrgus antipodarum*), although the available data are not sufficiently robust for direct use in the PNEC derivation. Whilst some of these effects might be an artefact of the experimental design, histopathological changes are difficult to dismiss in this way (although these are not necessarily directly related to effects that could influence population growth).

There therefore remains a possibility that the $PNEC_{water}$ does not take full account of the potential effects of bisphenol-A on snails. Further work being conducted by the UK Government should be taken into account when results are available in 2008. The implications for other endocrine active compounds will also need to be considered at the same time.

The PNEC for the marine compartment should also be considered as provisional for the same reasons as for freshwater; it is noted that effects of bisphenol-A on marine molluscs have been recorded.

If the aquatic PNEC is revised, then the sediment ratios would also change.

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ABBREVIATIONS

ADI	Acceptable Daily Intake
AF	Assessment Factor
ASTM	American Society for Testing and Materials
ATP	Adaptation to Technical Progress
AUC	Area Under The Curve
B	Bioaccumulation
BBA	Biologische Bundesanstalt für Land- und Forstwirtschaft
BCF	Bioconcentration Factor
BMC	Benchmark Concentration
BMD	Benchmark Dose
BMF	Biomagnification Factor
BOD	Biochemical Oxygen Demand
bw	body weight / *Bw*, *bw*
C	Corrosive (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
CA	Chromosome Aberration
CA	Competent Authority
CAS	Chemical Abstract Services
CEC	Commission of the European Communities
CEN	European Standards Organisation / European Committee for Normalisation
CEPE	European Committee for Paints and Inks
CMR	Carcinogenic, Mutagenic and toxic to Reproduction
CNS	Central Nervous System
COD	Chemical Oxygen Demand
CSTEE	Scientific Committee for Toxicity, Ecotoxicity and the Environment (DG SANCO)
CT_{50}	Clearance Time, elimination or depuration expressed as half-life
d.wt	dry weight / dw
dfi	daily food intake
DG	Directorate General
DIN	Deutsche Industrie Norm (German norm)
DNA	DeoxyriboNucleic Acid
DOC	Dissolved Organic Carbon
DT50	Degradation half-life or period required for 50 percent dissipation / degradation
DT90	Period required for 90 percent dissipation / degradation
E	Explosive (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
EASE	Estimation and Assessment of Substance Exposure Physico-chemical properties [Model]

EbC50	Effect Concentration measured as 50% reduction in biomass growth in algae tests
EC	European Communities
EC10	Effect Concentration measured as 10% effect
EC50	median Effect Concentration
ECB	European Chemicals Bureau
ECDIN	Environmental Chemicals Data and Information Network
ECETOC	European Centre for Ecotoxicology and Toxicology of Chemicals
ECVAM	European Centre for the Validation of Alternative Methods
EDC	Endocrine Disrupting Chemical
EEC	European Economic Communities
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of New Chemical Substances
EN	European Norm
EPA	Environmental Protection Agency (USA)
ErC50	Effect Concentration measured as 50% reduction in growth rate in algae tests
ESD	Emission Scenario Document
EU	European Union
EUSES	European Union System for the Evaluation of Substances [software tool in support of the Technical Guidance Document on risk assessment]
F(+)	(Highly) flammable (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
FAO	Food and Agriculture Organisation of the United Nations
FELS	Fish Early Life Stage
foc	Organic carbon factor (compartment depending)
GLP	Good Laboratory Practice
HEDSET	EC/OECD Harmonised Electronic Data Set (for data collection of existing substances)
HELCOM	Helsinki Commission -Baltic Marine Environment Protection Commission
HPLC	High Pressure Liquid Chromatography
HPVC	High Production Volume Chemical (> 1000 tonnes/annum)
IARC	International Agency for Research on Cancer
IC	Industrial Category
IC50	median Immobilisation Concentration or median Inhibitory Concentration
ILO	International Labour Organisation
IPCS	International Programme on Chemical Safety
ISO	International Organisation for Standardisation
IUCLID	International Uniform Chemical Information Database (existing substances)
IUPAC	International Union for Pure and Applied Chemistry
JEFCA	Joint FAO/WHO Expert Committee on Food Additives

JMPR	Joint FAO/WHO Meeting on Pesticide Residues
Koc	organic carbon normalised distribution coefficient
Kow	octanol/water partition coefficient
Kp	solids-water partition coefficient
L(E)C50	median Lethal (Effect) Concentration
LAEL	Lowest Adverse Effect Level
LC50	median Lethal Concentration
LD50	median Lethal Dose
LEV	Local Exhaust Ventilation
LLNA	Local Lymph Node Assay
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed Effect Concentration
LOED	Lowest Observed Effect Dose
LOEL	Lowest Observed Effect Level
MAC	Maximum Allowable Concentration
MATC	Maximum Acceptable Toxic Concentration
MC	Main Category
MITI	Ministry of International Trade and Industry, Japan
MOE	Margin of Exposure
MOS	Margin of Safety
MW	Molecular Weight
N	Dangerous for the environment (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC
NAEL	No Adverse Effect Level
NOAEL	No Observed Adverse Effect Level
NOEL	No Observed Effect Level
NOEC	No Observed Effect Concentration
NTP	National Toxicology Program (USA)
o/oo	Parts per thousand
O	Oxidising (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
OC	Organic Carbon content
OECD	Organisation for Economic Cooperation and Development
OEL	Occupational Exposure Limit
OJ	Official Journal
OSPAR	Oslo and Paris Convention for the protection of the marine environment of the Northeast Atlantic
P	Persistent

PAH	Polycyclic aromatic hydrocarbons
PBT	Persistent, Bioaccumulative and Toxic
PBPK	Physiologically Based PharmacoKinetic modelling
PBTK	Physiologically Based ToxicoKinetic modelling
PEC	Predicted Environmental Concentration
pH	logarithm (to the base 10) (of the hydrogen ion concentration $\{H^+\}$
pKa	logarithm (to the base 10) of the acid dissociation constant
pKb	logarithm (to the base 10) of the base dissociation constant
PNEC	Predicted No Effect Concentration
POP	Persistent Organic Pollutant
PPE	Personal Protective Equipment
QSAR	(Quantitative) Structure-Activity Relationship
R phrases	Risk phrases according to Annex III of Directive 67/548/EEC
RAR	Risk Assessment Report
RC	Risk Characterisation
RfC	Reference Concentration
RfD	Reference Dose
RNA	RiboNucleic Acid
RPE	Respiratory Protective Equipment
RWC	Reasonable Worst-Case
S phrases	Safety phrases according to Annex IV of Directive 67/548/EEC
SAR	Structure-Activity Relationships
SBR	Standardised birth ratio
SCE	Sister Chromatic Exchange
SCHER	Scientific Committee on Health and Environmental Risks
SDS	Safety Data Sheet
SETAC	Society of Environmental Toxicology And Chemistry
SNIF	Summary Notification Interchange Format (new substances)
SSD	Species Sensitivity Distribution
STP	Sewage Treatment Plant
T(+)	(Very) Toxic (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
TDI	Tolerable Daily Intake
TG	Test Guideline
TGD	Technical Guidance Document
TNsG	Technical Notes for Guidance (for Biocides)
TNO	The Netherlands Organisation for Applied Scientific Research
ThOD	Theoritical Oxygen Demand

UC	Use Category
UDS	Unscheduled DNA Synthesis
UN	United Nations
UNEP	United Nations Environment Programme
US EPA	Environmental Protection Agency, USA
UV	Ultraviolet Region of Spectrum
UVCB	Unknown or Variable composition, Complex reaction products of Biological material
vB	very Bioaccumulative
VOC	Volatile Organic Compound
vP	very Persistent
vPvB	very Persistent and very Bioaccumulative
v/v	volume per volume ratio
w/w	weight per weight ratio
WHO	World Health Organisation
WWTP	Waste Water Treatment Plant
Xn	Harmful (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)
Xi	Irritant (Symbols and indications of danger for dangerous substances and preparations according to Annex II of Directive 67/548/EEC)

Appendix 1 Non-summarised references

The following table lists all references retrieved from the literature search that were considered to be of low relevance for the environment update report based on the abstract. A brief reason for this decision is given in the final column. Some of these may be relevant for the human health assessment, and a few, indicated in bold highlighting, may need to be reviewed in future.

Year	Authors	Title	Reference	Notes
2007	Bannister, R., Beresford, N., May, D., Routledge, E. J., Jobling, S., and Rand-Weaver, M.	Novel estrogen receptor-related transcripts in *Marisa* cornuarietis; a freshwater snail with reported sensitivity to estrogenic chemicals.	Environmental Science and Technology. In Press. (Supplemental information in summary column)	Receptor studies with *Marisa*, not with bisphenol A.
2007	Brian, J. V., Harris, C. A., Scholze, M., Kortenkamp, A., Booy, P., Lamoree, M., Pojana, G., Jonkers, N., Marcomini, A., and Sumpter, J. P.	Evidence of estrogenic mixture effects on the reproductive performance of fish.	Environmental Science and Technology. 41(1):337-344.	Effects of mixtures
2007	Cabana, H., Jiwan, J.-L. H., Rozenberg, R., Elisashvili, V., Penninckx, M., Agathos, S. N., Jones, J. P.	Elimination of endocrine disrupting chemicals nonylphenol and bisphenol A and personal care product ingredient triclosan using enzyme preparation from the white rot fungus *Coriolopsis polyzona*.	Chemosphere. 67(4):770-778.	Clean up method.
2007	Canesi, L., Lorusso, L. C., Ciacci, C., Betti, M., Rocchi, M., Pojana, G., and Marcomini, A.	Immunomodulation of *Mytilus* hemocytes by individual estrogenic chemicals and environmentally relevant mixtures of estrogens: *In vitro* and *in vivo* studies.	Aquatic Toxicology. 81(1):36-44.	Development of screening study, similar papers included.
2007	Chen, P.-J., Rosenfeldt, E. J., Kullman, S. W., Hinton, D. E., and Linden, K. G.	Biological assessments of a mixture of endocrine disruptors at environmentally relevant concentrations in water following UV/H2O2 oxidation.	Science of the Total Environment. In Press.	Non-environmental oxidation.
2007	Chin, S. S., Lim, T. M., Chiang, K., and Fane, A. G.	Hybrid low-pressure submerged membrane photoreactor for the removal of bisphenol A.	Desalination. 202(1-3):253-261.	Analytical paper.
2007	Diano, N., Grano, V., Franconte, L., Caputo, P., Ricupito, A., Attanasio, A., Bianco, M., Bencivenga, U., Rossi, S., Manco, I., Mita, L., Del Pozzo, G., and Mita, D. G.	Non-isothermal bioreactors in enzymatic remediation of waters polluted by endocrine disruptors: BPA as a model of pollutant.	Applied Catalysis B - Environmental. 69(3-4):252-261.	Remediation.
2007	Duft, M., Schmitt, C., Bachmann, J., Brandelik, C., Schulte-Oehlmann, U., and Oehlmann, J.	Prosobranch snails as test organisms for the assessment of endocrine active chemicals – an overview and a guideline proposal for a reproduction test with the freshwater mudsnail *Potamopyrgus antipodarum*.	Ecotoxicology. In Press.	No new data
2007	Fernandez, M. P., Ikonomou, M. G., and Buchanan, I.	An assessment of estrogenic organic contaminants in Canadian wastewaters.	Science of the Total Environment. 373(1):250-269.	Waste water and contamination.
2007	Fu, K.-Y., Chen, C.-Y., and Chang, W.	Application of a yeast estrogen screen in non-biomarker species *Varicorhinus barbatulus* fish with two estrogen receptor subtypes to assess xenoestrogens.	Toxicolgy In Vitro. In Press.	Yeast assay, screening study.

Year	Authors	Title	Reference	Notes
2007	Gatidou G., Thomaidis N. S., Stasinakis A. S., Lekkas T. D.	Simultaneous determination of the endocrine disrupting compounds nonylphenol, nonylphenol ethoxylates, triclosan and bisphenol A in wastewater and sewage sludge by gas chromatography–mass spectrometry.	J Chromatography A. 1138(1-2):32-41.	Bisphenol A in wastewater.
2007	Hashimoto, S., Ueda, Y., Kurihara, R., and Shiraishi, F.	Comparison of the estrogenic activities of seawater extracts from Suruga Bay, Japan, based on chemical analysis or bioassay.	Environmental Toxicology and Chemistry. 26(2):279-286.	Bioassay on seawater extracts
2007	Hayashi, H., Nishimoto, A., Oshima, N., and Iwamuro, S.	Expression of the estrogen receptor alpha gene in the anal fin of Japanese medaka, *Oryzias latipes*, by environmental concentrations of bisphenol A.	The Journal of Toxicological Sciences. 32(1):91-96.	Estrogen receptor gene expression.
2007	Imaoka, S., Mori, T., and Kinoshita, T.	Bisphenol A causes malformation of the head region in embryos of *Xenopus laevis* and decreases the expression of the ESR-1 gene mediated by notch signalling.	Biological and Pharmaceutical Bulletin. 30(2):371-374.	Gene study
2007	Iso, T., Futami, K., Iwamoto, T., and Furuichi, Y.	Modulation of the expression of bloom helicase by estrogenic agents.	Biological and Pharmaceutical Bulletin. 30(2):266-271.	Gene study.
2007	Li, C. and Li, X. Z.	Degradation of endocrine disrupting chemicals in aqueous solution by interaction of photocatalytic oxidation and ferrate (VI) oxidation.	Water Science Technology. 55(1-2): 217-223.	Non-environmental degradation.
2007	Li, F., Li, X., Liu, C., Li, X., and Liu, T.	Effect of oxalate on photodegradation of bisphenol A at the interface of different iron oxides.	Industrial and Engineering Chemistry Research. 46(3):781-787.	Non-environmental photodegradation.
2007	Liu, Y., Deng, L., Chen, Y., Wu, F., and Deng, N.	Simultaneous photocatalytic reduction of Cr(VI) and oxidation of bisphenol A induced by Fe(III)-OH complexes in water.	Journal of Hazardous Materials. 139(2):399-402.	Paper looks at non-environmental reduction and oxidation.
2007	Mandich, A., Bottero, S., Benfenati, E., Cevasco, A., Erratico, C., Maggioni, S., Massari, A., Pedemonte, F., and Vigano, L.	*In vivo* exposure of carp to graded concentrations of bisphenol A.	General and Comparative Endocrinology. In Press.	Similar results included.
2007	Masuda, M., Yamasaki, Y., Ueno, S., and Inoue, A.	Isolation of bisphenol A-tolerant/degrading *Pseudomonas monteilii* strain N-502.	Extremophiles. In Press	Bacterial study.
2007	Oehlmann, J., Di Benedetto, P., Tillmann, M., Duft, M., Oetken, M., and Schulte-Oehlmann, U.	Endocrine disruption in prosobranch molluscs: evidence and ecological relevance.	Ecotoxicology. In Press.	Review of earlier studies
2007	Press-Kristensen, K., Ledin, A., Schmidt, J. E., and Henze, M.	Identifying model pollutants to investigate biodegradation of hazardous XOCs in WWTPs.	Science of the Total Environment. 373(1):122-130.	Similar information included
2007	Torres, R. A., Petrier, C., Combet, E., Moulet, F., and Pulgarin, C.	Bisphenol A mineralization by integrated ultrasound-UV-Iron (II) treatment.	Environmental Science and Technology. 41(1):297-302.	Non-environmental mineralization.

Year	Authors	Title	Reference	Notes
2007	Urbatzka, R., van Cauwenberge, A., Maggioni, S., Vigano, L., Mandich, A., Benfenati, E., Lutz, I., and Kloas, W.	Androgenic and antiandrogenic activities in water and sediment samples from the river Lambro, Italy, detected by yeast androgen screen and chemical analyses.	Chemosphere. 67(6):1080-1087.	Yeast screening assay.
2007	Vitrac, O., Challe, B., Leblanc, J. C., and Feigenbaum, A.	Contamination of packaged food by substances migrating from a direct-contact plastic layer: Assessment using a generic quantitative household scale methodology.	Food Additives and Contaminants. 24(1):75-94.	Paper looks at migration of plastics into food.
2007	Zhang, C., Zeng, G., Yuan,L.,Yu, J., Li, J., Huang, G., Xi, B., and Liu, H.	Aerobic degradation of bisphenol A by *Achromobacter xylosoxidans* strain B-16 isolated from compost leachate of municipal solid waste.	Chemosphere. In Press.	Similar information included.
2007	Zhou, J. L., Liu, R., Wilding, A., and Hibberd, A.	Sorption of selected endocrine disrupting chemicals to different aquatic colloids.	Environmental Science and Technology. 41(1):206-213.	Sorption to colloids.
2006	Abd-El-Aziz A. S., Okasha R. M., May L. J., Hurd J.	Synthesis of norbornenes containing cationic mono- and di(cyclopenta-dienyliron) arene complexes and their ring-opening metathesis polymerization.	J Polymer Sci Part A: Polymer Chemistry. 44(9):3053-3070.	Polymers.
2006	Aguei L., Yanez-Sedeno P., Pingarron J. M.	Preparation and characterization of a new design of carbon-felt electrode for phenolic endocrine disruptors.	Electrochimica Acta. 51(12): 2565-2571.	Analytical paper.
2006	Ahlers, J., Riedhammer, C., Vogliano, M., Ebert, R.-U., Kühne, R., and Schüürmann, G.	Acute to chronic ratios in aquatic toxicity - variation across trophic levels and relationship with chemical structure.	Environmental Toxicology and Chemistry. 25(11):2937-2945.	Ratios in aquatic toxicity.
2006	Alizadeh M., Ota F., Hosoi K., Kato M., Sakai T., Satter M. A.	Altered allergic cytokine and antibody response in mice treated with Bisphenol A.	J Med Invest. 53(1-2):70-80.	Mammalian study.
2006	Alonso-Magdalena P., Morimoto S., Ripoll C., Fuentes E., Nadal A.	The estrogenic effect of bisphenol A disrupts pancreatic □-cell function *in vivo* and induces insulin resistance.	Environ Health Perspect. 114(1):106-12.	Mammalian study
2006	Amari S., Aizawa M., Zhang J., Fukuzawa K., Mochizuki Y., Iwasawa Y., Nakata K., Chuman H., Nakano T.	VISCANA: Visualized cluster analysis of protein-ligand interaction based on the *ab initio* fragment molecular orbital method for virtual ligand screening.	J Chem Information and Modeling. 46(1):221-230.	QSAR
2006	Anahara R., Yoshida M., Toyama Y., Maekawa M., Kai M., Ishino F., Toshimori K., Mori C.	Estrogen agonists, 17□-estradiol, bisphenol A, and diethylstilbestrol, decrease cortactin expression in the mouse testis.	Arch Histol Cytol. 69(2):101-7.	Mammalian study, gene expression in mice.
2006	Ankley, G. T. and Villeneuve, D. L.	The fathead minnow in aquatic toxicology: Past, present and future.	Aquatic Toxicology. 78(1):91-102.	Review
2006	Apraiz, I., Mi, J., Bourin, S., and Cristobal, S.	Peroxisomal proteomics reveals a protein expression signature of exposure to several environmental pollutants.	Marine Environmental Research. 62(Supplement S):S38-S39.	Paper deals with proteomics.
2006	Apraiz I., Mi J., Cristobal S.	Identification of proteomic signatures of exposure to marine pollutants in mussels (*Mytilus edulis*).	Mol Cell Proteomics. 5(7):1274-85.	Proteomic study

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2006	Arbeli, Z., Ronen, Z., and Diaz-Baez, M. C.	Reductive dehalogenation of tetrabromobisphenol-A by sediment from a contaminated ephemeral streambed and an enrichment culture.	Chemosphere. 64(9):1472-1478.	Addressed in TBBPA assessment.
2006	Auriol, M., Filali-Meknassi, Y., Adams, C. D., and Tyagi, R. D.	Natural and synthetic hormone removal using the horseradish peroxidase enzyme: Temperature and pH effects.	Water Research. 40(15):2847-2856.	Water purification.
2006	Auriol, M., Filali-Meknassi, Y., Adams, C. D., and Tyagi, R.D.	Comparative study of reactions of endocrine disruptors bisphenol A and diethylstilbestrol in electrochemical treatment and chlorination.	Water Research. 40(5):1070-1078.	Water purification
2006	Auriol, M., Filali-Meknassi, Y., Adams, C. D., and Tyagi, R.D.	Photodecomposition of bisphenol A on nanometer-sized TiO2 thin film and the associated biological toxicity to zebrafish (*Danio rerio*) during and after photocatalysis.	Water Research. 40(9):1906-1914.	Non-environmental degradation.
2006	Ballesteros O., Zafra A., Navalon A., Vilchez J. L. J	Sensitive gas chromatographic-mass spectrometric method for the determination of phthalate esters, alkylphenols, bisphenol A and their chlorinated derivatives in wastewater samples.	Chromatography A. 1121(2):154-162.	Wastewater samples.
2006	Barber L. B., Keefe S. H., Antweiler R. C., Taylor H. E., Wass R. D.	Accumulation of contaminants in fish from wastewater treatment wetlands.	E S & T. 40(2):603-611.	Analysis of water and fish from US wastewater treatment wetlands.
2006	Barsiene, J., Dedonyte, V., Rybakovas, A., Andreikenaite, L., and Andersen, O. K.	Investigation of micronuclei and other nuclear abnormalities in peripheral blood and kidney of marine fish treated with crude oil.	Aquatic Toxicology. 78(Supplement 1):S99-S104.	Mutagenicity.
2006	Barsiene J., Syvokiene J., Bjornstad A.	Induction of micronuclei and other nuclear abnormalities in mussels exposed to bisphenol A, diallyl phthalate and tetrabromodiphenyl ether-47.	Aquat Toxicol. 78 Suppl 1:S105-8.	Mutagenicity study
2006	Beck I. -C.	Estrogens in coastal surface waters - investigations in the Baltic Sea using chemical analysis and an *in vitro*-bio assay.	Available Metadata on Internet Documents, Order No. 362572 From: Metadata Internet Doc. No pp. given.	Analytical paper
2006	Beck I. -C., Bruhn R., Gandrass J.	Analysis of estrogenic activity in coastal surface waters of the Baltic Sea using the yeast estrogen screen.	Chemosphere. 63(11):1870-1878.	Analysis by yeast screening.
2006	Benigni A., Zoja C., Tomasoni S., Campana M., Corna D., Zanchi C., Gagliardini E., Garofano E., Rottoli D., Ito T., Remuzzi G.	Transcriptional regulation of nephrin gene by peroxisome proliferator-activated receptor-gamma agonist: molecular mechanism of the antiproteinuric effect of pioglitazone.	J Am Soc Nephrol. 17(6):1624-32.	Gene regulation.
2006	Berkowitz G.	Limitations of a case-control study on bisphenol A (BPA) serum levels and recurrent miscarriage.	Hum Reprod. 21(2):565-6; author reply 566-7. [No abstract available].	Human health study.

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2006	Blazso M., Czegeny Z.	Catalytic destruction of brominated aromatic compounds studied in a catalyst microbed coupled to gas chromatography/mass spectrometry.	J Chromatogr A. May 30; [Epub ahead of print].	Non-environmental degradation
2006	Blomqvist, A., Berg, C., Holm, L., Brandt, I., Ridderstrale, Y., and Brunstrom, B.	Defective reproductive organ morphology and function in domestic rooster embryonically exposed to o.p'-DDT or ethynylestradiol.	Biology of Reproduction. 74(3):481-486.	Paper deals with o.p'-DDT and ethynylestradiol.
2006	Boas M., Feldt-Rasmussen U., Skakkebaek N. E., Main K. M.	Environmental chemicals and thyroid function.	Euro J Endocrin. 154(5):599-611.	Mammalian study.
2006	Bolognesi C., Perrone E., Roggieri P., Pampanin D. M., Sciutto A.	Assessment of micronuclei induction in peripheral erythrocytes of fish exposed to xenobiotics under controlled conditions.	Aquat Toxicol. 78 Suppl 1:S93-8.	Assesses predictive value of biomarker for marine pollution.
2006	Botolin S., McCabe L. R.	Inhibition of PPARgamma prevents type I diabetic bone marrow adiposity but not bone loss.	J Cell Physiol. Sep 13; [Epub ahead of print].	Cellular study.
2006	Brenner A., Mukmenev I., Abeliovich A., Kushmaro A.	Biodegradability of tetrabromobisphenol A and tribromophenol by activated sludge.	Ecotoxicology. 15(4):399-402.	Addressed in TBBPA assessment.
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2006	Buterin T., Koch C., Naegeli H.	Convergent transcriptional profiles induced by endogenous estrogen and distinct xenoestrogens in breast cancer cells.	Carcinogenesis. 27(8):1567-78.	Human cells.
2006	Cajaraville M. P., Ortiz- Zarragoitia M.	Specificity of the peroxisome proliferation response in mussels exposed to environmental pollutants.	Aquat Toxicol. 78 Suppl 1:S117-23.	Biomarkers. Info covered in another paper by same authors.
2006	Calafat A. M., Ye X., Silva M. J., Kuklenyik Z., Needham L. L.	Human exposure assessment to environmental chemicals using biomonitoring.	Int J Androl. 29(1):166-71; discussion 181-5. Review.	Biomonitoring for human exposure.
2006	Campbell, P. M., Fernandez, M. P., Royston, S., Smith, J. L., van Poppelen, P., Ikonomou, M. G., and Devlin, R. H.	Male coho salmon (*Oncorhynchus kisutch*) exposed to a time-course of urban sewage effluent exhibit a sporadic low incidence of sex reversal and intersex.	Water Quality Research Journal of Canada. 41(3):235-243.	Sewage effluent.
2006	Cargouet M., Bimbot M., Levi Y., Perdiz D.	Xenoestrogens modulate genotoxic (UVB) induced cellular responses in estrogen receptors positive human breast cancer cells.	Env Tox Pharma. 22(1):104-112.	Mammalian study.
2006	Chen P. J., Kullman S. W., Hinton D. E., Linden K. G.	Comparisons of polychromatic and monochromatic UV-based treatments of bisphenol-A in water via toxicity assessments.	Chemosphere. In Press.	Non-environmental degradation.

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2006	Chiu S. J., Chen S. H., Tsai C. T.	Effect of metal chlorides on thermal degradation of (waste) polycarbonate.	Waste Manag. 26(3):252-9.	Degradation of plastics.
2006	Choi K. J., Kim, S. G., Kim C. W., Park J. K.	Removal efficiencies of endocrine disrupting chemicals by coagulation, flocculation, ozonation, powdered/granular activated carbon adsorption, and chlorination.	Korean J Chem Eng. 23(3):399-408.	Water purification.
2006	Chu C. Y., Ponten A., Sun C. C., Jee S. H.	Concomitant contact allergy to the resins, reactive diluents and hardener of a bisphenol A/F-based epoxy resin in subway construction workers.	Contact Dermatitis. 54(3):131-9.	Health study.
2006	Colosi L. M., Huang Q., Weber W. J. Jr.	Quantitative structure-activity relationship based quantification of the impacts of enzyme-substrate binding on rates of peroxidase-mediated reactions of estrogenic phenolic chemicals.	J Am Chem Soc. 128(12):4041-4047.	Mammalian cells.
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2006	Daftary G. S., Taylor H. S.	Endocrine regulation of HOX genes.	Endocr Rev. 27(4):331-55.	Gene regulation study.
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2006	Dash C., Marcus M., Terry P. D.	Bisphenol A: Do recent studies of health effects among humans inform the long-standing debate?	Mutat Res. Jun 6; [Epub ahead of print]. No abstract available.	Human health review.
2006	Della Seta D., Minder I., Belloni V., Aloisi A. M., Dessi-Fulgheri F., Farabollini F.	Pubertal exposure to estrogenic chemicals affects behaviour in juvenile and adult male rats.	Horm Behav. 50(2):301-7.	Mammalian study
2006	Deng L., Liu Y. -X., Chen P. -Y., Wang L., Deng N. -S.	Determination of trace bisphenol A in leachate by solid phase microextraction coupled with high performance liquid chromatography.	Anal Lett. 39(2):395-404.	Analytical paper.
2006	Dhooge W., Arijs K., D'Haese I., Stuyvaert S., Versonnen B., Janssen C., Verstraete W., Comhaire F.	Experimental parameters affecting sensitivity and specificity of a yeast assay for estrogenic compounds: results of an interlaboratory validation exercise.	Anal Bioanal Chem. Aug 3; [Epub ahead of print].	Method validation.

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2006	Dlubek G., Hassan E. M., Krause-Rehberg R., Pionteck J.	Free volume of an epoxy resin and its relation to structural relaxation: evidence from positron lifetime and pressure-volume-temperature experiments.	Phys Rev E Stat Nonlin Soft Matter Phys. 73(3 Pt 1): 031803.	Polymers.
2006	Dondero, F., Dagnino, A., Jonsson, H., Capri, F., Gastaldi, L., and Viarengo, A.	Assessing the occurrence of a stress syndrome in mussels (*Mytilus edulis*) using a combined biomarker/gene expression approach.	Aquatic Toxicology. 78(Supplement 1):S13-S24.	Gene expression and biomarkers.
2006	Dong, J., Li, F.-B., Lan, C.-Y., Liu, C.-S., Li, X.-M., and Luan, T.-G.	Dependence of bisphenol A photodegradation on the initial concentration of oxalate in the lepidocrocite-oxalate complex system.	Journal of Environmental Sciences-China. 18(4):777-782.	Non-environmental degradation.
2006	Duan, Z.-H. and Zhu, L.	Toxicity of bisphenol A on the growth of zebrafish embryos.	Acta Hydrobiologica Sinica. 30(6):638-642.	Toxicity of BPA to fish embryos. Few details available.
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2006	Endo, Y., Kimura, N., Ikeda, I., Fujimoto, K., and Kimoto, H.	Adsorption of bisphenol A by lactic acid bacteria, *Lactococcus*, strains.	Applied Microbiology and Biotechnology. In Press.	Bacterial study.
2006	Engel S. M., Levy B., Liu Z., Kaplan D., Wolff M. S.	Xenobiotic phenols in early pregnancy amniotic fluid.	Reprod Toxicol. 21(1):110-2.	Mammalian study.
2006	Fujimoto T., Kubo K., Aou S.	Prenatal exposure to bisphenol A impairs sexual differentiation of exploratory behavior and increases depression-like behavior in rats.	Brain Res. 1068(1):49-55.	Mammalian study.
2006	Furuichi, T., Kannan, K., Suzuki, K., Tanaka, S., Giesy, J. P., and Masunaga, S.	Occurrence of estrogenic compounds in and removal by a swine farm waste treatment plant.	Environmental Science and Technology. 40(24):7896 -7902.	Water purification.
2006	Gee, D.	Late lessons from early warnings for EDSs.	Environmental Health Perspectives. 114(Supplement 1):152-160.	Review
2006	George, S. G., Diab, A., Sabine, V., and Chipman, K.	A genomic analysis of pollutant response in liver of flounders from two highly polluted European estuaries.	Marine Environmental Research. 62(Supplement S):S165-S166.	Genomic analysis
2006	Gerecke, A. C., Giger, W., Hartmann, P. C., Heeb, N. V., Kohler, H.-P. E., Schmid, P., Zennegg, M., and Kohler, M.	Anaerobic degradation of brominated flame retardants in sewage sludge.	Chemosphere. 64(2):311-317.	Addressed in TBBPA assessment.

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2006	Gomez M. J., Martinez Bueno M. J,. Lacorte S., Fernandez-Alba A. R., Aguera A.	Pilot survey monitoring pharmaceuticals and related compounds in a sewage treatment plant located on the Mediterranean coast.	Chemosphere. 66(6):993-1002.	Sewage treatment plant.
2006	Gomez M. J., Mezcua M., Martinez M. J., Fernandez-Alba A. R., Aguera A.	A new method for monitoring oestrogens, N-octylphenol, and bisphenol A in wastewater treatment plants by solid-phase extraction-gas chromatography-tandem mass spectrometry.	International Journal of Environmental Analytical Chemistry. 86(1-2):3-13.	Wastewater treatment plant.
2006	Gomiero A., Pampanin D. M., Bjornstad A., Larsen B. K., Provan F., Lyng E., Andersen O. K.	An ecotoxicoproteomic approach (SELDI-TOF mass spectrometry) to biomarker discovery in crab exposed to pollutants under laboratory conditions.	Aquat Toxicol. 78 Suppl 1:S34-41.	Biomarkers in crabs.
2006	Goodman J. E., McConnell E. E., Sipes I. G., Witorsch R. J., Slayton T. M., Yu C. J., Lewis A. S., Rhomberg L. R.	An updated weight of the evidence evaluation of reproductive and developmental effects of low doses of bisphenol A.	Crit Rev Toxicol. 36(5):387-457.	Mammalian study
2006	Gross-Sorokin, M. Y., Roast, S. D., and Brighty, G. C.	The Environment Agency's assessment of feminisation of male fish in English rivers.	Environmental Health Perspectives. 114(Supplement 1):147-151.	Review.
2006	Hahn T., Tag K., Riedel K., Uhlig S., Baronian K., Gellissen G., Kunze G.	A novel estrogen sensor based on recombinant *Arxula adeninivorans* cells.	Biosensors & Bioelectronics. 21(11):2078-2085.	Biosensors.
2006	Hamerton I., Howlin B. J., Mitchell A. L.	Developing poly(bis-benzoxazines) with improved fracture toughness. 1: Using molecular simulation to determine and predict structure-property relationships.	Reactive & Functional Polymers. 66(1):21-39.	Polymers.
2006	Han N., Liu Z., Jin L., Yue Y.	Preparation and characterization of poly(silyl ester)s containing 2,2-bis(p-dimethylsiloxy-phenyl)propane units in the polymer backbones.	App Polymer Sci. 101(3):1937-1942.	Polymers.
2006	Harbers, J. V., Huuijbregts, M. A. J., Posthuma, L., and van de Meent, D.	Estimating the impact of high-production-volume chemicals on remote ecosystems by toxic pressure calculation.	Environmental Science and Technology. 40(5):1573-1580.	Risk assessment methodology.
2006	Hastwell P. W., Chai, L. -L., Roberts K. J., Webster T. W., Harvey J. S., Rees R. W., Walmsley R. M.	High-specificity and high-sensitivity genotoxicity assessment in a human cell line: validation of the GreenScreen HC GADD45a-GFP genotoxicity assay.	Mut Res. 607(2):160-175.	Study carried out with human cells.
2006	Hattori K., Inoue M., Arai H., Tamura H. O.	A novel sulfotransferase abundantly expressed in the dauer larvae of *Caenorhabitis elegans*.	J Biochen (Tokyo). 139(3):355-62	Biochemistry.
2006	Hayden O., Podlipna D., Chen X., Krassnig S., Leidl A., Dickert F. L.	Nanolithography and subnanomolecular interactions for biomimetic sensors.	Mat Sci &Eng C: Biom and Supramolecular Systems. 26(5-7): 924-928.	Materials science.

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2006	Helsel, D. R.	Fabricating data: How substituting values for nondetects can ruin results, and what can be done about it.	Chemosphere. 65(11):2434-2439.	Data analysis.
2006	Hess-Wilson J. K., Boldison J., Weaver K. E., Knudsen K. E.	Xenoestrogen action in breast cancer: impact on ER-dependent transcription and mitogenesis.	Breast Cancer Res Treat. 96(3):279-92.	Human health study.
2006	Hillen U., Jappe U., Frosch P. J., Becker D., Brasch J., Lilie M., Fuchs T., Kreft B., Pirker C., Geier J; German Contact Dermatitis Research Group.	Late reactions to the patch-test preparations para-phenylenediamine and epoxy resin: a prospective multicentre investigation of the German Contact Dermatitis Research Group.	Br J Dermatol. 154(4):665-70.	Human health study.
2006	Hiroi T., Okada K., Imaoka S., Osada M., Funae Y.	Bisphenol A binds to protein disulfide isomerase and inhibits its enzymatic and hormone-binding activities.	Endocrinology. 147(6):2773-80.	Binding activity in rats.
2006	Hjelmborg, P. S., Ghisari M., Bonefeld-Jorgensen E. C.	SPE-HPLC purification of endocrine-disrupting compounds from human serum for assessment of xenoestrogenic activity.	Anal and Bioanal Chem. 385(5):875-887.	Analytical paper.
2006	Ho S. M., Tang W. Y., Belmonte de Frausto J., Prins G. S.	Developmental exposure to estradiol and bisphenol A increases susceptibility to prostate carcinogenesis and epigenetically regulates phosphodiesterase type 4 variant 4.	Cancer Res. 66(11):5624-32.	Human health study.
2006	Honkanen, J. O. and Kukkonen, J. V. K.	Environmental temperature changes uptake rate and bioconcentration factors of bisphenol A in tadpoles of *Rana temporaria*.	Environmental Toxicology and Chemistry. 25(10):2804-2808.	Similar information included.
2006	Honma T., Miyagawa M., Suda M., Wang R. S., Kobayashi K., Sekiguchi S.	Effects of perinatal exposure to bisphenol A on brain neurotransmitters in female rat offspring.	Ind Health. 44(3):510-24.	Mammalian study.
2006	Hoppin J. A., Ulmer R., Calafat A. M., Barr D. B., Baker S. V., Meltzer H. M., Ronningen K. S.	Impact of urine preservation methods and duration of storage on measured levels of environmental contaminants.	J Expo Sci Environ Epidemiol. 16(1):39-48.	Levels in human urine.
2006	Houtman C. J., Van Houten Y. K., Leonards P. E., Brouwer A., Lamoree M. H., Legler J.	Biological validation of a sample preparation method for ER-CALUX bioanalysis of estrogenic activity in sediment using mixtures of xeno-estrogens.	Environ Sci Technol. 40(7):2455-61.	Method for bioanalysis of estogenic activity.
2006	Hu J. Y., Chen X., Jin X., Tan X. L.	Effect of chlorination on estrogenicity in chlorinated treated effluent.	Water Sci & Tech: Water Supply. 6(2):185-191.	Water purification.
2006	Huerta G., Fomina L., Rumsh L., Zolotukhin M. G.	New polymers with N-phenylpyrrole fragments obtained by chemical modifications of diacetylene containing-polymers.	Polymer Bulletin (Heidelberg, Germany). 57(4):433-443.	Polymers.

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2006	Huschek, G. and Hansen, P.-D.	Ecotoxicological classification of the Berlin river system using bioassays in respect to the European water framework directive.	Environmental Monitoring and Assessment. 121(1-3):15-31.	Bioassays and classification.
2006	Hutchinson, T. H, Shillabeer, N., Winter, M. J., and Pickford, D. B.	Acute and chronic effects of carrier solvents in aquatic organisms: A critical review.	Aquatic Toxicology. 76(1):69-92.	Review.
2006	Hutchinson, T. H., Ankley, G. T., Segner, H., and Tyler, C. R.	Screening and testing for endocrine disruption in fish - biomarkers as signposts not traffic lights in risk assessment.	Environmental Health Perspectives. 114(Suppl 1):106-114.	Review
2006	Hwang, H.-M., Green, P. G., and Young, T. M.	Tidal salt marsh sediment in California, USA. Part 1: Occurrence and sources of organic contaminants.	Chemosphere. 64(8):1383-1392.	Levels in US
2006	Iguchi, T., Watanabe, H., and Katsu, Y.	Application of ecotoxicogenomics for studying endocrine disruption in vertebrates and invertebrates.	Environmental Health Perspectives. 114(Supplement 1):101-105.	Genomic study.
2006	Ike M., Chen M. Y., Danzl E., Sei K., Fujita M.	Biodegradation of a variety of bisphenols under aerobic and anaerobic conditions.	Water Sci Technol. 53(6):153-9.	Weight of evidence is that little or no degradation occurs under anaerobic conditions.
2006	Inoue, K., Yoshida, S., Nakayama, S., Ito, R., Okanouchi, N., and Nakazawa, H.	Development of stable isotope dilution quantification liquid chromatography-mass spectrometry method for estimation of exposure levels of bisphenol A, 4-*tert*-octylphenol, 4-nonylphenol, tetrabromobisphenol A, and pentachlorophenol in indoor air.	Archives of Environmental Contamination and Toxicology. 51(4):503-508.	Analytical paper.
2006	Ioan, I., Wilson, S., Lundanes, E., and Neculai, A.	Comparison of Fenton and sono-Fenton bisphenol A degradation.	Journal of Hazardous Materials. In Press.	Non-environmental degradation.
2006	Irmak, S., Erbatur, O., and Kusvuran, E.	Degradation of alkylphenolic compounds in aqueous media by Fenton and ultraviolet induced Fenton reaction.	Fesenius Environmental Bulletin. 15(12B):1601-1606.	Non-environmental degradation.
2006	Ishibashi, H., Hirano, M., Matsumura, N., Watanabe, N., Takao, Y., and Arizono, K.	Reproductive effects and bioconcentration of 4-nonylphenol in medaka fish (*Oryzias latipes*).	Chemosphere. 65(6):1019-1026.	Paper deals with 4-nonylphenol.
2006	Iso T., Watanabe T., Iwamoto T., Shimamoto A., Furuichi Y.	DNA damage caused by bisphenol A and estradiol through estrogenic activity.	Biol Pharm Bull. 29(2):206-10.	Effects of estrogenic activity.
2006	Itoh N., Tao H., Ibusuki T.	In-tube silylation in combination with thermal desorption gas chromatography-mass spectrometry for the determination of hydroxy polycyclic aromatic hydrocarbons in water.	Analytica Chimica Acta. 555(2):201-209.	Analytical paper.

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2006	Jaballah N., Trad H., Majdoub M., Jouini M., Roussel J., Fave J. L.	Synthesis and characterization of new blue-photoluminescent copolymer derived from bisphenol A.	J App Polymer Sci. 99(6):2997-3004.	Polymers.
2006	James, M. O., Faux, L. R., Stuchal, L. D., Sacco, J. C., and Wang, L.	Interaction of environmental chemicals with glucuronidation pathways in channel catfish.	Marine Environmental Research. 62(Supplement S):S66.	Biochemistry
2006	Jiang M., Zhang J. H., Mei S. R., Shi Y., Zou L. J., Zhu Y. X., Dai K., Lu B.	Direct enrichment and high performance liquid chromatography analysis of ultra-trace Bisphenol A in water samples with narrowly dispersible Bisphenol A imprinted polymeric microspheres column.	J Chromatogr A. 1110(1-2):27-34.	Analytical paper.
2006	Jondeau A., Dahbi L., Bani-Estivals M. -H., Chagnon M. -C.	Evaluation of the sensitivity of three sublethal cytotoxicity assays in human HepG2 cell line using water contaminants.	Toxicology. 226(2-3):218-228.	Cell line study.
2006	Jonsson H., Schiedek D., Goksoyr A., Grosvik B. E.	Expression of cytoskeletal proteins, cross-reacting with anti-CYP1A, in *Mytilus* sp. exposed to organic contaminants.	Aquat Toxicol. 78 Suppl 1:S42-8.	Gene expression.
2006	Jonsson, H., Schiedek, D., Grøsvik, B. E., and Goksøyr, A.	Protein responses in blue mussels (*Mytilus edulis*) exposed to organic pollutants: A combined CYP-antibody/proteomic approach.	Aquatic Toxicology. 78(Supplement 1):S49-S56.	Biochemistry study .
2006	Kallivretaki E., Eggen R., Neuhauss S., Alberti M., Kausch U., Segner H.	Aromatase in zebrafish: a potential target for endocrine disrupting chemicals.	Marine Env Res. 62(Suppl.):S187-S190.	Biochemistry study.
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2006	Kang, J. H. and Kondo, F.	Distribution and biodegradation of bisphenol A in water hyacinth.	Bull of Env Contamination and Tox. 77(4):500-507.	Water purification
2006	Kang J. H, Kondo F., Katayama Y.	Human exposure to bisphenol A.	Toxicology. 226(2-3):79-89.	Human exposure paper.
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2006	Kanoh N., Kyo M., Inamori K., Ando A., Asami A., Nakao A., Osada H.	SPR Imaging of Photo-Cross-Linked Small-Molecule Arrays on Gold.	Anal Chem. 78(7):2226-2230.	Polymers.

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2006	Killinger D., Sivaprakasam V.	Water monitoring with laser fluorescence.	Optics & Photonics News. 17(1):34-39.	Analytical paper.
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2006	Kuruto-Niwa R., Tateoka Y., Usuki Y., Nozawa R.	Measurement of bisphenol A concentrations in human colostrum.	Chemosphere. Aug 10; [Epub ahead of print].	Human health paper.
2006	Kwon J. -H., Liljestrand H. M., Katz L. E.	Partitioning of moderately hydrophobic endocrine disruptors between water and synthetic membrane vesicles.	Env Tox and Chem. 25(8):1984-1992.	Non-environmental partitioning.
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2006	Liu, G.-B., Dai, L., Gao, X., Li, M.-K., and Thiemann, T.	Reductive degradation of tetrabromobisphenol A (TBBPA) in aqueous medium.	Green Chemistry. 8(9):781-783.	Non-environmental degradation of TBBPA.
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2006	Martin-Skilton, R., Coughtrie, M. W. H., and Porte, C.	Sulfotransferase activities towards xenobiotics and estradiol in two marine fish species (*Mullus barbatus* and *Lepidorhombus boscii*): Characterization and inhibition by endocrine disrupters.	Aquatic Toxicology. 79(1):24-30.	Biochemistry paper.
2006	Martin-Skilton, R., Thibaut, R., and Porte, C.	Endocrine alteration in juvenile cod and turbot exposed to dispersed crude oil and alkylphenols.	Aquatic Toxicology. 78(Supplement 1):S57-S64.	Mixture toxicity.
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2006	Miyamoto K., Kotake M.	Estimation of daily bisphenol A intake of Japanese individuals with emphasis on uncertainty and variability.	Environ Sci. 13(1):15-29.	Exposure of humans in Japan.
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2006	Pampanin D. M., Viarengo A., Garrigues P., Andersen O. K.	An overview of the BEEP Stavanger workshop.	Aquat Toxicol. 78 Suppl 1:S124-6.	Biomarkers.
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2006	Sanchez-Bayo F.	Comparative acute toxicity of organic pollutants and reference values for crustaceans I. Branchiopoda, Copepoda and Ostracoda.	Env Pollution. 139(3):385-420.	Comparison of acute toxicity to planktonic crustaceans by T_{rel} and statistical analysis.

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2006	Tsai W. T., Lai C. W., Su T. Y.	Adsorption of bisphenol-A from aqueous solution onto minerals and carbon adsorbents.	J Hazard Mater. 134(1-3): 169-75.	Water purification.
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2005	Matsumoto K., Sakai T., Torimaru A., Ishitobi S.	A surface plasmon resonance-based immunosensor for sensitive detection of bisphenol A.	J Faculty of Agriculture, Kyushu University. 50(2): 625-634.	Analytical paper.
2005	Matsuoka, M., Ishibashi, H., Takao, Y., Kohra, S., and Arizono, K.	Ecotoxicological effect and an estrogenic activity by BPA-related compounds.	8th Annual Meeting Japan Soc Endocrine Disrupters Res, Program and Abstracts, 27-29, Sept. 2005.	BPA-related substances only.
2005	Meulenberg E. P., Koopal K., Rhemrev R.	Immunoassays for alkylphenolic pollutants with endocrine disrupting activity.	Int J Env Analytical Chem. 85(12-13):871-883.	Bioassay.
2005	Michelini E., Leskinen P., Virta M., Karp M., Roda A.	A new recombinant cell-based bioluminescent assay for sensitive androgen-like compound detection.	Biosensors & Bioelectronics. 20(11):2261-2267.	Bioluminescent assay.
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2005	Milnes, M. R., Bermudez, D. S., Bryan, T. A., Edwards, T. M., Gunderson, M. P., Larkin, I. L. V., Moore, B. C., and Guilletette Jr., L. J.	Contaminant-induced feminization and demasculinization of nonmammalian vertebrate males in aquatic environments.	Environmental Research. 100(1):3-17.	Review
2005	Miyazaki, S., Kitamura, S., Satoh, J., Gotoh, Y., and Hanada, H.	Effects of estrogen-like substances on amphibian metamorphosis.	8th Annual Meeting Japan Soc Endocrine Disrupters Res, Program and Abstracts, 27-29, Sept. 2005.	Meeting abstract only.
2005	Mlynarcikova A., Fickova M., Scsukova S.	Ovarian intrafollicular processes as a target for cigarette smoke components and selected environmental reproductive disruptors.	Endocr Regul. 39(1):21-32. Review.	Human health effects.
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2005	Mormann W., Spitzer D.	Ammonolysis of polycarbonates with (supercritical) ammonia: an alternative for chemical recycling.	ACS Symposium Series, 898 (Advances in Polycarbonates), 244-261.	Polycarbonate recycling.
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2005	Oehlmann, J., Schulte-Oehlmann, U., Bachmann, J., and Oetken, M.	Low dose effects of bisphenol A in the freshwater snail *Marisa cornuarietis*.	Environmental Research. 98(3):413.	Covered in other papers
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2005	Ohnuma, A., Conlon, J. M., Kawasaki, H., and Iwamuro, S.	Induction by thyroid hormone of a novel antimicrobial peptide gene in the skin of *Rana tagoi* and its suppression by bisphenol A.	Zoological Science. 22(12):1500.	Gene suppression
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2005	Ohtani Y., Shimada Y., Kozawa K., Shiraishi F.	Estrogen activity increased in the process of biodegradation of bisphenol A.	Zenkoku Kankyoken Kaishi. 30:18-23.	Endocrine activity of breakdown products.
2005	Okada A., Niwa Y., Katase T., Kai O.	Controlled release of estradiol-17□ and bisphenol A from a silicone tube for long-term administration in mice.	Animal Science Journal (Carlton South, Australia). 76(6):535-539.	Mammalian study.
2005	Okada K., Hiroi T., Imaoka S., Funae Y.	Inhibitory effects of environmental chemicals on protein disulfide isomerase *in vitro*.	Osaka City Med J. 51(2):51-63.	Enzyme study.
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2005	Olsen C. M., Meussen-Elholm E. T., Hongslo J. K., Stenersen J., Tollefsen K. E.	Estrogenic effects of environmental chemicals: an interspecies comparison.	Comp Biochem Physiol C Toxicol Pharmacol. 141(3):267-74.	Cell line studies.

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2005	Oota S., Murakami T., Takemura K., Noto K.	Evaluation of MBR effluent characteristics for reuse purposes.	Water Sci and Tech. 51(6-7, Water Env--Membrane Technology):441-446.	Evaluation of effluents.
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2005	Pillon A., Boussioux A. -M., Escande A., Ait-Aissa S., Gomez E., Fenet H., Ruff M., Moras D., Vignon F., Duchesne M. -J., Casellas C., Nicolas J. -C., Balaguer P.	Binding of estrogenic compounds to recombinant estrogen receptor-□: application to environmental analysis.	Env Health Perspectives. 113(3):278-284.	Paper reports a binding assay.
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2005	Pressman E. J., Johnson B. F., Shafer S. J.	Monomers for polycarbonate manufacture: Synthesis of BPA and DPC.	ACS Symposium Series, 898 (Advances in Polycarbonates), 22-38.	Synthesis of bisphenol A.
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2005	Rao B. S., Reddy K. R., Pathak S. K., Pasala A. R.	Benzoxazine-epoxy copolymers: Effect of molecular weight and crosslinking on thermal and viscoelastic properties.	Polymer Int. 54(10):1371-1376.	Polymers.
2005	Rasmussen K., Carstensen O., Ponten A., Gruvberger B., Isaksson M., Bruze M.	Risk of contact allergy and dermatitis at a wind turbine plant using epoxy resin-based plastics.	Int Arch of Occupational and Env Health. 78(3):211-217.	Human health study.
2005	Ravit B., Ehrenfeld J. G., Haeggblom M. M.	Salt marsh rhizosphere affects microbial biotransformation of the widespread halogenated contaminant tetrabromobisphenol-A (TBBPA).	Soil Biology & Biochemistry. 37(6):1049-1057.	Paper looks at TBBPA.
2005	Razzoli M., Valsecchi P., Palanza, P.	Chronic exposure to low doses of bisphenol A interferes with pair-bonding and exploration in female Mongolian gerbils.	Brain Research Bulletin. 65(3):249-254.	Mammalian study.
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2005	Rivera A., Blochowicz T., Porokhonskyy V., Rossler E. A.	Comment on "Thermal glass transition beyond the Vogel-Fulcher-Tammann behavior for glass forming diglycidylether of bisphenol A".	Phys Rev Lett. Apr 1;94(12):129603; author reply 129604. [No abstract available].	Polymers.
2005	Ronen Z., Visnovsky S., Nejidat A.	Soil extracts and co-culture assist biodegradation of 2,4,6-tribromophenol in culture and soil by an auxotrophic *Achromobacter piechaudii* strain TBPZ.	Soil Biol & Biochem. 37(9): 1640-1647.	Paper deals with the biodegradation of 2,4,6-tribromophenol.
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2005	Rykowska I., Szymanski A., Wasiak W.	Determination of bisphenol-A in drinking water using new SPE sorbents with chemically bonded ketoimine groups.	Polish Journal of Food and Nutrition Sciences. 14(3): 237-241.	Analytical paper.

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2005	Sajiki, J. and Izumi, N.	Concentration of BPA and insect hormones in larvae and pupae of house fly exposed to bisphenol-A (BPA).	8th Annual Meeting Japan Soc Endocrine Disrupters Res, Program and Abstracts, 27-29, Sept. 2005.	Meeting abstract only
2005	Sakazaki H., Ido R., Ueno H., Nakamuro K.	17□-Estradiol primes elicitation of inducible nitric oxide synthase expression by lipopolysaccharide and interferon-□ in mouse macrophage cell line J774.1.	J Health Sci. 51(1):62-69.	Mammalian cell line study.
2005	Sakurai K., Sugaya N., Nakagawa T., Uchiyama T., Fujimoto Y., Takahashi K.	Simultaneous analysis of endocrine disruptors, 4-alkylphenol and bisphenol A, contained in synthetic resin products used for drug containers and household utensils.	J Health Sci. 51(5):538-548.	Possible levels in plastics.
2005	Sambe H., Hoshina K., Hosoya K., Haginaka J.	Direct injection analysis of bisphenol A in serum by combination of isotope imprinting with liquid chromatography-mass spectrometry.	Analyst (Cambridge, United Kingdom). 130(1):38-40.	Analytical paper.
2005	Sando, S. K., Furlong, E. T., Gray, J. L., Meyer, M. T., and Bartholomay, R. C.	Occurrence of organic wastewater compounds in wastewater effluent and the Big Sioux River in the upper Big Sioux River basin, South Dakota, 2003-2004.	U. S. Geological Survey Scientific Investigations Report 2005-5249.	Levels in US
2005	Sandstrom M. W., Kolpin D. W., Thurman E. M., Zaugg S. D.	Widespread detection of N,N-diethyl-m-toluamide in U.S. Streams: Comparison with concentrations of pesticides, personal care products, and other organic wastewater compounds.	Environ Tox and Chemistry. 24(5):1029-1034.	Possible levels in US waters.
2005	Sanseverino J., Gupta R. K., Layton A. C., Patterson S. S., Ripp S. A., Saidak L., Simpson M. L.; Schultz T. W., Sayler G. S.	Use of *Saccharomyces cerevisiae* BLYES expressing bacterial bioluminescence for rapid, sensitive detection of estrogenic compounds.	Appl Env Microbiology. 71(8):4455-4460.	Bioassay.
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2005	Schirling, M., Jungmann, D., Ladewig, V., Nagel, R., Triebskorn, R., and Koehler, H.-R.	Endocrine effects in *Gammarus fossarum* (Amphipoda): Influence of wastewater effluents, temporal variability, and spatial aspects on natural populations.	Archives of Environmental Contamination and Toxicology. 49(1):53-61.	Not specific to bisphenol A.
2005	Schultis, T.	Detection of estrogen activity of environmental samples and pure substances by biological test systems - development and comparison of *in vitro* assays.	Stuttgarter Berichte zur Siedlungswasserwirtschaft. 181:i-xix, 1-232.	Assay development

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2005	Segner, H.	Developmental, reproductive, and demographic alterations in aquatic wildlife: Establishing causality between exposure to endocrine-active compounds (EACs) and effects	Acta Hydrochimica et Hydrobiologica. 33(1):17-26.	General paper discussing exposure to EDCs and effects.
2005	Seidlova-Wuttke D., Jarry H., Christoffel J., Rimoldi G., Wuttke W.	Effects of bisphenol-A (BPA), dibutylphtalate (DBP), benzophenone-2 (BP2), procymidone (Proc), and linurone (Lin) on fat tissue, a variety of hormones and metabolic parameters: a 3 months comparison with effects of estradiol (E2) in ovariectomized (ovx) rats.	Toxicology. 213(1-2):13-24.	Mammalian study.
2005	Shao B., Han H., Hu J., Zhao J., Wu G., Xue Y., Ma Y., Zhang S.	Determination of alkylphenol and bisphenol A in beverages using liquid chromatography/electrospray ionization tandem mass spectrometry.	Analytica Chimica Acta. 530(2):245-252.	Analytical paper.
2005	Shao J., Shi G., Jin X., Song M., Shi J., Jiang G.	Preliminary survey of estrogenic activity in part of waters in Haihe River, Tianjin.	Chinese Science Bulletin. 50(22):2565-2570.	Possible levels of EDCs in China.
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2005	Shirai M., Mitsukura K., Okamura H., Miyasaka M.	Multi-functional methacrylates bearing thermal degradation properties - Synthesis, photo- and thermal curing, and thermolysis.	J Photopolymer Sci & Tech. 18(2):199-202.	Polymers.
2005	Shoji R., Nishimura T., Vepsalainen J., Ljungberg K.	Activated carbon adsorption, activated sludge and ozonation treatments evaluated by impact intensity based on acute toxicity test.	Toxicological and Environ Chemistry. 87(1):55-65.	Water purification.
2005	Silva, E., Scholze, M., Backhaus, T., and; Kortenkamp, A.	Assessment of combinations of six mitogenic agents in the E-screen assay reveals small deviations from concentration additivity.	Environmental Research. 98(3):415.	Mixture toxicity
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2005	Simoneit, B., R. T., Medeiros, P. M., and Didyk, B. M.	Combustion products of plastics as indicators for refuse burning in the atmosphere.	Environmental Science and Technology. 39(18):6961-6970.	Paper looks at plastics.

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2005	Skjevrak I., Brede C., Steffensen I. -L., Mikalsen A., Alexander J., Fjeldal P., Herikstad H.	Non-targeted multi-component analytical surveillance of plastic food contact materials: Identification of substances not included in EU positive lists and their risk assessment.	Food Add & Contaminants. 22(10):1012-1022.	Food contamination.
2005	Skretas G., Wood D. W.	A bacterial biosensor of endocrine modulators.	J Mol Biol. 349(3):464-474.	Paper describes a bacterial biosensor.
2005	Sonoki T., Kajita S., Ikeda S., Uesugi M., Tatsumi K., Katayama Y., Iimura Y.	Transgenic tobacco expressing fungal laccase promotes the detoxification of environmental pollutants.	Appl Microbiol & Biotech. 67(1):138-142.	Non-environmental degradation.
2005	Sosiak, A. and Hebben, T.	A preliminary survey of pharmaceuticals and endocrine disrupting compounds in treated municipal wastewaters and receiving rivers of Alberta.	Alberta Environment Publication Number T/773.	Survey of EDCs in wastewaters in Canada.
2005	Srividhya M., Lakshmi M. S., Reddy B. S. R.	Chemistry of siloxane amide as a new curing agent for epoxy resins: Material characterization and properties.	Macromolecular Chem and Physics. 206(24):2501-2511.	Polymers.
2005	Stuart J. D., Capulong C. P., Launer K. D., Pan X.	Analyses of phenolic endocrine disrupting chemicals in marine samples by both gas and liquid chromatography-mass spectrometry.	J Chromatogr A. 1079(1-2):136-45.	Analytical paper.
2005	Su Y. -C., Yei D. -R., Chang F. -C.	The kinetics of B-a and P-a type copolybenzoxazine via the ring opening process.	J Applied Polymer Science. 95(3):730-737.	Polymers.
2005	Sugiura-Ogasawara M., Ozaki Y., Sonta S., Makino T., Suzumori K.	Exposure to bisphenol A is associated with recurrent miscarriage.	Hum Reprod. 20(8):2325-9.	Human health.
2005	Sugiyama S., Miyoshi H., Yamauchi K.	Characteristics of a thyroid hormone responsive reporter gene transduced into a *Xenopus laevis* cell line using lentivirus vector.	Gen Comp Endocrinol. 144(3):270-9.	Cell line study.
2005	Sugiyama, S., Shimada, N., Miyoshi, H., and Yamauchi, K.	Detection of thyroid system-disrupting chemicals using *in vitro* and *in vivo* screening assays in *Xenopus laevis*.	Toxicological Sciences. 88(2):367-374.	Method development.
2005	Sumpter, J. P.	Endocrine disrupters in the aquatic environment: An overview.	Acta hydrochimica et hydrobiologica. 33(1):9-16.	Review
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2005	Sun S., Sun P., Liu D.	The study of esterifying reaction between epoxy resins and carboxyl acrylic polymers in the presence of tertiary amine.	European Polymer Journal. 41(5):913-922.	Polymers.
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2005	Sybert P., Klei S., Rosendale D., Di J., Shen D.	Weatherability and physical properties of opaque injection moldable LEXAN SLX resins.	Annual Technical Conference, Society of Plastics Engineers, 63rd, 2523-2527.	Polymers.
2005	Tai C., Jiang G., Liu J., Zhou Q., Liu J.	Rapid degradation of bisphenol A using air as the oxidant catalyzed by polynuclear phthalocyanine complexes under visible light irradiation.	J Photochem & Photobiol A: Chem. 172(3):275-282.	Non-environmental degradation.
2005	Takahashi M., Tsukamoto S., Kawaguchi A., Sakamoto A., Morikawa H.	Phytoremediators from abandoned rice field.	Plant Biotech (Tokyo, Japan). 22(2):167-170.	Non-environmental degradation.
2005	Takemura H., Ma J., Sayama K., Terao Y., Zhu B. T., Shimoi K.	*In vitro* and *in vivo* estrogenic activity of chlorinated derivatives of bisphenol A.	Toxicology. 207(2):215-221.	Paper deals with chlorinated BPA.
2005	Takao, Y., Oishi, M., Yamaguchi, H., Nagae, M., Kohra, S., and Arizono, K.	Time changes of bisphenol A concentrations in Medaka and in their eggs.	8th Annual Meeting Japan Soc Endocrine Disrupters Research, Prog and Abs, 27-29, Sept. 2005.	Meeting abstract only.
2005	Tanaka M., Ishizaka Y., Tosuji H., Kunimoto M., Hosoya N., Nishihara N., Kadono T., Kawano T., Kosaka T., Hosoya H.	A new bioassay for toxic chemicals using green paramecia, *Paramecium bursaria*.	Environmental Chemistry, 673-680.	Bioassay.
2005	Taniguchi M., Kato K., Shimauchi A., Ping X., Nakayama H., Fujita K., Tanaka T., Tarui Y., Hirasawa E.	Proposals for wastewater treatment by applying flocculating activity of cross-linked poly-gamma-glutamic acid.	J Biosci Bioeng. 99(3):245-51.	Non-environmental degradation.
2005	Teeguarden J. G., Waechter J. M. Jr., Clewell H. J., Covington T. R., Barton H. A.	Evaluation of oral and intravenous route pharmacokinetics, plasma protein binding, and uterine tissue dose metrics of bisphenol A: a physiologically based pharmacokinetic approach.	Tox Sci. 85(2):823-838.	Mammalian study.
2005	ten Cate M. G. J., Reinhoudt D. N., Crego-Calama M.	Binding of small guest molecules to multivalent receptors.	J Org Chem. 70(21):8443-8453.	Binding study.
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2005	Terasaka H., Kadoma Y., Sakagami H., Fujisawa S.	Cytotoxicity and apoptosis-inducing activity of bisphenol A and hydroquinone in HL-60 cells.	Anticancer Res. 25(3B):2241-7.	Cellular study.

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2005	Terasaki M., Shiraishi F., Nishikawa T., Morita M., Makino M.	A practical synthesis and estrogenic activity of 5-hydroxy-1-(4'-hydroxyphenyl)-1,3,3-trimethylindan, a contaminant in industrial grade bisphenol A.	Chem Lett. 34(2):188-189.	Similar information already included.
2005	Thiruvenkatachari R., Kwon T. O., Moon I. S.	A total solution for simultaneous organic degradation and particle separation using photocatalytic oxidation and submerged microfiltration membrane hybrid process.	Korean J of Chem Eng. 22(6): 938-944.	Non-environmental degradation.
2005	Thiruvenkatachari R., Kwon T. O., Moon I. S.	Application of slurry type photocatalytic oxidation-submerged hollow fiber microfiltration hybrid system for the degradation of bisphenol A (BPA).	Science and Technology. 40(14):2871-2888.	Non-environmental degradation.
2005	Thomson B. M., Grounds P. R.	Bisphenol A in canned foods in New Zealand: an exposure assessment.	Food Addit Contam. 22(1):65-72.	Human exposure.
2005	Tilton, S. C., Foran, C. M., and Benson, W. H.	Relationship between ethinylestradiol-mediated changes in endocrine function and reproductive impairment in Japanese medaka (*Oryzias latipes*).	Environmental Toxicology and Chemistry. 24(2):352-359.	Not BPA specific.
2005	Timms B. G., Howdeshell K. L., Barton L., Bradley S., Richter C. A., vom Saal F. S.	Estrogenic chemicals in plastic and oral contraceptives disrupt development of the fetal mouse prostate and urethra.	Proc Natl Acad Sci U S A. 102(19):7014-9.	Mammalian study.
2005	Toda M., Ogawa N., Itoh H., Hamada F.	Unique molecular recognition property of bis-pyrene-modified □-cyclodextrin dimer in collaboration with □-cyclodextrin.	Analytica Chimica Acta. 548(1-2):1-10.	Molecular recognition.
2005	Tokumoto T., Tokumoto M., Nagahama Y.	Induction and inhibition of oocyte maturation by EDCs in zebrafish.	Reprod Biol and Endocrinol 3. No pp. given.	Effects of EDCs on oocyte maturation.
2005	Trad H., Jaballah N., Majdoub M., Roudesli S., Roussel J., Fave J. L.	Synthesis of a novel luminescent copolymer based on bisphenol A.	Polymer International. 54(9):1314-1319.	Polymer synthesis.
2005	Tran T. T. M., Tran T. L., Pham H. V.	Analytical determination of relevant alkylphenols and bisphenol A of landfill leachates samples collected in Hanoi's dumping sites.	Tap Chi Phan Tich Hoa, Ly Va Sinh Hoc. 10:66-71.	Analytical paper.
2005	Trubo R.	Endocrine-disrupting chemicals probed as potential pathways to illness.	JAMA. 294(3):291-3. [No abstract available].	Human response to EDCs.
2005	Tilton, S. C., Foran, C. M., and Benson, W. H.	Relationship between ethinylestradiol-mediated changes in endocrine function and reproductive impairment in Japanese medaka (*Oryzias latipes*).	Environmental Toxicology and Chemistry. 24(2):352-359.	Not BPA specific.

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2005	Tsue H., Takimoto T., Kikuchi C., Yanase H., Takahashi H., Amezawa K., Ishibashi K., Tanaka S., Tamura R.	Adsorptive removal of bisphenol A by calix[4]crown derivatives: Significant contribution of hydrogen bonding interaction to the control of adsorption behavior.	Chem Lett. 34(7):1030-1031.	Water purification.
2005	Tsuruta Y., Inoue H., Fukunaga K., Munemura S., Ozaki M., Ohta M., Matsuura F.	Determination of bisphenol-A in water by semi-micro column high-performance liquid chromatography using 2-methoxy-4-(2-phthalimidinyl)phenylsulfonylchloride as a fluorescent labeling reagent.	Anal Sci. 21(6):697-9.	Analytical paper.
2005	Tsutsumi O.	Assessment of human contamination of estrogenic endocrine-disrupting chemicals and their risk for human reproduction.	J Steroid Biochem Mol Biol. 93(2-5):325-30.	Human health.
2005	Turan N., Waring R. H., Ramsden D. B.	The effect of plasticisers on "sulphate supply" enzymes.	Molecular and Cellular Endocrin. 244(1-2):15-19.	Paper looks at plasticizers.
2005	Turner S. R., King B., Ponasik J., Adams V., Connell G.	Amorphous copolyesters containing monomers derived from bisphenols.	High Performance Polymers. 17(3):361-376.	Polymers.
2005	Ueda, T., Imaoka, T., and Yoshimura, T.	Leaching load of bisphenol A from the plastic sheet by rainfall.	8th Annual Meeting Japan Soc Endocrine Disrupters Research, Prog and Abs, 27-29, Sept. 2005.	Meeting abstract only.
2005	Ueki T., Nishijima S., Izumi Y.	Designing of epoxy resin systems for cryogenic use.	Cryogenics. 45(2):141-148.	Polymers.
2005	Ulrich S., Wachtershauser A., Loitsch S., von Knethen A., Brune B., Stein J.	Activation of PPARgamma is not involved in butyrate-induced epithelial cell differentiation.	Exp Cell Res. 310(1):196-204.	Cellular study.
2005	Urase T., Kagawa C., Kikuta T.	Factors affecting removal of pharmaceutical substances and estrogens in membrane separation bioreactors.	Desalination. 178(1-3):107-113.	Non-environmental degradation.
2005	Urase T., Kikuta T.	Separate estimation of adsorption and degradation of pharmaceutical substances and estrogens in the activated sludge process.	Water Res. 39(7):1289-300.	Not easy to relate to wwtp or environment.
2005	Vedani A., Dobler M., Lill M. A.	Combining protein modeling and 6D-QSAR. Simulating the binding of structurally diverse ligands to the estrogen receptor.	J Med Chem. 48(11):3700-3703.	Binding modelling.
2005	Verslycke, T. A., Vethaak, A. D., Arijs, K., and Janssen, C. R.	Flame retardants, surfactants and organotins in sediment and mysid shrimp of the Scheldt estuary (The Netherlands).	Environmental Pollution. 136(1):19-31.	Paper looks at flame retardants.

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2005	Vethaak A.D., Lahr J., Schrap S. M., Belfroid A. C., Rijs G.B.J., Gerristen A., de Boer J., Bulder A. S., Grinwis G. C. M., Kuiper R. V., Legler J., Murk T. A. J., Peijnenburg W., Verhaar H. J. M., de Voogt P.	An integrated assessment of estrogenic contamination and biological effects in the aquatic environment of the Netherlands.	Chemosphere. 59, 511-524.	Field study in NL. Mixed exposure, not useable in assessment.
2005	Viglietti-Panzica, C., Montoncello, B., Mura, E., Pessatti, M., and Panzica, G.	Organizational effects of diethylstilbestrol on brain vasotocin and sexual behavior in male quail.	Brain Research Bulletin. 65(3):225-233.	Not BPA
2005	Voelkel W., Bittner N., Dekant W.	Quantitation of bisphenol A and bisphenol A glucuronide in biological samples by high performance liquid chromatography-tandem mass spectrometry.	Drug Metab Dispos. 33(11):1748-57.	Analytical paper.
2005	Vogel, J. R., Barber, L. B., Furlong, E. T., Coplen, T. B., Verstraeten, I. M., and Meyer, M. T.	Occurrence of selected pharmaceutical and non-pharmaceutical compounds and stable hydrogen and oxygen isotope ratios in a riverbank filtration study, Platte River, Nebraska, 2002 to 2005, volume 2.	U. S. Geological Survey Data Series 141.	Levels in US
2005	Vogel, J. R., Verstraeten, I. M., Coplen, T. B., Furlong, E. T., Meyer, M. T., and Barber, L. B.	Occurrence of selected pharmaceutical and non-pharmaceutical compounds and stable hydrogen and oxygen isotope ratios in a riverbank filtration study, Platte River, Nebraska, 2001 to 2003, volume 1.	U. S. Geological Survey Data Series 117. (Supplemental section in Critical Evaluation column)	Levels in US
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2005	vom Saal F. S., Nagel S. C., Timms B. G., Welshons W. V.	Implications for human health of the extensive bisphenol A literature showing adverse effects at low doses: a response to attempts to mislead the public.	Toxicology. 212(2-3):244-52, author reply 253-4. [No abstract available].	Paper looks at human response to bisphenol A.
2005	vom Saal F. S., Richter C. A., Mao J., Welshons W. V.	Commercial animal feed: variability in estrogenic activity and effects on body weight in mice.	Birth Defects Res A Clin Mol Teratol. 73(7):474-5. [No abstract available].	Mammalian study.
2005	vom Saal F. S., Richter C. A., Ruhlen R. R., Nagel S. C., Timms B. G., Welshons W. V.	The importance of appropriate controls, animal feed, and animal models in interpreting results from low-dose studies of bisphenol A.	Birth Defects Research, Part A: Clinical and Molecular Teratology. 73(3):140-145.	Mammalian study.
2005	Vranova D.	Quantification of soy isoflavones in meat products by HPLC.	Scripta Medica Facultatis Medicae Universitatis Brunensis Masarykianae. 78(4):235-242.	Analytical methodology.
2005	Wagner, M. and Nicell, J. A.	Evaluation of horseradish peroxidase for the treatment of estrogenic alkylphenols.	Water Quality Research Journal of Canada. 40(2):145-154.	Non-environmental degradation.

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2005	Wan L., Luo Y., Hu Y., Huang F., Du L.	Synthesis and characterization of a novel polymer containing 1,2,3-triazole.	Pol Preprints (Am Chem Soc, Division Polymer Chem). 46(2):1014-1015.	Polymer synthesis.
2005	Wang S., Wei X., Du L., Zhuang H.	Determination of bisphenol A using a flow injection inhibitory chemiluminescence method.	Luminescence. 20(1):46-50.	Analytical paper.
2005	Wang X. Q., Cui S., Liu S., Yin D., Wang L.	Holographic QSAR of environmental estrogens.	Science in China, Series B: Chemistry. 48(2):156-161.	QSAR study.
2005	Wang X., Liu N., Cao H., Liu W., Chen C., Zhang W., Wei Y.	Chiral crystal structure of racemic binaphthyl Poly(ether ketone) macrocycles.	Macromolecular Rapid Comm. 26(7):554-557.	Polymer.
2005	Wang Y., Hu W., Cao Z., Fu X., Zhu T.	Occurrence of endocrine-disrupting compounds in reclaimed water from Tianjin, China.	Anal Bioanal Chem. 383(5):857-63.	Analytical.paper.
2005	Warbritton R.	BPA: Acute Toxicity Test (96 hours) with the Giant Ramshorn Snail, *Marisa cornuarietis*, determined under static renewal test conditions.	Unpublished report, ABC Laboratories Study Number 50017, ABC Laboratories, Columbia, MO.	Acute tox to snails would not affect outcome. RAR discusses chronic exposures only.
2005	Watabe Y., Hosoya K., Tanaka N., Kondo T., Morita M., Kubo T.	LC/MS determination of BPA in river water using a surface-modified molecularly-imprinted polymer as an on-line pretreatment device.	Analytical and Bioanalytical Chemistry. 381(6):1193-1198.	Analytical paper.
2005	Watabe Y., Hosoya K., Tanaka N., Kubo T., Kondo T., Morita M.	Novel surface modified molecularly imprinted polymer focused on the removal of interference in environmental water samples for chromatographic determination.	J Chromatogr A. 1073(1-2): 363-70.	Chromatography.
2005	Watabe Y., Hosoya K., Tanaka N., Kubo T., Kondo T., Morita M.	Shielded molecularly imprinted polymers prepared with a selective surface modification.	J Polymer Science, Part A: Polymer Chemistry. 43(10): 2048-2060.	Polymers.
2005	Watanabe E., Eun H., Baba K., Arao T., Endo S., Ueji M., Ishii Y.	Synthesis of haptens for development of antibodies to alkylphenols and evaluation and optimization of a selected antibody for ELISA development.	J Agric Food Chem. 53(19): 7395-403.	Bioanalytical paper.
2005	Watanabe, M., Mitani, N., Ishii, N., and Miki, K.	Erratum: A mutation in a cuticle collagen causes hypersensitivity to the endocrine disrupting chemical, bisphenol A, in Caenorhabditis elegans.	Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis. 578(1-2):436.	Correction to paper already included.
2005	Watanabe, N., Ishibashi, H., Miyazaki, H., Hirano, M., Chihiro, K., Takao, Y., Nishimura T., Arizono, K.	Combination effects of estradiol-17ß, 4-t-octylphenol and bisphenol A on the reproduction of medaka.	8th Annual Meeting Japan Soc Endocrine Disrupters Research, Prog and Abs, 27-29, Sept. 2005.	Mixture toxicity
2005	Watermann B. T., Daehne B., Sievers S., Dannenberg R., Overbeke J. C., Klijnstra J. W., Heemken O.	Bioassays and selected chemical analysis of biocide-free antifouling coatings.	Chemosphere. 60(11):1530-41.	No BPA effects reported.

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2005	Webb L. J., Miles K. K., Auyeung D. J., Kessler F. K., Ritter J. K.	Analysis of substrate specificities and tissue expression of rat UDP-glucuronosyl transferases UGT1A7 and UGT1A8.	Drug Metabolism and Disposition. 33(1):77-82.	Mammalian study.
2005	Weber S., Leuschner P., Kaempfer P., Dott W., Hollender J.	Degradation of estradiol and ethinyl estradiol by activated sludge and by a defined mixed culture.	Appl Microbiol & Biotech. 67(1):106-112.	Non-environmental degradation.
2005	Weltje L., vom Saal F. S., Oehlmann J.	Reproductive stimulation by low doses of xenoestrogens contrasts with the view of hormesis as an adaptive response.	Hum Exp Toxicol. 24(9): 431-7.	Effects of xenoestrogens on human reproduction.
2005	Westerhoff, P., Yoon, Y., Snyder, S., and Wert, E.	Fate of endocrine-disruptor, pharmaceutical, and personal care product chemicals during simulated drinking water treatment processes.	Environmental Science and Technology. 39(17):6649-6663.	Water purification.
2005	Wetherill Y. B., Fisher N. L., Staubach A., Danielsen M., de Vere White R. W., Knudsen K. E.	Xenoestrogen action in prostate cancer: Pleiotropic effects dependent on androgen receptor status.	Cancer Res. 65(1):54-65.	Human health study.
2005	Wong K. O., Leo L. W., Seah H. L.	Dietary exposure assessment of infants to bisphenol A from the use of polycarbonate baby milk bottles.	Food Addit Contam. 22(3):280-8.	Human exposure.
2005	Wozniak A. L., Bulayeva N. N., Watson C. S.	Xenoestrogens at picomolar to nanomolar concentrations trigger membrane estrogen receptor-□-mediated Ca^{2+}fluxes and prolactin release in GH3/B6 pituitary tumor cells.	Environmental Health Perspectives. 113(4):431-439.	Cell assay.
2005	Xie, J.	Analysis of Xenopus laevis claudius (Xcla) tight junction genes in development.	Developmental Biology. 283(2):692-693.	Gene assay.
2005	Xu J. -z., Jiang N. -z., Zhang J., Jiang R. -s.	Synthesis of bisphenols carrying long hydrocarbon side chains.	Chem Research in Chinese Universities. 21(1):65-68.	Paper looks at derivatives of BPA.
2005	Xu J., Wong C. P.	Dielectric behavior of ultrahigh-k carbon black composites for embedded capacitor applications.	Proceedings - Electronic Comp & Tech Conf 55th (Vol. 2), 1864-1869.	Polymers.
2005	Xu L. C., Sun H., Chen J. F., Bian Q., Qian J., Song L., Wang X. R.	Evaluation of androgen receptor transcriptional activities of bisphenol A, octylphenol and nonylphenol *in vitro*.	Toxicology. 216(2-3):197-203.	Paper focuses on transcriptional activities of BPA.
2005	Yamashita U., Sugiura T., Yoshida Y., Kuroda E.	Effect of endocrine disrupters on macrophage functions *in vitro*.	Journal of UOEH. 27(1):1-10.	Macrophge functions.
2005	Yamazaki N., Washio I., Shibasaki Y., Ueda M.	Facile synthesis of poly(phenylene-ether) dendrimers from unprotected AB2-building block using thionyl chloride as a condensing agent.	Polymer Preprints (Am Chemical Society, Division of Polymer Chemistry). 46(1): 645-646.	Polymers.

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2005	Yanagihara N., Toyohira Y., Ueno S., Tsutsui M., Utsunomiya K., Liu M., Tanaka K.	Stimulation of catecholamine synthesis by environmental estrogenic pollutants.	Endocrinology. 146(1):265-272.	Paper discusses catecholamine synthesis.
2005	Yang C. -P., Chen R. -S., Chen K. -H.	Organosoluble and light-colored fluorinated polyimides based on 2,2-bis[4-(4-amino-2-Trifluoromethyl phenoxy)phenyl]propane and aromatic dianhydrides.	J Applied Polymer Science. 95(4):922-935.	Polymers.
2005	Yang F. -X., Xu Y., Pfister G., Henkelmann B., Schramm K. -W.	Nonylphenol, bisphenol-A and DDTs in Lake Donghu, China.	Fresenius Environmental Bulletin. 14(3):173-180.	Possible levels in China.
2005	Yang K. L., Zongbin M. M., Zhang X., Zhao C., Nishi N.	Molecularly imprinted polyether-sulfone microspheres for the binding and recognition of bisphenol A.	Analytica Chimica Acta. 546(1):30-36.	Analytical paper.
2005	Yasuda S., Wu P. -S., Okabe M., Tachibana H., Yamada K.	Tissue-specific distribution of genistein, daidzein and bisphenol A in male Sprague-Dawley rats after intragastric administration.	Food Science and Technology Research. 11(2):187-193.	Mammalian study.
2005	Ye X., Kuklenyik Z., Needham L. L., Calafat A. M.	Quantification of urinary conjugates of bisphenol A, 2,5-dichlorophenol, and 2-hydroxy-4-methoxybenzo phenone in humans by online solid phase extraction- high performance liquid chromatography-tandem mass spectrometry.	Anal Bioanal Chem. 383(4):638-44.	Analytical paper.
2005	Ye X., Kuklenyik Z., Needham L. L., Calafat A. M.	Automated on-line column-switching HPLC-MS/MS method with peak focusing for the determination of nine environmental phenols in urine.	Anal Chem. 77(16):5407-13.	Analytical paper.
2005	Yoshino T., Kato F., Takeyama H., Nakai M., Yakabe Y., Matsunaga T.	Development of a novel method for screening of estrogenic compounds using nano-sized bacterial magnetic particles displaying estrogen receptor.	Analytica Chimica Acta. 532(2):105-111.	Analytical paper.
2005	Yoshioka T., Sugawara K., Mizoguchi T., Okuwaki A.	Chemical recycling of polycarbonate to raw materials by thermal decomposition with calcium hydroxide/steam.	Chem Letters. 4(3):282-283.	Paper looks at polycarbonate recycling.
2005	Zandi-Zand R., Ershad-Langroudi A., Rahimi A.	Organic-inorganic hybrid coatings for corrosion protection of 1050 aluminum alloy.	J Non-Crystalline Solids. 351(14&15):1307-1311.	Paper looks at polymers.
2005	Zeng Z., Shan T., Tong Y., Lam S. H., Gong Z.	Development of estrogen-responsive transgenic medaka for environmental monitoring of endocrine disrupters.	Environ Sci Technol. 39(22):9001-8.	Development of fish strain for monitoring.
2005	Zhan M., Yang X., Xian Q., Kong L.	Photosenstized degradation of bisphenol A involving reactive oxygen species in the presence of humic substances.	Chemosphere, 63, 378-386	Possible small effect on regional PECs only

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2005	Zhao C. Y., Zhang R. S., Zhang H. X., Xue C. X., Liu H. X., Liu M. C., Hu, Z. D., Fan B. T.	QSAR study of natural, synthetic and environmental endocrine disrupting compounds for binding to the androgen receptor.	SAR and QSAR in Env Res. 16(4):349-367.	QSAR study.
2005	Zhao Y., Foryst-Ludwig A., Bruemmer D., Culman J., Bader M., Unger T., Kintscher U.	Angiotensin II induces peroxisome proliferator-activated receptor gamma in PC12W cells via angiotensin type 2 receptor activation.	J Neurochem. 94(5):1395-401.	Cellular study.
2005	Zhou X., Andrienko D., Delle Site L., Kremer K.	Dynamic surface decoupling in a sheared polymer melt.	Europhysics Letters. 70(2): 264-270.	Polymers.
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2005	Zoeller R. T.	Environmental chemicals as thyroid hormone analogues: new studies indicate that thyroid hormone receptors are targets of industrial chemicals?	Mol Cell Endocrinol. 242(1-2):10-5. Review.	Mammalian study.
2005	Zoeller R. T., Bansal R., Parris C.	Bisphenol-A, an environmental contaminant that acts as a thyroid hormone receptor antagonist *in vitro*, increases serum thyroxine, and alters RC3/neurogranin expression in the developing rat brain.	Endocrinology. 146(2):607-612.	Mammalian study.
2005	Zsarnovszky A., Le H. H., Wang H. S., Belcher S. M.	Ontogeny of rapid estrogen-mediated extracellular signal-regulated kinase signaling in the rat cerebellar cortex: potent nongenomic agonist and endocrine disrupting activity of the xenoestrogen bisphenol A.	Endocrinology. 146(12):5388-96.	Mammalian study.
2004	Benijts T., Lambert W., De Leenheer A.	Analysis of multiple endocrine disruptors in environmental waters via wide-spectrum solid-phase extraction and dual-polarity ionization LC-Ion Trap-MS/MS.	Analytical Chemistry. 76(3):704-711.	Analytical paper.
2004	Chin Y-P., Miller P. L.,Cawley K., Weavers L. K.	Photosensitized degrdadation of bisphenol A by dissolved organic matter.	Environ. Sci. Technol., 38, 5888-5894	Possible small effect on regional PECs only
2004	Eriksson J., Rahm S., Green N., Bergman A., Jakobsson E.	Photochemical transformation of tetrabromobpisheol A and related phenols in water.	Chemosphere, 63, 117-126	Not environmental conditions
2004	Hernando M. D., Mezcua M., Gomez M. J., Malato O., Aguera A., Fernandez-Alba A. R.	Comparative study of analytical methods involving gas chromatography-mass spectrometry after derivatization and gas chromatography-tandem mass spectrometry for the determination of selected endocrine disrupting compounds in wastewaters.	J Chromatography A. 1047(1):129-135.	Wastewater.
2004	Jacobsen B. N., Kjersgaard D., Winther-Nielsen M., Gustavson K.	Combined chemical analyses and biomonitoring at Avedoere wastewater treatment plant in 2002.	Water Science and Technology. 50(5):37-43.	Wastewater treatment plant.

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2004	Sone K., Hinago M., Kitayama A., Morokuma J., Ueno N., Watanabe H., Iguchi T.	Effects of 17β-estradiol, nonylphenol, and bisphenol-A on developing *Xenopus laevis* embryos.	Gen. Comp. Endocrinol. 138:228-236.	Covered elsewhere.
2004	Stehmann A., Meesters R. J. W., Schroeder H. Fr.	Mass spectrometric analytical methods for the determination of endocrine disrupting chemicals (EDCs).	Water Science and Tech. 50(5):165-171.	Paper looks at analytical methods.
2003	Arbeli Z., Ronen Z.	Enrichment of a microbial culture capable of reductive debromination of the flame retardant tetrabromobisphenol-A, and identification of the intermediate metabolites produced in the process.	Biodegradation. 14:385-395.	TBBPA reference.
2003	Arizono K., Ura K., Tominaga N., Kai T., Kohara Y., Iguchi T.	*C. elegans* as a tool for environmental toxicology.	First Toxicogenomics International Forum Tokyo, Japan October 31 - November 01, 2001. Toxicogenomics. 129-134.	*C elegans*, plate exposure so not relevant for assessment.
2003	Fuerhacker M.	Bisphenol A emission factors from industrial sources and elimination rates in a sewage treatment plant.	Water Science and Technology. 47(10):117-122.	Paper deals with sewage treatment plants.
2003	Furuya M., Sasaki F., Hassanin A. M., Kuwahara S., Tsukamoto Y.	Effects of bisphenol-A on the growth of comb and testes of male chicken.	The Canadian Journal of Veterinary Research. 67(1):68-71.	Injection, not relevant route of exposure (chicken).
2003	Ishihara K., Nakajima N.	Improvement of marine environmental pollution using eco-system: decomposition and recovery of endocrine disrupting chemicals by marine phyto- and zooplanktons.	J Molecular Catalysis B: Enzymatic. 23:419-424.	Sorption study, does not effect the conclusions.
2003	Ohtani Y., Shimada Y., Shiraishi F., Kozawa K.	Variation of estrogenic activities during the bio-degradation of bisphenol A.	Kankyo Kagaku. 13:1027-1031.	Endocrine activity of breakdown products.
2003	Sashihara K., Yamashita T., Takagi T., Nakanishi T., Furuse M.	Effects of Intrayolk Injection of Bisphenol A on Hatchability and Sex Ratio in Chickens.	Journal of Applied Animal Research. 24:113-122.	More recent study by same authors in update (chicken).
2002	Nieminen P., Lindstrom-Seppa P., Juntunen M., Asikainen J., Mustonen A., Karonen S., Mussalo-Rauhamaa H., Kukkonen J.V.K.	In vivo effects of bisphenol A on the polecat (*Mustela putorius*).	Journal of Toxicology and Environmental Health, Part A., 65(13), 933-945.	Limited secondary poisoning section to standard org. Would not affect assessment.

Year	Authors	Title	Reference	Notes
2002	Nieminen P., Lindstrom-Seppa P., Mustonen A., Mussalo-Rauhamaa H., Kukkonen J.V.K.	Bisphenol A Affects Endocrine Physiology and Biotransformation Enzyme Activities of the Field Vole (*Microtus agrestis*).	General and Comparative Endocrinology. 126:183-189.	Limited secondary poisoning section to standard organsisms. Not relevant route of exposure, injection.
2002	Staples C. A., Woodburn K., Caspers N., Hall A. T., Klečka G. M.	A weight of evidence approach to the aquatic hazard assessment of bisphenol A.	Hum. Ecol. Risk Assess. 8:1083-1105.	Review paper, no new data reported.
2001	Ishibashi H., Tachibana K., Tsuchimoto M., Soyano K., Ishibashi Y., Nagae M., Kohra S., Takao Y., Tominaga N., Arizono K.	In Vivo Testing System for Determining the Estrogenic Activity of Endocrine-Disrupting Chemicals (EDCs) in Goldfish (*Carassius auratus*).	Journal of Health Science. 47(2):213-218.	VTG goldfish. Nothing significantly different to what is already included.
2001	Kishida M., McLellan M., Miranda J. A., Callard G.V.	Estrogen and xenoestrogens upregulate the brain aromatase isoform (P450aromB) and perturb markers of early development in zebrafish (*Danio rerio*).	Comparative Biochemistry and Physiology. 129B:261-268.	Not significantly different to what is already included.
2001	Spengler P., Korner W., Metzger J. W.	Substances with estrogenic activity in effluents of sewage treatment plants in south western Germany. 1. Chemical analysis.	Env Tox and Chem. 20(10):2133-2141.	Sewage treatment plants.
2000	Bolz U., Koerner Q., Hagenmaier H.	Development and validation of a GC/MS method for determination of phenolic xenoestrogens in aquatic systems.	Chemosphere. 40(9-11):929-935.	Analytical paper.
2000	Fuerhacker M., Scharf S., Weber H.	Bisphenol A: emissions from point sources.	Chemosphere. 41(5):751-756.	Covered elsewhere.
2000	Koerner W., Bolz U., Sussmuth W., Hiller G., Schuller W., Hanf V., Hagenmaier H.	Input/output balance of estrogenic active compounds in a major municipal sewage plant in Germany.	Chemosphere. 40(9-11):1131-1142.	Wastewater treatment.
2000	Ronen Z., Abeliovich A.	Anaerobic-aerobic process for microbial degradation of tetrabromobisphenol A.	Applied Environ Microbiol. 66:2372-2378.	TBBPA reference.
2000	Weltin D.	Part 1. Mobility and fate of endocrine disrupters in soil. Lysimeter and run-off studies.	Final Report. Contract no ENV4-CT97-0473.	Sorption study, does not affect the conclusions.
1999	Caunter J. E., Evans M. R., Sumpter J., Sohoni A.	Bisphenol A: Effect on the embryo-larval developmental stage of the fathead minnow (*Pimephales promelas*).	Unpublished report, Brixham Environmental Laboratories, Brixham, UK.	Range finder for study not included in RAR, would not change outcome.

Year	Authors	Title	Reference	Notes
1999	Celius T., Haugen T.B., Grotmol T., Walther B.T.	A sensitive zonagenetic assay for rapid in Vitro assessment of estrogenic potency of xenobiotics and mycotoxins.	Environmental Health Perspectives. 107(1):63-68.	Not significantly different to what is already included.
1999	Islinger M., Pawlowski S., Hollert H., Volkl A., Braunbeck T.	Measurement of vitellogenin-mRNA expression in primary cultures of rainbow trout hepatocytes in a non-radioactive dot blot/RNAse protection-assay.	The Science of the Total Environment. 233:109-122.	Not significantly different to what is already included.
1999	Koerner W., Spengler P., Bolz U., Hagenmaier H., Metzger J.	Monitoring of estrogenic substances in sewage plant effluents by biological and chemical analysis.	Organohalogen Compounds. 42:29-32.	Wastewater.
1999	Lutz I., Kloas W.	Amphibians as a model to study endocrine disruptors: I. Environmental pollution and estrogen receptor binding.	The Science of the Total Environment. 225: 49-57.	Not significantly different to what is already included.
1989	Bayer AG.	Biodegradation study.	Unpublished report by Bayer AG.	Biodegradation, does not affect conclusions.
1989	Bayer AG.	Acute toxicity for *Brachydanio rerio*.	Unpublished report by Bayer AG, 114A/89F.	RAR has value from Bayer for *B. rerio*, but not same value. Would not affect assessment.
1984	Alexander H. C.	Analysis of Bisphenol A (p,p') in Lagoon Feed and 303 Outfall.	Unpublished report of the Dow Chemical Company.	Biotreatment pond, unusual treatment, not useable in the assessment.

European Commission

EUR 24588 EN – Joint Research Centre – Institute for Health and Consumer Protection
Title: 4,4' – Isopropylidenediphenol (Bisphenol – A)
Editor(s): K. Aschberger, S. Munn, H. Olsson, S. Pakalin, , G. Pellegrini, S. Vegro and A. B. Paya Perez
Luxembourg: Office for Official Publications of the European Communities
2010 – VIII pp and 204 pp. – 17.0 x 24.0 cm
EUR – Scientific and Technical Research series – ISSN 1831-9424
ISBN 978-92-79-17541-1
DOI 10.2788/40195

Abstract

A risk assessment of 4,4'-isopropylidenediphenol (Bisphenol-A, BPA) produced in accordance with Council Regulation (EEC) 793/93[27] was published in 2003[28]. This Addendum (2008) has been prepared by the UK in the frame of Council Regulation (EEC) No. 793/93 on the evaluation and control of the risks of existing substances, following the principles for assessment of the risks to man and the environment, laid down in Commission Regulation (EC) No. 1488/94. The evaluation considers the emissions and the resulting exposure to the environment and the human populations in all life cycle steps. Following the exposure assessment, the environmental risk characterisation for each protection goal in the aquatic, terrestrial and atmospheric compartment has been determined.

This Addendum of environmental risk assessment for bisphenol-A, concludes that there is concern to the freshwater and marine aquatic compartments (including sediment, since the equilibrium partitioning approach has been used). Although no risks are indicated using the freshwater and marine PNEC for any scenario, there are still some uncertainties over the potential effects of bisphenol-A on snails, despite the thorough testing undertaken as part of the conclusion (i) programme.

The human health risk assessment for bisphenol-A is reported in Part II.

The format of the report is broadly in line with that of the original (2003) risk assessment. Significant new information is summarised in this updated (2008) risk assessment and a comment is added to indicate how this affects the findings from the original risk assessment.

27 O.J. No. L 084, 05/04/1993 p. 0001 - 0075

28 European Union Risk Assessment Report: 4,4'-isopropylidenediphenol (BPA) – 3rd Priority List, Volume 37. European Commission Joint Research Centre, EUR 20843 EN.

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Aluehallintovirasto
Etelä-Suomi

Päätös
Nro 71/2013/1
Dnro ESAVI/118/04.08/2012
Annettu julkipanon jälkeen
3.4.2013

ASIA

Ympäristönsuojelulain mukainen hakemus, joka koskee Jujo Thermal Oy:n Kauttuan paperitehtaan ympäristölupapäätöksen lupamääräysten tarkistamista, Eura.

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Y-tunnus: 0842018-1

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HAKIJA

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PL 92
27501 KAUTTUA

Y-tunnus: 0842018-1

TOIMINTA JA SEN SIJAINTI

Jujo Thermal Oy:n paperitehdas sijaitsee Euran kunnassa Jujo Thermal Oy:n omistamilla kiinteistöillä r:no 050-406-0013-0053 (Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n paperitehtaat) ja r:no 050-406-0002-0591 (Hiilisuuli / jätevedenpuhdistamo). Myös viereisen voimalaitoksen kiinteistö kuuluu Jujo Thermal Oy:n omistukseen.

Kaikilla paperikoneilla (Jujo Thermal Oy:n PK1 ja PK2, sekä Ahlstrom Tampere Oy:n PK4) on yhteinen massaosasto. Selluloosan pulpperoinnissa voidaan kuitenkin käyttää kunkin paperikoneen omia kierrätettyjä vesiä. Paperin käsittelyyn, varastointiin ja muodostuvien jätevesien käsittelyyn liittyvät toiminnat ovat pääosin yhteisiä. Samassa kiinteistössä toimii lisäksi paperitehtaille tukipalveluja tuottavia yrityksiä.

Tehtaan käyntiosoite on Paperitehtaantie 15, 27500 Kauttua. Toimialatunnus on 17120.

HAKEMUKSEN VIREILLETULO

Hakemus on tullut vireille Etelä-Suomen aluehallintovirastossa 4.6.2012.

LUVAN HAKEMISEN PERUSTE

Ympäristönsuojelulain 28 §:n 1 momentti

Ympäristönsuojeluasetuksen 1 §:n 1 momentin kohdat 1 a) ja 13 a)

Länsi-Suomen ympäristölupaviraston 29.12.2005 myöntämä ympäristölupa (nrot 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391).

LUPAVIRANOMAISEN TOIMIVALTA

Etelä-Suomen aluehallintovirasto on toimivaltainen viranomainen ympäristönsuojeluasetuksen 5 §:n 1 momentin kohdan 1 a) perusteella.

TOIMINTAA KOSKEVAT LUVAT, PÄÄTÖKSET JA SOPIMUKSET

Voimassa oleva ympäristölupa

Länsi-Suomen ympäristölupaviraston Ahlstrom Kauttua Oy:lle ja Jujo Thermal Oy:lle 29.12.2005 myöntämä ympäristönsuojelulain mukainen ympäristölupapäätös (nrot 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391).

Vaasan hallinto-oikeuden Ahlstrom Kauttua Oy:lle ja Jujo Thermal Oy:lle yhteisesti 23.4.2007 antama päätös koskien ympäristölupapäätöksen johdosta jätettyjä valituksia (nro 07/0132/1, dnro 00787-00789/06/5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.

Muut luvat ja korvauspäätökset

Länsi-Suomen vesioikeuden 29.1.1992 A. Ahlström Osakeyhtiölle antama päätös (nro 6/1992/4, dnro 85394) koskien jätevesien johtamista edelleen Eurajokeen. Päätöksessä on määrätty maksettavaksi kertakaikkiset korvaukset vesialueiden kalataloudellisen tuoton alenemisesta vesialueiden omistajille vuoden 1986 alusta alkaen.

Etelä-Suomen aluehallintoviraston Jujo Thermal Oy:lle 12.11.2010 myöntämä ympäristönsuojelulain 58 §:n mukainen päätös (nro 48/2010/1, dnro ESAVI/18/04.08/2010) ympäristömelua koskevan lupamääräyksen muuttamiseksi.

Vaasan hallinto-oikeuden 10.11.2011 antama päätös koskien edellisen päätöksen johdosta jätettyjä valituksia (nro 11/0311/1, dnro 00226/11/-5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.

Energiamarkkinaviraston 15.3.2010 antama kasvihuonekaasujen päästölupa (dnro 11/310/2010).

Muut korvauksia koskevat päätökset

Länsi-Suomen vesioikeuden 29.1.1992 Euran kunnalle antama päätös (nro 10/1992/4, dnro 90377) koskien jätevesien johtamista edelleen Eurajokeen. Päätöksessä on määrätty maksettavaksi kertakaikkiset korvaukset vesialueiden kalataloudellisen tuoton alenemisesta vesialueiden omistajille vuoden 1986 alusta alkaen.

MUUT PÄÄTÖKSET, VIRANOMAISMÄÄRÄYKSET JA SOPIMUKSET

Tarkkailua koskevat päätökset

Turun vesi- ja ympäristöpiiri on 21.4.1994 päivätyllä kirjeellä (dnro 0292A278/111) hyväksynyt Eurajoen ja Eurajoensalmen vesistön yhteistarkkailuohjelman.

Lounais-Suomen ympäristökeskus on 28.10.2008 hyväksynyt (nro 99 YLO, dnro LOS-2007-Y-367-121) Eurajoen ja Eurajoensalmen vesistön päivitetyn yhteistarkkailuohjelman.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on 9.6.2011 hyväksynyt (dnro 2104/5723/2011) Eurajoen kalataloudellisen yhteistarkkailuohjelman vuosiksi 2011 – 2019.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on 26.5.2011 pidetyssä neuvottelussa edellyttänyt Jujo Thermal Oy:tä lisäämään kustannuksellaan JVP-Eura Oy:n jätevedenpuhdistamon tarkkailuohjelmaan bisfenoli-A:n tarkkailun.

Hakemuksen liitteenä on 31.3.2006 laadittu ja 5.3.2013 päivitetty käyttö-, päästö- ja kuormitustarkkailusuunnitelma. Suunnitelmaa ei ole käsitelty viranomaisessa.

Muut asian käsittelyyn liittyvät luvat

Ahlstrom Tampere Oy:n lupapäätökset

Länsi-Suomen ympäristölupaviraston 29.12.2005 samassa kiinteistössä sijaitsevalle Ahlstrom Tampere Oy:n Kauttuan paperitehtaalle myöntämä ympäristölupa (nro 53/2005/1, dnro LSY-2005-Y-381).

Vaasan hallinto-oikeuden Ahlstrom Kauttua Oy:n Kauttuan tehtaalle 23.4.2007 antama päätös koskien ympäristölupapäätöksen johdosta jätettyjä valituksia (Nro 07/0138/1, Dnro 00790-00792/06/5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.

Etelä-Suomen aluehallintoviraston Ahlstrom Tampere Oy:lle 12.11.2010 myöntämä ympäristönsuojelulain 58 §:n mukainen päätös (nro 47/2010/1, dnro ESAVI/17/04.08/2010) ympäristömelua koskevan lupamääräyksen muuttamiseksi.

Vaasan hallinto-oikeuden 10.11.2011 antama päätös koskien edellisen päätöksen johdosta jätettyjä valituksia (nro 11/0310/1, dnro 00225/11/-5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.

Voimalaitoksen lupapäätökset

Länsi-Suomen ympäristölupaviraston Fortum Power and Heat Oy:lle 4.7.2005 myöntämä ympäristölupa (nro 11/2005/2, dnro LSY-2004-Y-208).

Länsi-Suomen ympäristölupaviraston 2.9.2005 antama päätös edellisen päätöksen täytäntöönpanemiseksi muutoksenhausta huolimatta (nro 18/2005/2, dnro LSY-2005-Y-252).

Vaasan hallinto-oikeuden 20.4.2007 antama päätös koskien em. ympäristöluvan johdosta jätettyjä valituksia (nro 07/0130/1, dnro 01738/05/5103).

Jätevesiyhtiön lainvoimainen lupapäätös

Länsi-Suomen ympäristölupaviraston 27.12.2002 Euran kunnalle perustettavan jätevesiyhtiön nimiin myöntämä ympäristölupa (nro 78/2002/4, dnro LSY-2002-Y-12).

Jätevesiyhtiön valituksenalainen lupapäätös

Etelä-Suomen aluehallintoviraston JVP-Eura Oy:lle 23.1.2013 myöntämä valituksenalainen ympäristölupa (nro 11/2013/1, dnro ESAVI/27/04.08/-2011), joka koskee yhdyskunta- ja teollisuusjätevedenpuhdistamon toiminnan muuttamista ja 27.12.2002 annetun ympäristöluvan lupamääräysten tarkistamista.

Muut jätevesiyhtiön toimintaa koskevat päätökset

Länsi-Suomen ympäristölupavirasto on antanut 8.1.2008 päätöksen (nro 1/2008/1, dnro LSY-2007-Y-361) koskien koeluonteista toimintaa jätevedenpuhdistamolla. Päätöksessä ympäristölupavirasto on määrännyt JVP-Eura Oy:n noudattamaan myös koeluonteisen toiminnan aikana lainvoimaisen ympäristölupapäätöksen määräyksiä. Koeluonteinen toiminta on koskenut esiselkeytysaltaan ottamista käyttöön paperiteollisuuden jätevesien esikäsittelyssä ja samalla kuntalinjan jätevesien (mukaan lukien nykyisen HK Ruokatalo Oy:n jätevedet) johtamista välppäyksen ja hiekanerotuksen jälkeen biologiseen prosessiin ilman erillistä esiselkeytystä. Kokeen tarkoituksena on ollut myös luopua HK Ruokatalo Oy:n broileriteurastamon jätevesien erillisestä biologisesta esikäsittelystä, pois lukien rasvan poisto flotaatiomenetelmää käyttäen.

Länsi-Suomen ympäristölupavirasto on antanut 22.12.2008 päätöksen (dnro LSY-2008-Y-297**,** nro 63/2008/1) koskien koeluonteisen toiminnan määräajan jatkamista. Päätöksessä ympäristölupavirasto on määrännyt JVP-Eura Oy:n noudattamaan myös koeluoteisen toiminnan aikana vuonna 2009 lainvoimaisen ympäristölupapäätöksen määräyksiä.

Etelä-Suomen aluehallintovirasto on 28.5.2010 antanut päätöksen (nro 17/2010/12, dnro ESAVI/424/04.08/2010) toistaiseksi voimassa olevan ympäristölupapäätöksen muuttamisesta. Aluehallintovirasto on jättänyt asian käsittelyn sikseen, koska hakija on peruuttanut hakemuksen.

Muut viranomaismääräykset

Jujo Thermal Oy:n paperitehdas on teollisuuden päästödirektiivin (IED, 2010/75/EU) tarkoittama laitos direktiivin liitteen 1 kohdan 6.1.b perusteella.

Jujo Thermal Oy:n paperitehdas kuuluu epäpuhtauksien päästöjä ja siirtoja koskevan eurooppalaisen rekisterin perustamisesta annetun asetuksen (Euroopan päästörekisteri, E-PRTR, 166/2006/EY) määrittämän raportointivelvollisuuden piiriin liitteen 1 kohdan 6.b) perusteella.

Sopimukset

Yhtiöllä on sopimus teollisuus- ja saniteettijätevesien käsittelystä JVP-Eura Oy:n jätevedenpuhdistamolla.

Vakuutukset

Jujo Thermal Oy:llä on lakisääteinen ympäristövahinkovakuutus vakuutusyhtiö Pohjolassa (nro 48-01390-2).

ALUEEN KAAVOITUSTILANNE

Tehdas sijaitsee alueella, joka on vuonna 1994 hyväksytyssä yleiskaavassa varattu teollisuus- ja varastoalueeksi (T). Eurajoen länsipuolella, tehtaan luoteispuolella, on osayleiskaavassa pienehkö alue merkinnällä AP/s (pientalovaltainen asuntoalue, jolla ympäristö säilytetään), tehtaan länsi- ja eteläpuolella on maatalousaluetta (MT) ja maa- ja metsätalousvaltaista aluetta (M). Tehtaantien eteläpuolella on pientalovaltainen asuntoalue (PA). Eurajoen itäpuolella, tehtaan kaakkoispuolella, on yksityisten palvelujen ja hallinnon aluetta, jolla ympäristö säilytetään (PK/s). Sepäntien pohjoispuolella on samalla kaavamerkinnällä (PK/s) alue ja siitä luoteeseen Sepäntien varressa pientalovaltainen asuntoalue, jolla ympäristö säilytetään (AP/s).

Alueella on 21.3.2005 hyväksytty asemakaava, jossa teollisuuskiinteistö on osoitettu nykyiseen käyttöönsä. Asemakaava noudattelee osayleiskaavaa, mutta sisältää myös uutta asuntorakentamista Varkaudenmäelle ja asunto-, liike- ja toimistorakentamista Sepäntien varteen. Kaavassa on asetettu meluun liittyviä kaavamääräyksiä vähentämään erityisesti asuntojen sisämelua.

TOIMINNAN SIJAINTIPAIKKA JA SEN YMPÄRISTÖ

Toiminnan sijaintipaikka

Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n paperitehtaat sijaitsevat Euran kunnan Kauttuan taajamassa Eurajoen varrella, vajaan kilometrin etäisyydellä Pyhäjärvestä. Alueella on ollut teollista toimintaa yhtäjaksoisesti yli 300 vuoden ajan. Rautaruukista alkanut teollisuus on synnyttänyt paikalle asumis- ja teollisuusympäristön, Kauttuan ruukinpuiston. Paperin valmistusta on harjoitettu alueella vuodesta 1908.

Alueen nykyinen rakennuskanta on syntynyt noin 200 vuoden aikana, ja lähinnä tehdasta, sen itäpuolella Sepäntien varrella sijaitsee 1800 ja 1900 -lukujen vaihteen asuinrakennuksia, jotka ovat edelleen asuinkäytössä.

Jätevedenpuhdistamon sijaintipaikka ja jäteveden purkupaikka

Jätevesiyhtiön jätevedenpuhdistamo sijaitsee Euran kunnan Sorkkisten kylässä Kunta-Järstä -nimisellä tilalla osoitteessa Harjavallantie 130, 27500 Eura. Jätevedenpuhdistamossa käsitellyt jätevedet johdetaan purkuputkella Eurajokeen puhdistamon kohdalla noin 2 km Euran keskustan alapuolella.

Yleiskuvaus vesistöstä

Eurajoki saa alkunsa Säkylän Pyhäjärvestä. Joki virtaa noin 50 kilometrin matkan maatalousalueella laskien lopulta Selkämereen pitkän ja kapean Eurajoensalmen kautta. Vesireitin suurehkon pudotuskorkeuden ansiosta (45 m) joessa on yhtensä 11 koskea, joista Eurakoskessa, Paneliankoskessa ja Pappilankoskessa toimii vesivoimalaitos. Joen varsi on kohtalaisen asuttua, merkittävimmät asutuskeskittymät ovat Euran kuntakeskus, Kiukainen, Irjanteen kylä ja Eurajoen kuntakeskus.

Eurajoki eroaa muista Lounais-Suomen joista siinä mielessä, että sen valuma-alueen (1 336 km^2) järvi-% on varsin suuri (13,8 %). Kauttuankoskessa toimiikin säännöstelypato, jolla säädellään Pyhäjärven veden korkeutta. Säännöstely vaikuttaa voimakkaasti Eurajoen virtaamaan joen yläosalla. Eurajoen merkittävin sivuhaara on Köyliönjoki, joka saa alkunsa Köyliönjärvestä. Köyliönjoki yhtyy Eurajokeen Kiukaisissa lisäten samalla joen virtaamaa. Eurajoen tavoin myös Köyliönjoen valuma-alueella on paljon maataloutta. Eurajoen toinen hieman suurempi sivuhaara on Juvanjoki, joka laskee Eurajokeen Eurajoen kirkonkylän kohdalta. Varsinaisen jokiosuuden virtaamaolosuhteisiin vaikutetaan Paneliankosken ja Pappilankosken voimalaitosten säännöstelytoimilla.

Pyhäjärven luusuassa Kauttuankosken tasalla valuma-alueen pinta-ala on 616 km^2 ja järvisyys 25,2 %.

Vesistön virtaamat

Eurajoen virtaamiin vaikuttavat sääolosuhteiden lisäksi Pyhäjärven säännöstely ja veden johtaminen Lapinjokeen Eurajoen alajuoksulta. Jäteveden purkupaikan yläpuolella Kauttuankoskessa keski-, keskiali- ja alivirtaamat ovat vuosina 1965 – 1990 olleet 4,9 m^3/s, 1,8 m^3/s ja 0,7 m^3/s. Vuosina 1990 – 2010 Eurajoen Pappilankosken keskivirtaama oli 8,4 m^3/s, keskiylivirtaama 36 m^3/s ja keskialivirtaama 0,86 m^3/s. Viiden viime vuoden aikana vuosina 2007 – 2011 vastaavat luvut olivat 8,6 m^3/s, 35 m^3/s ja 0,81 m^3/s.

Vesistökuormitus

Satakunnan pintavesien toimenpideohjelmassa vuoteen 2015 todetaan Eurajoen vesistöalueen vesistökuormituksesta mm. seuraavaa: Eurajoen vesistöalueen kokonaisainevirtaama on 18 tonnia fosforia ja 572 tonnia typpeä vuodessa. Suurin osa Pyhäjärveen tulevasta kuormituksesta jää Pyhäjärveen. Pyhäjärvestä poistuu vuosittain Kauttuan kosken kautta keski-

määrin noin 2,4 tonnia fosforia ja 65,6 tonnia typpeä. Satakunnan pintavesien toimenpideohjelmassa vuoteen 2015 on Eurajoen kuormituksen jakautuminen esitetty seuraavasti:

Kuormittaja	***Kuormituksen jakautuminen lähteittäin***	
	Fosfori (%)	***Typpi (%)***
Hajakuormitus		
Maatalous	52	43
Metsätalous	3	2
Haja-asutus	12	12
Luonnonhuuhtouma	18	20
Laskeuma	7	17
Hulevesi	0,1	0,4
Pistekuormitus		
Yhdyskunnat	7	12
Teollisuus	1	3
Turvetuotanto	0,6	1
Kalankasvatus	-	-
Yhteensä (t/a)	**8**	**339**

Eurajokeen johdetaan JVP-Eura Oy:n jätevedenpuhdistamon lisäksi pistekuormitusta Säkylän kunnan jätevedenpuhdistamolta ja Lännen Tehtaat Oyj:n jätevedenpuhdistamolta noin 2 km JVP-Eura Oy:n jätevedenpuhdistamon purkupaikan yläpuolelle. Teollisuuden ja yhdyskuntien kuormituksen osalta toimenpideohjelmassa on todellista pienemmät kuormitusosuudet.

Vesistön veden laatu

Eurajoen yläosa kuuluu Pyhäjärvestä Köyliönjoen yhtymäkohtaan asti keskisuuriin savimaiden jokiin ja Köyliönjoen alapuolella suuriin savimaiden jokiin. Eurajoen ekologinen luokka on tyydyttävä. Köyliönjoki puolestaan on keskisuuri savimaiden joki, jonka luokka on tyydyttävä. Eurajoen veden laatu on luokiteltu osin tyydyttäväksi, osin välttäväksi. Köyliönjoen ja Pyhäjärveen laskevan Yläneenjoen veden laatu on pääosin välttävää. Pyhäjärven veden laatu kuuluu kuitenkin luokkaan hyvä tai tyydyttävä. Kemiallisen tilan osalta fysikaaliskemiallisen arvion perusteella Eurajoen yläosan laatu on hyvä, mutta alaosan laatu on tyydyttävä tai hyvää huonompi.

Hajakuormituksella ja luonnonhuuhtoumalla on suuri vaikutus Eurajoen veden laatuun etenkin runsasvirtaamaisina aikoina. Joen yläjuoksulla veden laadullinen käyttökelpoisuus on ollut huonoimmillaan vähävirtaamaisina jaksoina. Eurajoen veden laatu muuttuu tarkkailupisteiden 12 ja 14 välillä hyvästä tyydyttäväksi (Savikon alueen oja sekä Säkylän kunnan ja Lännen Tehtaat Oyj:n jätevesien purku) ja pisteiden 16 ja 24 välissä välttäväksi (maatalousalue, haja-asutusta sekä JVP-Eura Oy:n purkupiste). Etenkin bakteeripitoisuus nousee tällä välillä ja Kiukaisissa uimaranta on ollut ajoittain uintikiellossa. JVP-Eura Oy:n yhteispuhdistamon rakentamisen jälkeen vesistön kuorma on ollut pahimmillaan samalla tasolla kuin liittyjien yhteinen kuorma vuosina 1985 – 1997. JVP-Eura Oy:n BOD- ja kiintoainekuor-

mitus on ollut noin kaksinkertainen Säkylän kunnan ja Lännen Tehtaat Oyj:n yhteenlaskettuun kuormitukseen nähden. Typpikuormitus on ollut hieman matalampi ja fosforikuormitus huomattavasti matalampi kuin em. toimijoilla yhdessä.

Happamien sulfaattimaiden valumavesien vaikutuksesta savimineraalien metallit liukenevat, mistä johtuen Eurajoen kadmiumpitoisuus ylittää prioriteettiainedirektiivin laatunormin (0,05 µg/l) ollen vuosina 2001 – 2006 tasoa 0,09 – 0,21 µg/l.

Vesistön käyttömuodot

Kalastus Eurajoessa on ollut ei-ammattimaista, pienimuotoista onki- ja katiskapyyntiä.

Eurajoesta ottavat vettä tehtaiden alapuoliselta jokiosuudelta Rauman kaupunki ja UPM-Kymmene Oyj Rauma. Jälkimmäiset johtavat Eurajoen vettä Pappilankosken patoaltaasta Lapinjokeen ja edelleen Rauman seudulle vähävirtaamaisina jaksoina. Olkiluodon Vesi Oy ottaa ajoittain tarvitsemansa makean veden joen alajuoksulta Tiironkosken yläpuolelta. Lisäksi Eurajoesta otetaan kasteluvettä.

Ilmanlaatu

Pyhäjärviseudun (Eura, Köyliö ja Säkylä) ilman laatuun vaikuttavat pääasiassa teollisuuden ja energiantuotannon sekä lämmityksen rikkidioksidin päästöt ja kaukokulkeutuma. Liikenteen päästöillä on merkitystä typen oksidien ja hiilivetyjen osalta. Alueen teollisuudesta aiheutuu myös mm. hiilivetyjen ja ammoniakin päästöjä. Vuosina 2010 ja 2011 rikkidioksidin raportoitu kokonaispäästö Pyhäjärviseudulla oli 330 – 340 tonnia. Suurimmat pistemäiset päästölähteet alueella ovat Sucros Oy ja Hankkija-Maatalous Oy Säkylässä sekä Fortum Power and Heat Oy:n Kauttuan voimalaitos Eurassa. Lisäksi päästöjä aiheutuu mm. lämpövoimaloista ja valimosta.

Melu

Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n, sekä viereisen Fortum Power and Heat Oy:n toiminnoista, liikenteestä sekä Eurajoen virtaamasta aiheutuu melua, joka ylittää lähimpien asuinkäytössä olevien kiinteistöjen pihapiirissä ja muissa häiriintyvissä kohteissa päiväaikaan (klo 7 – 22) ekvivalenttitason (L_{Aeq}) 55 dB ja/tai yöaikaan (klo 22 – 7) ekvivalenttitason (L_{Aeq}) 50 dB. Etelä-Suomen aluehallintoviraston 12.11.2010 antamassa päätöksessä (Nro 48/2010/1**,** Dnro ESAVI/18/04.08/2010) ympäristömelua koskevan lupamääräyksen muuttamiseksi on määrätty toteuttamaan toimenpiteitä ympäristömelun vähentämiseksi vuoden 2012 loppuun mennessä em. lukuarvojen alle.

Maaperä

Alueella on ollut teollista toimintaa yli 300 vuoden ajan, jona aikana maaperä on voinut pilaantua.

Pohjaveden tila

Paperitehtaat eivät sijaitse tärkeällä pohjavesialueella. Lähin pohjavesialue (Kauttua) sijaitsee noin puolen kilometrin etäisyydellä Eurajoen toisella puolella.

Suojeltavat kohteet

Lähin Natura-alue (Harolanlahti) sijaitsee puoli kilometriä tehtaasta Pyhäjärven pohjoispäässä. Se on sisällytetty Natura 2000 -verkostoon sekä luonto- että lintudirektiivin perusteella.

HAKEMUS

Yleistä

Jujo Thermal Oy osti Ahlstrom Kauttua Oy:n osakkeet vuonna 2005. Ahlstrom Kauttua Oy:n nimi muutettiin tällöin Kauttua Paper Mill Oy:ksi. Vuoden 2009 lopussa Kauttua Paper Mill Oy fuusioitui Jujo Thermal Oy:öön. Paperikone 4:n toiminnot koneineen jäivät Ahlstrom-konserniin kuuluvalle Ahlstrom Tampere Oy:lle.

Jujo Thermal Oy:n paperitehdas valmistaa lämpöherkkää paperia ja toispuoleisesti päällystettyä erikoispaperia kahdella paperikoneella ja kahdella päällystyskoneella. Tehtaan paperinvalmistuskapasiteetti on nykyisillä tuotteilla noin 90 000 tonnia vuodessa. Valmistettu paperi myydään asiakkaille ympäri maailmaa.

Paperikoneiden valmistaman pohjapaperin pääraaka-aineet ovat valkaistu pitkä- ja lyhytkuituinen selluloosa ja kalsiumkarbonaatti. Päällystyskoneilla paperin pintaan laitettavat päällysteet valmistetaan omilla päällystekeittämöillä. Päällysteiden pääraaka-aineita ovat kaoliini, styreenibutadieenilateksi ja erilaiset paperin toimintaan vaikuttavat kemikaalit.

Tehtaan käyttämät raaka-aineet, sähkö- ja lämpöenergia sekä kunnossapito- ja kuljetuspalvelut ostetaan ulkopuolisilta toimittajilta. Lämpöenergian toimittaa Fortum Power and Heat Oy:n Kauttuan voimalaitos, mikä sijaitsee Jujo Thermal Oy:n omistamalla kiinteistöllä.

Tehdas ottaa käyttämänsä raakaveden Eurajoesta ja johtaa syntyvän jäteveden JVP-Eura Oy:n puhdistamolle, minkä yksi osakas Jujo Thermal Oy on. Eurajoesta otettava vesi puhdistetaan flotaatioselkeyttimessä ennen sen käyttöä. Tehtaan oma jätevedenpuhdistamo pidetään käyttökunnossa mahdollisten puhdistamoyhtiön jätevedenpuhdistamon häiriöiden takia. Normaalisti oman puhdistamon altaat toimivat erilaisten pesu- ja päästöti-

lanteiden varoaltaina. Tehtaan jätevesilinjoissa on pH- ja sameusmittaukset, mitkä ohjaavat normaalista poikkeavat vedet varoaltaille automaattisesti. Tehtaan prosesseissa jäähdytykseen käytettyjä puhtaita vesiä ja pihaalueelta tulevia sadevesiä johdetaan tehtaan kohdalta suoraan Eurajokeen.

Ympäristöluvan tarkistushakemuksessa on huomioitu tehtaalla voimassa olevan ympäristöluvan aikana tehdyt muutokset, toteutetun ympäristötarkkailun tulokset, esiintyneet häiriötilanteet ja käytössä olevat kemikaalit. Ympäristölle haitallisten ja vaarallisten kemikaalien esiintymistä jätevesissä on selvitetty mittauksin ja laskennallisesti. Nämä kemikaalit on huomioitu tehtaan ympäristöriskiarvioinneissa.

Voimassa olevan ympäristöluvan aikana tapahtunut suurin muutos on valmistettavan lämpöherkän paperin määrän kasvu ja vastaavasti muiden paperilajien määrän väheneminen. Tämä oli huomioitu jo nykyistä lupaa haettaessa. Lämpöherkän paperin valmistukseen käytettävien kemikaalien käyttö on kasvanut vastaavasti. Jäteveden määrässä ja siitä mitattavissa ominaisuuksissa ei ole hakemuksen perusteella tapahtunut oleellisia muutoksia. Syntyvien kiinteiden jätteiden lajittelua ja kierrätystä on lisätty, minkä seurauksena mm kaatopaikalle menevän jätteen määrää on saatu pienennettyä merkittävästi.

Jujo Thermal Oy:llä on standardiin ISO 14001 perustuva, sertifioitu ympäristöjärjestelmä.

Yleiskuvaus toiminnasta

Jujo Thermal Oy:llä on Kauttualla kaksi paperikonetta ja kaksi päällystyskonetta. Paperikoneilla tuotanto tapahtuu yleensä keskeytymättömästi kolmessa vuorossa. Jouluna ja juhannuksena tuotanto on yleensä pysäyksissä. Huolto- ja pesuseisokeissa tuotanto pysäytetään hetkellisesti. Myös muut työaikamuodot ovat mahdollisia. Vuoden 2011 ja 2012 aikana paperikoneet ovat olleet ajoittain keskeytyvässä kolmessa vuorossa maanantaista perjantaihin. Tuotantolinjan muiden koneiden käynti riippuu paperikoneiden käynnistä. Päällystyskoneilla päällystetään vähäisiä määriä ulkopuolista paperia.

Paperitehtaan jätevesistä otetaan maanantaista perjantaihin vuorokauden (viikonloppuna 3vrk:n) mittaiset kokoomanäytteet, joista määritetään jäteveden sisältämä kiintoaineen määrä, pH, sähkönjohtavuus. Jätevedestä mitataan kuukausittain vuorokausinäytteistä kootusta kokoomanäytteestä biologinen (BOD_{7atu}) ja kemiallinen hapenkulutus (COD_{Cr}), kokonaisfosfori ja kokonaistyppi. Neljännesvuosittain jätevedestä mitataan liuennut orgaaninen hiili (DOC) ja kerran viikossa mitataan jäteveden sisältämä bisfenoli-A -kemikaalin pitoisuus, mikä määritetään myös JVP-Eura Oy:n puhdistamolta lähtevästä jätevedestä. Jäteveden määrää seurataan jatkuvatoimisin määrämittarein.

Osa tehtaan toiminnasta syntyvästä kiinteästä jätteestä poltetaan viereisessä voimalaitoksessa. Erilaisia jätejakeita kerätään kierrätettäväksi, mu-

kaan lukien hylätty paperi, mitä ei voida käyttää uudelleen raaka-aineena paperin valmistuksessa. Hallavaaran kaatopaikalle vietävän tavanomaisen jätteen määrä pyritään pitämään mahdollisimman pienenä.

Tuotanto ja prosessit

Muutokset lainvoimaisen ympäristöluvan jälkeen

Lämpöherkän paperin tuotantomäärä on noussut 30 000 t/a tasolle 50 000 – 60 000 t/a. Perinteisten märkäliimattavien ja tarraetikettien pintapapereiden määrä on vähentynyt 45 000 t/a:sta tasolle 15 000 t/a.

Tuotantomäärät ovat vaihdelleet markkinatilanteen mukaan. Tuotantokapasiteetissa ei ole muutosta. Tuotantokapasiteetti on 80 000 t/a.

1960-luvulla rakennettu off-line -päällystyskone on uusittu vuonna 2006. Päällystysasema, ohjausjärjestelmä ja kuivatustekniikka ovat nyt nykyaikaista parasta tekniikkaa. Päällystyskone on nimetty PÄK4:ksi.

Thermal-päällystyskeittämö on laajennettu ja ohjausjärjestelmä on uusittu vuonna 2006.

Pituusleikkaukseen on hankittu uusi pituusleikkuri vuonna 2006. Pituusleikkuri on nimetty PL11:ksi. Pituusleikkuri PL10:n ohjausjärjestelmä on uusittu vuonna 2011.

Rakennusta on laajennettu etupihan puolella PÄK4:n ilmalaite- ja sähkötiloilla (1 560 m^2 / 6 770 m^3) ja takapihan puolella thermal-päällystyskeittämön laajennuksena (1 300 m^2 / 7 700 m^3). Lisäksi on laajennettu kunnossapidon käyttöön telahallia (134 m^2 / 976 m^3).

Vuoden 2005 jälkeen suurin muutos on ollut lämpöherkkien papereiden valmistusmäärän lisääntyminen ja perinteisten etikettipapereiden valmistusmäärän väheneminen. Tämän muutoksen on mahdollistanut vuonna 2006 tehty investointi päällystyskoneeseen ja päällystekeittämöön.

Paperi- ja päällystyskoneet

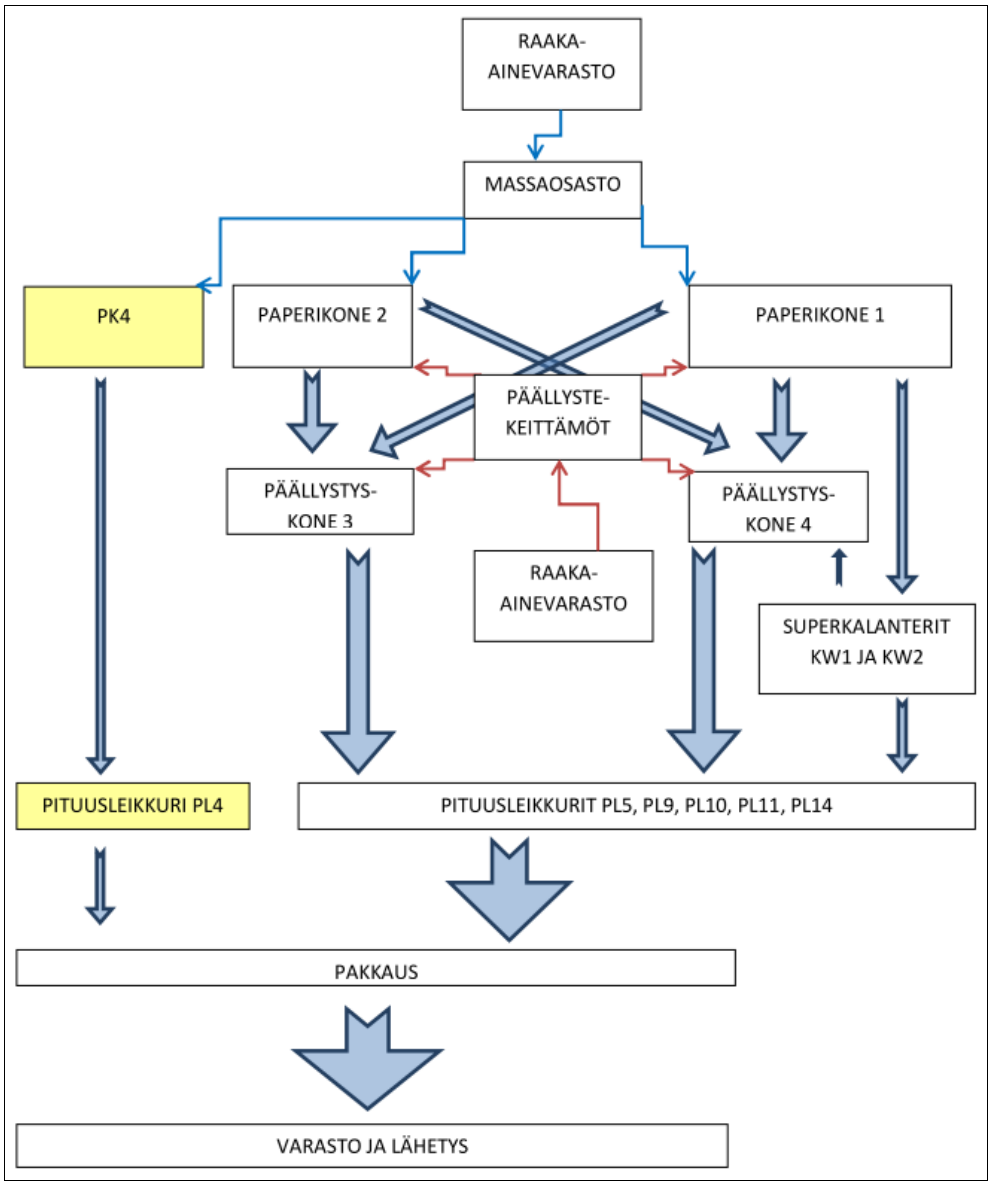
<u>*Paperikone 1:llä (PK1)*</u> valmistetaan tarrapapereita ja märkäliimattavia etikettipapereita. Koneella on kaksi paperin päällystysasemaa. Paperi päällystetään yleensä kahteen kertaan. Päällystysten välissä paperia kuivataan lämpösäteilijöillä. Päällystyksessä paperin pintaan laitetaan päällystyspasta, joka sisältää pigmenttejä (esim. kalsiumkarbonaatti, titaanidioksidi) ja sideaineita. Päällystepasta valmistetaan päällystekeittämö 1:llä. PK1:n jälkeen rullattu paperi ohjataan tuotteesta riippuen joko suoraan superkalanterille kiillotettavaksi tai se päällystetään vielä toiseen tai kolmanteen kertaan erillisellä päällystyskoneella (PÄK4). Kalanteroinnin jälkeen paperi pituusleikataan ja pakataan toimitettavaksi asiakkaille.

PK1:llä valmistetaan myös lämpöherkän paperin pohjapaperia. Tällöin paperikoneen jälkeen paperi esirullataan ja päällystetään sen jälkeen päällys-

tyskoneilla 3 (PÄK3) ja 4. PK1:tä on uusittu viimeksi vuonna 2000, jolloin mm. sen puristinosa ja kuivatusosan sähkökäyttö uusittiin. Lisäksi otettiin käyttöön toinen on-line -päällystysyksikkö.

Paperikone 2:lla (PK2) valmistetaan lämpöherkän paperin pohjapaperia. Paperi päällystetään paperikoneella yleensä kerran. Paperikoneen jälkeen paperi päällystetään lämpöherkällä päällysteellä päällystyskoneilla 3 tai 4. Sekä paperi- että päällystyskoneen päällysteet valmistetaan itse liettämällä veteen päällysteiden raaka-aineet. Erikoispiirteenä Jujo Thermal Oy:n paperinvalmistusprosessissa on päällysteiden raaka-aineiden jauhaminen. Lopuksi paperi pituusleikataan ja pakataan toimitettavaksi asiakkaille.

Kuvassa keltaisella kuvatut prosessit kuuluvat Ahlstrom Tampere Oy:lle.



Paperikone 4 (PK4) ja pituusleikkuri 4 (PL4) muodostavat Ahlstrom Tampere Oy:n Kauttuan tehtaan. Sen osalta Ahlstrom Tampere Oy on jättänyt erillisen ympäristölupahakemuksen. Sen kapasiteetti on noin 10 000 tonnia vuodessa. Toiminnallisesti PK4 on rinnastettavissa Jujo Thermal Oy:n pa-

perikoneisiin. Raaka-aineiden ja jätevesien käsittelyn laitteet ovat samat kuin Jujo Thermal Oy:llä. Erityispiirteenä PK4:llä on paperin värjääminen. PK4:llä paperia ei päällystetä.

Päällystyskeittämö

Päällysteiden raaka-aineet saapuvat tehtaalle jauhoina tai nesteinä maantiekuljetuksilla. Lietteet ja muut nestemäiset raaka-aineet varastoidaan säiliöissä, nestekonteissa tai pienemmissä astioissa. Jauhot varastoidaan suursäkeissä tai pienemmissä säkeissä. Puolivalmisteprosesseissa osa päällysteiden raaka-aineista, lietetään veteen, keitetään tai jauhetaan halutuiksi. Myös valmiit puolivalmisteet varastoidaan säiliöissä. Osa raaka-aineista tai puolivalmisteista varastoidaan jäähdytettyinä. Päällysteiden valmistuksessa raaka-aineita annostellaan reseptin mukaisesti mikseriin, jossa tapahtuu päällysteen sekoitus ja kuiva-ainepitoisuuden säätö laimentamalla. Valmis päällyste välivarastoidaan säiliöissä ennen painesihtausta ja pumppausta koneille. Koneiden päällystekierroissa päällystettä varastoidaan, sekoitetaan, jäähdytetään, sihdataan ja annostellaan paperiin.

Ajon loputtua ylimääräinen päällyste palautetaan koneilta päällystekeittämölle. Palautettu päällyste hyödynnetään seuraavassa tuotantoajossa tai se toimitetaan hävitettäväksi polttamalla.

Tuotantomäärät

Jujo Thermal Oy:n tuotanto- ja toimitusprosessi käsittää kaksi paperinvalmistuslinjaa (PK1 ja PK2). Tuotteet jaetaan kahteen pääryhmään; lämpöherkät paperilajit ja ei lämpöherkät paperilajit. Tuotantokapasiteetti riippuu valmistettavista tuotteista. Nykyisellä tuotevalikoimalla tuotantokapasiteetti on 80 000 t/a ja ympäristölupahakemuksessa on varauduttu 90 000 t vuosituotantoon. Lämpöherkän paperin tuotanto on lisääntynyt 2000-luvulla noin 30 000 tonnista noin 50 000 tonniin vuodessa.

Tuotanto

Paperin pääraaka-aineena ovat kuituina valkaistu sellu ja valkaistu kemitermohierre (Bleached Chemi-Thermomechanical Pulp, BCTMP) sekä täyteaineena talkki ja karbonaatti. Pääapuaineita ovat tärkkelys, karboksimetyyliselluloosa (CMC), massaliimat, retentioaineet, vaahdonestoaineet ja biosidit. Kaikki raaka-aineet tuodaan tehtaalle maantiekuljetuksin.

Kuidut kuidutetaan ja pumpataan jauhatuksen kautta paperikoneen sekoitussäiliöön ja sieltä edelleen pumpuilla konesäiliöön ja paperikoneen perälaatikolle. Kuituvesilietteen täyteaineet ja apuaineet annostellaan sekoitussäiliön jälkeen lyhyenkierron eri vaiheissa. Perälaatikolta kuituvesiliete syötetään märkäviiralle massarainaksi.

Suurin osa massarainasta on vettä, jota kuivatetaan viira-, puristin- ja kuivatusosalla. Viiraosalla suurin osa vedestä poistuu suotautumalla. Puristinosalla massaraina kulkee pyörivien telojen välistä, jotka puristavat vettä

pois huopiin. Puristinosan jälkeen massarainassa jäljellä olevaa vettä haihdutetaan kuivatusosassa höyryllä kuumennettujen sylinterien, sähköisten/kaasukäyttöisten IR-kuivattimien ja kaasukäyttöisen leijukuivaimen avulla.

Paperia päällystetään sekä paperikoneilla että päällystyskoneilla. Paperikoneilla päällysteen pääraaka-aineina ovat kaoliini, karbonaatti, lateksi, tärkkelys ja polyvinyyliasetaatti (PVA). Päällystyskoneilla päällysteet ovat pääosin lämpöherkkiä päällysteitä, joissa käytetään väriaineita, kehittimiä, herkistimiä, polyvinyyliasetaattia (PVA), karboksimetyyliselluloosaa (CMC) ja epäorgaanisia pigmenttejä. Sekä paperi- että päällystyskoneen päällysteet valmistetaan liettämällä veteen päällysteiden raaka-aineet. Lämpöherkkien päällysteiden erikoispiirteenä on raaka-aineiden jauhaminen. Päällystyskoneilla paperin kuivatus tapahtuu höyrylämmitteisillä leijukuivaimilla.

Asiakkaille lähetettävät rullat rullataan pituusleikkureilla ja rullat pakataan joko lava- tai rullapakkauksiin. Osa papereista superkalanteroidaan ennen pituusleikkausta.

Tehtaalla käytettävä höyry tulee Fortum Power and Heat Oy:n Kauttuan voimalaitokselta putkea pitkin. Paperikoneiden leijukuivaimissa käytettävä nestekaasu toimitetaan rekka-autoilla etupihalla olevaan säiliöön, josta kaasu pumpataan höyrystimien kautta leijukuivaimien polttimille. Sähkö johdetaan 110 kV:n runkolinjasta Fortumin voimalaitoksen alueella sijaitsevan kytkinkentän kautta paperitehtaalle.

Raaka-aineiden ja kemikaalien käyttö sekä varastointi

Pääraaka-aineena on valkaistu sellu. Muita raaka-aineita ovat veden lisäksi erilaiset täyteaineet ja kemikaalit kuten kalsiumkarbonaatti ja hydrofobiliima. Sellupaalit tuodaan rekoilla tehtaalle. Paalit puretaan ja hajotetaan kuiduiksi veteen pulpperissa. Sieltä kuituliete kulkee jauhatuksen kautta paperikoneen sekoitussäiliöön, jossa kuituvesilietteeseen sekoitetaan muut paperin valmistuksessa tarvittavat raaka-aineet. Seos pumpataan paperikoneen perälaatikon kautta viiralle massarainaksi. Paperin valmistuksessa ja päällysteiden valmistuksessa käytetään mm. seuraavia raaka-aineita ja kemikaaleja:

	Kemikaalien käyttömäärät (t/a)					
	2006	***2007***	***2008***	***2009***	***2010***	***2011***
Vedenkäsittelyaineet	360	418	359	346	376	325
Biosidit	117	100	100	56	61	48
Dispergointiaineet	15	13	13	13	14	14
Pinta-aktiiviset- ja vaahdonestoaineet	17	19	16	11	8	6
Retentioaineet	175	123	116	99	65	50
Pesukemikaalit	3	3	3	4	4	3
Aliklorihapoke 0,01 – 0,1 %	0	0	0	0	0	6
Rikkihappo (93 %)	232	198	32	0	0	0
Nestemäinen CO_2						115
Natronlipeä (50 %)	340	274	107	67	73	65

Hakemuksessa esitetyt tuotannossa käytetyt raaka-aineet ja kemikaalit vuosina 2009 – 2012 ovat tiivistetysti esitettynä seuraavat:

	Luokitus	***Kemikaalin käyttömäärät vuosittain (t/a)***		
		2009	***2010***	***2011***
Selluloosa	-	50 000	50 000	45 000
Kaoliini	-	10 000	11 000	10 000
Kalsiumkarbonaatti	-	3 000	3 500	3 000
muut pigmentit *(TiO_2, talkki, muovit ym.)*	-	1 700	2 400	2 300
Tärkkelys	-	800	1 200	1 100
Muut sideaineet *(CMC, lateksit, PVA)*	-	2 600	2 500	2 200
Optiset värinkirkasteet	-	<200	<200	<200
Reaktiiviset väriaineet	R52/53,	≥200	≥200	≥200
Märkälujaliimat	R52/53, Aq.Chron.3, H412	300	360	350
reaktiiviset väriaineet	R52/53,	≥200	≥200	≥200
Kehittimet	R37, R41, R43, R62, R52, Xn R36, (H412, H319) N, R51/53, (H411)	≥600	≥600	600
Herkistimet		540	560	530
Antistaattiset aineet		110	120	110

Kemikaali	***CAS ja EINECS/-ELINKS -numerot***	***Luokitus ja lausekkeet***	**Prosessissa ja varastossa (t)**	**käyttö (t/a)**	**Tuotteeseen (%)**	**Vesiin (%)**	**Ilmaan (%)**	**Jätteeseen (%)**
		Kehittimet						
Bisfenoli-A, *4,4'-isopropyli-deenidifenoli*	80-05-7 201-245-8	X_n; R37, R41, R43, R62, R52; H317, H318, H335, H361f, (H370, H411, H412)	38	500	96,2	2,2	0	1,6
Bisfenoli-S, *4,4'-sulfonyylidi-fenoli*	80-09-1 201-250-5	R36		<100	96,2	2,2	0	1,6
Poistettu päätöksestä hakijan pyynnöstä liikesalaisuutena		N, R51/53	4	<100	96,2	2,2	0	1,6
		-		<100	96,2	2,2	0	1,6
		Reaktiiviset värit						
Reaktiivinen väri, *6'-(dibutyyliamino)-3'-metyyli-2'-(fenyyliamino) spiro[isobentso-furaani-1(3H),9-(9H)-ksanten]-3-oni*	89331-94-2 *612-184-00-5* 403-830-5	R52/53 Aq.chronic 3, H412	14	<200	96,2	2,2	0	1,6
		Muut kemikaalit						
Märkälujaliima, *adipiinihappo-di-etyleenitriamiiniepi-kloorihydriinipoly-meeri*	25212-19-5	N, R51/53 Aq.chronic 3, H411, H412						
Lipeä, *natriumhydroksidi*	1310-73-2 215-185-5	C ,R35 H314, H290	15	<100		100	0	
Polyalumiinikloridi	1327-41-9 215-477-2	X_i ;R36/38 H319, H315	20	300		100	0	

Laitoksella käytetään tai voidaan käyttää muitakin kehittimiä ja reaktiivisia väriaineita. Lisäksi laitoksella käytetään useita luokiteltuja puhdistus- ja pesuaineita.

Nestemäiset raaka-aineet, kemikaalit ja polttonesteet varastoidaan tehdasrakennuksen sisäpuolella lähellä käyttökohdetta. Kemikaalisäiliöiden kokonaistilavuus on lähes 1 000 m^3. Varastosäiliöalue on kokonaisuudessaan allastettu.

Kemikaalikontit ovat pääsääntöisesti varustettu turva-alltailla. Yksittäiset mahdolliset vuodot ohjautuvat tehtaan kanaaleihin. Raaka-aineiden, kemikaalien ja tuotteiden lastaussillat ja purkupaikat sijaitsevat päällystetyllä piha-alueella. Piha-alueen sadevedet on viemäröity öljynerottimien kautta. Tehtaan lastauslaiturien viereiset kaivot on liitetty tehtaan jätevesijärjestelmään.

Tärkeimmät kemikaalisäiliöt ovat seuraavat:

Säiliön numero	***Sisältö***	***Tilavuus (m^3)***	***Allastettu***
08-056	Lipeä	12	on
08-060	Kiinnityskemikaali	15	on
08-075	Märkälujaliima	19	ei
08-151	Hydrofobointiaine	10	ei
08-153	Hydrofobointiaine	10	ei
08-155	Hydrofobointiaine	10	ei
914	Kehitin	30	on
916		40	on
941	Kehitin	10	on
911	Kehitin	10	on
969	Kehitin	10	on
910	Kehitin	10	on
928	Reaktiivinen väri	40	on
929	Reaktiivinen väri	15	on

Massavaraston vieressä on 2,7 m^3:n dieselpolttoainesäiliö, joka on asianmukaisesti allastettu ja varustettu ylitäytönestimellä. Trukit ja paloveden dieselpumput käyttävät dieselpolttoainetta. Vuosikäytön arvioidaan olevan noin 4 000 litraa. Nestekaasusäiliö (99 m^3) on tehdasrakennuksen eteläpuolisella piha-alueella.

Energiantuotanto

Jujo Thermal Oy:llä ei ole omaa energiantuotantoa.

Polttoaineiden käyttö

Paperikoneiden IR-kuivaimissa ja ilmapuhalluskuivaimissa käytetään propaania, jonka kulutus on vuosina 2005 – 2011ollut noin 1000 t/a. Lisäksi trukit käyttävät diesel-polttoainetta noin 4 000 l/a.

Veden hankinta ja viemäröinti

Veden hankinta

Tehtaan käyttämä raakavesi otetaan Pyhäjärvestä laskevasta Eurajoesta. Vesi puhdistetaan ensin kemiallisessa, flotaatioon perustuvassa, puhdistuslaitteessa ja sen jälkeen hiekkasuodattimilla. Flotaatiossa erotettu humus (pinta- ja pohjaliete, yhteensä noin 300 kg/d) johdetaan JVP-Eura Oy:n puhdistamolle ja hiekkasuodatuksen huuhteluvedet (kiintoainetta noin 6 – 12 kg/d) johdetaan määrämittauksen kautta takaisin jokeen.

Veden käyttö

Paperin valmistusprosessissa käytetään runsaasti vettä. Eniten vettä käytetään paperikoneiden puristin- ja viiraosan pesu- ja voitelusuihkuilla. Toiseksi suurimman jakeen muodostavat lähinnä paperikoneiden tiiviste- ja jäähdytysvedet, kuten esim. imupumppujen tiivistevedet. Viiraosan massarainasta erottuva vesi esiselkeytetään flotaatioselkeyttimellä. Selkeyttimen liete palautetaan paperin raaka-aineeksi ja kirkaste käytetään uudelleen imupumppujen tiivistevetenä ja viiraosan suihkuvetenä. Ylimääräinen kirkaste johdetaan jätevesilaitokselle käsittelyä varten samoin kuin imupumpuilta poistuva tiivistevesi.

Jujo Thermal Oy on käyttänyt vettä vuosina 2006 – 2012 seuraavasti:

	Raakaveden käyttömäärät vuosina 2006 – 2011					
	2006	***2007***	***2008***	***2009***	***2010***	***2011***
Raakavesi (1000 m^3)	1 600	1 600	1 500	1 600	1 700	1 500
Prosessivesi (%)	93	95	93	80	82	93
Jäähdytysvesi (%)	6	4	6	19	17	7

Hakemuksessa esitetyn mukaisesti Jujo Thermal Oy:n vesitase vuosina 2006 – 2011 on ollut seuraava:

	Vesitase (1000 m^3)					
	2006	***2007***	***2008***	***2009***	***2010***	***2011***
Vesi sisään	1 600	1 600	1 500	1 600	1 700	1 500
Raakavesi Eurajoesta	1 600	1 600	1 500	1 600	1 600	1 400
Talousvesi Euran kunnalta	<50	<50	<50	<50	<50	<50
Vesi ulos	1 650	1 600	1 500	1 600	1 700	1 500
Jätevesi JVP-Eura Oy:n jätevedenpuhdistamolle	1 400	1 400	1 300	1 200	1 300	1 300
Haihtuma	≥100	≥100	≥100	≥100	≥100	≥100
Paperin mukana	<10	<10	<10	<10	<10	<10
Jäähdytysvesi Eurajokeen	100	60	100	300	300	100

Paperin päällystysprosessissa ja päällysteiden valmistuksessa syntyy jätevettä lähinnä pesu- ja lajinvaihtotilanteissa. Epäorgaanisia pigmenttejä sisältävä päällystepitoinen vesi on huonosti selkeytyvää ja se lisää siten jäteveden sameutta. Päällystepitoisen veden orgaaniset sideaineet lisäävät jäteveden biologista ja kemiallista hapenkulutusta. Lämpöherkän päällysteen raaka-aineissa on vesistölle haitallisia aineita. Näiden haittojen vähentämi-

seksi osa päällystepitoisesta jätevedestä käsitellään ultrasuodattimella. Suodattimen kirkaste lasketaan jäteveteen ja liete poltetaan voimalaitoksella. Jäteveden kuormitusta vähennetään keräämällä talteen lajinvaihtotilanteiden päällysteitä ja käyttämällä niitä uudelleen.

Merkittävä raakaveden käyttökohde on prosessin jäähdyttäminen. Prosessin jäähdyttämistarve aiheutuu siitä, että paperin päällysteitä ja niiden puolivalmisteita pitää lopputuotteen laatuominaisuuksien saavuttamiseksi säilyttää viileässä.

Viemäröinti

Jätevedet on käsitelty JVP-Eura Oy:n jätevedenpuhdistamolla keväästä 2004 alkaen. Paperitehdas tasoittaa JVP-Eura Oy:lle menevää jätevesikuormitusta kahdella pystyselkeytysaltaalla, A- ja B-allas. Nämä toimivat myös varoaltaina. Poikkeustilanteissa paperitehtaalla on tekninen mahdollisuus johtaa jätevettä myös suoraan Eurajokeen. Riskinarvioinnin mukaan tällaisia poikkeustilanteita on harvoin, sillä paperitehtaiden jätevedet voidaan JVP-Eura Oy:n häiriötilanteessa ohittaa puhdistamolla ja johtaa Eurajokeen puhdistamoyhtiön purkuputken kautta. Poikkeustilanteita voi liittyä siirtoviemärin ennakoimattomiin häiriötilanteisiin. Nykyinen puhdistamo pidetään poikkeustilanteiden vuoksi toimintakuntoisena.

Liikenne ja liikennejärjestelyt

Tehdasalueella käy vuoden aikana kuorma-, säiliö-, paketti- ja henkilöautoja yhteensä noin 20 000 kertaa. Liikenne tapahtuu pääosin arkipäivisin ja koostuu raaka-aineiden, tuotteiden ja jätteiden kuljetuksesta sekä henkilöautoliikenteestä. Arkipäivisin tehdasalueella liikennöi noin 80 autoa päivässä.

Ympäristökuormitus ja ympäristövaikutukset

Kuormitus vesiin ja viemäriin

Paperitehtaan jätevedet johdetaan JVP-Eura Oy:n jätevedenpuhdistamolle käsiteltäväksi. Tehtaalta lähtevistä puhdistamattomista jätevesistä mitataan päivittäin otettavasta kokoomanäytteestä kiintoaine, pH, sähkönjohtavuus, BOD_7, COD_{Cr}, DOC, kokonaisfosfori ja kokonaistyppi. Jäteveden määrää seurataan magneettisen määrämittarin lukemien perusteella. Mittaukset tehdään kolmesta eri jätevesijakeesta: Jujo Thermal Oy:n PK1-linja ja PK2-linja sekä Ahlstrom Tampere Oy:n Kauttuan tehtaan PK4. Jujo Thermal Oy:n PK1 -linjan näyte sisältää myös Ahlstrom Tampere Oy:n Kauttuan tehtaan jätevedet (PK4).

Lämpöherkän paperin valmistuksessa käytettävien päällystekemikaalien käsittelyn yhteydessä syntyvät pesuvedet ohjataan ultrasuodatukseen, missä vesien sisältämä liukenematon aine pyritään erottamaan. Erotettu osa on poltettu Fortum Power and Heat Oy:n Kauttuan voimalaitoksella.

Päällystepitoisten jätevesien sisältämien liukenemattomien kemikaalien poistamiseksi on käynnistetty oma projekti kesäkuussa 2011. Paperikoneiden prosessikierroissa on käytössä flotaattorit kiertovesien sisältämän hienoaineen erottamiseksi ja näiden vesien kierrätettävyyden parantamiseksi.

Tehtaalta viemäröitävien jätevesien pH:ta voidaan säätää hiilidioksidia käyttäen. Rikkihappoa ei tähän tarkoitukseen tällä hetkellä käytetä. Tehtaalta lähteville jätevesille ei ole ympäristöluvassa asetettu erityisiä vaatimustasoja minkään mitattavan ominaisuuden suhteen. Jujo Thermal Oy on asettanut vuosittain omia tavoitteita jäteveden ja kiintoaineen määrälle.

Tuotannossa vuosina 2006 – 2008 tapahtuneista muutoksista huolimatta jätevesien mittaustuloksissa perinteisten jätevesiparametrien osalta ei ole todettavissa suuria muutoksia. PK2-linjan vesistä vuosina 2009 – 2011 mitatut kiintoaine, COD_{Cr} ja BOD_7 -tasot ovat olleet aiempaa korkeammalla tasolla. Vuonna 2010, jolloin tasot ovat olleet korkeimmat, tilanne on johtunut normaalia suuremmasta paperikoneen alas- ja ylösajojen määrästä. Paperitehtaan jätevedet on marraskuusta 2008 alkaen johdettu JVP-Eura Oy:n jätevedenpuhdistamon esiselkeytysaltaaseen. Esiselkeytyksessä jäteveden kiintoaine saostetaan polymeeriä käyttäen ja saostunut kiintoaine poistetaan lingolla. Mittaustulosten perusteella jäteveden kiintoaineesta saadaan normaalisti poistettua yli 90 %. Paperitehtaalta lähtevästä jätevedestä tehtyjen mittausten perusteella 50 – 70 % kiintoaineesta on epäorgaanista ainetta.

Parametri	***Kuormitus jätevedenpuhdistamolle (kg/a)***			
	2008	***2009***	***2010***	***2011***
Jäteveden määrä (m^3/a)	1 600 000	1 800 000	1 700 000	1 600 000
BOD_7	260 000	330 000	380 000	280 000
COD_{Cr}	1 100 000	1 250 000	1 660 000	1 330 000
Kokonaisfosfori	350	270	410	320
Kokonaistyppi	7 000	7 800	9 500	9 000
	Kuormitus jokeen			
Huuhteluveden määrä jokeen (m^3/a)	60 000	56 000	58 000	57 000
Jäähdytysvesi Eurajokeen (m^3/a)	100	300	300	100
Jäteveden ohitukset jokeen	206 m^3/a 416 min			

Jätevesien yleinen käsittelytulos jätevesiyhtiön jätevedenpuhdistamolla

Puhdistamolta lähtevälle puhdistetulle jätevedelle on asetettu vaatimukset JVP-Eura Oy:n ympäristöluvassa. Jätevedenpuhdistamolla tapahtuneen käsittelyn tehokkuutta ei pysty täysin arvioimaan JVP-Eura Oy:llä tapahtuneiden ohitusten ja JVP-Eura Oy:n kuormitusraportoinnissa tapahtuneiden virheiden vuoksi. Paperiteollisuuden jätevesiä ei puhdistamolta ole ohijuoksutettu.

Kemikaalit jätevesissä

Ympäristöluvassa on edellytetty biosidien määrän mittaamista ja kokonaismyrkyllisyystutkimuksen tekemistä jätevesistä. Biosidinä käytetään hakijan ilmoittaman mukaan tällä hetkellä alikloorihapoketta. Tulosten mukaan jätevesi ei ole akuutisti toksista vesikirpuille.

Vuonna 2011 on käynnistetty seuranta bisfenoli-A:n esiintymisestä paperitehtaalta lähtevissä jätevesissä ja puhdistamolla puhdistetuissa jätevesissä. Bisfenoli-A:n määrä Eurajoessa on hakemuksessa arvioitu näiden tulosten perusteella laskennallisesti, huomioiden mittausajankohdan todelliset virtaamat.

Muiden kehittimien ja reaktiivisten värien pitoisuuksia ei hakemuksessa esitetyn perusteella pystytä jätevesistä analysoimaan. Jujo Thermal Oy on arvioinut käytössä olevien ympäristölle haitallisten kemikaalien kehittimien ja reaktiivisten värien esiintymistä jätevesissä ja Eurajoessa. Hakija ilmoittaa arvioineensa ne bisfenoli-A:n käyttötilanteet, joissa kemikaalia voi päästä jätevesiin, sekä kuinka usein tilanteita esiintyy ja paljonko kemikaalia voi päästä jätevesiin. Arviot jätevesiin päätyvästä määrästä perustuvat jätevesien kiintoainemittauksiin ja tietoihin kemikaalin käyttömääristä. Selvityksen perusteella hakija on arvioinut bisfenoli-A:n hävikiksi jätevesiin 2,2 %. Koska muiden kehittimien ja reaktiivisten värien käyttö on luonteeltaan samankaltaista, on näiden hävikiksi arvioitu sama määrä.

Tehtaalla on aloitettu aikaisempaa laajemmassa mittakaavassa jätevesiin päätyvän liukenemattoman kemikaalimäärän vähentäminen ultrasuodattamalla. Edellä mainittujen kemikaalien lisäksi ympäristölle ongelmallisia, tuotannossa käytössä olevia kemikaaleja ovat lipeä ja polyalumiinikloridi (PAC). Normaalissa käytössä niillä ei katsota olevan ympäristövaikutuksia, mutta häiriötilanteessa niillä voi olla voimakas veden pH:ta muuttava vaikutus.

Hakija on arvioinut, että E-PRTR -raportoitavien tai vesipuitedirektiivin tarkoittamien prioriteettiaineiden esiintymisen todennäköisyys jätevesissä on alhainen muiden kuin fenolisten yhdisteiden osalta.

Kemikaalien laskennalliset ekotoksikologiset vaikutukset Eurajoessa

Kemikaalien haitallisuutta ja haitallista pitoisuutta Eurajoessa voidaan arvioida ekotoksikologisin menetelmin. Komission direktiivin (93/67/ETY) neuvoston direktiivin 67/548/ETY mukaisesti ilmoitettujen aineiden ihmisille ja ympäristölle aiheuttamien vaarojen arviointiperiaatteiden vahvistamisesta mukaisesti kemikaalin ei yksistään arvioida aiheuttavan haittaa ihmisille tai ympäristölle, jos:

PEC/PNEC < 1 (tai EC/PNEC < 1), jossa

PEC = arvioitu pitoisuus ympäristössä (predicted environmental concentraton)
EC = pitoisuus ympäristössä (environmental concentration)
PNEC = arvioitu haitaton pitoisuus ympäristössä (predicted no-effect concetration)

EU:n vuonna 2003 julkaiseman ja vuonna 2008 täydentämän bisfenoli-A:n riskinarviointiraportissa on mainittu bisfenoli-A:lle seuraavat PNEC-arvot:

$PNEC_{vesi}$ = 1,6 µg/l
$PNEC_{mikro\text{-}organismit}$ = 320 mg/l
$PNEC_{sedimentti}$ = 60 µg/$kg_{kuiva\text{-}aine}$
$PNEC_{maaperä}$ = 23 µg/$kg_{märkäpaino}$

Puhdistamolta poistuvassa jätevedessä on seurannan perusteella ollut bisfenoli-A:ta vuosina 2011 – 2012 velvoitetarkkailunäytteissä 7 – 11 000 µg/l (keskiarvo 820 µg/l, mediaani 430 µg/l). JVP-Eura Oy:n jätevesien osuus Eurajoen kokonaisvirtaamasta jäteveden purkupaikan alapuolella on ollut enimmillään 6 % ja keskimäärin (mediaani) noin 2,5 %. Vuosien 2011 – 2012 velvoitetarkkailun perusteella bisfenoli-A:n EC/PNEC -suhde Eurajoessa on ollut enimmillään 100 ja keskimäärin 8 (mediaani 4). Laskennallinen EC/PNEC -suhde on ollut kaikkina tarkkailukertoina toukokuuta 2012 lukuun ottamatta selvästi yli yhden (EC/PNEC > 1). Tämän perusteella jokiveden laskennallinen bisfenoli-A -pitoisuus aiheuttaa riskin Eurajoen jokiekosysteemille.

Bisfenoli-A:n korvaavat tai sille vaihtoehtoiset kemikaalit

Jujo Thermal Oy:n lämpöherkän paperin tuotannossa on vaiheittain korvattu bisfenoli-A:ta (CAS: 80-05-7) bisfenoli-S:llä (4,4'-bisfenoli-S, CAS: 80-09-1), sekä muilla liikesalaisuutena pidettävillä kemikaaleilla. Hakemuksessa on esitetty myös muita bisfenoli-A:n rinnalla käytettäviä tai mahdollisesti sen korvaavia kehittimiä. Bisfenoli-A:ta korvaavien kehittimien ominaisuuksista on rajoitetusti tietoa saatavilla. Näitä on tutkittu vähemmän, mutta ovat virallisen luokituksen perusteella terveydelle vähemmän haitallisia. Tieteellisissä tutkimuksissa kuitenkin bisfenoli-S ja muut korvaavat kehittimet ovat osoittautuneet heikosti tai hyvin heikosti biohajoavaksi ja mahdollisesti biologisesti kertyväksi. Esimerkiksi bisfenoli-S:n osalta ekotoksikologisuutta käsitteleviä tutkimuksia tai raportteja on julkaistu ainakin seuraavasti:

<u>Bisfenoli-S:n</u> ominaisuuksia on käsitelty mm. Yhdysvaltojen ympäristöviranomaisen (US-EPA) laatimassa yhteenvedossa, josta on julkaistu luonnos heinäkuussa 2012, sekä Ruotsin kemikaaliviranomaisen (Kemi) kesäkuussa 2012 julkaisema selvityksessä. Bisfenoli-S on vähemmän estrogeeniaktiivinen kuin bisfenoli-A, mutta huonosti biohajoava useimpien testitulosten perusteella, ei-vesiliukoinen. Käyttöturvallisuustiedotteessa todetaan, että n-oktanoli/vesi -jakokertoimen (1,65) perusteella merkittävää rikastumista organismeissa ei ole odotettavissa.

Hakemuksessa esitetään kemikaalien pitoisuudesta Eurajoessa seuraavaa: Eurajoen kannalta haitallisin tilanne syntyy, kun virtaama joessa on pieni ja kuormitus suurimmillaan (puhdistamo ei poista kemikaalia tai jätevesi johdetaan puhdistamon ohi). Eurajoen pienin virtaama on 2 m^3/s. Paperitehtaan ja puhdistamon keskimääräiset virtaamat vuonna 2011 olivat 133 000 m^3/kk ja 520 000 m^3/kk. Kuukauden aikana käytettyjen kemikaalimäärien avulla saadaan em. arvojen avulla laskettuna pitoisuudeksi Eura-

joessa bisfenoli-A:n osalta 140 µg/l, korvaavan kehittimen osalta 50 µg/l ja reaktiivisten värien osalta 60 µg/l. Bisfenoli-A:n ja korvaavan kehittimen pitoisuudet ylittävät tällaisessa tilanteessa PNEC-arvon.

Tehtaalla laajemmin käytössä olevien kehitteiden ekotoksikologisia tunnusarvoja em. lähteistä on koottu seuraavaan taulukkoon.

	Yksikkö	***Kehitin***		
		Bisfenoli-A	***Bisfenoli-S***	***Muu korvaava kehitin***
Liukoisuus	mg/l	300	$1{,}1*10^{-3}$	35
72h-96h $EC50_{levä}$	mg/l	1 – 3,1		0,77 – 6,3
48h $EC50_{Daphnia\ magna}$	mg/l	3,9 – 10,2	55 – 100	13,8 – 57
$LC50_{kala}$	mg/l	3 – 15	100 – 500	
72h-96h $LC50_{kala,\ meri/-makeavesi}$	mg/l	5,1 – 8,3 7,5 – 9,4		
96h $NOEC_{kala}$	mg/l			63
48h $NOEC_{Daphnia\ magna}$	mg/l			36
21d $NOEC_{Daphnia\ magna}$	mg/l		2,7	10,2
$PNEC_{mikro-organismit}$	mg/l	320		
$PNEC_{sedimentti}$	µg/ $kg_{kuiva-aine}$	60		
$PNEC_{maaperä}$	µg/$kg_{märkäpaino}$	23		
$PNEC_{merivesi}$	µg/l	1,6		7,7
Log K_{ow}	-	3,3	1,2	2,6
Estrogeeniaktiivisuus	kerroin (verrattuna 17β-astradioli)	kyllä (≤0,0001)	(ehkä) (~0,00001)	ei tuloksia
Puoliintumisaika vedessä	a	>1	>1	>1
Biohajoavuus		kyllä	ei/hidas	hidas

Hakijan 5.3.2013 toimittamassa täydennyksessä on arvioitu bisfenoli-A:n ja sitä korvaavien tai sille vaihtoehtoisten kehittimien haitallisuutta seuraavasti:

		Kehitin			
		Bisfenoli-A	***Bisfenoli-S***	***Korvaava kehitin***	***Korvaava kehitin***
BPA-yhdiste		on	ei	ei	ei
Bisfenoli-yhdiste		on	on	ei	ei
Fenoliyhdiste		on	on	on	ei
Polymeeri		on	on	on	ei
Vesiliukoinen (mg/l)		300	$1{,}1*10^{-3}$	melko korkea	vähäinen
Ekotoksisuus	akuutti	korkea	kohtalainen	erittäin korkea	matala
	krooninen	korkea	kohtalainen	korkea	matala
Kulkeutuminen	pysyvyys	erittäin matala	kohtalainen	erittäin korkea	erittäin korkea
	bioakkumulaatio	matala	matala	matala	matala

Päästöt ilmaan

Tuotantoprosesseista ei hakemuksen perusteella aiheudu suoria päästöjä ilmaan muusta kuin päällysteiden kuivauksessa käytettävän nestekaasun poltosta. Nestekaasua käytetään PK1:n ja PK2:n tuotantolinjoilla kuivaimis-

sa yhteensä noin 2 200 m^3 vuodessa. Päästöt ovat laskennallisia ja perustuvat käytetyn nestekaasun määrään. Hiilidioksidipäästöjen osalta yrityksellä on päästökauppalain mukainen päästölupa.

	Päästö ilmaan			
Parametri	***2008***	***2009***	***2010***	***2011***
Hiilidioksidi (t/a)	2 900	2 600	2 900	2 800
Typen oksidit (kg/a)	3 100	2 800	3 200	3 000

Päästöt maaperään ja pohjaveteen

Tehtaan normaalitoiminnasta ei aiheudu päästöjä maaperään tai pohjaveteen.

Melu ja tärinä

Ympäristöluvassa on tehtaan aiheuttamalle ympäristömelulle annettu tavoitetasot ja määräaika tasojen saavuttamiseksi. Aikataulua on muutettu aluehallintoviraston päätöksellä vuonna 2010. Jujo Thermal Oy:n ympäristönsuojeluinvestointien kustannuksista noin puolet on tullut meluntorjuntaan liittyvistä toimenpiteistä. Melua tarkkaillaan vähintään kerran vuodessa maastossa tehtävin mittauksin. Mittaustulosten mukaan annettuja melutasoja ei olla saavutettu. Tavoitetasoja ei ole saavutettu mittaamalla kaikissa pisteissä myöskään tilanteessa, missä paperitehtaan tuotanto on seisonut. Tehtyjen havaintojen mukaan mittauspisteissä 2 – 4 voidaan aina kuulla tehtaan vieressä virtaavan Eurajoen kosken ääni. Ympäristömelun torjumiseksi on vuonna 2011 tehty kaksivuotinen toimintasuunnitelma. Hakija esittää meluntorjunnassa kaksivuotissuunnitelmin etenemistä. Vuonna 2009 tehtiin suunnitelma meluseinän rakentamisesta tehtaan katolle. Suunnitelmaa ei ole toteutettu korkean kustannusarvion vuoksi. Vuonna 2010 tehtaan kattoa korjattiin ja samalla tehtiin rakenteellisia muutoksia millä varauduttiin mahdolliseen seinän rakentamiseen tulevaisuudessa.

27.2.2013 päivätyssä ympäristömeluselvityksessä todetaan tehtyjen meluntorjuntatoimenpiteiden edelleen pienentäneen tehtaan kokonaisäänitehotasoa 2,5 dB(A), mikä on osittain nähtävissä myös mittaus- ja mallinnustuloksissa. Suunnitelman mukaisesti PK4:n uusitun raitisilmapuhaltimen ympärille kesällä 2013 rakennettava seinäke laskee edelleen ympäristön melutasoa noin desibelin. Laskentatuloksen perusteella tehtaan aiheuttama päiväajan keskiäänitaso ylittää 55 dB(A) neljällä asuinrakennuksella ja yöajan 50 dB(A) kuudella asuinrakennuksella. Taso on suurimmillaan lähimpien rakennuksien sivuilla noin 58 dB(A) ja tehtaan puoleisilla julkisivuilla taso on noin 60 dB(A). Samojen rakennusten suojanpuoleisilla varsinaisilla piha-alueilla taso on osittain alle tavoitearvon (50/55 dB(A)).

Pöly ja haju

Toiminta ei ole erityisen pölyävää tai haisevaa.

Jätteet

Hakemuksessa esitetyt jätemäärät tiivistetysti esitettynä ovat olleet vuosina 2008 – 2011 seuraavat:

Jätelaji	***Jäte-luokka***	***Sijoitus-tunnus***	***Määrä (t/a)***			
			2008	***2009***	***2010***	***2011***
Jäteöljy	130208	R01	3,7	3,7	4,8	4,4
Poltettava jäte [1]	230399	R01	1 010	960	1 660	940
Sekajäte kaatopaikalle [1]	200301	D01	30	33	51	37
Keräyspaperi	200101	R035	3 760	3 140	2 090	3 480
Paalilanka	170405	R042	50	50	60	60
Metalliromu	200140	R041	20	80	80	30
Puulavat	150103	R01	20	14	15	20
Muovitynnyrit ja kontit	150102	R035	40	40	60	80
Suursäkit (muovi)	150102	R035	80	80	80	70
Päällysteliete	030399	D10	60	40	40	50
Kaapeliromu	170411	R041	2	2	2	3
Sähkö- ja elektroniikkaromu	160297	R042	0,4	0,2	0,3	0
Loiste- ja purkauslamput	200121	R041	0,4	0	0,3	0
Paristot ja pienakut	200133	R041	0,1	0	0,2	0
Laboratorion ja tuotannon ongelmajäte (nyk. vaarallinen jäte)	160506	D10	2,5	3,9	8,9	0,7
Akut kierrätykseen	160601	R042	2,1	0	4,2	0,7

1) Jätemääristä vähennetty Ahlstrom Tampere Oy:n laskennallinen osuus.

Suurin jae on poltettava jäte, mikä on pääosin sellaista paperia, mitä ei pystytä itse hyödyntämään ja jolle ei ole löydetty hyötykäyttöä. Määrän vaihtelu johtuu hylätyn paperin laadusta. Poltettava jäte sisältää myös pakkausmateriaaleja. Keräyskuidun määrä on luvan voimassaoloaikana kasvanut selvästi. Pääasiallinen syy tähän on lämpöherkän paperin hylky. Määrä on kasvanut tuotannon kasvun myötä. Kyseisen hylyn uudelleen käytön lisääminen paperin raaka-aineena edellyttää hylkypaperin siistauksen. Hylätyn lämpöherkän paperin saamiseksi uudelleen käyttöön raaka-aineena tehtaalla otettiin käyttöön siistauslaitos. Siistauslaitos on pysäytetty lokakuussa 2011 kemikaalikuormituksen vuoksi, mutta se on tarkoitus käynnistää uudestaan, kun jätevesikuormitus on ratkaistu. Päällystyskemikaalien käsittelyssä jätevesiin joutuvat kemikaalit pyritään ottamaan talteen ultrasuodatuksella. Ultrasuodatuksessa syntyvä jäte (päällysteliete) poltetaan viereisellä voimalaitoksella. Kemikaalien talteen ottoa on tehostettu vuoden 2012 aikana jätevesissä olevien kemikaalien määrän pienentämiseksi. Tämä voi lisätä poltettavaa päällystelietemäärää.

Kaatopaikkajätteen määrä on pienentynyt selvästi edellisessä lupapäätöksessä mainitusta. Lajittelun tehostamista ja hyötykäytön lisäämistä voidaan hakemuksessa esitetyn perusteella edelleen tehostaa.

Arvio päästöjen kehittymisestä

Hakemus ei sisällä varsinaista arviota päästöjen kehittymisestä. Hakemuksessa kuitenkin todetaan, että jätteiden lajittelua voidaan entisestään tehostaa ja kemikaalijäämiä puhdistamolle johdettavassa jätevedessä vähentää

mm. ultrasuodattamalla valikoituja vesijakeita. Toisaalta lämpöherkän paperin osuus tuotannosta on edelleen kasvussa, mikä lisää kemikaalien käyttöä. Tehtyjen toimenpiteiden ja jätevesiyhtiöllä tehtävien toimenpiteiden johdosta päästöjen arvioidaan kokonaisuudessaan vähentyvän lähivuosien aikana.

Ympäristöasioiden hallintajärjestelmä ja auditoinnit

Hakijalla on toiminnalleen ISO 14 001:2004 -standardin mukainen ympäristöjohtamisjärjestelmä. Järjestelmä on auditoitu vuonna 2011.

Arvio parhaan käyttökelpoisen tekniikan (bat) soveltamisesta

Euroopan komissio on julkaissut parhaan käyttökelpoisen tekniikan (bat) vertailuasiakirjoja (bref). Tuorein sellu- ja paperiteollisuutta käsittelevä bref on julkaistu joulukuussa 2001 (*Reference Document on Best Available Techniques in the Pulp and Paper Industry*).

Hakemuksessa on peilattu valittua tekniikkaa vertailuasiakirjassa kuvattuun mm. seuraavasti:

- Jujo Thermal Oy:n jätevedet käsitellään JVP-Eura Oy:n jätevedenpuhdistamolla. Kunnallisen jäteveden ja teollisuuden jätevesien yhteisjätevedenpuhdistuslaitos edustaa määritelmien mukaan parasta mahdollista tekniikkaa. (Poistettu JVP-Eura Oy:n viranomaisille ja hakijalle ilmoittamiin virheellisiin kuormitus- ja käsittelytuloksiin viittaavat osat).
- Jujo Thermal Oy:n emissio ilmaan, kaatopaikkajätteen määrä ja lipeän käyttö ovat parempia kuin tavoitearvot. Lämpöenergian käyttö ja täyteaineen määrä on tavoitearvossa. Sähkön käyttömäärä ylittää tavoitearvon.
- Paperitehtaan jätevesimäärää voidaan vähentää tuotantoprosessin vesikiertoja sulkemalla. Tehtaan korkean iän vuoksi huomattava vesimäärien vähentäminen vertailuasiakirjan arvojen tasolle vaatisi mittavia investointeja ja prosessin sisäisten puhdistusratkaisujen lisäämistä. Vaikka pelkästään vesimäärän vähentämiseksi tehtäviin investointeihin ei ole tarkoitus ryhtyä, niin tuotettua tonnia kohden käytettyä vesimäärä on uusien kehitysinvestointien kautta tarkoitus edelleen asteittain vähentää. Paperitehtaan jätevesimääriä tarkastellaan tulevaisuudessa siten, että JVP-Eura Oy:n ja paperitehtaan muodostaman kokonaisuuden kannalta löydetään kustannustehokkain ja tarkoituksenmukaisin jäteveden puhdistusratkaisu.
- Jätteidenkäsittelyssä on jatkuvasti pyritty vähentämään kaatopaikalle menevän jätteen määrää. Tarkastelujaksolla 2006 – 2011 kaatopaikalle menevän jätteen määrä on vähentynyt yli 60 %. Poltettavan jätteen määrä on samalla ajanjaksolla vähentynyt 50 %. Poltettavan jätteen määrän oletetaan tulevaisuudessa kasvavan, koska jäteveden aiheuttamaa kemikaalikuormitusta pyritään vähentämään. Tämä lisää poltettavan päällystelietteen ja paperin määrää.

- Jujo Thermal Oy:n tuotantoprosessi poikkeaa luokan 6.2 hienopaperituotantolaitoksista siinä, että Jujo Thermal Oy jauhaa helmimyllyillä paperin päällysteiden raaka-aineita. Päällysteiden valmistusta voidaan verrata maaliteollisuuden vastaaviin prosesseihin. Tämä prosessin osa-alue kuluttaa runsaasti sähköenergiaa mikä vaikuttaa siihen, että Jujo Thermal Oy käyttää enemmän sähköenergiaa kuin muut luokkaan 6.2 kuuluvat tuotantolaitokset. Paperitehtaalla toteutetaan tulevaisuudessa niitä energiatehokkuutta lisääviä investointeja, jotka ovat liiketaloudellisesti kannattavia.
- Tehtaalla ei ole käytössä parhaan käyttökelpoisen tekniikan mukaista energiatehokkuusjärjestelmää. Tehtaan energiankäyttö on auditoitu viimeksi 2005 (KTM dnro 5330024/460/2005 ja 5330025/460/2005). Tällöin myös toteutettiin nopean takaisinmaksun tuoneet energiansäästöinvestoinnit. Tuotantoprosessi ei ole tämän jälkeen muuttunut merkittävästi eikä ole oletettavaa, että uusia energiansäästökohteita olisi tämän jälkeen tullut.
- Tehtaan ja valmistusprosessin kehittämisessä, vanhan kaluston uusimisessa ja investointeja tehtäessä otetaan huomioon prosessin tuotantotehokkuus. Prosessilaitteita, kuten putkistoja, pumppuja ja säiliöitä pyritään jatkuvasti uusimaan, niin että ne ovat toiminnaltaan luotettavia, käyttökustannuksiltaan alhaisia ja huollettavuudeltaan käytännöllisiä. Tämä on keskeinen asia korkean OEE:n (Overall Equipment Efficiency) saavuttamisessa.
- Prosessien ja tuotteiden kehittämisessä otetaan huomioon uusia tekniikoita. Näillä pyritään kustannustehokkaaseen toimintaan ja parempaan tuotelaatuun. Esimerkkejä tällaisista investoinneista ovat profiloitava perälaatikko (PK1, vuonna 1998), kenkäpuristintekniikka (PK1, vuonna 2000), uusinta tekniikkaa käyttävä raakaveden selkeytys (investointi kesällä 2004), paperikoneen kuivatusryhmän höyrysysteemin modernisointi (PK2, vuosina 2004 – 2005), verhopäällystys (PÄK4, vuonna 2006), invertterikäyttöinen paineilmakompressori (paineilmalaitteistojen optimointi, vuonna 2006), energiatehokas jäähdytysvesilaitteisto (jäähdytysvesilaitteen uusinta, vuonna 2010) ja päällystyskoneen kuivatusryhmän vesisysteemin modernisointi (PÄK3, vuonna 2010).

Energian käyttö ja arvio käytön tehokkuudesta

Hakemuksessa todetaan energiatehokkuudesta seuraavaa: Sähkön suhteellinen kulutus on noussut huomattavasti vuoden 2007 jälkeen vuoteen 2005 verrattuna, koska lämpöherkän paperin suhteellinen osuus on noussut merkittävästi. Lämpöherkän paperin valmistus kuluttaa enemmän sähköä kuin perinteisten etikettipapereiden valmistus. Myös lämmön suhteellinen käyttömäärä on noussut samalla ajanjaksolla. Lämmön suhteellinen käyttömäärä on noussut tuotantomäärän vähenemisen seurauksena. Energiatehokkuuden kehittymistä on näiden muutosten vuoksi vaikea arvioida.

Esitys lupamääräyksiksi

Hakija esittää lupamääräyksiä täydennettäväksi seuraavasti:

Päästöt vesistöön ja viemäriin
Puhdistetun jäteveden sisältämien haitallisten/vaarallisten kemikaalien pitoisuudet eivät saa ylittää kemikaalin käyttöturvallisuustiedotteessa annettuja myrkyllisyysrajoja. Jätevesien kokonaismyrkyllisyyttä tutkitaan yhteistyössä JVP-Eura Oy:n puhdistamon kanssa joka toinen vuosi tai useammin, jos se koetaan tarpeelliseksi.

Melu
Tavoitteena ovat ympäristöluvassa annetut melutasot. Tavoitteisiin pyritään tekemällä toimenpidesuunnitelma kahdeksi vuodeksi kerrallaan. Suunnitelman toteuttamisen jälkeen arvioidaan tilanne tekemällä tarvittaessa mallilaskentaan perustuva melunleviämisselvitys. Jos tavoitteisiin ei ole edelleenkään päästy, tehdään uusi suunnitelma. Näin edetään, kunnes tavoitetaso saavutetaan. Tämä toimintamalli vastaa hakijan mielestä aluehallintoviraston 12.11.2010 myöntämän ympäristömelua koskevan lupamääräyksen muuttamiseksi antamaa päätöstä.

Jätteet ja niiden käsittely ja hyödyntäminen
Uudelleenkäyttöön kelpaamattomat, ympäristölle haitallisia aineita sisältävät päällystelietteet ja jätevesistä ultrasuodatuksella poistetut kemikaalit poltetaan Fortum Power and Heat Oy:n Kauttuan voimalaitoksella. Poltettavat päällystelietteet on huomioitu määrällisesti voimalaitoksen ympäristöluvassa. Määrän kasvu tulee huomioida voimalaitoksen ympäristöluvassa.

TOIMINNAN VAIKUTUKSET YMPÄRISTÖÖN

Vaikutus luontoon ja luonnonsuojeluarvoihin

Toiminnan ei ole lausunnoissa arvioitu vaikuttavan merkittävästi luonnonsuojeluarvoihin. Olennaisimmat päästöt kohdistuvat kuormituksena vesiin.

Vaikutus pintavesiin

Tehtaan toiminnan vaikutukset kohdistuvat pintavesiin puhdistamoyhtiön jätevedenpuhdistamon kautta. Kokemäenjoen vesistön vesiensuojeluyhdistyksen laatimassa selvityksessä koskien Jujo Thermal Oy:n bisfenoli-A -satunnaispäästön vaikutuksia Eurajoen kalatalouteen vuonna 2011 todetaan seuraavaa: Eurajoen koskialueiden sähkökalastuksissa saatiin saaliiksi yhteensä 9 eri kalalajia. Lukumääräisesti eniten saatiin särkeä. Seuraavaksi eniten saatiin määrällisesti kivennuoliaista ja ahventa. Taimenia saatiin saaliiksi 4 koealalta. Vaikka kappalemääräisesti (20 kpl) taimen oli viidenneksi yleisin saalislaji, se muodosti suurimman osan Eurajoen sähkökalastusaineiston biomassasta (41 %). Taimenten esiintymistä sähkökalastussaaliissa voidaan pitää hyvänä, sillä aikaisemmissa Eurajoen velvoitetarkkailuissa ja erillistutkimuksissa taimenta on sähkökalastuksissa saatu

saaliiksi satunnaisesti ja yksilömäärät ovat olleet pieniä. Satunnaispäästön vaikutuksia selvittävissä sähkökalastuksissa ei saatu saaliiksi yhtään 0+ ikäistä taimenen tai lohen poikasta. Myöskään edellisenä vuonna (2010) istutettuja vastakuoriutuneita meritaimenen tai lohen poikasia ei saatu saaliiksi.

Eurajoella on parannettu kalojen liikkumismahdollisuuksia joen eri osien ja merialueen ja joen keskiosan välillä rakentamalla jokeen kolme kalatietä. Koskialueiden kalataloudellisia kunnostuksia on tehty tähän mennessä kahdeksalla koskialueella. Kunnostuksilla on luotu kutupaikkoja ja poikasten elinpaikoiksi sopivia alueita varsinkin taimenen ja lohen lisääntymiskierron vahvistamista varten. Kunnostusten avulla on pyritty parantamaan myös vaellussiian kudun onnistumisen edellytyksiä Eurajoen koskissa. Eurajoen virtavesikunnostuksen ja kalatierakentamisen kustannukset ovat tähän mennessä noin 260 000 euroa, josta noin 200 000 euroa on katettu valtion varoilla. Eurajoen velvoiteistutusten yhteenlaskettu arvo on vuosina 2009 – 2012 ollut 14 200 – 45 000 euroa/a.

Vaikutus maaperään ja pohjaveteen

Tehtaan normaalitoiminnasta ei aiheudu päästöjä maaperän tai pohjaveteen.

Vaikutus ilmaan

Toiminnasta ei aiheudu merkittäviä vaikutuksia lähialueen ilman laatuun.

Melun ja tärinän vaikutukset

Tehtaan toiminnasta aiheutuu melua, joka yhdessä Ahlstrom Tampere Oy:n Kauttuan tehtaan toimintojen kanssa ylittää ympäristöministeriön päätöksen melutason ohjearvoista mukaisen tason.

TARKKAILU

Hakemuksen liitteenä on 31.2.2006 laadittu ja 13.12.2011 päivitetty Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n yhteinen tarkkailusuunnitelma ja sen liitteenä jätevesien käsittelyn kuvaus normaali- ja poikkeustilanteissa. Tarkkailusuunnitelma käsittää melun tarkkailun, jätevesien käyttö- ja päästötarkkailun, hulevesien tarkkailun, jäähdytysvesien tarkkailun, raportoinnin sekä viittauksen jätteiden ja sivutuotteiden määrän tarkkailuun.

Tarkkailuohjelma on päätöksen liitteenä.

Käyttötarkkailu

Jätevesilinjoissa on jatkuvatoimiset määrä-, sameus- ja pH-mittaukset. Ahlstrom Tampere Oy:n Kauttuan tehtaan jäteveden määrä mitataan jätevesikanaaliin asennetulla pato-pinnankorkeus mittarilla ennen kuin se se-

koittuu paperikone 1 linjan jätevesiin. Osa PK4:n jätevesistä ei kulje patomittauksen kautta ja niistä pidetään kirjaa erikseen.

Mikäli tehtaan kemiallinen puhdistamo poikkeustilanteessa käynnistetään, kummallakin altaalla mitataan kerran päivässä näkösyvyys (Secchi-levy). Määrä- ja pH mittareiden antamat tiedot kerätään kerran vuorokaudessa ja syötetään tietojärjestelmään laboratoriossa.

Päästötarkkailu

Prosessijätevesien tarkkailu

Jätevesiyhtiön jätevedenpuhdistamolle johdettavien jätevesien näytteenotto tapahtuu pumppauskaivolle tulevista linjoista automaattisilla näytteenottimilla virtaamapainotteisesti. Mikäli poikkeustapauksissa jätevesi joudutaan johtamaan tehtaan oman puhdistuksen jälkeen Eurajokeen, näytteet otetaan A- ja B-altailta Eurajokeen lähtevistä kirkasteista. Näytteet kerätään vuorokauden mittaisina kokoomanäytteinä, paitsi viikonloppuisin kerätään kolmen vuorokauden näyte. Näytteenotin ottaa näytteen 50 m^3:n välein (Ahlstrom Tampere Oy:n Kauttuan tehtaan näytteessä 20 m^3). Normaalissa tilanteessa tämä vastaa noin 30 minuutin näytteenottoväliä. Osanäytetilavuus on noin 300 ml. Jos jätevettä johdetaan varoaltaiden kautta Eurajokeen alle vuorokauden ajan, näytteet kerätään tältä ajanjaksolta. Näytteet analysoidaan tehtaan omassa laboratoriossa (pH, sähkönjohtavuus, kiintoaine, COD_{Cr}) ja Lounais-Suomen vesi- ja ympäristötutkimus Oy:n tai vastaavan pätevyyden omaavassa laboratoriossa (BOD_{7atu}, kokonaisfosfori, kokonaistyppi, bisfenoli-A).

Raakaveden hiekkasuodatuksen huuhteluvesien tarkkailu

Raakaveden hiekkasuodatuksen huuhteluvesi (n. 100 m^3/vrk) johdetaan Eurajokeen. Määrätieto perustuu laskennalliseen arvioon, arvio tarkastetaan kerran vuodessa ja määrä raportoidaan jätevesiraportissa. Veden määrä riippuu suodatettavan veden puhtaudesta ja siitä johtuvasta suotimien tukkeutumisesta. Huuhteluvesi sisältää suunnitteluarvojen mukaan kiintoainetta 6 – 12 kg/vrk.

Jäähdytysvesien tarkkailu

Puhtaat jäähdytysvedet kerätään tehtaalla yhteiseen putkeen ja johdetaan avokanaalin kautta Eurajokeen. Jäähdytysveden määrä perustuu laskennalliseen arvioon. Veden lämpötila on arvio. Pieniä määriä jäähdytysvettä menee lattiakanaaleihin ja sitä kautta jätevesijärjestelmään.

Hulevesien tarkkailu

Sade- ja hulevedet johdetaan öljynerotuskaivon kautta Eurajokeen ilman tarkkailua.

Jätemäärien seuranta

Tehtaalta lähtevät jätejakeet punnitaan joko tehtaalla tai jätteen vastaanottajan toimesta. Jokainen tehtaalta lähtevä poltettava jäte-erä punnitaan autovaa'alla. Sekajäte punnitaan Satakierto Oy:n jätteenkäsittelylaitoksella. Kuljetus- ja varastoesimies kirjaa tiedostoon kuukausittain tehtaalta lähtevät poltettavan ja sekajätteen määrät.

Melun tarkkailu

Ekvivalenttimelutasot lähimpien asuinkiinteistöjen piha-alueilla on mitattava kerran vuodessa aina sen jälkeen, kun tehtailla on toteutettu kyseiselle vuodelle suunnitellut meluntorjuntatoimenpiteet. Melun mittauspisteitä on oltava vähintään 6. Mittaukset on suoritettava ympäristöministeriön ohjeen 1/1995 "Ympäristömelun mittaaminen" mukaisesti. Yksityiskohtainen suunnitelma edellä mainittujen melumittausten suorittamisesta on toimitettava Lounais-Suomen ympäristökeskukselle (nyk. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus) ja Euran kunnan ympäristönsuojeluviranomaiselle tiedoksi viimeistään kaksi kuukautta ennen mittausten aloittamista. Raportti mittaustuloksista ja leviämisselvityksen tuloksista on toimitettava valvontaviranomaisille. Melupäästöjen vähentämistä koskeva suunnitelma ja toimenpideohjelma ja siihen liittyvät melumittaukset ja leviämismallilaskelmat on tehtävä yhteisesti Jujo Thermal Oy:n sekä Ahlstrom Tampere Oy:n Kauttuan paperitehtaan ja mahdollisuuksien mukaan Fortum Power and Heat Oy:n Kauttuan voimalaitoksen kanssa. Ympäristömelua koskevien mittausten ja muiden melua koskevien selvitysten raportit on toimitettava tiedoksi Lounais-Suomen ympäristökeskukselle ja Euran kunnan ympäristöviranomaiselle vuosittain viimeistään lupamääräyksessä 20 tarkoitetun vuosiraportin yhteydessä.

Vaikutusten tarkkailu

Hakija on osallistunut Turun vesi- ja ympäristöpiirin 21.4.1994 kirjeellä hyväksymän ja Lounais-Suomen ympäristökeskuksen 28.10.2008 päätöksellä muuttaman Eurajoen ja Eurajoensalmen yhteistarkkailun rahoittamiseen.

Raportointi

Kuukausiraportissa ilmoitetaan erikseen Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n Kauttuan tehtaiden JVP-Eura Oy:n puhdistamolle johdettujen jätevesien tarkkailutiedot sekä JVP-Eura Oy:n puhdistamolta lähtevän, puhdistetun jäteveden tiedot. Raportti toimitetaan Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle, Pyhäjärviseudun ympäristötoimistoon, JVP-Eura Oy:lle ja voimassa olevan tehtaan sisäisen jakelun mukaisesti. Kuukausiraporteissa ilmoitetaan mahdolliset poikkeamatilanteet ja ohitukset. Poikkeustilanteet kuten oman puhdistamon käyttöönotto ja jätevesien johtaminen puhdistuksen jälkeen suoraan Eurajokeen tehtaan purkupaikalta, raportoidaan em. viranomaisille välittömästi. Mahdollisten päästötilanteiden raportointi tehdään erikseen tapauskohtaisesti.

Vuosiraportointi tehdään ympäristöluvassa määrätyn mukaisesti ja Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen ohjeita noudattaen.

Laadunvarmistus

Jätevesien analysointi tehdään olennaisimpien parametrien osalta akkreditoidussa laboratoriossa.

POIKKEUKSELLISET TILANTEET JA NIIHIN VARAUTUMINEN

Ympäristöriskit, onnettomuudet ja häiriötilanteet

Hakija on raportoinut valvontaviranomaisen ohjeen mukaisesti tuotannossa tapahtuneet häiriö- ja poikkeustilanteet. Nämä on hakemuksessa ryhmitelty seuraavasti:

- *Paperitehtaalta JVP-Eura Oy:n jätevedenpuhdistamolle johtavan viemäriputken putkiliitoksen aukeaminen*. Yksi tapauksista on ollut tehdasalueen ulkopuolella. Korjauksen aikana paperitehtaan jätevedet on johdettu varoaltaille tai puhdistamo on ajettu ylös. Oman puhdistamon puhdistettu vesi on tällöin johdettu tehtaan purkupaikalta Eurajokeen. Putkiliitokset on korjattu niin, että vastaava rikkoontuminen kyseisessä liitoksessa ei ole enää mahdollinen. Tehdasalueen ulkopuolella tapahtunut rikkoontuminen johtui ilmeisesti roudan sulamisesta. Putken omistaa JVP-Eura Oy.
- *Paperitehtaan jätevesipumppujen käyntihäiriöt*. Jätevesi nousee tehtaan kellarissa lattialle ja hakee purkautumispaikan tehtaan seinän raoista Eurajokeen. Pumppuja on kaivoissa kaksi kappaletta, toinen käytössä ja toinen varalla. Häiriötilanteissa kumpikaan ei ole käynyt. Kolme häiriötä on johtunut sähkön syötön ongelmista ja yksi jäteveden mukana kulkeneista puun kappaleista. Tavoitteeksi on asetettu, että tehdasrakennus toimii tarvittaessa varoaltaana. Rakennuksesta ulos johtavat reiät on tukittu.
- *Poikkeuksellinen määrä raaka-aineita tai kemikaaleja jätevesissä*. Päästö voi aiheuttaa ongelmia puhdistamon toimintaan tai vesistössä. Pahimpia näistä tapauksista ovat olleet ympäristölle haitallisen kemikaalin (bisfenoli-A) suuren määrän pääsy häiriötilanteessa puhdistamolle ja edelleen Eurajokeen sekä jätevedessä ollut paperisilppu, mikä tukki puhdistamolla välpän aiheuttaen ohivirtauksia. Paperitehtaan jätevesijärjestelmässä on pH:n ja sameuden mittaus, mitkä poikkeustilanteessa ohjaavat jätevedet varoaltaille. Hälytysjärjestelmän toimintaa on parannettu ja toimintatapoja kehitetty.
- *Poikkeuksellisen suuri määrä jätevettä.* Poikkeuksellisen suuri jätevesimäärä on johtunut virheellisestä toiminnasta laitteiden koekäytössä, rajusta sadekuurosta sekä oman puhdistamon käyttöaikana olleista paperikoneiden pesutilanteista. Kun oma puhdistamo on käytössä, sen varoallaskapasiteetti on rajoitettu.

Riskinarviointi

Hakemuksen liitteenä olevassa ympäristöriskinarvioinnissa on tunnistettu merkittävimmäksi riskiksi (riskiluokka II) (riskin todennäköisyys x vahingon merkityksellisyys) ympäristölle haitallisten tai vaarallisten kemikaalien päätyminen puhdistamolle ja/tai Eurajokeen korkeassa pitoisuudessa.

Riskiluokkaan III kuuluvaksi ympäristöriskinarvioinnissa on arvioitu jälkivesikellarin veden pinnan nousu ja siitä aiheutuva vuoto Eurajokeen.

Ympäristöriskinarvioinnissa on esitetty lukuisia alhaisempaan riskiluokkaan (IV) kuuluvaksi arvioituja riskikohteita, joista seuraukseltaan merkittävimmäksi, mutta vastaavasti todennäköisyydeltään pienemmäksi on arvioitu kemikaalisäiliön rikkoutuminen tai muu syy minkä vuoksi säiliön koko tilavuus ympäristölle haitallista tai vaarallista kemikaalia purkautuisi Eurajokeen.

Toimet onnettomuuksien estämiseksi

Toimintaohjeistusta on parannettu ja tehty riskinarvioinnin perusteella kiireellisimmiksi luokiteltuja parannustoimenpiteitä.

Toimet onnettomuus- ja häiriötilanteiden aikana

Jätevesien liiallisen sameuden tai pH -mittauksen perusteella jätevesiyhtiön jätevedenpuhdistamolle johdettava jätevesi käännetään tehtaan omalle puhdistamolle, joka toimii tällöin tehtaan jätevesien varoaltaana. Altaille käännetty jätevesi häiriön aiheuttajasta riippuen joko johdetaan myöhemmin vähitellen puhdistamolle tai käsitellään altailla ennen jätevedenpuhdistamolle johtamista ja kemiallisen käsittelyn liete toimitetaan muualle käsiteltäväksi.

Jätevesiyhtiön häiriötilanteessa Jujo Thermal Oy:llä on valmius käynnistää oma kemiallinen jätevedenpuhdistamo. Jätevesien purkupaikka on tällöin ensisijaisesti jätevesiyhtiön purkupaikka Eurajoessa ja toissijaisesti tehtaan oma purkupaikka.

Hakemuksen liitteenä olevassa Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n Kauttuan tehtaan yhteisessä tarkkailusuunnitelmassa on mainittu omana kohtanaan tilanteet, joissa Jujo Thermal Oy:n kemiallinen puhdistamo on otettu käyttöön ja jätevedet puretaan Eurajokeen joko tehtaan tai JVP-Eura Oy:n purkupaikalla

ESITETYT MUUT TOIMENPITEET JA KORVAUKSET

Kalatalousvelvoitteet ja muut toimenpiteet

Hakijalla ei ole ollut kalatalousvelvoitetta jätevesien JVP-Eura Oy:n puhdistamolle johtamisen jälkeen.

Haittojen ja vahinkojen korvaaminen

Hakemuksessa todetaan, että hakijan vastuuvakuutus kattaa toiminnasta aiheutuvan äkillisen ja odottamattoman vahingon. Hakemuksessa ei oteta kantaa edellisen luvan myöntämisen jälkeen sattuneiden vahinkojen johdosta syntyneiden haittojen mahdolliseen korvaamiseen.

HAKEMUKSEN KÄSITTELY

Hakemuksen täydentäminen

Hakemusta on täydennetty 6.8.2012, 28.12.2012 ja 6.3.2013.

Hakemuksesta tiedottaminen

Hakemuksesta on ympäristönsuojelulain 38 §:n mukaisesti tiedotettu kuuluttamalla siitä 17.8.2012 – 17.9.2012 Etelä-Suomen aluehallintoviraston ilmoitustaululla ja Euran sekä Eurajoen kuntien virallisilla ilmoitustauluilla. Kuuluttamisesta on lisäksi ilmoitettu Länsi-Suomi -nimisessä sanomalehdessä.

Hakemuksesta on lisäksi erikseen annettu tieto niille asianosaisille, joita asia erityisesti koskee.

Tarkastukset ja neuvottelut

Hakemuksen johdosta on pidetty neuvottelut 19.12.2012 ja 7.3.2013. Jälkimmäisen neuvottelun yhteydessä on tutustuttu tehtaaseen. Neuvottelujen muistiot on liitetty hakemusasiakirjoihin.

Lausunnot

Aluehallintovirasto on ympäristönsuojelulain 36 §:n mukaisesti pyytänyt hakemuksesta lausunnon 1) Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen ympäristö ja luonnonvarat -vastuualueelta, 2) Varsinais-Suomen elinkeino- liikenne- ja ympäristökeskuksen elinkeinot, työvoima ja kulttuuri -vastuualueelta (kalatalousviranomaiselta), 3) Euran kunnalta, 4) Eurajoen kunnalta, sekä 5) – 6) Euran ja 7) – 8) Eurajoen kuntien ympäristönsuojelu- ja terveydensuojeluviranomaisilta.

Aluehallintovirasto on lisäksi pyytänyt lausunnot 9) Lounais-Suomen aluehallintovirastolta (ympäristöterveydenhuoltoviranomainen) ja 10) Turvallisuus- ja kemikaalivirastolta (kemikaaliviranomainen) sekä 11) Suomen ympäristökeskukselta.

1) *Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen ympäristö ja luonnonvarat -vastuualue* on 1.11.2012 saapuneessa lausunnossaan lausunut mm. seuraavaa:

Nykyisestä toiminnasta yhdessä alueen muiden toimijoiden kanssa aiheutuu vesistön merkittävää pilaantumista sekä merkittävää melu-haittaa. Jujo Thermal Oy on lupakauden aikana lisännyt lämpöherkän paperin tuotantoa lähes kaksinkertaiseksi ja vastaavasti pienentänyt muiden paperilajien määrää. Tämän vuoksi myös lämpöherkän paperin valmistuksessa käytettävien kemikaalien käyttömäärät ovat lisääntyneet. Jatkossa on tarkoitus myös varautua entistä suurempiin lämpöherkän paperin tuotantomääriin muiden erikoispaperijakeiden vähentyessä. Tämän vuoksi tarkistettavan ympäristöluvan määräyksissä tulee huomioida lämpöherkän paperin tuotannosta aiheutuvan kemikaalikuormituksen aiheuttamat ympäristöhaitat ja niiden vähentäminen aiempaa yksityiskohtaisemmin.

Jätevedet johdetaan JVP-Eura Oy:n jätevedenpuhdistamon kautta Eurajokeen. Vesistöhaittojen pienentäminen edellyttää jätevedenpuhdistuksen merkittävää tehostamista, häiriöpäästöjen merkittävää vähentämistä sekä päästöjen vähentämistä esim. prosessivesien kierrätystä tehostamalla. Pidemmällä aikavälillä paras vaihtoehto ympäristön kannalta olisi se, että teollisuuden ja yhdyskuntien jätevedet johdetaan muualle puhdistettaviksi tai jätevesien purkupaikka siirretään suurempaan vesistöön, kun otetaan huomioon Eurajoen ajoittain erittäin pieni vesivirtaama, prosessilaitosten häiriöherkkyys sekä joen virkistyskäyttö ja käyttö raakavetenä.

JVP-Eura Oy:n jätevedenpuhdistamolle johdettavien jätevesien laadulle ei ole asetettu vaatimuksia nykyisessä ympäristöluvassa. Laatumääräystä on syytä tarkentaa ja asettaa raja-arvot jätevedenpuhdistamon toimintaa ja vesistöä haittaaville päästöille. Jätevedenpuhdistamon toiminnan kannalta on tarpeellista, että jätevedet ovat mahdollisimman tasalaatuisia: poikkeavat jätevedet tulee käsitellä ultrasuodatuksella ja varoaltailla (esim. pH:n säätö) ennen johtamista puhdistettaviksi. Lisäksi hakijan tulee huolehtia, että jätevesivirtaamassa ei ole puhdistamon toimintaa haittaavia virtaama- tai haitta-ainepiikkejä ja tarvittaessa tasata niitä varoaltailla. Jätevesien laadun tulee olla sellainen, ettei niistä aiheudu haittaa jätevedenpuhdistamon toiminnalle tai vesistölle.

Hakija esittää, että haitallisten kemikaalien pitoisuuksille asetettaisiin JVP-Eura Oy:n puhdistamolta lähtevälle vedelle luparajaksi käyttöturvallisuustiedotteen myrkyllisyysrajat. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen näkemyksen mukaan tällaiset pitoisuudet aiheuttavat vesistön pilaantumista eikä ne sen vuoksi sovellu luparajoiksi. Luparaja Jujo Thermal Oy:n luvassa tulee asettaa puhdistamolle johdettavalle vedelle, koska korkeat haitta-ainepitoisuudet voivat aiheuttaa vesistön lisäksi ongelmia myös puhdistamon biologisen osion toiminnalle. Puhdistettua jätevettä koskevat luparajat tulee aset-

taa JVP-Eura Oy:n ympäristöluvassa. Paperiteollisuuden jätevesille on nykyisin puhdistamolla oma esikäsittely, joten paperiteollisuuden vesille asetettavat laatuvaatimukset voidaan saavuttaa vasta tämän jälkeisestä vedestä. Erityisesti kemikaalien pitoisuuksiin tulee kiinnittää huomiota. Hakijan tulee laatia selvitys päällystepitoisten jätevesien esikäsittelyn tehostamismahdollisuuksista ja nykyisen menetelmän (ultrasuodatus) riittävyydestä ja laajuudesta. Nyt tunnetut bisfenoli-A:n pitoisuudet jätevesissä ovat korkeampia kuin EU:n bisfenoli-A:ta koskevassa riskiarviossa esitetyt, joten selvityksessä tulee esittää nykyisen ja vaihtoehtoisten menetelmien suhde parhaaseen käyttökelpoiseen tekniikkaan.

Jäähdytys- ja hulevedet voidaan jatkossakin johtaa Eurajokeen lupamääräyksen 3 mukaisesti. Hulevesiviemäreiden tulee olla suljettavissa ympäristövahinkojen varalle ja joessa oleva pH-mittari tulee pitää osana varojärjestelmää säännöllisellä kalibroinnilla ja huollolla häiriöpäästöjen havaitsemiseksi. Ympäristöluvan määräys 4 velvoittaa pitämään vanhat, nykyisin varoaltaina toimivat jätevedenpuhdistamon altaat käyttökuntoisina, jotta JVP-Eura Oy:n häiriötilanteessa ne pystytään tarvittaessa ottamaan omaan käyttöön. Kyseinen määräys tulee säilyttää myös jatkossa häiriötilanteiden ympäristövaikutusten minimoimiseksi. Määräystä tulee tarkentaa siten, että käynnistysvalmiudelle on asetettu aikaraja, esimerkiksi 24 – 48 tuntia.

Hakija on, mm. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esityksestä, aikaistanut ympäristöluvan tarkistusta erityisesti siksi, että käytössä olevia kemikaaleja ja niiden vaikutuksia ei ole käsitelty voimassa olevan ympäristöluvan käsittelyn yhteydessä riittävän kattavasti. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus pitää tärkeänä erityisesti päällystekemikaaleista aiheutuvien haittojen käsittelemisen ja huomioimisen lupamääräyksissä. Lupahakemuksessa on esitetty ympäristölle haitalliset ja vaaralliset kemikaalit, joista kiinnittimet sekä värit liittyvät lämpöherkän paperin päällysteisiin. Tehty seuranta on kohdistunut bisfenoli-A:han, jonka mitattuja pitoisuuksia lähtevässä vedessä ja vesistössä voidaan hyödyntää muiden vaikeammin havaittavien aineiden pitoisuuksien arvioinnissa. Bisfenoli-A -pitoisuudet lähtevässä jätevedessä tunnetaan noin vuoden jatkuneen tiiviin seurannan tuloksena ja Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus pitää nykyisiä pitoisuuksia vesistössä ja jätevedessä huolestuttavan korkeina, vaikka pitoisuudet ovat jo laskeneet tehtyjen toimenpiteiden ansiosta.

Bisfenoli-A:n lisäksi käytössä oleva kiinnite on vesieliöstölle jopa haitallisempi kuin bisfenoli-A. Bisfenoli-A ei ole biokertyvä ja hajoaa kohtuullisen nopeasti ympäristössä (DT_{50} 1 – 4 vrk). Sen haitallisimmat ominaisuudet liittyvät lisääntymiselle aiheutuvaan vaaraan (nk. hormonihäirikkö). Osa lupahakemuksessa esitetyistä kemikaaleista on myrkyllisiä ja kertyviä eli saattavat aiheuttaa pitkäaikaisia vaikutuksia ympäristössä. Näiden pitoisuuksia ei tunneta analyysimenetelmien rajallisuu-

den vuoksi. Niiden käyttö tehtaalla tulee kuitenkin huomioida luvan käsittelyssä ympäristön pilaantumisen estämiseksi. Bisfenoli-A:lle ei ole Suomessa vahvistettu EQS ympäristölaatunormia, mutta Suomen ympäristökeskuksen haitallisten aineiden yksikkö arvio kysyttäessä kesällä 2011 soveltuvaksi ympäristölaatunormiksi 1 µg/l. EU:n uudistetussa aineen ympäristöarvioissa on määritelty makeanveden PNEC-arvoksi 1,5 µg/l. Jujo Thermal Oy:n kemikaalintoimittaja on käyttöturvallisuustiedotteessa ilmoittanut PNEC-arvoksi 16 µg/l. Koska ennustetulle haitattomalle bisfenoli-A -pitoisuudelle ei ole esitetty yksiselitteistä arvoa, varovaisuusperiaatteeseen nojaten tavoitteeksi tulisi ottaa, ettei bisfenoli-A -pitoisuus 1,0 µg/l ylity vesistössä jätevesien sekoittumisvyöhykkeen alapuolella. Tämä varmistaa todennäköisesti myös sen, ettei muita vesiympäristössä haitallisia tai myrkyllisiä päällystekemikaaleja päädy vesistöön haitallisen korkeita pitoisuuksia. Hakija on lupahakemuksessa arvioinut päällystekemikaalien kulkeutumismäärät ja tavat melko samankaltaisiksi.

Bisfenoli-A:n pitoisuudet Eurajoessa tunnetaan huonommin kuin lähtevän jäteveden pitoisuudet. Seurantaa on ollut lähinnä häiriöiden aikana, jolloin vesistöstä mitatut pitoisuudet ovat olleet poikkeuksellisen korkeita. Keskimääräisellä kuormituksella (ei häiriötä) on tarkkailupisteestä Eura 42 (noin 30 km purkupisteestä) mitattu huhtikuussa 2012 2 – 4 µg/l bisfenoli-A -pitoisuuksia. Häiriötilanteessa syyskuussa 2012 mitattiin seurantapisteestä Eura 22 (noin kilometri purkupaikalta) suurimmillaan pitoisuus 460 µg/l ja pisteestä Eura 42 pitoisuus 17 µg/l. Laskennallisia vesistöpitoisuuksia on esitetty lupahakemuksessa ja niitä tulee lisää viikoittaisen seurannan myötä. Laskennallisen vesistöpitoisuuden keskiarvo on marraskuun 2011 ja heinäkuun 2012 välillä ollut 13 µg/l vaihdellen 0,1–168,1 µg/l. Laskennallisen pitoisuuden voidaan arvioida kuvaavan tarkkailupisteen Eura 22 tilannetta. Keskieurooppalaisissa jokiselvityksissä on saatu Bisfenoli-A:n maksimipitoisuuksista seuraavia tuloksia: Bisfenoli-A löytyy 34 % näytteistä, maksimi 0,32 µg/l ja toisen selvityksen mukaan maksimi oli 2,3 µg/l. Eurajoen osalta voidaan todeta haitattoman bisfenoli-A -pitoisuuden rajaarvon ylittymisen jatkuvan ainakin noin 30 km matkalla.

Euroopan unionin bisfenoli-A:ta koskevassa riskinarviossa (2003, päivitetty 2010) on arvioitu lämpöpaperiteollisuuden aiheuttamat riskit bisfenoli-A:n osalta pieniksi. Arvio on tehty seitsemän kemikaalia käyttävän ja lämpöherkkää paperia valmistavan tehtaan perusteella. Jujo Thermal Oy:n pitoisuudet ja kuormitukset ovat kuitenkin huomattavasti esitettyjä vertailutehtaita korkeammat eikä riskejä siten voida pitää pieninä. Riskiarviossa esitetään esimerkkitehtaiden puhdistamattoman jäteveden sisältävän 10 – 470 µg/l bisfenoli-A:ta. Euran paperiteollisuuden puhdistamattomat jätevedet ovat seurannoissa sisältäneet bisfenoli-A:ta keskimäärin arviolta 3 000 – 4 000 µg/l. Riskiraportissa on oletettu jätevedenpuhdistuksen poistotehoksi 88 %, mutta JVP-Eura Oy ei tähän tehdyn seurannan perusteella ole päässyt. Riskiraportissa aiheutuneet vesistökuormitukset olivat 242 – 483 t/a bisfenoli-A:ta käyttävillä

tehtailla (vrt. Jujo 490 t) korkeimmillaan 120 g/d bisfenoli-A:ta vesistöön. JVP-Eura Oy:n bisfenoli-A -kuormitus jokeen on keskimäärin useita kiloja päivässä joulukuussa 2011 aloitetun seurannan perusteella. Vaihtelu on suurta ja korkeammilla pitoisuuksilla jokeen menee kymmeniä kiloja bisfenoli-A:ta päivässä.

Myös ympäristön kautta ihmiselle haitalliset aineet ja mahdolliset eri aineiden ympäristölle tai ihmiselle vaaralliset yhdisteet tulee huomioida kemikaaliasioita käsiteltäessä. Näiden arviointi on lupahakemuksessa puutteellista. Hakijan tulee täydentää hakemusta näiltä osin tai hakija tulee määrätä tekemään laajempi kemikaaliselvitys kattaen myös kemikaalien yhteisvaikutukset ja ihmiselle haitalliset ja vaaralliset kemikaalit. Lisäksi tulee arvioida häiritsevätkö haitta-aineet jätevedenpuhdistamon toimintaa.

Hakemuksen tarkoittama tehdas ei sijaitse luokitellulla pohjavesialueella. Lähin pohjavesialue Vaanii on lähimmillään noin 300 metrin päässä tehtaan itä- ja pohjoispuolella. Tehdasalueen ja pohjavesialueen välissä on kalliomäki ja Eurajoki, jotka rajoittavat hydraulista yhteyttä pohjavesialueen suuntaan. Läheisyydessä oleva Vaaniin pohjavesialue on osa Säkylästä Euran kautta Kiukaisiin kulkevaa pitkittäisharjujaksoa. Pohjavesialue muodostuu luode-kaakko -suuntaisesta alavasta jokilaaksosta, jossa vettä johtavat kerrokset ovat laajalti tiiviiden maakerrosten peittämät. Jokilaakson keskellä savenalainen harjujakso erottuu osaksi näkyvinä pienialaisina harjuesiintyminä ja kumpareina. Muodostuma kokoaa vettä myös ympäröiviltä alueilta. Harjussa veden virtaus tapahtuu luoteeseen päin. Eurajoki kulkee pohjavesialueen läpi laaksossa, jossa joen uoman pohja on ainakin paikoitellen harjuaineksen tasolla ja osa pohjavedestä saattaa purkautua Eurajokeen. JVP-Eura Oy:n keskuspuhdistamon jätevesien purkupaikka on Eurajoessa pohjavesialueella. Tehdasalueen pohjaveden laadusta ei ole käytettävissä tietoja. Tehdas sijaitsee Eurajoen välittömässä läheisyydessä siten, että tehdasalueella mahdollisessa vahinkotilanteessa maaperään ja sitä kautta pohjaveteen kulkeutuvien haitta-aineiden vaikutukset kohdistuisivat todennäköisesti Eurajokeen tehtaan itä- tai pohjoispuolelta.

Etelä-Suomen aluehallintovirasto muutti 12.11.2010 antamillaan päätöksillä Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n esityksestä melulle annettua määräystä siten, että meluraja-arvot ovat tavoitteellisia vuoden 2012 loppuun saakka. Mikäli silloinkaan ei päästä tavoitetasoon, niin on esitettävä uusi suunnitelma 30.6.2013 mennessä osana lupamääräysten tarkistushakemuksia. Meluntorjuntatoimiin kuului mm. paperitehtaan katolle rakennettava meluseinä, josta tehtiin suunnitelma vuonna 2009. Seinän kustannusarvio oli yli 200 000 euroa. Korkean kustannusarvion takia sitä ei ole toteutettu, kun samalla melukonsultti totesi, että seinä ei ole lopullinen ratkaisu meluongelmaan. Kun tehtaan kattoa korjattiin vuonna 2010, korjauksen yhteydessä huomioitiin varmuuden vuoksi meluseinän vaatimat tukirakenteet. Paperitehtaat

esittivät ympäristöluvan tarkistuspäätöksessä vaaditun toimenpidesuunnitelman 31.3.2010 ja ovat jo toteuttaneet osan siinä esitetyistä toimenpiteistä. Toimenpiteiden todelliset vaikutukset on ilmoitettu saatavan selville vuonna 2012 tehtävän meluselvityksen perusteella. Viimeisimmän meluselvityksen (5.1.2009) mukaan valtioneuvoston päätöksessä (382/1987) annetut melutason ohjearvot ylittyvät sekä päivä- että yöohjearvojen osalta lähimpien asuinrakennusten luona suurimmillaan 8 dB. Melupäästöjä rajoitettaessa lähtökohtana tulee olla, että paperitehtaiden toiminnasta ei aiheudu terveydellistä varaa tai merkittävää viihtyisyyshaittaa lähimpien asuntojen tonteilla. Koska paperitehtaan melu on luonteeltaan tasaista, niin riittää kun Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n paperitehtaiden toiminnoista aiheutuvat melutasot alittavat valtioneuvoston päätöksessä (382/1987) annetut melutason ohjearvot. Kun otetaan huomioon meluntorjuntatoimien toteuttamiseksi jo käytetty aika, niin meluntorjuntatoimien toteuttamiselle saa varata aikaa korkeintaan kaksi vuotta. Melua aiheuttavia laitteita hankittaessa ja sijoitettaessa tulee toiminnanharjoittaja velvoittaa ottamaan huomioon paras käytettävissä oleva tekniikka ja kiinnittämään erityistä huomiota myös melun häiritsevyyden vähentämiseen.

Hakija on ottanut käyttöön siistauslaitteiston vuonna 2007 hylätyn lämpöherkän paperin käsittelyyn. Sen käyttö on lopetettu lokakuussa 2011 korkean jätevesien kemikaalikuormituksen takia. Siistauksen lopettaminen on pienentänyt seuratun bisfenoli-A:n pitoisuuksia jätevesissä. Pitoisuudet ovat kuitenkin edelleen niin korkeita, ettei siistausta tule sallia ennen kuin toiminnanharjoittaja pystyy osoittamaan sen haitattomuuden jätevesien laadulle. Tehtaan jätteenkäsittelyssä ja jätteen synnyn ehkäisyssä tulee noudattaa jätelain (646/2011) 8 § etusijajärjestystä. Hakijan tulee suunnitelmallisesti vähentää jätteen syntyä ja lisätä hyötykäyttökelpoisten jätejakeiden lajittelua. Päällystelietteet tulee tilastoida jätekoodilla 030310 (mekaanisessa erotuksessa syntyvät kuitujätteet sekä kuitu-, täyteaine- ja päällystysainelietteet) tarkentaen sitä, että päällysteainelietteet ja mahdolliset muut lietteet raportoidaan erikseen.

Lupahakemuksessa todetaan, että päällystelietteiden määrä tulee mahdollisesti lisääntymään tehostettavan kemikaalien talteenoton vuoksi. Lupahakemuksessa ei ole esitetty yksityiskohtaisia tietoja päällystelietteen ominaisuuksista. Voidaan kuitenkin olettaa, että siinä on merkittäviä pitoisuuksia päällysteessä käytettyjä ympäristölle vaarallisia kemikaaleja, joista hakijan arvion mukaan 1,6 % päätyy jätteisiin. Toiminnanharjoittajan tulee selvittää tarkemmin lietteen laatu ja lupaviranomaisen tulee lupapäätöksessä määritellä päällysteliete vaaralliseksi jätteeksi, mikäli jäteasetuksen (179/2012) liitteen 3 mukaiset kriteerit täyttyvät. Hakija on toimittanut lupamääräyksen 8 mukaisen selvityksen päällystelietteiden hyödyntämismahdollisuuksista Lounais-Suomen ympäristökeskukselle 19.2.2007. Selvityksessä esitetään polttoa ympäristönäkökohdat huomioon ottaen järkevimpänä hävitystapana. Siinä ei kuitenkaan arvioida tarkemmin päällystelietteen laatua ja sen sisältä-

miä haitta-aineita. Jujo Thermal Oy:n tulee selvittää päällystelietteen muut käsittely- tai loppusijoitusvaihtoehdot ja jätevesien esikäsittelyn vaihtoehtoisten tapojen vaikutukset lietteen laatuun päällystekeittämön jätevesien esikäsittelystä tehtävän selvityksen yhteydessä. Tämän hetken tietojen perusteella päällystelietteiden ja thermal-hylkypapereiden polttaminen Fortum Power and Heat Oy:n voimalaitoksella on ympäristön kannalta paras vaihtoehto. Toiminnanharjoittajan tulee kuitenkin selvittää myös muiden käsittelyvaihtoehtojen mahdollisuudet mikäli voimalaitoksen ympäristöluvan tarkistuksen yhteydessä nykyistä käytäntöä rajoitetaan. Jujo Thermal Oy:n tulee yhteistyössä JVP-Eura Oy:n ja Ahlstrom Tampere Oy:n kanssa tutkia JVP-Eura Oy:n puhdistamon lietteen ominaisuudet teollisuudessa käytettyjen haitallisten ja vaarallisten aineiden pitoisuuksien osalta.

Tehtaan ympäristöpäästöriskisuunnitelmasta käy ilmi, että sen toiminnassa on edelleen tarvetta toimenpiteisiin ympäristöriskien pienentämiseksi. Riskiluokan I – III riskit tulee saada hallintaan pikaisesti. Toiminnanharjoittajan tulee esittää aikataulu ehdotettujen toimenpiteiden toteuttamiseksi. Riskienhallintasuunnitelma tulee laajentaa kattamaan vesipäästöriskien lisäksi päästöt maaperään sekä päästöt ilmaan sekä meluun. Ympäristöriskienhallintasuunnitelma tulee tarkistaa vuosittain ja toimittaa päivitetty suunnitelma valvontaviranomaiselle vuosiraportin yhteydessä. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle tulee varata mahdollisuus täydentää esitettyä suunnitelmaa. Paperitehtailla ennakkoon tiedettävistä ja jo tapahtuneista häiriöpäästöistä pitää velvoittaa tiedottamaan välittömästi valvontaviranomaisille sekä poikkeuksellisista jätevesipäästöistä JVP-Eura Oy:lle. Lisäksi poikkeuksellisista päästöistä vesistöön tulee tiedottaa valvontaviranomaisten lisäksi välittömästi myös Eurajoen veden käyttäjille yhteistyössä JVP-Eura Oy:n ja Ahlstrom Tampere Oy:n kanssa.

Laitoksen parasta käyttökelpoista tekniikkaa on arvioitu lupahakemuksessa vain jätevesien ja jätteiden käsittelyn osalta. Lupahakemukseen olisi pitänyt sisältyä myös muiden ympäristönsuojelusektoreiden arviointi, erityisesti meluntorjuntaan ja kemikaalien käyttöön liittyvän tekniikan osalta. Jätevesipäästöjen osalta selvityksessä on todettu, että tehtaan päästöt ylittävät metsäteollisuuden parhaan käyttökelpoisen tekniikan (bat) vaatimukset, erityisesti BOD_7, COD_{Cr} ja kokonaistypen osalta. Koska päästöt ylittävät parhaan käyttökelpoisen tekniikan (bat) vaatimukset ja tehtaan jätevedet puhdistetaan JVP-Eura Oy:n jätevedenpuhdistamossa, niin metsäteollisuuden parasta käyttökelpoista tekniikkaa (bat) koskevat vaatimukset tulee ottaa huomioon myös JVP-Eura Oy:n jätevedenpuhdistamon ympäristöluvan käsittelyssä.

Laitoksen energiatehokkuudesta ei ole nykyisessä ympäristöluvassa muita määräyksiä kuin velvoite raportoida valvontaviranomaisille energiatehokkuustoimista. Sähkö- ja lämpöenergian ominaiskulutus on kasvanut viime vuosina selvästi tuotannon muutosten myötä. Viimeisin

energia-analyysi on tehty vuonna 2005. Koska analyysi tulisi uusia prosessimuutosten yhteydessä tai vähintään viiden vuoden välein, niin se tulee uusia mahdollisimman pian. Yhtenä selvityskohteena tulisi seuraavassa analyysissä olla jätevesien kierrätys, joka on erittäin tärkeätä myös jätevesipäästöjen vähentämistarpeen takia. Yhtiö ei ole enää liittynyt teollisuuden vapaaehtoiseen energiatehokkuussopimukseen, jonka yhteydessä energiatehokkuutta olisi todennäköisesti kehitetty. Ympäristöluvassa tulee vaatia yhtiötä laatimaan ulkopuolisen asiantuntijan todentama ajantasainen energiatehokkuusanalyysi ja suunnitelma energian tehostamistoimista. Analyysin tulee sisältää myös jäteveden kierrätystä tai muulla tavoin veden käytön vähentämistä koskevan selvityksen myös siitä syystä, että tehtaan toiminnassa muodostuva jätevesimäärä on merkittävästi korkeampi kuin vertailuasiakirjojen perusteella esitetty viitearvo. Analyysi ja sen päivitykset sekä vuosittain toteutetut ja suunnitteilla olevat energiatehokkuustoimet tulee raportoida ympäristönsuojelun valvontaviranomaisille vuosittain.

Hakijan 13.12.2001 päivittämää tarkkailuohjelmaa tulee tarkistaa seuraavilla tiedoilla: Jätevesien seurantaa tulee jatkaa nykyisessä laajuudessaan. Bisfenoli-A -pitoisuuden viikoittaista seurantaa voidaan harventaa sopimalla siitä valvontaviranomaisen kanssa sen jälkeen, kun pitoisuudet ovat asettuneet riittävän alhaiselle tasolle. Seurantaa tulee kuitenkin jatkaa sekä puhdistamattomista että puhdistetuista jätevesistä yhteistyössä JVP-Eura Oy:n kanssa teollisuuden aiheuttaman haitta-ainekuormituksen arvioimiseksi. Ympäristöluvan määräyksen 15 mukainen velvoite mitata jäteveden biosidien pitoisuuksia on osoittautunut ongelmalliseksi. Käytettyjen biosidien tutkiminen jätevesistä on ollut hankalaa ja se on korvattu kemikaalitoimittajan laskennallisilla arvioilla biosidien määrästä. Soveltuvampi tapa arvioida jätevesien myrkyllisyyttä on kokonaismyrkyllisyystestaus soveltuvalla menetelmällä, joka tulee suorittaa joka toinen vuosi yhteistyössä Ahlstrom Tampere Oy:n kanssa. Kokonaismyrkyllisyys huomioi myös muut kemikaalit kuin biosidit, esimerkiksi päällystekemikaalit.

Melupäästöjen tarkkailuun tulee lisätä merkittävimpien melulähteiden melupäästön mittaus vähintään kahden vuoden välein, jotta ollaan selvillä melupäästöissä ja meluvaikutuksissa tapahtuvista muutoksista.

Lupapäätöksen edellyttämällä tavalla tarkistettu päästö- ja vaikutustarkkailusuunnitelma tulee toimittaa tiedoksi ympäristöluvan valvontaviranomaisille kolmen kuukauden kuluessa lupapäätöksen antamisesta. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle tulee varata mahdollisuus tarkentaa tai muuttaa sitä vastaamaan paremmin valvonnan tarpeita.

Laitoksen toiminnan vaikutusten tarkkailua on tarkoituksenmukaista jatkaa yhteistyössä alueen muiden toimijoiden ja kuntien kanssa siten, että yhteistarkkailua koskevat suunnitelmat toimitetaan Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen hyväksyttäväksi.

Jujo Thermal Oy, Ahlstrom Tampere Oy, Fortum Power and Heat Oy Kauttuan voimalaitos ja JVP-Eura Oy tulee velvoittaa osallistumaan vesistövaikutusten yhteistarkkailuun. Yhteistarkkailussa tulee jatkuvatoimisesti tai jaksoittain seurata vesistössä havaittujen ko. teollisuuslaitoksista peräisin olevien haitallisten ja vaarallisten aineiden pitoisuuksia käyttäen parasta tekniikkaa. Lisäksi Jujo Thermal Oy, Ahlstrom Tampere Oy ja Fortum Power and Heat Oy Kauttuan voimalaitos tulee osallistua meluvaikutusten yhteisselvityksiin sekä energiatehokkuusselvityksiin.

Varsinais-Suomen elinkeino- liikenne- ja ympäristökeskuksen lausunnon liitteenä on lisäksi toimitettu yhteenveto Eurajoen ja Eurajoensalmen yhteistarkkailuista ja yleisestä tilasta.

2) *Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen elinkeino, työvoima ja kulttuuri -vastuualue (kalatalousviranomainen)* on lausunut mm. seuraavaa:

Tieto bisfenoli-A:n käytöstä tuli ilmi, kun Jujo Thermal Oy:n tehtaalta pääsi 20.5.2011 noin 1000 kg bisfenoli-A:ta jätevedenpuhdistamon kautta Eurajokeen. Tämän jälkeen selvisi, että tehdas käyttää ko. kemikaalia säännöllisesti ja se on tehtaan jätevesien tavanomainen komponentti. Bisfenoli-A:n pitoisuuksien eikä vaikutusten tarkkailua ei ole tehty ja aineen mahdollisia kalataloudellisia vaikutuksia ei ole otettu huomioon, kun JVP-Eura Oy:n kalatalousmaksun taso on määritelty. Bisfenoli-A:n käyttöturvallisuustiedotteen mukaan kyseessä on lisääntymiselle vaarallinen ja mahdollisesti hedelmällisyyttä heikentävä aine, joka on haitallista vesieliöille. Bisfenoli-A:n on todettu olevan myös karsinogeeni. Ainetta ei saa käyttöturvallisuustiedotteen mukaan päästää vesistöön, viemäriin eikä maaperään.

Jujo Thermal käyttää bisfenoli-A:ta keskimäärin 490 000 kg vuodessa. Laskennallisesti tästä joutuu jäteveteen ja siten puhdistamolle 2,2 %, eli noin 10 780 kg vuodessa (n. 29,5 kg/d). Puhdistamolle tulevan jäteveden bisfenoli-A -pitoisuus on vaihdellut vuonna 2012 tehdyn seurannan mukaan varsin paljon (0,8 – 55 mg/l). Biologinen puhdistamo poistaa bisfenoli-A:ta jätevedestä suhteellisen hyvin, mutta puhdistusteho vaihtelee huomattavasti. Parhaimmillaan puhdistusteho on ollut 94 %, huonoimmillaan seurannan aikana 19 %. Puhdistetun jäteveden pitoisuus on vaihdellut välillä 7 µg/l – 11 mg/l. Eurajoen pitoisuusarvo vaihtelee puhdistamolta tulevan veden sisältämän bisfenoli-A:n ja joen virtaaman mukaan. Seuranta-ajan pitoisuudet ovat vaihdelleet välillä 0,1 – 168,1 µg/l. Arvioitu haitaton pitoisuus (PNEC) eli 16 µg/l on ylittynyt 5 kertaa havaintojaksolla, jonka aikana näytteitä on tutkittu 26 kertaa. Jos puhdistetun jäteveden bisfenoli-A -pitoisuus on usein jopa 10 mg/l, se tarkoittaa joka tapauksessa, että purkupaikan alapuolella pitoisuudet ovat joessakin suuria.

Seurantaa on tehty sen jälkeen, kun bisfenoli-A:n käyttö tuli yleiseen tietoon. Lienee mahdollista, että tänä aikana aineen käyttö on ollut huolellisempaa kuin aikaisemmin, joten seuranta-ajan tiedot eivät välttämättä edusta pitoisuuksien tavanomaista tasoa.

Vuonna 2011 tapahtuneen bisfenoli-A -päästön aikaan aineen pitoisuus oli jokivedessä arviolta noin 2 mg/l. Kyseessä on taso, joka on vesieliöille akuutisti toksinen. Laboratoriotestien mukaan bisfenoli-A:n välitön myrkyllisyys rasvapäämudulle on 4,6 mg/l (LC50) ja seeprakalalle 9,9 mg/l (LC50). Aineen toksisuudesta esimerkiksi lohikalojen kehittyvälle mädille, nuoruusvaiheille tai ravunpoikasille ei ole tietoa.

Jujo Thermal Oy:n bisfenoli-A -päästön kalastovaikutuksia selvitettiin vuonna 2011 koekalastusten avulla. Työssä selvitettiin vaikutusalueen rapukannan tilaa ja koskialueiden kalastoa sekä päästön mahdollisia vaikutuksia koskille istutettujen lohien ja taimenten eloonjäämiseen (Holsti 2011). Vuonna 2011 toteutettu Eurajoen kalataloudellinen yhteistarkkailu antoi lisää tietoa joen kalaston tilasta (Holsti 2012).

Koekalastustulosten mukaan koskialueiden kalaston tiheydet ja biomassat olivat varsin pieniä. Tulosten mukaan taimenen ja lohen vk-istutukset eivät näytä tuottaneen tulosta, sillä vuonna 2010 tehdyistä vk-istutuksista peräisin olevia lohia tai taimenia ei löytynyt koko joesta. Sähkökalastusten taimensaalis oli 20 kpl, jotka olivat peräisin 2-v poikasilla tehdyistä istutuksista. Velvoitetarkkailun mukaisten sähkökalastusten saalis oli puolestaan 14 kpl 2v-taimenta. Yhtään 2v-lohenpoikasta ei saatu saaliiksi.

Jos kalojen elinolot olisivat kunnossa Eurajoella, joen koskialueilla olisi pitänyt esiintyä edellisen kevään istutuksista peräisin olevia reilun vuoden ikäisiä lohia ja taimenia. Poikasia ei kuitenkaan havaittu, mikä viittaa vedenlaatuongelmiin, sillä pienpoikaset ovat hyvin herkkiä veden laadun vaihtelulle. Poikasten kohtalosta voi jälkikäteen esittää vain arvauksia. JVP-Eura Oy:n puhdistamon ohijuoksutusten aiheuttamat vedenlaatuongelmat tai muut veden laatuun liittyvät ongelmat ovat voineet aiheuttaa poikasten kuolemia heti niiden kuoriuduttua tai vähitellen ensimmäisen elinvuoden aikana. Jokeen kohdistuva jatkuva bisfenoli-A -kuormitus on voinut vaikuttaa pienten poikasten eloonjäämiseen. Lopullinen tuho – ehkä merkittävin – on luultavasti tapahtunut viimeistään bisfenoli-A:n satunnaispäästön vaikutuksesta, mikäli istutuseristä oli jotain vielä jäljellä.

Vuoden 2011 lohi-istutukset tehtiin Eurajokeen 4.5.2011 ja taimenistutukset 16.5.2011. Viljelylohet ovat 2-vuotiaina vaellusvalmiita ja lähtevät merelle pian istutuksen jälkeen, joten on mahdollista, että ne olivat tai suurin osa niistä oli jo ehtinyt poistua joesta merivaellukselle ennen bisfenoli-A -päästöä. Taimenistutus tehtiin vain neljä päivää ennen bisfenoli-A –päästöä, eli merkittävä osa istukkaista oli vielä joessa kun päästö tapahtui. Koskialueilla oleilleet taimenet ovat altistuneet bisfe-

noli-A:lle ja saaneet sitä elimistöönsä. Osa on ehkä menehtynyt, osa vaurioitunut, ehkä sairastunut ja kuollut myöhemmin ja loput ovat ilmeisesti paenneet alavirtaan.

Raumanmeren kalastusalue istutti 750 000 kpl vastakuoriutunutta vaellussiikaa Eurajoen alaosalle 15.5.2011. Myös tämä istutuserä on altistunut bisfenoli-A -päästön vaikutuksille.

Tavallisesti osa 2-vuotiaista taimenistukkaista jää istutuksen jälkeen aina jokeen, joko vuodeksi tai pidemmäksi aikaa, riippuen istukkaiden koosta, ympäristöolosuhteista ym. Koekalastusten taimenmäärät olivat kuitenkin pieniä kaikilla tutkituilla koskilla, mikä voi viitata siihen, että osa kaloista on lähtenyt ehkä pakosta liian varhain merivaellukselle siihen nähden mikä niiden vaellusvalmius on ollut. Myrkylle altistuminen voi myös aiheuttaa lisääntynyttä postsmolttikuolleisuutta merivaelluksen aikana. Bisfenoli-A on luonnossa nopeasti hajoavaa, mutta se on toisaalta ns. hormonihäirikkö, eli se reagoi elimistössä hormonin tavoin. Mahdollinen vaikutus voi tulla esiin lisääntymishäiriöiden kautta. Bisfenoli-A:n hormonaalinen vaikutus kohdistuu toki myös joen paikalliseen kalastoon.

Eurajokeen nousee syksyisin vaellussiikoja kudulle, tietojen mukaan aina Pappilankoskelle saakka. Tietoja lisääntymisen onnistumisesta ja esim. poikastuotannon määrästä ei kuitenkaan ole. Siian mäti hautoutuu kosken pohjalla kuten lohen ja taimenenkin mäti ja on samalla lailla alttiina ympäristöolojen vaihtelulle koko talven ajan. Eurajoen kuormitusvaihtelut ja yhtenä tekijänä bisfenoli-A -päästöt ovat selkeä riski myös kehittyvälle siian mädille ja kuoriutuville poikasille.

Koskialueilla esiintyy myös paikallista kalastoa, siis koskien tyyppilajistoa, joka viettää koko elinikänsä koskialueilla ja ilmentää siten koskialueen tilaa ja elinympäristön vakautta. Näistä lajeista kivisimppua tavattiin harvakseltaan neljältä koskelta seitsemästä ja kivennuoliaista kaikilta koskilta. Pienien yksilöiden osuus saaliista oli vähäinen, joka voi viitata lisääntymishäiriöihin, samoin kuin se, että kivisimppua ei esiinny kaikilla koskilla. Koskialueiden kalaston tiheydet ja biomassat olivat kaikkiaan varsin pieniä. Myös koeravustuksissa havaittiin, että pieniä yksilöitä tuli saaliiksi vain muutamia. Koskikalastossa havaitut poikkeamat saattavat viitata yksittäisen bisfenoli-A -päästön vaikutuksiin tai pitkäaikaisiin ongelmiin joen veden laadussa.

Eurajoella tehtyjen selvitysten mukaan joessa on tapahtunut jotain, mikä on hävittänyt istutetun, joessa elävän lohikalaston lähes kokonaan. Muun koskissa elävän kalaston osalta merkillepantavaa ovat puutteet lajistossa sekä nuorten kalojen pieni määrä. Myöskään täpläravun lisääntyminen ei näytä onnistuvan Eurajoessa. Joen kalaston kehittämisen ja varsinkin virtakutuisten vaelluskalakantojen elvyttämisen kannalta joen jatkuvat vedenlaatuongelmat muodostavat merkittävän epä-

varmuustekijän. Päästöt Jujo Thermal Oy:ltä tai JVP-Eura Oy:n puhdistamolta voivat tehdä tyhjäksi kaiken työn mitä joen hyväksi on tehty.

Jujo Thermal Oy:n satunnaispäästö on helposti osoitettava yksittäinen selittäjä, joka voi olla syyllinen joen kalastossa ja ravustossa havaittuihin ongelmiin. Jujo Thermal Oy on käyttänyt bisfenoli-A:ta jo vuosien ajan, eikä käytettävissä ole mitään tietoa tähänastisesta ”normaalipäästöjen” tasosta, saati yksittäisten isompien päästöjen määristä ja mahdollisista vaikutuksista. Eurajoelta on usein raportoitu, että joen vesi on sameaa ja epämiellyttävää, mutta varsinaista syytä veden huonoon laatuun ei ole saatu. Viime aikoina on käynyt ilmi, että JVP-Eura Oy:n puhdistamo on joutunut usein ohijuoksuttamaan puhdistamattomia jätevesiä jokeen. Näinä jaksoina jokeen on kohdistunut voimakasta ravinnekuormitusta, happea kuluttavaa kuormitusta ja kiintoainekuormitusta. Ohijuoksutukset ovat merkinneet myös piikkejä joen bisfenoli-A -kuormituksessa, mikäli myös Jujo Thermal Oy:n jätevesiä on mennyt näiden jaksojen aikana puhdistamattomana jokeen. Häiriöt Jujo Thermal Oy:n prosesseissa voivat aiheuttaa häiriöitä puhdistamon puhdistusprosesseissa ja edelleen kuormituspiikkejä jokeen.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut-ryhmä pitää välttämättömänä, että Eurajokeen kohdistuva bisfenoli-A -kuormitus vähenee olennaisesti. Bisfenoli-A:n vähentämisen tulee lähteä Jujo Thermal Oy:n prosesseista, jotta jäteveteen joutuvan bisfenoli-A:n määrä on mahdollisimman pieni. JVP-Eura Oy:n puhdistamolle johdettavan jäteveden bisfenoli-A -pitoisuudelle tulee asettaa yläraja. Puhdistamon toiminnan kaikinpuolinen varmistaminen on myös tärkeää, koska kaikki häiriöt heijastuvat puhdistamon toimintaan. Bisfenoli-A -kuormituksen olennaisen vähentämisen kannalta on erittäin tärkeää, että puhdistamo toimii hyvin. Puhdistamatonta jätevettä ei saa missään tilanteessa päästää suoraan jokeen.

Koska Jujo Thermal Oy:n jätevedet puhdistetaan JVP-Eura Oy:n puhdistamolla, Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut-ryhmä esittää bisfenoli-A -kuormituksesta aiheutuvien kalataloudellisten vahinkojen estämistä ja vähentämistä koskevat vaatimuksensa JVP-Eura Oy:n ympäristölupahakemusta koskevassa lausunnossaan.

3) *Euran kunta* lausuu seuraavaa:

Kunnanhallitus yhtyy Pyhäjärviseudun ympäristölautakunnan asiassa antamaan lausuntoon ja esittää Jujo Thermal Oy:n Kauttuan paperitehtaan ympäristölupahakemuksen ratkaisemista lupaviranomaisessa kiireellisenä.

4) *Eurajoen kunta* lausuu seuraavaa:

Jujo Thermal Oy:n jätevesipäästöjen ympäristövaikutuksista tärkeimmiksi kohoavat biologinen hapenkulutus ja suuri veden käyttö, jotka

myös heijastuvat JVP-Eura Oy:n puhdistamon toimintaan, sekä vesistölle haitalliset kemikaalit. Tehtaan veden käyttöä ja päästöjä on tarkasteltava kokonaisuutena tuotantoprosessin ja JVP-Eura Oy:n puhdistamon osalta. Jätevedet on johdettava puhdistamolle siten käsiteltyinä, että puhdistamon toiminta on mahdollisimman tehokasta, eivätkä vedet saa sisältää sellaisia jätevesiä tai kemikaalipäästöjä, jotka haittaavat puhdistamon toimintaa tai puhdistamolietteen käyttöä. Jujo Thermal Oy:n jätevesiin tulee soveltaa samoja vaatimuksia kuin teollisuudesta vesihuoltolaitoksen viemäriin laskettaville jätevesille. Luvassa on myös edellytettävä selvitystä, voidaanko ympäristölle haitallisia kemikaaleja korvata vähemmän haitallisilla.

Luvassa on myös edellytettävä, että haitallisia aineita ei joudu puhdistettuun veteen ja jokivesistöön. Suoraan jokeen johdettavien jäähdytysvesien ja muiden tehdasalueelta johdettavien puhdistamattomien vesien aiheuttamien päästöjen tulee olla mahdollisimman pienet ja niille on määrättävä vähintään pistonäytteisiin perustuva valvonta. Häiriöiden ehkäisyyn on kiinnitettävä erityistä huomiota ja tehtaan jätevesipäästöjen on täytettävä ympäristöluvan ehdot silloinkin, kun jätevedet puhdistetaan poikkeusjärjestelyin. Tehtaan tulisi myös laatia taloudellisesti toteuttamiskelpoinen ohjelma veden käytön ja jätevesimäärän pienentämiseksi pitkällä tähtäyksellä sekä raportoida sen edistymisestä vuosiraporttien yhteydessä.

5) ja 6) <u>Euran kunnan ympäristönsuojelu- ja terveydensuojeluviranomaisena toimivan Pyhäjärviseudun ympäristölautakunnan</u> lausunnossa todetaan mm. seuraavaa:

Ympäristöluvan lupamääräysten päivittäminen on tarpeellista monestakin syystä: voimassa olevassa luvassa tehtaan laajamittainen kemikaalien varastointi ja käyttö on otettu huomioon puutteellisesti. Aikaa on jo kulunut edellisen luvan myöntämisestä ja tehtaan toiminnasta on aiheutunut monta kertaa poikkeuksellisia päästöjä viemäriin tai Eurajokeen. Tehtaan vedet vastaanottava jätevedenpuhdistamo ei aina pysty tyydyttävästi käsittelemään tehtaan jätevesiä esim. erilaisissa poikkeustilanteissa. Lisäksi paperitehtaan melua koskevia määräyksiä on jouduttu tarkistamaan jo aiemmin kesken lupakauden, koska yhtiö ei ole saavuttanut luvassa määrättyjä ehtoja.

Ympäristöluvan valmistelussa on kiinnitettävä huomiota lämpöherkän paperin tuotantomäärien lisääntymiseen vuoden 2005 jälkeen ja erityisesti siihen, miten lämpöherkän paperin tuotannon lisääntyminen on vaikuttanut tehtaan kemikaalien ja raaka-aineiden käyttöön, päästöihin sekä ympäristöriskeihin. Muutoinkin erityistä huomiota on kiinnitettävä paperitehtaan melko suureen kemikaalien käyttöön, joka on viime vuosien valitettavien kokemusten mukaan merkittävä ympäristön pilaantumisen vaaraa aiheuttava riskitekijä. Tuotantoa kehittämällä ja muita käytettävissä olevia keinoja käyttäen ympäristölle ja terveydelle haitallisten jätevesiin ja jätteisiin jäävien kemikaalien määrää on edelleen

vähennettävä. Fossiilisen energian käyttö paperitehtaalla on laajamittaista ja siltä osin toimintaa on mahdollisuuksien mukaan kehitettävä kasvihuoneilmiön voimistumista vähemmän edistävään suuntaan.

Jujo Thermal Oy:n paperitehtaalta JVP-Eura Oy:n puhdistamolle lähtevälle jätevedelle on asetettava keskeisten vaarallisten ja haitallisten kemikaalien mm. bisfenoli-A:n osalta tiukat raja-arvot tai ko. kemikaalien johtaminen tehtaalta jätevesiin on kokonaan kiellettävä. Samalla on varmistuttava siitä, että JVP-Eura Oy:n puhdistamo pystyy käsittelemään mahdolliset paperitehtaan jätevesien kemikaalit, jos puhdistamolle paperitehtaalta tulevissa jätevesissä ko. kemikaaleja sallitaan. Kaikessa toiminnassa on noudatettava erityistä huolellisuutta ja varovaisuutta ympäristövahinkojen ehkäisemiseksi ja päästöjen vähentämiseksi. Tehtaan säännöllisellä kunnossapito- ja huoltotoiminnalla sekä yrityksen sisäisillä tarkastuksilla on osaltaan ehkäistävä kemikaali- ja ympäristövahinkoja. Ympäristövahinkojen varalta lupaehdoissa on annettava määräykset, joilla vahinkojen haitalliset seuraukset estetään. Ympäristövahingoista on lupaan kirjattavin menettelyin viipymättä tiedotettava viranomaisille, asianosaisille ja julkisuuteen.

Jujo Thermal Oy:n paperitehtaan meluntorjuntatoimia on jatkettava suunnitelmallisesti niin, että tavoitteena on saavuttaa ympäristölupapäätökseen kirjattavat kohtuulliset immissioarvot. Myös asemakaavassa olevat melumääräykset on otettava huomioon lupaa valmisteltaessa.

7) *<u>Eurajoen kunnan ympäristölautakunta</u> on lausunut seuraavaa:*

Jujo Thermal Oy:lle on myönnetty ympäristölupa vuonna 2005, jossa on annettu toimintaa koskevat vaatimukset. Nykyisen luvan mukaan tehtaan jätevedet on johdettava JVP-Eura Oy:n keskuspuhdistamolle jätevesiyhtiön kanssa tehdyn sopimuksen mukaisesti ja siten käsiteltyinä, että puhdistamon toiminta on mahdollisimman tehokasta. Tehtaan jätevedet eivät saa sisältää sellaisia jätevesiä tai kemikaalipäästöjä, jotka haittaavat puhdistamon toimintaa tai puhdistamolietteen hyötykäyttöä. Vuosien 2006 – 2010 aikana Jujo Thermal Oy:n paperitehtaalla on kirjattu yhteensä 17 häiriötilannetta, joista seitsemän koski poikkeuksellista raaka-aine-, kemikaali- tai öljymäärää jätevedessä. Muita häiriöitä olivat putki- ja pumppurikot ja suuret jätevesimäärät. Vuonna 2011 tehtaalta pääsi jokiveteen bisfenoli-A -kemikaalia, joka aiheutti vakavan ongelman vesistössä. Lautakunta katsoo, että toiminnanharjoittajan tulee laatia säännöllisesti päivitettävä tarkastus- ja huoltosuunnitelma tehtaan koneille ja laitteille, jotta mahdolliset käyttöhäiriöt saadaan minimoitua. Mahdollisista toimintahäiriöistä on pidettävä kirjaa ja niistä on raportoitava valvonnasta vastaavalle viranomaiselle. Tehtaalta suoraan Eurajokeen johdettavien jäähdytysvesien ja muiden tehdasalueelta johdettavien puhdistamattomien vesien aiheuttamien päästöjen tulee olla mahdollisimman pienet. Jos näihin vesiin on joutunut vesistölle haitallisia aineita, ne on viipymättä kerättävä erikseen puhdistamolle johdetta-

viksi, elleivät ne ole puhdistamolle haitallisia. Mikäli tämä ei ole mahdollista, tulee haitalliset aineet johtaa ongelmajätteiden käsittelyyn. Jätevesien aiheuttaman tulokuormituksen tulee noudattaa suunnitteluarvoja, mikäli JVP-Eura Oy:n kanssa ei toisin sovita. Lautakunta esittää, että hakijan tulee selvittää, voidaanko nykyiset käytössä olevat kemikaalit korvata ympäristöä vähemmän kuormittavilla kemikaaleilla. Tehtaan omat jätevedenkäsittelyjärjestelmät on pidettävä toimintakuntoisina poikkeustilanteita varten.

8) *Eurajoen kunnan terveydensuojeluviranomaisena toimiva Porin ympäristölautakunta* ilmoittaa lausuntonaan seuraavaa:

Tehtaan toiminnasta ei saa aiheutua terveyshaittaa aiheuttavia määriä melu-, haju-, pöly- tai muita päästöjä. Tehtaalta lähtevät jätevedet eivät saa sisältää sellaisia jätevesiä tai kemikaalipäästöjä, jotka voivat haitata JVP-Eura Oy:n puhdistamon toimintaa. Jätevesistä ei saa aiheutua terveydellistä haittaa tai ympäristön pilaantumisen vaaraa. Paperitehtaan oma puhdistamo tulee pitää käyttökunnossa mahdollisten JVP-Eura Oy:n puhdistamon häiriötilanteiden varalta. Ympäristöterveysjaosto esittää, että toiminnanharjoittajan tulee selvittää, voidaanko nykyisin käytössä olevat kemikaalit korvata ympäristöä vähemmän kuormittavilla kemikaaleilla. Lisäksi jaosto esittää, että toiminnanharjoittajan tulee laatia säännöllisesti päivitettävä tarkastus- ja huoltosuunnitelma tehtaan koneille ja laitteille, jotta mahdolliset käyttöhäiriöt saadaan minimoitua. Mahdollisista toimintahäiriöistä on pidettävä kirjaa ja niistä on raportoitava valvonnasta vastaavalle viranomaiselle.

9) *Lounais-Suomen aluehallintovirasto* lausuu asiasta seuraavaa:

Rauman Vesi ottaa raakaveden talousveden valmistukseen Eurajoesta. Lisäksi Teollisuuden Voima Oyj ottaa raakavetensä Eurajoesta. Käsiteltyä vettä käytetään mm. talousvetenä Olkiluodon voimalaitoksella. Eurajoen varrella on myös uimarantoja ja vettä käytetään kasteluvetenä.

Bisfenoli-A:n pitoisuudelle talousvedessä ei ole asetettu raja-arvoa. Euroopan elintarviketurvallisuusviranomainen (EFSA) on määritellyt vuonna 2006 bisfenoli-A:n turvalliseksi todetuksi päivittäiseksi saantiarvoksi 0,05 mg henkilön painokiloa kohden. Jos ihminen altistuisi bisfenoli-A:lle pelkästään juomaveden välityksellä ja 70 kg painava henkilö nauttisi 2 litraa vettä päivässä, tarkoittaa se, että talousveden pitoisuudesta 1,75 mg/l ei pitäisi aiheutua terveyshaittaa. Uudempien tutkimusten mukaan bisfenoli-A:n on epäilty häiritsevän hormonitoimintoja EFSA:n asettamaa turvallista raja-arvoa pienemmissä pitoisuuksissa. Varovaisuusperiaatteen takia Euroopan komissio kielsi bisfenoli-A:n käytön polykarbonaattimuovisten tuttipullojen valmistuksessa 1.3.2011.

Ihmiset altistuvat bisfenoli-A:lle lähinnä suun kautta ruuan välityksellä. Bisfenoli-A on polykarbonaattimuovien ja epoksipinnoitteiden raaka-

aine, jota saattaa vapautua tuotteista elintarvikkeisiin epätäydellisen polymeraation tai muovituotteen hajoamisen seurauksena.

Maailman terveysjärjestö (WHO), YK:n elintarvike- ja maatalousjärjestö (FAO), ESFA, Kanadan terveysvirasto, USA:n kansallinen ympäristöterveystieteiden instituutti ja USA:n elintarvike- ja lääkevirasto (FDA) julkaisivat vuonna 2010 asiantuntijaraportin bisfenoli-A:n toksikologisista ja terveydellisistä vaikutuksista ja sen mukaan bisfenoli-A ei ole välittömästi myrkyllistä tai genotoksista eikä aineen toteamiseksi syöpää aiheuttavaksi ole riittävästi tutkimustuloksia. Vaikutukset ihmisen lisääntymisterveyteen alhaisilla altistumisen tasoilla ovat raportin mukaan huomattavan epävarmoja. Aine on ihmisen ihoa herkistävä, mutta selvää näyttöä haitallisista vaikutuksista immuunijärjestelmään ei ole. Edellä kuvattuun perustuen Lounais-Suomen aluehallintovirasto katsoo, että bisfenoli-A:n pitoisuutta on tarkkailtava tehtaalta puhdistamolle lähtevästä jätevedestä säännöllisesti. Häiriötilanteisiin on varauduttava mahdollisimman tehokkaasti siten, että tehtaalta tapahtuvat puhdistamon ohijuoksutukset voidaan välttää.

10) *Turvallisuus- ja kemikaalivirasto (Tukes)* toteaa lausunnossaan seuraavaa:

Jujo Thermal Oy on Turvallisuus- ja kemikaaliviraston (Tukes) valvontakohde vaarallisten kemikaalien teollisen käsittelyn ja varastoinnin osalta. Yritys on lupalaitos. Yrityksen yksittäinen varastomäärältään suurin kemikaali on nestekaasu (49,5 tonnia). Lisäksi tehtaalla on muita vaarallisia kemikaaleja. Tehtaan jätevesijärjestelmään pääsi 20.5.2011 bisfenoli-A:ta laitehäiriön vuoksi. Yhtiö on antanut selvityksen välittömistä ja muista toimenpiteistä. Tukes tekee määräaikaistarkastuksen yritykseen 11.10.2012. Bayer Material Science AG on laatinut käyttöturvallisuustiedotteen 10.12.2010 bisfenoli-A:sta. Käyttöturvallisuustiedotteen luokitus vastaa nykyisen kemikaalien luokitusta, merkintöjä ja pakkaamista koskevaan asetuksen (CLP-asetus, EU/1272/2008) mukaista luokitusta.

Muistutukset ja mielipiteet

Hakemuksen johdosta on jätetty 75 muistutusta tai mielipiteen ilmaisua. Muistutuksissa ja mielipiteen ilmaisuissa esitetään tiivistetysti esittäen kirjaamisjärjestyksessä seuraavaa:

1. (**1**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle. Vaatii Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n toimintojen keskeyttämistä. Vastustaa puhdistamon laajentamista, jolloin ruvettaisiin käsittelemään entistä suurempia määriä jätevesiä.
2. (**2**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle. Huomauttaa vaahdosta veden pinnalla.
3. Raumanmeren kalastusalue muistuttaa, että joen kalataloudellinen kunnostus ei ole edennyt odotetusti. Pitää keskeisenä toiminnan riskinarviointia, määräyksiä häiriötilanteiden estämiseksi ja häiriöpäästö-

jen hallitsemiseksi esim. varoaltaan avulla. Vaatii nykyistä selkeämpää menettelyä kalastolle aiheutuvan haitan korvaamiseksi. Huomauttaa, että Raumanmeren kalastusalue istutti 15.5.2011 Eurajokeen 750 000 vastakuoriutunutta vaellussiian poikasta noin viikkoa ennen Jujo Thermal Oy:n bisfenoli-A -päästöä.

4. (**4**): Huolissaan kemikaalipäästöistä ja toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja jokiveden käytöstä kasteluvetenä. Moittii puhdistamoa puutteellisesta tiedottamisesta. Vaatii sanktioita.
5. (**5**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja rantaan laskeutuvasta liejusta. Vaatii korvauksia ja parempaa tiedottamista.
6. (**6**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle. Huomauttaa hajusta. Vaatii korvauksia ja puhdistamon kunnostamista.
7. (**7**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle, kasvien ja eläinten hyvinvoinnille, sekä jokiveden käytöstä vihannesten kasteluvetenä. Huolissaan kemikaalipäästöistä ja veden bakteeripitoisuudesta. Vaatii tuotantorajoituksia, raja-arvoja käsitellyn jäteveden bakteeripitoisuuksille, puhdistamolle sanktioita ja ilmoitusvelvollisuutta veden huonosta laadusta. Vaatii Mäkelänrannan näytteenottopisteen säilyttämistä.
8. Olkiluodon Vesi Oy huomauttaa, että hakijan tulisi nopeammin tiedottaa muille Eurajoen veden käyttäjille normaalista poikkeavista päästöistä poikkeustilanteissa. Esittää, että tiedotusprosessi tulisi kuvata hakemuksen yhteydessä.
9. (**9**): Vastustaa luvan myöntämistä hakijan esittämillä ehdoilla. Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä kemikaalipäästöistä ja vedessä näkyvästä sameasta massasta. Vaatii, että ympäristöluvassa pitää määrätä bisfenoli-A -pitoisuusmäärityksistä saatujen tulosten perusteella tehtävistä toimista. Bisfenoli-A:n päästö jokeen on kiellettävä. Vahingon sattuessa asianosaisille on tiedotettava välittömästi ja tuotanto laskettava sellaiselle tasolle, ettei aiheudu riskitilanteita.
10. (**10**): Kuten muistutus nro 9.
11. UPM-Kymmene Oyj muistuttaa, että Eurajoen vedestä valmistetaan Rauman kaupungin talousvesi ja Rauman metsäteollisuuden prosessivesi. Tulevan veden puhtauden merkitys on suuri sekä hygieenisesti että taloudellisesti. Ympäristölupaan tulee kirjata, että poikkeustilanteiden ilmoitusmenettelystä on sovittava erikseen UPM:n kanssa.
12. (**12**): Huolissaan jokialueen virkistyskäyttö- ja kalastusmahdollisuuksista. Huomauttaa puutteellisesta tiedottamisesta.
13. (**13**): Vastustavat lupaehtojen lieventämistä. Muistuttaa, että vesistön hyvinvoinnista huolehtiminen olisi hyödyksi yrityksen imagolle.
14. (**14**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle, joen kalataloudellisen kunnostuksen onnistumiselle, sekä jokiveden käytölle kasteluvetenä. Huomauttaa joessa esiintyvästä

vaahdosta ja hajusta. Huolissaan puhdistamon kapasiteetin riittävyydestä ja jäteveden laadusta. Huomauttaa, että tiedotus poikkeustilanteissa on ollut liian hidasta. Vaatii, että toiminnalle on asetettava riittävän tiukat lupaehdot.

15. Kiukaisten rantakalastajat ry muistuttaa, että Eurajoen harrastekäyttö ei ole vähäistä, vaan joen rannalla on vireää kalastustoimintaa. Kalastusta on myös edistetty joen kunnostamisella ja kalaistutuksilla. Esittää hakijan velvoittamista joen kunnostamiseen esimerkiksi ruoppauksin. Vastustaa luvan myöntämistä nykyisillä ehdoilla.
16. Laukolan – Mäkelän – Rahvolan kyläyhdistys on huolissaan kemikaalipäästöistä sekä niiden vaikutuksista joen virkistyskäytölle, ihmisten terveydelle ja kalakuolemiin. Huomauttaa, että kemikaalipäästöistä tiedottaminen on ollut puutteellista. Esittää, että hakija tulee velvoittaa toimenpiteisiin ja investointeihin kemikaalipäästöjen ehkäisemiseksi. Vaatii sanktioita kemikaalipäästöistä.
17. (**17**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä jokiveden käytöstä kasteluvetenä.
18. (**18**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle.
19. (**19**): Huolissaan kemikaalipäästöistä sekä toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä jokiveden käytöstä kasteluvetenä
20. (**20**): Huolissaan veden bakteeripitoisuudesta ja toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle. Huomauttaa, että tiedottaminen on ollut puutteellista.
21. Huhdan, Irjanteen ja Mullilan vesialueiden osakaskunnat muistuttavat, että Eurajoen virkistyskäytön lisäämiseksi on parannettu joen kalakantaa ja kalastusmahdollisuuksia, mutta päästöt voivat tappaa joen kalakannan ja pieneliöstön. Esittää tiukkoja päästörajoja, riittävän suuria varoaltaita, vaatimusta tuotannon alasajosta poikkeustapauksissa ja tulevaisuudessa siirtoviemärin rakentamista Poriin Harjavallan kautta tai Raumalle.
22. (**22**): Huolissaan toiminnan vaikutuksesta jokialueen virkistyskäytölle, kalastukselle, eläinten ja kasvien hyvinvoinnille, sekä jokiveden käytöstä kasteluvetenä. Epäilevät myös kaivoveden puhtautta. Huolissaan jokiveden bakteeripitoisuuksista ja kemikaalipäästöistä. Vaativat tuotantorajoituksia, raja-arvoja bakteeripitoisuuksille, sanktioita veden pilaamisesta, ilmoitusvelvollisuutta poikkeustilanteista ja Mäkelänrannan näytteenottopisteen säilyttämistä. Esittää, että luvassa tulisi vaatia koko jätevedenpuhdistuksen uudenaikaistamista.
23. (**23**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja ihmisten terveydelle, sekä veden käytöstä kasteluvetenä. Vaativat kemikaalipäästöjen kieltämistä luvassa sekä päästöistä sanktioita. Vaatii myös välitöntä tiedottamista poikkeustilanteissa.
24. (**24**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä kemikaalipäästöistä. Huomauttaa välinpitämättömästä asenteesta. Esittää tiukkoja lupaehtoja päästöjen ehkäisemiseksi. Esittää siirtoviemärin rakentamista Raumalle tai Poriin.

25. Osakaskunta Sorkkisten kalastuskunta on huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä jokiveden käytöstä kasteluvetenä, Eurajoen lohijoeksi ennallistamiselle, jokiveden talousvetenä käyttämiselle, sekä ihmisten terveydelle. Huomauttaa hajuhaitoista. Vaativat lupaehtojen kiristämistä ja puhdistamon laajentamista. Vaatii, että Jujo Thermal Oy:ltä ei saa päästää sellaisia vesiä, jotka tärvelevät JVP-Eura Oy:n puhdistamon prosessin.
26. (**26**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä veden bakteeripitoisuudesta.
27. Eurajoen – Lapijoen kalastusalue: kuten muistutus 25.
28. (**28**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle, jokiveden käytöstä kasteluvetenä, sekä kemikaalipäästöistä ja silmämääräisesti näkyvästä lietteestä. Vaatii, että haitallisia kemikaaleja ei saa päästä jokeen. Vaatii nopeampaa tiedottamista poikkeuksellisista päästöistä. Esittävät riittävän tiukkoja lupaehtoja, sanktioita välinpitämättömyydestä, toiminnan kieltämistä, sekä veden laadun tarkkailun tehostamista.
29. (**29**): Ammatinharjoittajia, joilla jokiveden käyttö kasteluvetenä on estynyt. Huomauttaa, että eivät ole saaneet riittävän nopeasti ilmoituksia veden epäpuhtauksista tai käyttökielloista. Eivät hyväksy häiriöpäästöjä. Huolissaan puhdistamon kapasiteetin ylittämisestä, puhdistamon huonosta kyvystä puhdistaa teollisuusjätevettä, riittämättömistä varoaltaista ja ympäristölle haitallisista kemikaaleista. Vaativat riittävän tiukkoja lupaehtoja.
30. (**30**): Esittää, että jokiveden tulee olla riittävän puhdasta virkistyskäytölle, kalastukselle, käytölle eläinten juomavetenä ja kasteluvetenä. Esittää, että häiriötilanteissa tehtaan jätevedet on ohjattava varoaltaasiin. Vaatii, että jokaisesta päästöstä on määrättävä sanktiot.
31. Rahvolan kylän kalastuskunta: kuten muistutukset 25 ja 27.
32. (**32**): Maanviljelijä, jonka pellot rajoittuvat Eurajokeen. Huolissaan kemikaalipäästöjen vaikutuksista kalastukselle ja jokialueen virkistyskäytölle sekä peltojen kastelulle. Vaatii, että kemikaalit täytyy poistaa kokonaan jokeen johdettavasta jätevedestä. Kemikaalipäästöt puhdistamattomina jokeen on estettävä ja niistä on määrättävä sanktiot. Esittää, että teollisuuden jätevedet eivät saa vaarantaa puhdistamoprosessin toimintaa. Riittävään henkilöstön määrään on kiinnitettävä huomiota. Vaatii tehokasta valvontaa.
33. (**33**): Huolissaan kemikaalipäästöjen vaikutuksista jokialueen virkistyskäyttöön, kalakuolemiin ja jokiveden käytölle kasteluvetenä. Huomauttaa puutteellisesta tiedottamisesta. Vaatii jätevedelle varoaltaita.
34. (**34**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, jokiveden käytölle kasteluvetenä tai raakavetenä, kalataloudellisen kunnostuksen onnistumiselle sekä pahanhajuisesta lietteestä. Vaatii, ettei lupamääräyksiä lievennetä, vaan että vaaditaan parannuksia puhdistustehoon. Vaatii sanktioita häiriöpäästöistä, veden laadun riippumatonta tarkkailua sekä häiriötilanteista tiedottamista.

35. Ala-Satakunnan ympäristöseura ry, Rauman seudun luonnonystävät ry ja SSL:n Satakunnan piiri ry esittävät muistutuksessaan seuraavaa: yhtiö tulee velvoittaa hakemaan uusille kemikaaleille viranomaisluvat, siten että sen on ennen kemikaalin käyttöönottoa hyväksytettävä valvontaviranomaisella merkittävästi puhdistusprosessiin vaikuttavat kemikaalit tai muut olennaiset muutokset. Kemikaalilupamuutokset tulee kirjata ympäristölupaan ajantasaisesti. Lupa-arvoksi esitetty käyttötiedotteen myrkyllisyysraja on riittämätön. Varovaisuusperiaatteen mukaan Jujo Thermal Oy:n lähtevän jäteveden pitoisuusrajaksi tulee asettaa bisfenoli-A:n haitallisen pitoisuuden raja (PNEC-arvo). Yhtiö pitää velvoittaa kehittämään toimivat menetelmät myös muiden haitallisten aineiden (kuten reaktiiviset värit ja kehittimet) pitoisuuden määrittämiseen ja täydentämään tältä osin ympäristölupahakemustaan. Ei pidä sallia jäteveden poikkeusjuoksutusta suoraan vesistöön eikä JVP-Eura Oy:n puhdistamon toimintaa häiritsevien aineiden juoksuttamista puhdistamolle. Yhtiö pitää velvoittaa tehtaan toimintahäiriön aikana käyttämään omaa puhdistamoa ja varoaltaita tai keskeyttämään tuotannon. Ympäristölupaan pitää kirjata seuraamusmenettely, jos lupa-arvoja ylitetään tai jos poikkeusjuoksutuksessa jätevesiä päästetään suoraan jokeen tai puhdistamolle. Tiedottamista tulee kehittää siten, että myös yksityishenkilöt saavat mahdollisimman pian tiedon häiriöpäästöistä.
36. (**36**): Vaatii, että Eurajokeen ei saa päästää kemikaaleja tai jätteitä. Huolissaan päästöjen vaikutuksista jokialueen virkistyskäytölle, kalastukselle, ihmisten ja eläinten terveydelle, sekä rehevöitymistä ja veden vaihtelevasta väristä. Huomauttaa puutteellisesta tiedottaminen poikkeustilanteissa.
37. (**37**): Huomauttaa välinpitämättömästä asenteesta joen virkistys- ja kalastuskäytön suhteen. Vaatii, että ei saa antaa lupaa kuormituksen lisäämiseen. Eurajoen virkistyskäyttö ja kalastus tulee mahdollistaa.
38. (**38**): Huolissaan päästöjen vaikutuksista jokialueen virkistyskäytölle ja kalastukselle sekä jokiveden käytölle kasteluvetenä ja tuotantoeläinten juomavetenä.
39. (**39**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle. Huomauttaa puutteellisesta tiedottamisesta häiriötilanteissa. Vaatii, että puhdistamon laitteisto tulee uusia.
40. (**40**): Huolissaan kemikaalipäästöistä, pahanhajuisesta lietteestä ja raakaveden laadusta. Vaatii 200 euron kertakorvausta Eurajokeen johdettavan huonosti puhdistetun jäteveden aiheuttamasta kalastusveden huononemisesta. Vaatii, että puhdistamon ja jätevesien purkupaikan välille rakennetaan ainakin 30 000 m^3:n varoaltaat, joiden rakentamiseen Jujo Thermal Oy:n tulee osallistua. Esittää, että ohijuoksutuksia ei pidä sallia.

41. (**41**): Huomauttaa, että Jujo Thermal Oy:n käyntihäiriöillä on merkittävä vaikutus JVP-Eura Oy:n puhdistamon toimintaan. Päästöt aiheuttavat epävarmuutta jokialueen virkistyskäytölle, maatalouden elinkeinonharjoittajille sekä Rauman kaupungin, UPM Kymmene Oyj:n ja TVO:n vedenotolle. Vaatii, että lupaehtoihin tulee sisällyttää varajärjestelmän käyttöönottovelvoite sekä määritellä sanktiot häiriöpäästöistä. Vaatii, että tiedottamista häiriötilanteissa tulee parantaa.
42. (Munakarin yhteisalue): Kuten muistutus 40, mutta korvausvaatimus 2000 euroa.
43. (**43**): Vaativat kemikaalipäästöjen kieltämistä sekä velvollisuutta tiedottaa onnettomuuksista välittömästi.
44. (**44**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja viljelylle. Muistuttaa luonnonsuojelun tärkeydestä.
45. (**45**): Vaativat, että jätevesi käsitellään siten, että niistä ei aiheudu haittaa jokialueen virkistyskäytölle, kalastukselle tai jokiveden käytölle kasteluvetenä.
46. Suiston yhteisalue: kuten muistutus 42.
47. (**47**): Maanviljelijä, joka on siirtynyt vihannesten viljelystä viljan viljelyyn. Huomauttaa, että vihannesten viljely oli hankalaa jokiveden huonon laadun vuoksi. Ei pidä hyväksyttävänä, että hakija säästää ympäristöasioissa aiheuttaen tappioita maataloudelle ja haittoja alueen asukkaille. Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle. Huomauttaa, että jokialueen virkistyskäytön vähäisyys on seurausta hakijan toiminnasta. Esittää, että luvan ehtoja tulee kiristää ja että jokiveden laatu, pohjasedimenttiin kertyneet aineet sekä päästöjen aiheuttajat selvitetään.
48. (**48**): Huolissaan jokiveden laadusta, kiintoaineen määrästä jokivedessä jokisuiston liettymisestä. Esittää, ettei kuormitusken vaikutusta Eurajoen kalakantaan ole arvioitu hakemuksessa riittävästi. Vaatii puhdistamolle mm. riskinarviointia ja parempaa kunnossapitoa. Vaatii parempaa tiedottamista häiriöpäästöistä, ohijuoksutusten lopettamista viiden vuoden kuluessa ja valvonnan tehostamista. Vaatii vahinkojen korvaamista asianosaisille.
49. (**49**): Elinkeinonharjoittajia, jotka ovat joutuneet investoimaan Eurajoen veden laadun vuoksi. Huomauttaa, että häiriöpäästöistä tiedottaminen on ollut puutteellista. Vesijohtoveden käyttö kasteluvetenä lisää kustannuksia. Huolissaan veden vaahtoamisesta, hajusta, kiintoaineen lisääntymisestä, sairaista ja kuolleista kaloista sekä päästöjen mahdollisista vaikutuksista ihmisten ja eläinten terveyteen.
50. (**50**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja jokiveden käytölle kasteluvetenä. Huomauttaa puutteellisesta häiriöpäästöistä tiedottamisesta. Esittävät, että hakemusasiakirjojen pitäisi olla nähtävillä myös Internetissä. Vaativat tekstiviesteihin perustuvan tiedotusjärjestelmän perustamista, huomion kiinnittämistä kemikaalipäästöihin, tehdasalueen vanhojen viemäriputkien kartoittamista ja tarvittaessa tukkimista, parempaa varautumista häiriö-

tilanteisiin käyttämällä varoaltaita, korvausvelvollisuutta elinkeinonharjoittajille ja sanktioiden käyttöönottoa.

51. (**51**): Huolissaan kemikaali- ja lietepäästöjen vaikutuksesta jokialueen virkistyskäytölle, kalastukselle, kalaistutusten onnistumiselle, viljelysten kasteluun sekä raakaveden laatuun. Vaatii sanktioita häiriöpäästöistä ja valvonnan ajanmukaistamista. Huomauttaa, että tiedotus häiriöpäästöistä on ollut puutteellista.
52. (**52**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja jokiveden käytölle kasteluvetenä.
53. (**53**): Huolissaan veden sameuden vaihtelusta, vaahdosta, kalakuolemista, hajuhaitoista, vesistön rehevöitymisestä, liettymisestä sekä toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja rantakiinteistöjen arvolle. Huomauttaa, että joen virkistyskäyttö ja kalastus on merkitykseltään suurempaa kuin hakemuksessa annetaan ymmärtää. Vaatii tiukempia lupaehtoja, nykyaikaista välitöntä tiedottamista häiriöpäästöistä, sanktioita häiriöpäästöistä sekä varoaltaiden rakentamista.
54. (**54**): Huolissaan veden bakteeripitoisuudesta, jokiveden pahasta hajusta ja väristä sekä joen rehevöitymisestä. Huomauttaa, että Eurajokea käytettäisiin virkistykseen, kalastukseen ja peltojen kasteluun, jos veden laatu sen sallisi. Vaatii siirtoviemärin rakentamista, järjestelmää häiriöpäästöistä tiedottamiseen sekä sanktioita lupaehtojen vastaisesta toiminnasta.
55. (**55**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäyttöön, kalastukseen ja joen kunnostukseen lohijoeksi.
56. (**56**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, jokiveden käyttömahdollisuuksille kasteluvetenä, rantakiinteistöjen arvolle, kalastukselle, joen kalataloudelliseen kunnostukseen sekä terveys- ja hajuhaitoista. Esittää, että jätevedet pitää johtaa käsiteltäväksi suuremmassa jätevedenpuhdistamossa tai käsitellyt jätevedet pitäisi johtaa suurempaan purkuvesistöön. Ympäristöluvassa pitää edellyttää parempaa tiedottamista poikkeustilanteista ja ohijuoksutuksista sekä tehokkaampaa riskinarviointia ja poikkeustilanteiden käsittelyä. Luvassa pitää esittää määräykset mm. kemikaalien säiliöalueiden allastamisesta sekä säiliöiden määräaikaistarkastuksista. Lupaehtoihin tulisi lisätä vaatimuksia laitoksen käytöstä ja jäteveden tarkkailusta. Jokeen laskevat putket tulee kartoittaa ja laitokselta tulee edellyttää sadevesikaivojen keräys- ja sulkumahdollisuutta mahdollisten vuotojen rajaamiseksi. Tulee myös harkita hule- ja jäähdytysvesien sisällyttämistä velvoitetarkkailun piiriin. Huomauttaa, että hakemuksesta ei ilmene, onko paperiteollisuuden puhdistamoaltaita käytetty varoaltaina. Lupaehdoissa pitää määrätä tuotannon rajoittamisesta, jos puhdistamon toiminnassa on ongelmia eikä kuormitusta pystytä rajoittamaan omiin varoaltaisiin. Vaihtoehtoisesti jätevedet on kuljetettava muualle. Tarkkailuvelvoitteisiin tulee sisällyttää määräyksiä jäteveden ja jokiveden kemikaalipitoisuuksien ja niiden vaikutusten seurannasta. Tarkkailua tulee suorittaa myös silloin, kun jätevesiä ei voida käsitellä yhteispuh-

distamossa. Esittää, että yksittäisten kemikaalien myrkyllisyysrajan alittaminen ei ole riittävä, koska se ei kerro kemikaalien yhteisvaikutuksista vesistössä. Kemikaaleilla voi olla myös vaikutusta puhdistamon bakteerikantaan. Hakija on saanut merkittävää taloudellista hyötyä alajuoksun asukkaiden ja maanviljelijöiden kustannuksella, kun sen ei ole tarvinnut huolehtia riittävistä vesiensuojelutoimenpiteistä eikä rikkomuksista ole asetettu sanktioita. Jujo Thermal Oy:lle tulisi määrätä omat lupaehdot jätevesipäästöille aikaisemman sopimusperusteisen mallin sijasta. Lupapäätöksessä pitäisi määrätä myös kapasiteettiraja tuotannolle sekä raja-arvot kemikaalipäästöille.

57. (**57**): Maanviljelijä, joka ilmoittaa olevansa estynyt käyttämään jokivettä kasteluvetenä. Toteaa virkistyskäytön ja kalastuksen joessa käyneen mahdottomaksi joen huonon tilan vuoksi.
58. (**58**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle. Vaatii hakijaa huolehtimaan ympäristönsuojeluvelvoitteistaan sekä osaltaan puhdistamon toiminnasta, tehokkaampaa puuttumista poikkeustilanteisiin, parempia toiminta- ja tiedotussuunnitelmia, tuotannon rajoittamista puhdistamon häiriötilanteissa, riittävää varoallaskapasiteettia, jätevesien seurannan lisäämistä, Esittää sanktioiden määräämistä lupamääräysten noudattamiseksi.
59. (**59**): Vaatii lupaehtojen kiristämistä ja valvonnan lisäämistä. Huolissaan Eurajoen veden laadusta.
60. (**60**): Maanviljelijöitä, jotka ovat ilmoittamansa mukaan luopuneen erikoiskasvien viljelystä osittain kasteluvetenä käytetyn jokiveden huonon laadun vuoksi. Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja kasteluveden laadulle sekä kala- ja rapuistutusten onnistumiselle. Vaatii tuotannon rajoittamista puhdistamon häiriötilanteissa, tehokkaampaa puuttumista poikkeustilanteisiin, jätevesien tasaus- ja varoallastusta. Huomauttaa huonosta tiedottamisesta poikkeustilanteissa.
61. Kiukaisten kylän kalastuskunta vaatii hakijan jäte-, jäähdytys- ja hulevesien parempaa seurantaa sekä puhdistamon toiminnan vaarantavien jätevesien puhdistamolle pääsyn estämistä.
62. (**62**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja jokiveden käytölle kasteluvetenä. Vaativat lupamääräyksiä kemikaaleille ja ohijuoksutusten lopettamista.
63. Panelian kotiseutuyhdistys vaatii sanktioita häiriöpäästöille, rajoja kemikaalipäästöille ja hakijan tuotannon rajoittamista vastaamaan jätevedenpuhdistamon kapasiteettia.

64. (**64**): Huomauttaa Eurajoen veden olevan nykyisin soveltumatonta kasteluvedeksi.
65. (**65**): Maanviljelijöitä, jotka ilmoittavat JVP-Eura Oy:n Säkylän kunnan ja Lännen Tehtaat Oyj:n jätevesien huonontavan Eurajoen veden laatua siinä määrin, että viljely saattaa muuttua mahdottomaksi. Vaatii korvausten maksamista viljelijöille muistuttaen edellisten korvausten maksetun vesialueiden omistajille.
66. (**66**): Muistuttaa, että jokea käytetään uimiseen ja kalastukseen.
67. Kiukaisten aluetoimikunta toteaa, että lupaehdot tulee määritellä siten, että Eurajoen virkistyskäyttö ja jokiveden käyttö mm. kasteluvetenä on mahdollista.
68. (**68**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle ja kalastukselle.
69. Rauman kaupungin sosiaali- ja terveysvirasto muistuttaa, että Rauman kaupunki käyttää Eurajoen vettä. Vaatii toiminnanharjoittajaa tekemään ilmoituksen Rauman terveysvalvontaan Eurajoen veden laatuun vaikuttavista häiriöistä.
70. Laihiankylän kalastuskunta ja Panelian kalastuskunta yhdessä vaativat, että luvassa on määrättävä jätevesien riittävälle esikäsittelylle ennen niiden johtamista JVP-Eura Oy:n jätevedenpuhdistamolle. Erityisesti huomiota on kiinnitettävä kemikaaleihin.
71. (**71**): Huolissaan toiminnan vaikutuksista jokialueen virkistyskäytölle, kalastukselle ja jokiveden käytölle kasteluvetenä. Vaatii hakijaa rajoittamaan tuotantoaan mikäli puhdistamo ei kykene jätevesiä vastaanottamaan sekä esikäsittelemään jätevetensä. Vaatii sanktioita häiriöpäästöistä.
72. (**72**): Maanviljelijöitä, jotka ilmoittavat veden käyttökiellon vaarantavan elinkeinon ja joen virkistyskäytön Huomauttavat puutteellisesta tiedottamisesta häiriötilanteissa Vaatii tiukkoja määräyksiä erityisesti bakteerien osalta, sekä varoaltaiden rakentamista.
73. (**73**): Vaatii varoaltaiden rakentamista ja sanktioiden määräämistä häiriöpäästöistä.
74. (**74**): Huolissaan Eurajoen tilasta ja virkistyskäyttömahdollisuuksista.
75. (**75**): Huolissaan Eurajoen virkistyskäyttömahdollisuuksista).

Muistutuksen jättäneiden ja mielipiteen ilmaisseiden yksityishenkilöiden nimet on poistettu julkisessa verkossa olevasta päätöksen versiosta.

Hakijan kuuleminen ja vastine

Jujo Thermal Oy on toimittanut 10.12.2012 yhteisen vastineen Ahlstrom Tampere Oy:n Kauttuan tehtaan kanssa. Vastineessaan hakija toteaa mm. seuraavaa:

Lounais-Suomen aluehallintovirasto on tehnyt laskeman, jonka mukaan 70 kg painava henkilö voi nauttia turvallisesti päivittäin 2 litraa vettä, jonka bisfenoli-A -pitoisuus on 1,75 mg/l. Jujo Thermal Oy huomauttaa tässä kohtaa, että tämä laskelma perustuu Euroopan elintarviketurvallisuusviranomaisen (EFSA) määrittelemään siedettävään päiväannokseen (TDI, tolerable daily intake), jonka varmuuskerroin on 100. Lounais-Suomen aluehallintovirasto on lausunnossaan todennut, että uusimpien tutkimusten mukaan bisfenoli-A:n on epäilty häiritsevän hormonitoimintoja EFSA:n asettamaa turvallista raja-arvoa pienemmissä pitoisuuksissa. Jujo Thermal Oy pyytää viranomaiselta selvitystä mihin tutkimukseen he tällä viittaavat ja miten se muuttaa bisfenoli-A:n turvallista päivittäistä saantiarvoa 0,05 mg/kg (henkilön painokiloa).

Bisfenoli-A:n käyttöturvallisuudesta Jujo Thermal Oy tuo esille seuraavaa: EU:n säädöksen, 10/2011/EU mukaan bisfenoli-A:ta voidaan käyttää aineissa, jotka ovat kontaktissa ruokatarvikkeisiin. Euroopan elintarvikeviraston, EFSA:n mukaan samanlainen säädös on voimassa mm. USA:ssa ja Japanissa. EU:n direktiivin, 2011/8/EU mukaan bisfenoli-A:ta ei saa käyttää tuttipullojen polykarbonaattimuoveissa. EFSA on tiedotteessaan 29.1.2007 todennut bisfenoli-A:n NOAEL-arvoksi 5 mg henkilön painokiloa kohden päivässä. EFSA käyttää varmuuskerrointa 100 määritellessään bisfenoli-A:n siedettävää päiväannosta. Tämän perusteella EFSA:n kanta bisfenoli-A:n turvallisesta päivittäisestä saantiarvosta on 0,05 mg henkilön painokiloa kohti. EFSA on tarkistanut vuonna 2002 määrittelemäänsä kantaa bisfenoli-A:n turvallisuudesta vuosien 2006 ja 2010 – 2012 aikana. Vuonna 2002 EFSA päätyi käyttämään varmuuskerrointa 500 siedettävää päiväannosta määritellessään. Vuoden 2006 jälkeen EFSA on käyttänyt varmuuskerrointa 100, koska heidän näkemyksen mukaan bisfenoli-A:n riskit ovat lukuisien tutkimusten vuoksi paremmin tunnettu. EFSA:n määrittelemä bisfenoli-A:n turvallinen päivittäinen saantiarvo 0,05 mg henkilön painokiloa kohti on säilynyt muuttumattomana vuoden 2006 jälkeen. Lounais-Suomen aluehallintovirasto katsoo, että Jujo Thermal Oy:n tulee varautua häiriötilanteisiin mahdollisimman tehokkaasti siten, että tehtaalta tapahtuvat puhdistamon lyhytaikaiset ohitukset voidaan välttää. Jujo Thermal Oy:n mukaan häiriötilannevarautumisesta huolimatta puhdistamon hallittu ja tarkkailtu lyhytaikainen ohitus tulee olla luvassa sallittu. Jujo Thermal Oy:n esitys perustuu paperitehtaan pitkäaikaisiin jäteveden tarkkailumittauksiin ja jäteveden kokonaismyrkyllisyysmittaukseen, joiden tulosten perusteella jätevettä ei voida pitää ihmisille ja ympäristölle niin haitallisena ettei puhdistamon ohitusmahdollisuus olisi kohtuullinen edellytys. Jujo Thermal Oy:n toimintaperiaatteiden mukaan mahdollista ohitusta käsitellään toiminnan poikkeamana, joka edellyttää asian sisäisen tutkinnan ja korjaavien toimenpiteiden tekemisen.

Bisfenoli-A:n osalta ohituksen vaikutusta on arvioitu seuraavasti: Jujo Thermal Oy on prosessimuutoksien avulla pystynyt vähentämään merkittävästi jäteveteen menevää bisfenoli-A:ta vuosien 2011 – 2012 aikana. 1.6.2012 – 14.11.2012 välisen tarkkailujakson aikana jätevedenpuhdistamolle menevän jäteveden bisfenoli-A -pitoisuus on vaihdellut mittauksen mukaan keskimääräisen 1 mg/l ja huippuarvon 15 mg/l välissä. Mikäli Eura-

joen virtaama olisi joen minimivirtaus 2,5 m^3/s, jäteveden määrä maksimiarvo 6000 m^3/vrk ja jäteveden bisfenoli-A -pitoisuus maksimiarvo 15 mg/l, olisi Eurajoen bisfenoli-A -pitoisuus korkeintaan 0,42 mg/l jäteveden mennessä puhdistamattomana Eurajokeen. Keskimääräisillä arvoilla laskettuna, käytetty virtaamaa 4 m^3/s, päädytään bisfenoli-A -pitoisuuteen 0,014 mg/l. 70-kiloinen henkilö voisi edellä mainitun esimerkin maksimiarvotapauksessa juoda Eurajoen vettä 8,3 l/d turvallisesti, kun turvallisuus arvioidaan EFSA:n määrittelemän turvallisen päivittäisen saantiarvon perusteella. Koska paperitehtaan jätevesi ei ole myrkyllistä, 1.2.2012 suoritettu jäteveden kokonaisuusmyrkyllisyysmittaus, ja koska JVP-Eura Oy:n puhdistamon biologia on koko 9-vuotisen toimintansa aikana toiminut hyvin, ja koska Eurajoen ympäristö ei ole kärsinyt nykyistä huomattavasti korkeammista bisfenoli-A -pitoisuuksista vuosien 2000 – 2003 aikana, voidaan ohituksen ympäristövaikutusten vaikutus arvioida pieneksi. Edellä mainitun mittauksiin perustuvan bisfenoli-A:n tarkkailun tueksi Jujo Thermal Oy on tehnyt arviolaskelman Eurajoen bisfenoli-A -pitoisuudesta ja jäteveteen joutuvasta bisfenoli-A:n määrästä vuosien 2000 – 2013 aikana. Tämän arvion mukaan bisfenoli-A -pitoisuus on tarkastelujakson lopussa 25. osa siitä mitä se oli tarkastelujakson alussa. Jäteveteen joutuvan bisfenoli-A:n määrä on nyt 30 % pienempi ja ensi vuonna 50 % pienempi kuin vuosituhannen alussa.

Näiden asioiden perusteella Jujo Thermal Oy ei pidä perusteltuna Lounais-Suomen aluehallintoviraston esitystä puhdistamon ohijuoksutuksen estämisestä häiriötilanteessa. Bisfenoli-A:n tarkkailuvaatimukseen Jujo Thermal Oy esittää, että tarkkailutaajuuden ja -laajuuden tulee olla kohtuullinen.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen lausunnon ensimmäisessä kappaleessa todetaan, että hakijat aiheuttavat yhdessä alueen muiden toimijoiden kanssa vesistön merkittävää pilaantumista ja meluhaittaa. Paperitehtaan näkemyksen mukaan viranomaisen tulee määritellä perustelut tälle toteamukselle ja myös osoittaa miten se on todettu. Paperitehdas esittää, että sen vaikutus vesistöön ja meluun ei ole merkittävä. Toiminnan vaikutuksen merkittävyyttä vähentää osaltaan se, että Eurajoen veden laatua heikentää eniten maatalouden ja luonnon normaalit valumavedet. Lisäksi on todettavissa, että paperitehdas ei suoraan kuormita Eurajokea. Melun osalta on olemassa mittaustuloksia, joissa voidaan todeta tehtaan lähialueen melun ylittävän 55 dB, vaikka tehdas on pysäyksissä. Eurajoen virtaava vesi aiheuttaa ympäristöön merkittävän melulähteen. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen lausunnon toisessa kappaleessa on todettu lämpöherkän paperin tuotannon lähes kaksinkertaistuminen lupakauden aikana. Tämän asian Jujo Thermal Oy on esittänyt vielä voimassa olevassa luvassa eikä se siinä mielessä ole muutos nykyiseen lupaan verrattuna.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on todennut lämpöherkän paperin tuotannon aiheuttavan kemikaalikuormitusta ja ympäristöhaittaa. Nykyisen ympäristöluvan lupaprosessin aikana paperitehtaan jätevedet on alettu puhdistamaan JVP-Eura Oy:n puhdistamolla vuonna 2004. Tämän muutoksen myötä paperitehtaan jätevedet on käsitelty mekaanisen puhdistuksen lisäksi myös biologisessa puhdistusprosessissa.

JVP-Eura Oy:n puhdistamon käynnistyttyä lämpöherkän paperin valmistuksessa käytetyn bisfenoli-A:n reduktio JVP-Eura Oy:n puhdistamolla on ollut tyypillisesti yli 80 %, mikä on voitu todentaa bisfenoli-A:n tarkkailumittausten avulla 2011 alkaen. Bisfenoli-A:n tarkkailun aikana reduktio on ollut muutamilla kerroilla vain 20 %. Loppusyksystä 2012 bisfenoli-A:n reduktio on ollut yli 90 % ja ajoittain yli 98 %. Vuosina 2011 – 2012 Jujo Thermal Oy on pystynyt vähentämään lämpöherkkien päällystekemikaalien pitoisuutta jätevedessä viidenteen osaan siitä mitä se oli vuoden 2011 alussa ja, kemikaalikulutuksen lisääntymisen vuoksi, vähennystä 2000-luvun alkuun nähden on ollut 30 %. Nähtävissä on, että Jujo Thermal Oy tulee pääsemään bisfenoli-A:n määrässä tasolle 200 kg/kk sen omassa jätevedessä ensi vuoden alkupuolella. Yhteenvetona Jujo Thermal Oy toteaa, että lämpöherkkien papereiden valmistuksesta Eurajokeen joutuvien lämpöherkkien päällystekemikaalien määrä, lisääntyneestä tuotannosta riippumatta, on vähentynyt huomattavasti siitä mitä se oli nykyisen ympäristöluvan hakuprosessin aikana 2003 – 2005.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus toteaa, että ympäristön kannalta paras vaihtoehto olisi johtaa teollisuuden ja yhdyskuntien jätevedet muualle kuin JVP-Eura Oy:n puhdistamolle puhdistettavaksi tai puhdistamon jätevesien purkupaikka tulisi siirtää suurempaan vesistöön. Paperitehdas toteaa vastineena tälle, että tällä hetkellä ei olemassa muuta paikkaa kuin JVP-Eura Oy ja, että asiassa tulee ottaa huomioon myös esitetyn muutoksen kustannukset.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää, että paperitehtaalta JVP-Eura Oy:n puhdistamolle johdettaville jätevesille on asetettava laatumääräykset ja raja-arvot sekä, että jäteveden laatu on vakioitava virtaaman, pH:n, haitta-aineiden ja päästöjen suhteen. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen mukaan paperitehtaan jätevedelle tulee asettaa luparajat sen vuoksi, että paperitehtaan jätevedet voivat aiheuttaa vesistön lisäksi ongelmia myös puhdistamon biologisen osion toiminnalle. Paperitehdas haluaa tuoda esille, että niiden yhdeksän vuoden aikana, jona paperitehtaan jätevedet ovat menneet JVP-Eura Oy:lle, ei Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esittämä riski biologisen puhdistuksen häiriintymisestä ole toteutunut. Samaisen ajanjakson aikana paperitehtaan tuotantoprosessissa on tapahtunut muutama häiriö, joiden seurauksena JVP-Eura Oy:n puhdistusprosessi on häiriintynyt hetkellisesti, mutta siitä huolimatta Eurajokeen ei ole aiheutunut merkittävää pysyvää pitkäkestoista haittaa. Paperitehtaan jätevesien myrkyttömyys on lisäksi todennettu eikä sen selvityksen mukaan jätevettä voida pitää myrkyllisenä. Tämä myrkyllisyysselvitys on ympäristölupahakemuksen liitteenä. Jäteveden myrkyttömyyden vuoksi Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esittämän riskin tasoa voidaan pitää matalana ja JVP-Eura Oy:n toimintahistorian tapahtumien perusteella tapahtumaa epätodennäköisenä.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esitykselle paperitehtaan jäteveden ominaisuuksien määrittelylle ei näistä syistä ole aihetta. Kokonaisuuden kannalta ei myöskään ole oleellista ja toiminnalli-

sesti järkevää, että paperitehtaan jäteveden ominaisuudet rajataan ennen jäteveden käsittelyä JVP-Eura Oy:llä, tai että jäteveden laatu rajataan sellaiseksi, että JVP-Eura Oy:n lietteitä ei voida hyödyntää. Paperitehtaan näkemyksen mukaan ympäristöluvassa tulee tehdä vain sellaiset rajaukset, jotka perustuvat suoriin lakeihin ja määräyksiin sekä ovat toiminnan harjoittajan kannalta kohtuulliset. Paperitehdas on JVP-Eura Oy:n osakas ja jätevedet käsitellään JVP-Eura Oy:llä. Paperitehdas toteaa edellä mainitun lisäksi, että paperitehdas on tällä hetkellä ainoa taho JVP-Eura Oy:n asiakkaista, jonka jätevettä tarkkaillaan päivätasolla. Muiden tahojen jätevesiä ei tarkkailla tässä laajuudessa. Nykyisen tarkkailun laajuus antaa JVP-Eura Oy:lle keinot kehittää paperitehtaan jätevesien osalta toimintaansa ja se myös mahdollistaa viranomaiselle paperitehtaan jätevesien monitoroinnin.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää, että Jujo Thermal Oy:n tulee laatia selvitys päällystepitoisten jätevesien esikäsittelyn tehostamisesta. Jujo Thermal Oy toteaa vastineena tälle, että näin on toimittu ja tiedot siitä on toimitettu Jujo Thermal Oy:n ympäristölupaa valvovalle Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle. Jujo Thermal Oy on tässä selvityksessä myös arvioinut mitä käytännössä tunnettuja keinoja on bisfenoli-A -pitoisuuden vähentämiseksi. Parhaimpana tunnettuna tekniikkana tässä yhteydessä on pidettävä biologista puhdistusta, koska bisfenoli-A on helposti biohajoava ja bisfenoli-A:n reduktiossa päästään tasolle 90 – 99 %. Biologisen puhdistuksen toimivuus on myös osoitettavissa Jujo Thermal Oy:n ja JVP-Eura Oy:n jäteveden bisfenoli-A:n tarkkailutuloksista. Myös nämä tiedot ovat valvovan Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen käytössä. Jujo Thermal Oy:llä ei ole mahdollisuutta verrata sen omien jätevesien bisfenoli-A -pitoisuutta muiden alalla toimivien yritysten jätevesin pitoisuuteen tai verrata niillä käytössä olevaa tekniikkaa Jujo Thermal Oy:llä käytettyihin menetelmiin ja tekniikoihin. Jujo Thermal Oy esittää vastineena, että oleellista on tietää mitä haittaa missäkin bisfenoli-A -pitoisuudessa ympäristölle ja ihmisille aiheutuu ja sen mukaan tulee tehdä päätöksiä JVP-Eura Oy:n ympäristöluvassa koskien jäteveden bisfenoli-A -pitoisuutta. Esikäsittelyn tehostamisessa Jujo Thermal Oy jatkaa toimenpiteitä ja raportoi niistä Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on esittänyt arvion syistä miksi Jujo Thermal Oy on aikaistanut ympäristöluvan tarkistusta. Jujo Thermal Oy toteaa tähän, että ympäristöluvan aikaistaminen on johtunut Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen vaatimuksesta eikä Jujo Thermal Oy:n toiminnan muutoksesta.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on esittänyt tavoitteeksi bisfenoli-A:n pitoisuudelle Eurajoessa 0,001 mg/l. Jujo Thermal Oy on edellä esittänyt miten bisfenoli-A:n pitoisuus on arvioiden mukaan muuttunut vuosien 2000 – 2013 aikana. Pitoisuus on tämän arvion mukaan ollut alueella 0,003 – 0,139 mg/l. Ko. kemikaalia on käytetty 1990-luvun alusta alkaen. Eurajoen vaikutusalueella ei ole tiedossa henkilö- tai ympäristövaikutuksia, jotka ovat johtuneet bisfenoli-A:sta. Jujo Thermal Oy:n arvion mukaan bisfenoli-A:n pitoisuus alle 0,020 mg/l on mahdollista saavut-

taa keskiarvoisesti, mutta lähestyttäessä pitoisuutta 0,001 mg/l haasteet lisääntyvät eikä nykytekniikalla esitettyä tavoitetta tulla saavuttamaan. Bisfenoli-A:n tarkkailumittaukset tukevat tätä arviota. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on verrannut Eurajoesta mitattuja bisfenoli-A:n mittaustuloksia keskieurooppalaisiin mittaustuloksiin. EU:n bisfenoli-A:n riskienarvioinnissa vuonna 2010 on mainintoja suuremmista bisfenoli-A -pitoisuuksista kuin mitä Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on lausunnossaan esittänyt. EU:n riskienarvioinnin mukaan mm. Norjassa on mitattu 0,043 mg/l bisfenoli-A -pitoisuus. Vaikka Eurajoesta mitatut bisfenoli-A -pitoisuudet ovat joissakin tilanteissa ylittäneet Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esittämät muualla mitatut arvot, ei se Jujo Thermal Oy:n mukaan tarkoita että riski olisi suuri – suuremmankin luvun riski voi olla pieni. Jujo Thermal Oy viittaa edelleen yli 20 vuotta jatkuneeseen toiminnan historiaan ja esittää näkemyksen, että luonnosta tai ihmisistä ei tänä aikana ole voitu osoittaa bisfenoli-A:sta johtuvia ongelmia.

Koska julkisesti on esitetty arvioita, että bisfenoli-A on hormonihäirikkö, tulisi sen vuoksi noudattaa varovaisuusperiaatetta. Vuonna 2010 päivitetyssä EU:n bisfenoli-A:ta koskevassa riskienarvioinnissa bisfenoli-A:n NOEC-arvoksi on esitetty 0,016 mg/l. NOEC-arvossa on huomioitu bisfenoli-A:n mahdollinen hormonaalinen vaikutus eliöön. Turvallisuusperiaatteen vuoksi riskienarvioinnissa on esitetty PNEC-arvoksi 0,0016 mg/l. Kemikaalien valmistajien julkaisemissa käyttötuvallisuustiedoissa varovaisuusperiaate näkyy PNEC-arvojen pienenemisenä tämän riskienarvioinnin jälkeen. Jujo Thermal Oy vastaa bisfenoli-A:ta koskevaan esitykseen, että varovaisuusperiaatteen tule näkyä Jujo Thermal Oy:n toiminnassa bisfenoli-A:lle altistamisen vähentämisenä jatkuvan parantamisen toiminnan kautta. Ehdottomissa pitoisuusrajoissa tulisi asettaa rajat EU:n täsmällisten raja-arvojen mukaisesti ja valvoa raja-arvojen toteutumista EU:n sisäisten yhtenevien tarkkailumenetelmien avulla. Samalla tulee täsmennettyä se sekavuus, joka aiheutuu käyttöturvallisuustietojen PNEC-arvoista, jotka voivat vaihdella kemikaalin valmistajasta riippuen. Jujo Thermal Oy ei pidä kohtuullisena asettaa muita ehdottomia raja-arvoja bisfenoli-A:lle. Lisäksi Jujo Thermal Oy esittää, että mikäli ehdottomia raja-arvoja edellytetään toiminnanharjoittajalta, tulee raja-arvoihin pääsemisen aikataulu olla yhtenevä kaikkien toiminnanharjoittajien kesken.

EU:n riskienarvioinnissa esitetty PNEC-arvo 0,0016 mg/l on erittäin haastava ja se ei toteudu Euroopan joista mitattujen arvojen mukaisesti, minkä myös Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on muistutuksessaan todennut. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on todennut Ahlstrom Tampere Oy:n Kauttuan tehtaan käyttämän biosidin päätyvän 100 %:sti jätevesiin. Ahlstrom Tampere Oy:n ympäristölupahakemuksen liitteessä 8.2 näin on todettu, koska ei voida arvioida miten suuri osa biosidistä päätyy jäteveteen ja miten suuri osa paperiin tai miten suuri osa hajoaa jo prosessissa. Ahlstrom Tampere Oy Kauttuan tehdas yhdessä Jujo Thermal Oy:n kanssa on tutkinut biosidin määrää jätevedessä, liite 3, ja toteaa biosidin vaikuttavien aineiden määrien olevan niin pienet, että niiden määrää ei luotettavasti voida todentaa jätevedestä.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää hakijoille, että niiden tulee laatia laaja kemikaalien yhteisvaikutustutkimus ja arviointi haittaavatko kemikaalit jäteveden puhdistamon toimintaa. Hakijat esittävät, että jo tehty jäteveden kokonaismyrkyllisyystutkimus ja jäteveden biosidipitoisuusmääritys ovat riittävä osoitus hakijoiden jäteveden haitattomuudesta. Kemikaalien haittaavuuden tutkintaa jätevesilaitoksen toimintaan hakijat pitävät enemmän tieteellisen tutkimustyön aiheena kuin ympäristölupaan liittyvänä velvoitteena.

Kokemuksen mukaan on osoitettavissa, että JVP-Eura Oy:n suorituskyky on hyvää tasoa. JVP-Eura Oy:n toiminnan ongelmat eivät johdu hakijoiden jäteveden kemikaaleista. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus toteaa, että melutaso ylittää sekä päivä- että yöohjearvot suurimmillaan 8 dB. Paperitehtaan mittausten mukaan tällä hetkellä yöohjearvo ylitetään suurimmillaan 6 dB. Nykyisen ympäristöluvan päätöksen mukaisesti paperitehdas suorittaa laajemman melumallinnuksen ja raportoi tulokset viranomaiselle.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää, että paperitehtaalle tulee varata aikaa korkeintaan kaksi vuotta meluntorjuntatoimien toteuttamiselle. Hakijoiden mielestä Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen vaatimus on kohtuuton. Voimassa olevan Etelä-Suomen aluehallintoviraston päätöksen ja Vaasan hallinto-oikeuden vahvistaman menettelyn mukaan paperitehtaan tulee suorittaa kaksivuotisia toimenpidesuunnitelmia toimenpiteineen ja mittauksineen tavoitteena saavuttaa melun päivä- ja yöohjearvot. Hakijoiden vastine on, että näin tulee jatkaa myös tulevaisuudessa.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus arvioi, että Fortum Power and Heat Oy:n ympäristöluvassa saatetaan rajoittaa päällystelietteiden polttoa. Jujo Thermal Oy huomauttaa, että tämä rajoitus on kokonaisuutena huono päätös, koska Jujo Thermal Oy:n päällystelietteiden määrät tulevat kasvamaan jätevesien kiertoja suljettaessa yhä enemmän. Päällystelietteille ei todennäköisesti löydy muuta käsittelyvaihtoehtoa kuin polttaminen, varsinkin jos päällystelietteet luokitellaan vaarallisiksi jätteiksi.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää hakijoille vaatimuksen tutkia JVP-Eura Oy:n lietteen haitalliset ja vaaralliset aineet. Hakijat vastaavat, että JVP-Eura Oy:n lietteiden käsittely on JVP-Eura Oy:n ympäristöluvan alaista toimintaa ja sen vuoksi hakijoita ei tule velvoittaa tekemään JVP-Eura Oy:lle kuuluvia asioita.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus on huomauttanut Ahlstrom Tampere Oy:n lupahakemusta puutteelliseksi, koska siinä ei ole huomioitu liuottimien päätymistä ilmaan. Ahlstrom Tampere Oy:n vastine tähän on, että kiinnittimet ja liima-aineet ovat vesipohjaisia aineita, ei liuottimia.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää JVP-Eura Oy:lle vaatimuksen päästä metsäteollisuuden parhaan käyttökelpoisen tekniikan (bat) vertailuasiakirjassa (bref) esitettyihin jätevesiarvoihin. Hakijat vastaavat, että vertailuasiakirjan mukaan parasta mahdollista tek-

niikkaa edustaa jätevesien puhdistuksessa kunnallisen ja teollisuuden yhteistyössä tekemä jätevesien puhdistus. Metsäteollisuuden vertailuasiakirjassa on painotettu, että jokainen tehdas on omanlaisensa, eikä sen vuoksi jätevedelle voida suoranaisesti asettaa raja-arvoja sen perusteella. Hakijat vastaavat lisäksi, että JVP-Eura Oy:n ympäristölupaa tulee käsitellä omana lupanaan eikä se siten ole suoraan hakijoiden vertailuasiakirjan piirissä.

Paperitehtaalla on tehty edellisen kerran virallinen energia-analyysi vuonna 2005. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus esittää, että analyysi tulisi uusia. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus ottaa kantaa, että paperitehtaalla ei ole kehitetty energiatehokkuutta, koska paperitehdas ei ole liittynyt vapaaehtoiseen energiatehokkuussopimukseen. Hakijat toteavat, että energian ominaiskulutus on noussut asiakastuotevalikoiman muutoksen vuoksi eikä energiatehottomuuden vuoksi. Lämpöherkän paperin määrän kasvu lisää ominaisenergian kulutusta. Vuoden 2005 analyysin toimenpidesuositukset ovat osoittautuneet investoinneiltaan niin suuriksi, että hakijoilla ei ole ollut mahdollista toteuttaa niitä kaikkia. Nämä ideat eivät muuksi muutu, vaikka niitä uudelleen tutkitaan. Hakijat myös toteavat, että energiatehokkuus otetaan huomioon, kun tehdään niitä muutoksia, joihin hakijoilla on mahdollisuuksia. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen vaatima ja välittömästi toteutettava ulkopuolisen todentama ja tekemä suunnitelma toimenpiteistä koskien energiaa ja jätevettä on hakijoiden mielestä kohtuuton.

Hakijat toteavat, että tarkkailuohjelma on päivitetty 6.3.2012. Melupäästöjen tarkkailusta hakijat toteavat, että Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen esittämä merkittävimpien melulähteiden melupäästön mittaus on sellaisenaan epärelevantti. Paperitehtaan melun leviämistä on mallinnettu ja melun vähentämiselle on laadittu aluehallintoviraston jo hyväksymät periaatteet. Hakijat esittävät, että melun suhteen jatketaan tarkkailua nykyisen mallin mukaisesti. Hakijat esittävät, että lupapäätöksen edellyttämälle päästö- ja tarkkailusuunnitelman tekemiselle annetaan hakijoille aikaa kuusi kuukautta. Kolmen kuukauden määräaika tässä asiassa on käytännössä liian lyhyt, mikäli lupapäätöksen antaminen ajoittuu lomakauteen tai muutoin yrityksen resursseihin nähden sopimattomaan aikaan.

Hakijat huomattavat, että tässä liitteessä on mainittu paperitehtaan ongelmista ja satunnaispäästöistä ja pidetty niitä hyvin yleisesti tapahtuvina. Hakijat esittävät, että tämä Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen lausunto antaa väärän kuvan toiminnan vaikutuksesta ympäristöön. Hakijat toteavat, että häiriöt eivät ole vaikuttaneet merkittävästi ympäristön tilaa huonontavasti eikä pitkäaikaisia haittoja ole häiriöistä aiheutunut. Paperitehtaan avoimen häiriöilmoitusmenettelyn johdosta Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle lienee muodostunut kuva toiminnan haitallisuudesta ja jatkuvista päästöistä. Bisfenoli-A on luokiteltu vesistölle haitalliseksi, ei hyvin haitalliseksi aineeksi.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä on esittänyt bisfenoli-A:n olevan karsinogeeni. Jujo Thermal Oy:n vastine tähän on, että bisfenoli-A:ta ei ole luokiteltu karsinogeeniksi. Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen ka-

latalouspalvelut -ryhmä on esittänyt arvion bisfenoli-A:n määrästä jätevedessä. Jujo Thermal Oy:n esityksen mukaan paras arvio bisfenoli-A:n määrästä on kuvattu liitteessä 2. Jätevedestä mitattujen seuranta-arvojen mukaan bisfenoli-A:n määrä puhdistetussa jätevedessä on ollut 24.10.2012 alkaen alle 0,30 µg/l eli alle laboratorion määritysrajan. Nämä seurantatiedot on raportoitu ja raportoidaan säännöllisesti Jujo Thermal Oy:tä valvovalle viranomaiselle. Mikäli jäteveden pitoisuus on 0,30 µg/l, on Eurajoen bisfenoli-A -pitoisuus JVP-Eura Oy:n purkupisteessä 2 – 3 ng/l. Tulosten huomattava paraneminen viittaa johonkin Jujo Thermal Oy:stä riippumattomaan muutokseen. Viimeisimmät mitatut bisfenoli-A -pitoisuudet ovat sellaisia, joihin hyvin toimivalla biologisella puhdistuksella voidaan päästä.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä arvelee, että bisfenoli-A:n seurantamittaukset eivät anna luotettavaa kuvaa bisfenoli-A:n määristä, koska se arvelee Jujo Thermal Oy:n toimivan normaalitilanteessa välinpitämättömästi bisfenoli-A:n käsittelyn suhteen. Jujo Thermal Oy:tä valvova Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus, Turvallisuus- ja kemikaalivirasto ja Inspecta ovat tehneet säännöllisiä tarkastuskäyntejä Jujo Thermal Oy:llä. Näillä tarkastuskäynneillä ei ole tullut esille sellaisia asioita, joihin Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä viittaa. Seuranta-ajan tiedot pitävät sellaisenaan paikkansa eikä niihin liity minkäänlaista manipulointia. Jujo Thermal Oy on lisännyt seuranta-jakson aikana päällystepitoisten vesien keräilyä, joka osaltaan on vähentänyt bisfenoli-A:n määrää jätevedessä. Oman prosessin sulkemisasteen nostamisen lisäksi Jujo Thermal Oy on tehostanut jätevesien käsittelyä vuodesta 2004 alkaen liityttyään JVP-Eura Oy:n osakkaaksi. Tästä alkaen Jujo Thermal Oy:n jätevedet on käsitelty biologisessa puhdistusprosessissa, jonka on tiedetty poistavan bisfenoli-A:ta erittäin tehokkaasti, kuten viimeisimmät mittaustulokset sen myös osoittavat.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä käsittelee lausunnossaan Jujo Thermal Oy:n toimintaan liittyneitä poikkeustilanteita ja toimintaa yleisellä tasolla sekä näiden mahdollisia vaikutuksia Eurajoen kalatalouteen. Jujo Thermal Oy:n näkemyksen mukaan tämä lausunnon kohta ei anna Jujo Thermal Oy:n toiminnasta ja sen vaikutuksista objektiivista ja faktoihin perustuvaa arviota. Nykyisen bisfenoli-A riskienarvioinnin PNEC-arvojen perusteella Jujo Thermal Oy:n aiheuttamaa bisfenoli-A -kuormitusta ei voida pitää sellaisena, johon Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä lausunnossaan viittaa. Ennen vuotta 2004, jolloin Jujo Thermal Oy:n jätevesiä ei puhdistettu biologisesti, Jujo Thermal Oy:n bisfenoli-A -kuormitus Eurajokeen oli nykyistä suurempi, mutta siitä huolimatta arvot eivät ylittäneet nykyisiä NOEC-arvoja.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -ryhmä esittää, että 20.5.2011 – 21.5.2011 tapahtuneessa bisfenoli-A -päästössä Eurajoen bisfenoli-A -pitoisuus oli 2 mg/l. Jujo Thermal Oy huomauttaa, että tehtyjen mittausten mukaan joen bisfenoli-A -pitoisuus oli Laukolan sillan kohdalta otetussa näytteessä 0,72 mg/l. Lisäksi Jujo Ther-

mal Oy tuo esille, että JVP-Eura Oy:n puhdistamon biologinen osa ei kärsinyt päästön vaikutuksista. Mikäli päästö olisi ollut myrkyllinen, olisi se vaikuttanut biologisen puhdistamon toimintaan. Päästön kalataloudellisia vaikutuksia arvioitiin Kokemäenjoen vesistön vesiensuojeluyhdistyksen tekemällä tutkimuksella (Jujo Thermal Oy:n bisfenoli-A -satunnaispäästön vaikutukset Eurajoen kalatalouteen vuonna 2011). Tutkimuksen mukaan päästöllä ei voida osoittaa olleen suoria vaikutuksia Eurajoen kalataloudelliseen tilaan.

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen kalatalouspalvelut -yksikön näkemys siitä, että bisfenoli-A:n satunnaispäästö on helposti osoitettava yksittäinen selittäjä, joka voi olla syyllinen joen kalastossa ja ravustossa havaittuihin ongelmiin, ei edellä mainitun tutkimuksen perusteella pidä paikkansa. Tutkimuksessa tuli selville, että Eurajoen rapukanta kärsii rapurutosta. Tutkimuksesta kävi myös selville, että Eurajoen kalakannan arviointi on haastavaa, koska aikaisempia tutkimuksia on tehty harvakseltaan ja niiden arviointimenettelyt eivät ole olleet yhteneviä. Suomen ympäristökeskuksen julkaisun (Kunnallisten jätevesien hormonaalinen aktiivisuus 2003) mukaan jäteveden puhdistamot tuottavat sellaisia jätevesiä, jotka muuttavat kalojen normaalia aineenvaihduntaa ja elintoimintoja. Samassa tutkimuksessa on viitattu raskasmetallien ja typpiyhdisteiden vaikuttavan kalojen lisääntymishäiriöihin. Tähän tutkimukseen viitaten Jujo Thermal Oy tuo esille, että Eurajoen kaloihin kohdistuu lukuisia muita kuormittavia tekijöitä kuin pelkästään Jujo Thermal Oy:n jätevedet. Kokemäenjoen vesistön vesiensuojeluyhdistys toteaa Eurajoen olevan monikuormitteinen vesistö ja sen tilaan vaikuttaa myös muut tekijät kuin Jujo Thermal Oy:n jätevedet.

MERKINTÄ

Etelä-Suomen aluehallintovirastossa on ollut samanaikaisesti Jujo Thermal Oy:n paperitehtaan toimintaa koskevan ympäristölupahakemuksen kanssa vireillä myös Ahlstrom Tampere Oy:n paperitehtaan toimintaa koskeva ympäristölupahakemus (dnro ESAVI/119/04.08/2012) ja JVP-Eura Oy:n jätevedenpuhdistamon ympäristölupahakemus (dnro ESAVI/27/04.08/2011). Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n toiminnat sijaitsevat samassa kiinteistössä ja JVP-Eura Oy:n jätevedenpuhdistamo noin 4,5 km:n päässä. Jujo Thermal Oy:n ja Ahlstrom Tampere Oy:n jätevedet käsitellään JVP-Eura Oy:n jätevedenpuhdistamolla. Hakemukset on kuulutettu ja annettu tiedoksi samanaikaisesti. Päätös JVP-Eura Oy:n hakemuksesta on annettu 23.1.2013. Päätös Ahlstrom Tampere Oy:n hakemuksesta annetaan samanaikaisesti tämän päätöksen kanssa.

ALUEHALLINTOVIRASTON RATKAISU

Käsittelyratkaisu

Aluehallintovirasto hylkää muistutuksissa esitetyt vaatimukset korvausten maksamisesta.

Luparatkaisu

Etelä-Suomen aluehallintovirasto tarkistaa Euran kunnassa Kauttualla sijaitsevan Jujo Thermal Oy:n erikoispaperitehtaan toimintaa koskevan Länsi-Suomen ympäristölupaviraston myöntämän ympäristönsuojelulain 28 §:n mukaisen ympäristöluvan (nro 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391) lupamääräykset kuulumaan seuraavasti:

Lupamääräykset pilaantumisen ehkäisemiseksi

Kuormitus viemäriin ja vesistöön

1. Prosessi- ja muut jätevedet on johdettava asianmukaisesti käsiteltäväksi JVP-Eura Oy:n jätevedenpuhdistamolle tai muulle jätevedenpuhdistamolle, jossa käsittelytulos edustaa viimeistään 1.1.2016 alkaen parasta käyttökelpoista tekniikkaa. Jätevedet tulee johtaa jätevesiyhtiön kanssa tehtyä sopimusta noudattaen ja tarvittaessa siten esikäsiteltyinä, että puhdistamon tulokuormitus noudattaa jätevedenpuhdistamon suunnitteluarvoja.

2. Jätevesien sisältämien kehittimien, reaktiivisten värien tai muiden haitallisuudeltaan näihin rinnastettavien osittain jätevesiin päätyvien kemikaalien määrä ei saa ylittää pitoisuutta, joka vaarantaa puhdistamon toiminnan, puhdistamon biolietteen hyötykäytön, vastaanottavan vesistön vesiekosysteemin tilan tai vastaanottavan vesistön veden hyötykäytön.

   Toiminnanharjoittajan tulee kuuden kuukauden kuluessa tämän päätöksen lainvoimaiseksi tulosta toimittaa Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle selvitys bisfenoli-A:ta tai haitallisuudeltaan siihen rinnastettavaa muuta kehitintä tai kemikaalia korkeina pitoisuuksina sisältävistä prosessivesijakeista sekä suunnitelma näiden vesijakeiden palauttamisesta prosessiin tai esikäsittelemisestä esimerkiksi ultrasuodattamalla ennen niiden johtamista käsiteltäväksi jätevesiyhtiön jätevedenpuhdistamolle. Selvityksen ja suunnitelman teknistaloudellisesti toteuttamiskelpoiset, kemikaalien kuormitusta olennaisesti vähentävät toimenpiteet tulee toteuttaa kahden vuoden kuluessa tämän päätöksen lainvoimaiseksi tulosta. Em. käsittelyllä tulee varmistaa se, että kehittimien tai muiden kemikaalien pitoisuus jätevesiyhtiön jätevedenpuhdistamolle johdettavassa jätevedessä ei saa ylittää tasoa, jonka käsittelystä jätevesiyhtiön jätevedenpuhdistamon voi kemikaalin tunnetut ominaisuudet ja reduktio jätevedenpuhdistamolla huomioon ottaen olettaa selviävän siten, että kemikaalin tunnettu arvioitu haitaton pitoisuus (PNEC) Eurajoessa ei ylity.

3. Tehdasalueelta saa johtaa hulevesiä, jäähdytysvesiä ja vesilaitoksen hiekkasuodatuksen huuhteluvesiä Eurajokeen hakemuksessa esitetyllä tavalla. Muiden likaantumattomien vesijakeiden vesistöön johtaminen edellyttää vesijakeiden lisäämistä tarkkailuohjelmaan vähintään vesimäärän seurannan osalta ja tarkkailua Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen edellyttämällä tavalla. Hulevesien, jäähdytysvesien, raakavesilaitoksen hiekkasuodatuksen huuhteluvesien ja muiden tehdasalueelta puhdistamattomina vesistöön johdettavien vesien aiheuttaman kuormituk-

sen tulee olla mahdollisimman pieni. Mikäli näihin vesijakeisiin päätyy olennaisesti hakemuksessa esitettyä enemmän kuormitusta tai niihin voi riskinarvion perusteella todennäköisesti päätyä haitalliseksi luokiteltuja aineita, on ne kerättävä puhdistamolle johdettavaksi lupamääräyksen 1 mukaisesti.

4. Mikäli jätevesiä ei voida jätevesiyhtiön jätevedenpuhdistamon käyttöhäiriön tai muun toiminnanharjoittajasta riippumattoman syyn vuoksi käsitellä jätevesiyhtiön jätevedenpuhdistamolla, ne on puhdistettava mahdollisimman tehokkaasti tehtaan omalla kemiallisella puhdistamolla, joka on pidettävä tällaisten tilanteiden varalta toimintakuntoisena ja käynnistysvalmiina siten, että tehtaan toimiessa normaalisti ei jätevesiä päädy käsittelemättömänä jokeen. Jätevedet on tällöin ensisijaisesti johdettava varastoitavaksi jätevesiyhtiön varoaltaaseen myöhempää käsittelyä varten ja toissijaisesti jätevesiyhtiön purkuputken ja tarkkailun kautta vesistöön. Vain mikäli siirtoviemäriä ei voida käyttää, voidaan tehtaan omassa kemiallisessa jätevedenpuhdistamossa käsitellyt jätevedet johtaa Eurajokeen tehtaan kohdalla.

Mikäli jätevesiä ei voida jäteveden laadun vuoksi johtaa sellaisenaan jätevesiyhtiön jätevedenpuhdistamolle, tulee ne esikäsitellä tehtaan omalla kemiallisella puhdistamolla ennen niiden johtamista jätevesiyhtiön jätevedenpuhdistamolle käsiteltäväksi tai tarvittaessa toimittaa jätteenä muualle käsiteltäväksi.

Mikäli jätevesien laatua ja määrää ei saada kohtuullisessa ajassa normalisoitua ja jätevesistä uhkaa aiheutua haittaa puhdistamon toiminnalle tai jokiekosysteemille, tulee tehtaan toiminta tarvittaessa ajaa alas.

Melu

5. Toiminnasta aiheutuvaa melua on vähennettävä merkittävimpiin melupäästölähteisiin kohdistuvin toimenpitein siten, että asuinkäytössä olevien kiinteistöjen pihapiirissä ja muissa häiriintyvissä kohteissa sekä asemakaavassa asuinkäyttöön osoitetuilla tonteille ekvivalentin äänitason (L_{Aeq}) voidaan osoittaa edelleen pienentyvän. Tavoitteena on, että toiminnasta aiheutuva melu yhdessä Ahlstrom Tampere Oy:n ja lähialueiden muista toiminnoista aiheutuvan melun kanssa ei asuinkäytössä olevien kiinteistöjen pihapiirissä ja muissa häiriintyvissä kohteissa sekä asemakaavassa asuinkäyttöön osoitetuilla tonteilla ylitä päiväaikaan (klo 7–22) ekvivalenttitasoa (L_{Aeq}) 55 dB eikä yöaikaan (klo 22–07) ekvivalenttitasoa (L_{Aeq}) 50 dB.

Toiminnanharjoittajan on 30.11.2013 mennessä yhdessä Ahlstrom Tampere Oy:n kanssa toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle yksityiskohtainen suunnitelma melupäästöjen vähentämiseksi toteutettavista toimenpiteistä toteuttamisaikatauluineen ja kustannusarvioineen. Toimenpiteet on toteutettava vuoden 2015 loppuun mennessä. Mikäli suunnitelman mukaisilla toimenpiteillä ei saavuteta em. tavoitearvoja, on toiminnanharjoittajan laadittava uusi suunnitelma kustannusarvioineen ja toteuttamisaikatauluineen.

Toteutetuista toimenpiteistä ja niiden vaikutuksesta melupäästöihin on raportoitava vuosittain Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle edellistä vuotta koskevan vuosiraportin yhteydessä.

Uusien melua aiheuttavien laitteiden tai merkittävien muutosten aiheuttama vaikutus ympäristön melutasoon on mitattava tai arvioitava leviämismallilaskelmilla. Uudet laitteet on suunniteltava, rakennettava ja sijoitettava siten, että melutaso läheisillä asuinkiinteistöillä ei ainakaan lisäänny. Tarvittaessa toiminnanharjoittajan on rakenteellisin tai muin toimenpitein estettävä melun leviäminen.

Jätteet ja jätehuolto

6. Toiminnassa on pyrittävä siihen, että jätteitä syntyy mahdollisimman vähän. Toiminnassa syntyvät jätteet on mahdollisuuksien mukaan hyödynnettävä. Jätteet on ensisijaisesti hyödynnettävä aineena ja toissijaisesti energiantuotannossa. Syntyvät jätteet on lajiteltava ottaen huomioon eri jakeiden hyötykäyttömahdollisuudet. Hyötykäyttökelpoiset jätteet on kerättävä erilleen ja toimitettava hyödynnettäväksi. Mikäli hyödyntäminen ei ole kohtuullisin kustannuksin mahdollista, jätteet on toimitettava sellaiselle vastaanottopaikalle, jolla on ympäristölupa ottaa vastaan ja käsitellä kyseisenlaista jätettä.

7. Kaatopaikalle toimitettavien talousjätteestä poikkeavien jätteiden kaatopaikkakelpoisuus on selvitettävä jätteiden perusmäärittelyllä ja vuosittain tehtävillä vastaavuustesteillä. Jätteet on toimitettava paikkaan, jolla on ympäristönsuojelulain mukainen lupa vastaanottaa kyseisiä jätteitä. Kaatopaikkakelpoisuustodistus on esitettävä kaatopaikan pitäjälle ja pyynnöstä valvovalle viranomaiselle.

8. Vaaralliset jätteet (aik. ongelmajätteet) on varastoitava niille varatussa paikassa, suljetuissa ja asianmukaisesti merkityissä astioissa katettuna ja tiiviillä alustalla siten, ettei niistä aiheudu maaperän eikä pinta- tai pohjavesien pilaantumisvaaraa tai muuta haittaa ympäristölle. Erilaiset vaaralliset jätteet on pidettävä erillään toisistaan ja muista jätteistä ja ne on merkittävä ominaisuuksiensa mukaan. Vaaralliset jätteet on toimitettava käsiteltäväksi laitokseen, jonka ympäristöluvassa on hyväksytty kyseisen jätteen vastaanotto ja käsittely.

9. Jätteet saa luovuttaa kuljetettavaksi vain jätelain mukaan rekisteröityneelle jätteenkuljettajalle. Vaarallisiksi jätteiksi luokiteltavien jätteiden siirroista tulee laatia jätelain (646/2011) mukainen siirtoasiakirja. Siirtoasiakirja tai sen jäljennös on säilytettävä vähintään kolme vuotta.

10. Toiminnanharjoittajan tulee toimittaa Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle kolmen kuukauden kuluessa tämän päätöksen lainvoimaiseksi tulosta jäteasetuksen (179/2012) liitteen 3 mukainen selvitys koskien päällystelietejätteen laatua. Mikäli selvityksen perusteella kyseinen jätejae luokitellaan vaaralliseksi jätteeksi, tulee sen käsiteltäväksi toimittamisessa ja raportoinnissa noudattaa mitä vaarallisen jätteen toimit-

tamisesta ja raportoinnista on määrätty. Päällystelietteet tulee raportoida käyttäen jätenimikettä 030310 erikseen muista samalla nimikkeellä raportoiduista jätejakeista.

Varastointi

11. Raaka-aineet, kemikaalit, tuotteet, polttoaineet sekä jätteet on varastoitava ja käsiteltävä tehdasalueella siten, ettei niistä aiheudu epäsiisteyttä, roskaantumista, pölyämistä, hajuhaittaa, maaperän tai vesien pilaantumisvaaraa eikä muutakaan haittaa ympäristölle.

Öljy- ja muut kemikaalisäiliöt on sijoitettava tiivisrakenteisiin suoja-altaisiin tai muutoin päällystetylle ja tiiviille alustalle niin, että maaperän pilaantuminen säiliöiden täytön ja kemikaalien käyttämisen aikana tai säiliöiden mahdollisen rikkoutumisen seurauksena estyy tai voidaan ehkäistä. Varastotilojen lattiakaivot on varustettava asianmukaisin suojakansin tai sulkuventtiilein.

Varastopaikkojen ja niiden täyttö- ja tyhjennyspaikkojen kunto on tarkistettava säännöllisesti ja todetut vauriot korjattava viipymättä.

Häiriö- ja muut poikkeustilanteet

12. Poikkeuksellisiin tilanteisiin, kuten mahdollisiin kemikaalivahinkoihin, on varauduttava ennakolta. Vahingon tai onnettomuuden varalle on oltava aina saatavilla riittävä määrä tarkoitukseen sopivaa imeyttämismateriaalia ja -kalustoa. Laitoksella on myös oltava riittävä alkusammutuskalusto.

13. Häiriötilanteissa ja muissa poikkeuksellisissa tilanteissa, joissa on aiheutunut tai uhkaa aiheutua määrältään tai laadultaan tavanomaisesta poikkeavia päästöjä ilmaan, viemäriin, vesistöön, maaperään, pohjavesiin tai jätemateriaalien kertymistä alueelle, on ryhdyttävä välittömästi asianmukaisiin tarpeellisiin toimenpiteisiin tällaisten päästöjen ja niiden leviämisen estämiseksi ja päästöistä aiheutuvien vahinkojen torjumiseksi sekä tapahtuman toistumisen estämiseksi. Vuotoina ympäristöön päässeet kemikaalit, polttonesteet ja muut aineet on kerättävä välittömästi talteen. Laitteet on saatettava normaaliin toimintakuntoon niin pian kuin se on teknisesti mahdollista.

14. Poikkeavista päästöistä ja muista ympäristöön vaikuttavista vahinko- ja häiriötilanteista on ilmoitettava viipymättä Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle sekä Eurajoesta vettä ottaville vesilaitoksille, maatalouselinkeinonharjoittajille ja teollisuuslaitoksille sekä, mikäli päästöistä voi aiheutua vaaraa terveydelle, myös Euran kunnan terveydensuojeluviranomaiselle, ja ryhdyttävä heti toimenpiteisiin vahinkojen torjumiseksi ja tapahtuman toistumisen estämiseksi.

Poikkeuksellisesta tilanteesta ja satunnaispäästöstä on lisäksi ilmoitettava viivytyksettä tekstiviestillä ja/tai sähköpostilla kaikille niille Eurajoen vesi-

alueiden ja rantojen asianosaisille, jotka haluavat ilmoituksen saada ja ovat antaneet yhteystietonsa toiminnanharjoittajalle tarkoitusta varten perustettavaan rekisteriin vietäväksi.

Riskinhallinta

15. Vaaratilanteita ja terveydelle ja ympäristölle haitallisiksi luokiteltujen kemikaalien käsittelyä koskevien toimintaohjeiden on oltava aineiden kanssa työskentelevien tiedossa.

Toiminnanharjoittajan on toimitettava ajantasainen riskinarvio Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle vuosittain helmikuun loppuun mennessä. Riskinarvio tulee täydentää kolmen kuukauden kuluessa tämän päätöksen lainvoimaiseksi tulosta arviolla ympäristölle ja terveydelle haitallisiksi luokiteltujen suuressa mittakaavassa käytettävien kemikaalien jokialueen monimuotoisuudelle sekä jokiveden hyötykäytölle aiheuttamasta riskistä, arviolla maaperän pilaantumisen riskistä ja arviolla riskistä koskien muita poikkeuksellisia päästöjä, sekä suunnitelmalla riskiluokkaan I ja II kuuluvien riskien saattamiseksi hallintaan.

Tarkkailu- ja raportointimääräykset

Yleiset tarkkailumääräykset

16. Kaikki päästöjen ja vaikutusten tarkkailuun liittyvät mittaukset, näytteiden otto ja analysointi sekä jatkuvatoimisten mittausten laadunvarmennus on tehtävä CEN-standardien mukaisesti tai niiden puuttuessa ISO, SFS tai vastaavan tasoisen kansallisen tai kansainvälisen yleisesti käytössä olevan standardin mukaisesti. Tulosten raportoinnissa on esitettävä käytetyt menetelmät ja niiden mittausepävarmuus sekä tulosten edustavuus. Jos analyysimenetelmiä muutetaan tai käytetään standardien mukaisista menetelmistä poikkeavia tai standardeissa erikoistapauksiksi mainittuja menetelmiä, on tulosten laadun varmistamiseksi ja eri aikoina saatujen tulosten vertailtavuuden vuoksi tehtävä riittävä määrä vertailumittauksia.

17. Laitoksen päästö- ja kuormitustarkkailu on tehtävä tämän päätöksen ja päätöksen liitteenä olevan tarkkailuohjelman mukaisesti. Tarkkailusuunnitelmaa on täydennettävä annettujen määräysten mukaisesti ja siten, että se täyttää jätelain (646/2011) 120 §:n mukaiset jätteen käsittelyn seuranta- ja tarkkailusuunnitelman vaatimukset sekä siten, että E-PRTR -asetuksen (166/2006/EY) mukaiset raportointivelvoitteet täyttyvät. Tarkistettu tarkkailusuunnitelma on toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle viimeistään kolmen kuukauden kuluttua tämän päätöksen lainvoimaiseksi tulosta. Tarkkailuohjelma voi olla yhteinen muiden tehdasalueella toimivien toiminnanharjoittajien kanssa.

Jätevesien tarkkailu

18. Jätevesien käyttö- ja kuormitustarkkailu on toteutettava hakemuksessa ja tarkkailuohjelmassa esitetyllä ja lupamääräysten mukaisesti tarkistetulla tavalla. Tehtaalta viemäriverkkoon johdettavasta prosessijätevedestä on otettava tehtaan normaalitoiminnan aikana vuorokauden (viikonloppuisin 3 vrk) kestävät virtaamapainotteiset kokoomaosanäytteet kaikkina päivinä, jolloin prosessijätevettä johdetaan viemäriverkkoon.

Vuorokauden mittaisista kokoomanäytteistä on määritettävä tehtaan omassa laboratoriossa tai julkisen valvonnan alaisessa muussa laboratoriossa ainakin seuraavat parametrit: pH, sähkönjohtavuus ja kiintoaine.

Prosessijätevesinäytteistä on määritettävä kalenterikuukauden mittaisena vuorokauden mittaisista osanäytteistä virtaamapainotteisesti kootusta kokoomanäytteestä ainakin seuraavat parametrit: kokonaistyppi, kokonaisfosfori, biologinen hapenkulutus (BOD_{7atu}) ja kemiallinen hapenkulutus (COD_{Cr}). Näytteet on kemiallista hapenkulutusta (COD_{Cr}) lukuun ottamatta analysoitava julkisen valvonnan alaisessa laboratoriossa.

Prosessijätevesistä tulee lisäksi määrittää julkisen valvonnan alaisessa laboratoriossa neljännesvuosittain fenoliset yhdisteet ja bisfenoli-A, sekä kokonaisorgaaninen hiili (TOC).

19. Eurajokeen johdettavan puhtaan jäähdytysveden määrää ja lämpötilaa, sekä hiekkasuodatuksen huuhteluveden määrää on tarkkailtava ja jäähdytysvedestä aiheutuvaa lämpökuormaa jokeen on seurattava hakemuksessa ja tarkkailuohjelmassa esitetyllä tavalla ja siten, että kyseisten vesijakeiden likaantumattomuus varmistetaan vähintään neljännesvuosittain.

Melupäästöjen tarkkailu

20. Tehtaiden tärkeimpien melupäästölähteiden äänitehotasot (L_{WA}) on mitattava silloin kun niihin kohdistuneet meluntorjuntatoimet on toteutettu, mutta vuodelle 2015 suunniteltujen toimenpiteiden toteuttamisen jälkeen kuitenkin vähintään joka toinen vuosi. Melupäästölähteen äänitehotaso on muutoinkin mitattava aina, kun tehtailla tehdään muutoksia, joissa syntyy uusi päästölähde tai olemassa olevan päästölähteen äänitehotaso tai melun häiritsevyys voi muuttua siten, että muutos voi lisätä meluhaittaa.

21. Ekvivalenttimelutasot lähimpien asuinkiinteistöjen piha-alueilla on mitattava kerran vuodessa aina sen jälkeen, kun tehtailla on toteutettu ko. vuodelle suunnitellut meluntorjuntatoimenpiteet. Melun mittauspisteitä on oltava vähintään 6. Mittaukset on suoritettava ympäristöministeriön ohjeen 1/1995 "Ympäristömelun mittaaminen" mukaisesti.

Yksityiskohtainen suunnitelma edellä mainittujen melumittausten suorittamisesta on toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle tiedoksi viimeistään kaksi kuukautta ennen mittausten aloittamista.

Melupäästöjen vähentämistä koskeva suunnitelma ja toimenpideohjelma sekä siihen liittyvät melumittaukset ja leviämismallilaskelmat on tehtävä yhteisesti Ahlstrom Tampere Oy:n Kauttuan paperitehtaan ja mahdollisuuksien mukaan Fortum Power and Heat Oy:n Kauttuan voimalaitoksen kanssa.

Ympäristömelua koskevien mittausten ja muiden melua koskevien selvitysten raportit on toimitettava tiedoksi Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle vuosittain vuosiraportin yhteydessä.

Ympäristövaikutusten tarkkailu

22. Toiminnanharjoittajan tulee osallistua Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen hyväksymään Eurajoen ja Eurajoensalmen yhteistarkkailuun. Yhteistarkkailussa voidaan toistaiseksi noudattaa Lounais-Suomen ympäristökeskuksen 28.10.2008 hyväksymää yhteistarkkailuohjelmaa.

Tarkkailuohjelman tarkistaminen

23. Tarkkailuohjelmaa voidaan tarkentaa ja muuttaa Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen hyväksymällä tavalla edellyttäen, että muutokset eivät heikennä tulosten luotettavuutta, lupamääräysten noudattamisen valvottavuutta eivätkä tarkkailun kattavuutta ja läpinäkyvyyttä.

Kirjanpito ja raportointi

24. Tehtaan toiminnasta ja toimintaan liittyvistä ympäristönsuojelun kannalta merkityksellisistä tapahtumista ja toimenpiteistä on pidettävä tarkoituksenmukaisella tavalla kirjaa. Siihen on merkittävä jäljempänä esitetyt raportointia varten tarvittavat tiedot. Kirjanpito on pyydettäessä esitettävä ympäristöluvan valvontaviranomaisille.

25. Toiminnanharjoittajan on kalenterivuosittain, viimeistään tarkkailuvuotta seuraavan vuoden helmikuun loppuun mennessä toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle vuosiyhteenveto, joka sisältää ainakin:

- vuotuiset tuotantomäärät (t/a) ja tuotannon käyntiajat (h/a)
- tuotannossa käytettyjen raaka-aineiden ja kemikaalien määrät (t/a)
- päästöt ilmaan (t/a)
- veden käyttötiedot (m^3/a)
- jätevesikuormitus (m^3/a, kg/a) jätevesiyhtiön puhdistamolle
- tiedot oman puhdistamon käytöstä (käyttöpäivät ja tarkkailuohjelman mukaisen tarkkailun osoittama kuormitus) sekä jätevesikuormitus vesistöön purkupaikoittain (m^3/a, kg/a)
- jäähdytys- ja hiekkasuodatuksen huuhteluvesien määrät (m^3/a) ja jäähdytysvesien aiheuttama lämpökuorma (MW/a)
- energian kulutus (GWh) ja vuoden aikana toteutetut energiansäästötoimenpiteet

- toiminnassa syntyneiden jätteiden määrät, luokittelu ja toimituspaikat. Jätteiden luokittelussa tulee käyttää valtioneuvoston asetuksessa jätteistä (179/2012) liitteessä 4 esitettyä jaottelua
- selvitys vuoden aikana toteutetuista tai suunnitteilla olevista muutoksista kemikaalien käytössä sekä muutokset kemikaalien luokittelussa
- vuoden aikana tehdyt meluntorjuntatoimenpiteet sekä melunmittausten ja -mallinnusten tulokset
- yhteenveto ympäristönsuojelun kannalta merkityksellisistä tapahtumista ja käyttöhäiriöistä (syy, kestoaika, arvio päästöistä ja niiden ympäristövaikutuksista sekä suoritetut toimenpiteet) sekä ympäristön kannalta olennaisista huoltotoimenpiteistä.

Raportointi tulee soveltuvin osin tehdä sähköisesti ympäristönsuojelun tietojärjestelmään Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen tarkemmin ohjeistamalla tavalla.

Raportin perusteena olevat asiakirjat ja tallenteet on säilytettävä vähintään kuusi vuotta.

26. Toiminnanharjoittajan on neljännesvuosittain toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle jätevesiä ja niiden käsittelyä koskeva edeltävien kuukausien käyttö- ja päästötarkkailun raportti. Raportin tulee sisältää soveltuvin osin ja tarvittavassa laajuudessa samat tiedot kuin vuosiraportin.

Toiminnan muuttaminen ja lopettaminen

27. Toiminnanharjoittajan on viipymättä ilmoitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle toiminnan merkittävistä muutoksista tai toiminnan keskeyttämisestä. Luvanhaltijan vaihtuessa uuden haltijan on kirjallisesti ilmoitettava vaihtumisesta Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle.

28. Toiminnanharjoittajan on hyvissä ajoin, viimeistään kuusi kuukautta ennen toiminnan lopettamista, esitettävä Etelä-Suomen aluehallintovirastolle yksityiskohtainen suunnitelma vesiensuojelua, ilmansuojelua, jätehuoltoa ja maaperänsuojelua koskevista toiminnan lopettamiseen liittyvistä toimista ja mahdollisesta lopettamisen jälkeisestä ympäristön tilan tarkkailusta.

RATKAISUN PERUSTELUT

Käsittelyratkaisun perustelut

Aluehallintovirasto katsoo, että muistutuksissa esitetyillä korvausvaatimuksilla on tarkoitettu sellaisten JVP-Eura Oy:n jätevedenpuhdistamon toiminnasta aiheutuneiden edunmenetysten korvaamista, jotka tullaan käsittelemään aluehallintoviraston 23.1.2013 antaman päätöksen (nro 11/2013/1, dnro ESAVI/27/04.08/2011) mukaisesti aluehallintovirastossa erillisenä asiana. JVP-Eura Oy vastaa yksityisoikeudellisen teollisuusjätevesisopi-

muksen perusteella Jujo Thermal Oy:n ja muiden viemäriin liittyneiden teollisuuslaitosten jätevesien käsittelystä sopimuksen osoittamassa laajuudessa.

Luvan myöntämisen edellytykset

Luvan mukaisesta toiminnasta ei, lupamääräykset ja toiminnan sijoituspaikka huomioon ottaen, aiheudu yksinään eikä yhdessä alueen muiden toimintojen kanssa terveyshaittaa, merkittävää muuta ympäristön pilaantumista tai sen vaaraa, maaperän tai pohjaveden pilaantumista tai erityisten luonnonolosuhteiden huonontumista, vedenhankinnan tai yleiseltä kannalta tärkeän muun käyttömahdollisuuden vaarantumista toiminnan vaikutusalueella eikä eräistä naapuruussuhteista annetussa laissa tarkoitettua kohtuutonta rasitusta. Toimintaa ei ole sijoitettu asemakaavan vastaisesti.

Lupamääräysten yleiset perustelut

Tällä päätöksellä on tarkistettu Länsi-Suomen ympäristölupaviraston antama Ahlstrom Kauttua Oy:n ja Jujo Thermal Oy:n erikoispaperitehtaiden toimintaa koskevan ympäristölupapäätöksen (nrot 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391) lupamääräykset vastaamaan tämän hetken lainsäädännön vaatimuksia. Määräyksiä tarkistettaessa on otettu huomioon toiminnassa ja alueen ympäristössä tapahtuneet muutokset. Lupamääräyksiä annettaessa on ympäristönsuojelulain 43 §:n mukaan otettava huomioon toiminnan luonne, sen alueen ominaisuudet, jolla toiminnan vaikutus ilmenee, toiminnan vaikutus ympäristöön kokonaisuutena, pilaantumisen ehkäisemiseksi tarkoitettujen toimien merkitys ympäristön kokonaisuuden kannalta sekä tekniset ja taloudelliset mahdollisuudet toteuttaa nämä toimet. Päästöraja-arvoja sekä päästöjen ehkäisemistä ja rajoittamista koskevien lupamääräysten on perustuttava parhaaseen käyttökelpoiseen tekniikkaan. Lisäksi on tarpeen mukaan otettava huomioon energian käytön tehokkuus sekä varautuminen onnettomuuksien ehkäisemiseen ja niiden seurausten rajoittamiseen.

Lupamääräyksiä annettaessa on otettu huomioon toiminnan aiheuttaman pilaantumisen todennäköisyys ja onnettomuusriski sekä alueen kaavamääräykset. Lupamääräykset perustuvat ympäristönsuojelulain 43 §:ään, ympäristönsuojeluasetuksen 19 §:ään ja määräyskohtaisissa perusteluissa erikseen mainittuihin säännöksiin.

Ympäristönsuojeluasetuksen 37 §:ssä on lueteltu parhaan käyttökelpoisen tekniikan (bat) arvioinnissa huomioon otettavia tekijöitä, joita ovat mm. Euroopan yhteisöjen komission tai kansainvälisten toimielinten julkaisemat tiedot parhaasta käyttökelpoisesta tekniikasta. Toiminnan voidaan katsoa edustavan parasta käyttökelpoista tekniikkaa, kun tehdas toimii tämän ympäristölupapäätöksen mukaisesti.

Lupamääräysten yksilöidyt perustelut

Lupamääräykset 1 – 4

Tehtaalla muodostuvat jätevedet käsitellään erillisen jätevesiyhtiön jätevedenpuhdistamolla. Jätevedenpuhdistamolla on ollut merkittäviä puhdistamon mitoitukseen perustuvia ongelmia puhdistustuloksen suhteen. Paperiteollisuuden jätevedet puhdistamolla on kuitenkin käsitelty kohtalaisesti johtamalla kunnan viemäriverkosta johdettua jätevettä merkittäviä määriä käsittelemättömänä Eurajokeen. Paperiteollisuuden jätevesien käsittely jätevesiyhtiön jätevedenpuhdistamolla on olemassa olevista vaihtoehdoista paras.

Lämpöherkän paperin valmistuksessa on meneillään murros, jossa bisfenoli-A:ta ollaan kemikaalin luokittelussa tapahtuneiden muutosten vuoksi korvaamassa sellaisilla kemikaaleilla, jotka eivät luokittelun perusteella ole terveydelle samassa määrin haitallisia, mutta saattavat olla ympäristövaikutuksiltaan jopa haitallisempia. Ympäristöluvassa tulee nimenomaisesti kiinnittää huomiota näiden kemikaalien käytön vaikutuksiin ympäristössä ja erityisesti vastaanottavassa vesistössä, mistä johtuen lupamääräys 2 yhdessä riskinarvioinnin laajentamista, ajantasaistamista ja ajan tasalla pitämistä koskevan vaatimuksen kanssa on kemikaalien käytön ympäristövaikutuksen hallitsemisen ja toiminnan valvonnan edellytys. Laitoksella bisfenoli-A:n rinnalle ja ainakin osin sitä korvaamaan mahdollisesti käyttöönotettavat kehittimet ovat mitä ilmeisimmin olennaisesti vaikeammin biologisesti hajoavia jätevesiyhtiön jätevedenpuhdistamon prosesseissa, minkä vuoksi lupamääräyksessä on määrätty ultrasuodatuksen tai muun vastaavantehoisen menetelmän käyttöönotto niiden vesijakeiden käsittelyssä, joissa pitoisuudet ovat korkeat.

Tehdasalueella muodostuu vesijakeita, jotka eivät normaalitilanteessa ole likaantuneita ja joiden johtaminen sellaisenaan vesistöön on kokonaisuutena katsottuna paras toimintamalli – erityisesti jätevesiyhtiön jätevedenpuhdistamon alimitoituksen vuoksi. Näiden jakeiden tulee kuitenkin olla mukana seurannassa, riskinarvioinnissa ja tarkkailuohjelmassa, jotta jokeen ei häiriötilanteessakaan johdettaisi likaantuneita vesiä.

Toiminnanharjoittajalla on teknisesti mahdollista käsitellä jätevetensä omassa kemiallisessa puhdistamossaan. Aluehallintoviraston näkemyksen mukaan tämä mahdollisuus tulee säilyttää lupamääräyksessä mainituissa poikkeustilanteissa jatkossakin. Tietyissä poikkeustilanteissa toiminnanharjoittajalla on mahdollisuus johtaa jätevesiä pelkän kemiallisen käsittelyn jälkeen ensisijaisesti jätevesiyhtiön purkuputkea pitkin vesistöön. Jatkossa kuitenkin jätevesiyhtiön luvassa määrätty nykyistä laajemman varo- ja tasausaltaan rakentaminen vähentää entisestään tilanteita, joissa näin toimittaisiin. Aluehallintoviraston tiedossa ei ole, että näin olisi laajemmin toimittu, mutta poikkeustilanteen hallinnan vuoksi mahdollisuus aluehallintovirastonkin näkemyksen mukaan täytyy olla olemassa. (YSL 43 §, 47 §, YSA 36 §, 36 a §, 37 §, VNA 1022/2006)

Lupamääräys 5

Toiminnanharjoittaja on vuodesta 2006 alkaen toteuttanut useita toimenpiteitä, joiden avulla ekvivalenttiäänitasoa (L_{Aeq}) lähimpien asuinrakennusten piha-alueella on saatu merkittävästi alennettua, enimmillään 9 dB. Tehtaan kokonaisäänitehotaso (L_{WA}) on pienentynyt 7–8 dB.

Luvan myöntämisen jälkeen laaditut selvitykset ja toteutetut meluntorjuntatoimet ovat osoittaneet, että luvassa määrätyt raja-arvot ovat ko. toimintaympäristössä vaikeita toteuttaa vaaditussa aikataulussa, erityisesti yömelun osalta. Melutasolle asetetut vaatimukset ovat siksi tavoitteelliset.

Toiminnasta aiheutuu sen lähiympäristön asutukselle yhä varsinkin yöaikaan merkittävää meluhaittaa, joten toimenpiteitä haittojen vähentämiseksi on jatkettava.

Meluntorjuntatoimien kytkeminen Vaasan hallinto-oikeuden 10.11.2011 antaman päätöksen mukaisesti kahden vuoden välein toteutettavaan suunnitelmaan ilman tarkkaa numeerista tavoitetta on tarkoituksenmukaista, koska toimenpiteiden vaikutusten ennakointi on osoittautunut hankalaksi. Toiminnanharjoittaja on kyennyt jo tähän mennessä vähentämään meluhaittaa oleellisesti ja on sitoutunut tavoitteeseen myös jatkossa. Kahden vuoden välein tapahtuva tilanteen arviointi on sekä toimenpiteiden toteuttamismahdollisuuksien että valvonnan kannalta riittävä. Suunnitelma vuoden 2012 jälkeen tarvittavista toimenpiteistä on tässä päätöksessä siirretty Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksessa käsiteltäväksi, sillä lupa-asia on tullut vireille noin vuoden aiemmin aiottua aikaisemmin, minkä vuoksi asia ei ole tämän päätöksen antopäivän jälkeen aluehallintovirastossa vireillä. (YSL 42 ja 43 §, NaapL 17 ja 18 §, VNp 993/1992)

Lupamääräykset 6 – 10

Jätehuolto ja jätteiden käsittelyä koskevat lupamääräykset on kirjoitettu kokonaisuudessaan uudestaan erityisesti uuden jätelain (646/2011) ja sen nojalla annetun asetuksen jätteistä vuoksi. Lupamääräyksissä on annettu jätelakiin ja asetukseen jätteistä perustuvat jätteiden käsittelyyn ja luovuttamiseen liittyvät olennaisimmat määräykset. Näiden lupamääräysten lisäksi toiminnassa tulee muutenkin noudattaa jätelakia ja asetusta jätteistä.

Jätelain 8 §:n mukaan jäte on hyödynnettävä, jos se on teknisesti mahdollista ja jos siitä ei aiheudu kohtuuttomia lisäkustannuksia verrattuna muulla tavoin järjestettyyn jätehuoltoon. Ensisijaisesti on pyrittävä hyödyntämään jätteen sisältämä aine ja toissijaisesti sen sisältämä energia. Jätelain 8 §:n mukaan kaikessa toiminnassa on huolehdittava mahdollisuuksien mukaan siitä, että jätettä syntyy mahdollisimman vähän. Jätelain 15 §:n mukaan jätteet on kerättävä ja pidettävä toisistaan erillään jätehuollon kaikissa vaiheissa siinä laajuudessa kuin se on muun muassa jätehuollon asianmukaisen järjestämisen kannalta tarpeellista sekä teknisesti ja taloudellisesti mahdollista. Kaatopaikoista annetun valtioneuvoston päätöksen (861/1997)

6 §:n mukaan kaatopaikalle tuotavasta teollisuusjätteestä on kaatopaikan pitäjällä oltava tiedot jätteen kaatopaikkakelpoisuudesta.

Asetuksessa jätteistä 24 §:ssä on annettu vaarallisten jätteiden siirtoa varten laadittavaa siirtoasiakirjaa koskevat määräykset. Siirtoasiakirjamenettelyn avulla voidaan seurata vaarallisen jätteen kulkua tuottajalta asianmukaiseen hyödyntämis- tai käsittelypaikkaan. Siirtoasiakirjamenettely helpottaa valvontaa. Siirtoasiakirja tai sen jäljennös on säilytettävä kuuden vuoden ajan.

Lupamääräyksissä on määrätty valtioneuvoston asetuksen jätteistä (179/2012) liitteen 4 mukainen nimike (030310) jätetilastoinnin oikeellisuuden vuoksi. Nimikkeen 030310 laadusta ei tässä vaiheessa ole tarkempaa tietoa, joten näiden jakeiden luokittelu vaaralliseksi tai tavanomaiseksi jätteeksi on mahdollista selvittää vasta myöhemmin tehtävillä laboratoriotutkimuksilla. (YSL 42§, 43§, 45§; JäteL 8§, 15 §; JäteA 24§, VNp 861/1997)

Lupamääräys 11

Tehdasalueen kemikaalien varastointia ja siihen liittyviä riskejä valvoo ensisijaisesti turvallisuus- ja kemikaalivirasto (Tukes). Tässä päätöksessä kemikaalien varastointia koskevat määräykset ovat tarpeen varastoinnista aihetuvan maaperän, pohjaveden ja vesistön pilaantumisen ehkäisemiseksi em. pilaantumisriskien minimoimiseksi ja parhaan tekniikan vaatimusten täyttymiseksi. Määräykset perustuvat ympäristönsuojelulakiin ja noudattavat kemikaaliviranomaisen ohjeistusta. Kemikaalien asianmukainen, huolellinen varastointi ja käsittely on ympäristöriskien hallinnan kannalta tärkeää. (YSL 7 §, 8 §, 43 §, YSA 37 §)

Lupamääräykset 12 – 14

Poikkeuksellisia tilanteita koskevat määräykset ovat tarpeen ympäristölle aiheutuvien haittojen rajoittamiseksi ja minimoimiseksi. Ympäristönsuojelulain 5 §:n 1 momentin mukaan toiminnanharjoittajan on oltava riittävästi selvillä toimintansa riskeistä, niiden ympäristövaikutuksista ja haitallisten vaikutusten vähentämismahdollisuuksista. Ympäristönsuojelulain 5 §:n 2 momentin mukaan, jos toiminnasta aiheutuu tai uhkaa välittömästi aiheutua ympäristön pilaantumista, toiminnanharjoittajan on viipymättä ryhdyttävä tarpeellisiin toimenpiteisiin pilaantumisen ehkäisemiseksi tai jos pilaantumista on jo tapahtunut, sen rajoittamiseksi mahdollisimman vähäiseksi. Henkilökunnan kouluttaminen, häiriö- ja poikkeustilanteiden varautumissuunnitelma, jätevesien hallittu keräily poikkeuksellisissa tilanteissa ja imeytysaineiden helppo saatavuus vähentävät maaperän ja pohjaveden pilaantumisriskiä. Valvontaviranomainen voi tarvittaessa antaa ohjeita ympäristöhaitan torjumiseksi.

Lupamääräyksessä 14 on määrätty häiriötilanteista tiedottamisesta mm. valvontaviranomaisille, Eurajoesta vettä ottaville vesilaitoksille ja maatalouselinkeinonharjoittajille sekä niille Eurajoen vesialueiden ja rantojen asianosaisille, jotka antavat yhteystietonsa tähän tarkoitukseen. Velvoite on

annettu viranomaisten ja asianosaisten tiedon saannin varmistamiseksi ja valvonnan tehostamiseksi. Vastaava velvoite sisältyy jätevesiyhtiön sekä Ahlstrom Tampere Oy:n ympäristölupapäätöksiin, joten järjestelmä voi olla myös yhteinen. Poikkeustilanteita koskeva ilmoitusvaatimus perustuu ympäristönsuojelulain 62 §:ään ja ympäristönsuojeluasetuksen 30 §:ään. (YSL 5 §, 7 §, 8 §, 43 §, YSA 30 §)

Lupamääräys 15

Olemassa oleva riskinarviointi perustuu erityisesti kemikaalien käsittelystä aiheutuvien riskien kartoittamiseen. Käytössä olevien kemikaalien ominaisuudet ja jätevesiyhtiön jätevedenkäsittelyssä ilmenneet ongelmat huomioon ottaen aluehallintovirasto katsoo, että terveydelle ja ympäristölle haitallisiksi luokiteltujen kemikaalien pitoisuudet ja niistä aiheutuva riski jokiekosysteemille ja jokiveden hyötykäytölle tulee tiedostaa. Riskinarvion avulla toiminnanharjoittajan tulee arvioida yhdessä valvovan viranomaisen kanssa uusien kemikaalien käyttöönoton vaikutukset vastaanottavassa vesistössä kemikaalien luokittelun ja ekotoksikologisten arvojen (kuten PNEC) perusteella erityisesti ennen jätevesiyhtiön toiminnan kehittymistä jätevesiyhtiön ympäristöluvassa edellytetylle puhdistustasolle.

Lupamääräykset 16 – 23

Tarkkailumääräykset on annettu tarkentamaan liitteenä olevaa tarkkailuohjelmaa. Valvontaviranomaisella on oikeus saada jätteen vastaanottajalta ja haltijalta valvontaa ja tehtävien hoitamista varten tarvittavat tiedot. Tarkkailua, kirjanpitoa ja raportointia koskevat lupamääräykset 19 – 24 ovat tarpeen, jotta valvontaviranomaiset voivat seurata toiminnan asianmukaisuutta, käsittelytuloksia, lupamääräysten noudattamista ja jätevesien johtamisen vesistövaikutuksia sekä saada valvontaa varten tarpeellisia muita tietoja. Toiminnanharjoittajalla on selvilläolo- ja kirjanpitovelvollisuus toiminnan päästöistä sekä jätteistä.

Selvitys E-PRTR -raportoitavista parametreista perustuu EU-asetukseen 166/2006/EY, jossa toiminnanharjoittaja velvoitetaan raportoimaan asetuksen liitteessä 2 mainitut parametrit kynnysarvon ylittyessä vuosittain toimivaltaiselle viranomaiselle edelleen Euroopan päästörekisteriin raportoitavaksi. Selvityksessä tulee käyttää apuna seuraavaa julkaisua: ”Metsäteollisuuden päästöjen raportointi” (Linnunmaa Oy, ympäristöministeriön raportti 13/2007). (YSL 43 §)

Ekvivalenttimelutasot lähimpien asuinkiinteistöjen piha-alueilla on mitattava kerran vuodessa aina sen jälkeen, kun tehtailla on toteutettu ko. vuodelle suunnitellut meluntorjuntatoimenpiteet. Melumittauspisteitä on oltava vähintään 6 kpl. Mittaukset on suoritettava ympäristöministeriön ohjeen 1/1995 "Ympäristömelun mittaaminen" mukaisesti. Yksityiskohtainen suunnitelma edellä mainittujen melumittausten suorittamisesta on toimitettava Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle tiedoksi viimeistään kaksi kuukautta ennen mittausten aloittamista. Kun edellä määräyksessä 5 tarkoitetun meluntor-

juntaohjelman mukaiset toimenpiteet, jotka on määrätty toteutettaviksi vuoden 2015 loppuun mennessä, on toteutettu, kaikki tärkeimmät melupäästölähteet on mitattava ja mittausten perusteella on tehtävä melun leviämisselvitys samassa laajuudessa kuin vuonna 2013 laaditussa selvityksessä, Raportti mittaustuloksista ja leviämisselvityksen tuloksista on toimitettava em. valvontaviranomaisille viimeistään 28.2.2016. Melupäästöjen vähentämistä koskeva suunnitelma ja toimenpideohjelma ja siihen liittyvät melumittaukset ja leviämismallilaskelmat on tehtävä yhteisesti Ahlstrom Tampere Oy:n paperitehtaan ja mahdollisuuksien mukaan Fortum Power and Heat Oy:n Kauttuan voimalaitoksen kanssa. Ympäristömelua koskevien mittausten ja muiden melua koskevien selvitysten raportit on toimitettava tiedoksi Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskukselle ja Euran kunnan ympäristönsuojeluviranomaiselle vuosittain vuosiraportin yhteydessä.

Lupamääräykset 24 – 26

Kirjanpitoa ja raportointia koskevat määräykset ovat tarpeen valvonnan järjestämiseksi ja toteuttamiseksi. Jätelain 12 §:n nojalla jätteen haltijan on oltava riittävän hyvin selvillä hallinnassaan olevan jätteen määrästä, lajista, laadusta, alkuperästä ja jätehuollon kannalta merkityksellisistä ominaisuuksista sekä terveys- ja ympäristövaikutuksista. Jätelain 122 §:n nojalla valvontaviranomaisella on oikeus saada toiminnan valvontaa varten tarpeellisia tietoja. Kirjanpitoa ja raportointia koskevat määräykset ovat tarpeen toimintaan liittyvien ympäristönsuojelun kannalta olennaisten tietojen saamiseksi ja valvonnan järjestämiseksi. Jätelain 119 §:n nojalla jätteitä ja jätehuoltoa koskevat tiedot on säilytettävä kuusi vuotta. (YSL 43 §, 46 §, JäteL 12 §, 119 § ja 122 §)

Lupamääräykset 27 – 28

Ympäristöluvassa on annettava ympäristönsuojelulain 43 §:n mukaan tarpeelliset määräykset toiminnan lopettamisen jälkeisistä toimista, kuten alueen kunnostamisesta ja päästöjen ehkäisemisestä. Ympäristönsuojelulain 90 §:n mukaan lopettamista koskeva suunnitelma esitetään toimivaltaiselle lupaviranomaiselle. Yksityiskohtaisen suunnitelman tulee kattaa mm. säiliöiden ja putkistojen tyhjentämiseen, säiliöiden ja rakenteiden purkamiseen sekä jätteiden poiskuljettamiseen ja maaperän puhdistamiseen liittyvät toimet. (YSL 43 §)

VASTAUS LAUSUNNOISSA ESITETTYIHIN YKSILÖITYIHIN VAATIMUKSIIN

Lausunnot on otettu huomioon luparatkaisusta ja lupamääräyksistä sekä niiden perusteluista ilmenevällä tavalla.

Muilta osin aluehallintovirasto vastaa seuraavasti:

Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskuksen lausunnossaan edellyttämät vaatimukset:

- Energiatehokkuusselvityksen päivittämistä aluehallintovirasto ei tässä vaiheessa ole edellyttänyt. Tärkeimpänä syynä tähän on parhaan käyttökelpoisen tekniikan vertailuasiakirjan tuleva päivitys, jonka julkistamisen jälkeen kyseisen selvityksen anti on nykyistä suurempi erityisesti elinkeino-, liikenne- ja ympäristökeskuksen lausunnossaankin esittämän veden kierrättämisen tunnusarvojen osalta. Koska asiaa joudutaan joka tapauksessa tarkastelemaan vertailuasiakirjan julkaisemisen jälkeen, ei asiasta määrääminen siirtymäaikoineen tässä vaiheessa antaisi merkittävää lisäarvoa. Muilta osin hakemuksen liitteenä oleva energiatehokkuutta koskeva selvitys on todennäköisesti ajan tasalla.

- Jätevesien akuutin toksisuuden toistuvaa määrittämistä aluehallintovirasto ei ole määrännyt. Käytössä olevien jätevesiin päätyvien kemikaalien osalta päällimmäinen ongelma ei olemassa olevan tiedon perusteella ole akuutti toksisuus, joten määrityksistä tuskin saataisiin merkittävää uutta tietoa.

LUVAN VOIMASSAOLO JA LUPAMÄÄRÄYSTEN TARKISTAMINEN

Luvan voimassaolo

Ympäristölupa on voimassa toistaiseksi Länsi-Suomen ympäristölupaviraston 29.12.2005 antaman päätöksen (nrot 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391) mukaisesti.

Lupamääräysten tarkistaminen

Toiminnanharjoittajan on toimitettava aluehallintovirastolle hakemus lupamääräysten tarkistamiseksi viimeistään 31.12.2023. (YSL 55 §)

Hakemukseen on liitettävä selvitys mm. parhaan käyttökelpoisen tekniikan seurannasta ja hyödyntämisestä tehtaan toiminnassa sekä yhteenveto tehdyistä tarkkailuista sekä muut ympäristönsuojeluasetuksen 8 – 11 §:ssä mainitut selvitykset soveltuvin osin.

Korvattavat päätökset

Tämä päätös korvaa lainvoimaiseksi tultuaan seuraavat päätökset:

- Länsi-Suomen vesioikeuden 29.1.1992 A Ahlström Osakeyhtiölle antama päätös (nro 6/1992/4, dnro 85394) koskien jätevesien johtamista edelleen Eurajokeen. Päätöksessä on määrätty maksettavaksi kertakaikkiset korvaukset vesialueiden kalataloudellisen tuoton alenemisesta vesialueiden omistajille vuoden 1986 alusta alkaen.

- Länsi-Suomen ympäristölupaviraston Ahlstrom Kauttua Oy:lle ja Jujo Thermal Oy:lle 29.12.2005 myöntämä ympäristönsuojelulain mukainen ympäristölupapäätös (nrot 51-52/2005/1, dnrot LSY-2003-Y-390 ja LSY-2003-Y-391).

- Vaasan hallinto-oikeuden 23.4.2007 antama päätös koskien ympäristölupapäätöksen johdosta jätettyjä valituksia (nro 07/0132/1, dnro 00787-00789/06/5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.
- Etelä-Suomen aluehallintoviraston Jujo Thermal Oy:lle 12.11.2010 myöntämä ympäristönsuojelulain 58 §:n mukainen päätös (nro 48/2010/1, dnro ESAVI/18/04.08/2010) ympäristömelua koskevan lupamääräyksen muuttamiseksi.
- Vaasan hallinto-oikeuden 10.11.2011 antama päätös koskien edellisen päätöksen johdosta jätettyjä valituksia (nro 11/0311/1, dnro 00226/11/5101), jossa hallinto-oikeus on hylännyt valitukset kokonaisuudessaan.

Lupaa ankaramman asetuksen noudattaminen

Jos asetuksella annetaan tämän luvan määräystä ankarampia säännöksiä tai luvasta poikkeavia säännöksiä luvan voimassaolosta tai tarkistamisesta, on asetusta luvan estämättä noudatettava. (YSL 56 §)

PÄÄTÖKSEN TÄYTÄNTÖÖNPANO

Tämä päätös on lainvoimainen valitusajan jälkeen, jos päätökseen ei haeta muutosta. (YSL 100 §)

SOVELLETUT SÄÄNNÖKSET

Ympäristönsuojelulaki (86/2000) 4–8, 28, 31, 35–38, 41–43, 45, 46–47, 50, 52–56, 62, 71–74, 76, 90, 100, 105 §

Ympäristönsuojeluasetus (169/2000) 1, 5, 16, 19, 30, 36, 37 §

Jätelaki (646/2011) 29, 118, 119 – 121, 148, 149 §

Valtioneuvoston asetus jätteistä (179/2012) 7 – 9, 20, 22, 24, 37 §, liite 4

Laki eräistä naapuruussuhteista (26/1920) 17 §

Valtioneuvoston asetus vesiympäristölle vaarallisista ja haitallisista aineista (1022/2006)

Valtioneuvoston päätös melutason ohjearvoista (993/1992)

Valtioneuvoston päätös öljyjätehuollosta (101/1997)

Laki valtion aluehallinnon uudistamista koskevan lainsäädännön voimaanpanosta (903/2009)

Valtion maksuperustelaki (150/1992)

Laki valtion maksuperustelain muuttamisesta (961/1998)

Valtioneuvoston asetus aluehallintovirastojen maksuista vuosina 2012 ja 2013 (1572/2011)

KÄSITTELYMAKSU JA SEN MÄÄRÄYTYMINEN

Käsittelymaksu on **13 567 euroa**. Lasku lähetetään erikseen Valtion talous- ja henkilöstöhallinnon palvelukeskuksesta.

Käsittelymaksu määräytyy valtion maksuperustelain (150/1992) nojalla annetun valtioneuvoston asetuksen aluehallintovirastojen maksuista vuosina 2012 ja 2013 (1572/2011) mukaisesti. Asetuksen liitteenä olevan maksutaulukon mukaan paperitehtaan ympäristölupahakemuksen käsittelystä peritään maksu, jonka suuruus on 20 100 euroa. Lupamääräyksen tarkistamista (ympäristönsuojelulain 55 §:n 2 momentti) tai luvanmukaisen toiminnan jatkamista koskevan lupahakemuksen käsittelystä peritään maksu, jonka suuruus on 50 prosenttia taulukon mukaisesta maksusta. Maksu peritään 35 prosenttia taulukon mukaista maksua korkeampana, koska asian käsittelyn vaatima työmäärä on ollut taulukossa mainittua työmäärää suurempi.

Maksuasetuksen liitteen mukainen toiminnon kuvaus	***Maksuasetuksessa arvioitu työmäärä (htp)***	***Osuus (%)***	***Asetuksen mukainen maksu (€)***
Paperi- tai kartonkitehdas taikka muu massatehdas kuin sellutehdas	(40 – 70)	50 %	20 100
Maksu peritään 35 prosenttia taulukon mukaista maksua korkeampana, jos asian käsittelyn vaatima työmäärä on taulukossa mainittua työmäärää suurempi		+35 %	3 517
Yhteensä	>35		13 567

PÄÄTÖKSESTÄ TIEDOTTAMINEN

Päätös

Jujo Thermal Oy
PL 92
27501 KAUTTUA

Jäljennös päätöksestä

Euran kunnanhallitus
Euran kunnan ympäristönsuojeluviranomainen
Euran kunnan terveydensuojeluviranomainen
Eurajoen kunnanhallitus
Eurajoen kunnan ympäristönsuojeluviranomainen
Eurajoen kunnan terveydensuojeluviranomainen
Turvallisuus- ja kemikaalivirasto (Tukes)
Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus, ympäristö ja luonnonvarat -vastuualue (sähköisesti)
Varsinais-Suomen elinkeino-, liikenne- ja ympäristökeskus, kalatalouspalvelut -ryhmä (sähköisesti)
Suomen ympäristökeskus (sähköisesti)

Lounais-Suomen aluehallintovirasto, peruspalvelut, oikeusturva ja luvat -vastuualue / ympäristöterveydenhuolto (sähköisesti)

Ilmoitus päätöksestä

Asianosaisille listan dpoESAVI-118-04-08-2012 mukaan.

Ilmoittaminen kunnan ilmoitustaululla ja lehdissä

Tieto päätöksen antamisesta julkaistaan Etelä-Suomen aluehallintoviraston ympäristölupavastuualueen ilmoitustaululla ja päätöksestä kuulutetaan Euran ja Eurajoen kuntien virallisella ilmoitustaululla.

Kuulutuksesta ilmoitetaan Länsi-Suomi -nimisessä sanomalehdessä.

MUUTOKSENHAKU

Päätökseen saa hakea muutosta Vaasan hallinto-oikeudelta valittamalla.

LIITTEET

1. Valitusosoitus
2. Tarkkailuohjelma

Risto Lehtoranta Mikko Anttalainen

Kari Pirkanniemi

Asian ovat ratkaisseet ympäristöneuvos Risto Lehtoranta ja ympäristö-ylitarkastaja Mikko Anttalainen ja asian on esitellyt ympäristöylitarkastaja Kari Pirkanniemi.
KP/mn

Liite 1

VALITUSOSOITUS

Valitusviranomainen

Etelä-Suomen aluehallintoviraston päätökseen saa hakea valittamalla muutosta **Vaasan hallinto-oikeudelta**. Asian käsittelystä perittävästä maksusta valitetaan samassa järjestyksessä kuin pääasiasta.

Valitusaika

Määräaika valituksen tekemiseen on kolmekymmentä (30) päivää tämän päätöksen antopäivästä sitä määräaikaan lukematta. Valitusaika päättyy **3.5.2013.**

Valitusoikeus

Päätöksestä voivat valittaa ne, joiden oikeutta tai etua asia saattaa koskea, sekä vaikutusalueella ympäristön-, terveyden- tai luonnonsuojelun tai asuinympäristön viihtyisyyden edistämiseksi toimivat rekisteröidyt yhdistykset tai säätiöt, asianomaiset kunnat, elinkeino-, liikenne- ja ympäristökeskukset, kuntien ympäristönsuojeluviranomaiset ja muut asiassa yleistä etua valvovat viranomaiset.

Valituksen sisältö

Valituskirjelmässä, joka osoitetaan Vaasan hallinto-oikeudelle, on ilmoitettava
- päätös, johon haetaan muutosta
- valittajan nimi ja kotikunta
- postiosoite ja puhelinnumero ja mahdollinen sähköpostiosoite, joihin asiaa koskevat ilmoitukset valittajalle voidaan toimittaa (mikäli yhteystiedot muuttuvat, on niistä ilmoitettava Vaasan hallinto-oikeudelle, PL 204, 65101 Vaasa, sähköposti vaasa.hao@oikeus.fi)
- miltä kohdin päätökseen haetaan muutosta
- mitä muutoksia päätökseen vaaditaan tehtäväksi
- perusteet, joilla muutosta vaaditaan
- valittajan, laillisen edustajan tai asiamiehen allekirjoitus, ellei valituskirjelmää toimiteta sähköisesti (faxilla tai sähköpostilla)

Valituksen liitteet

Valituskirjelmään on liitettävä
- asiakirjat, joihin valittaja vetoaa vaatimuksensa tueksi, jollei niitä ole jo aikaisemmin toimitettu viranomaiselle
- mahdollisen asiamiehen valtakirja tai toimitettaessa valitus sähköisesti selvitys asiamiehen toimivallasta

Valituksen toimittaminen Etelä-Suomen aluehallintovirastolle

Valituskirjelmä liitteineen on toimitettava Etelä-Suomen aluehallintovirastolle. **Valituskirjelmän on oltava perillä määräajan viimeisenä päivänä ennen virka-ajan päättymistä.** Valituskirjelmä liitteineen voidaan myös lähettää postitse, faxina tai sähköpostilla. Sähköisesti (faxina tai sähköpostilla) toimitetun valituskirjelmän on oltava toimitettu niin, että se on käytettävissä vastaanottolaitteessa tai tietojärjestelmässä määräajan viimeisenä päivänä ennen virka-ajan päättymistä.

Etelä-Suomen aluehallintoviraston yhteystiedot

käyntiosoite:	Ratapihantie 9, 00520 Helsinki
postiosoite:	PL 110, 00521 Helsinki
puhelin:	(vaihde) 029 501 6000
fax:	09 6150 0533
sähköposti:	ymparistoluvat.etela@avi.fi
aukioloaika:	klo 8 - 16.15

Oikeudenkäyntimaksu

Valittajalta peritään asian käsittelystä Vaasan hallinto-oikeudessa oikeudenkäyntimaksu 90 euroa. Tuomioistuinten ja eräiden oikeushallintoviranomaisten suoritteista perittävistä maksuista annetussa laissa on erikseen säädetty eräistä tapauksista, joissa maksua ei peritä.