

## Environmental assessment of biocides in PT11 cooling water systems

This note contains the results of a NL Email consultation concerning the assessment of biocides in PT11 cooling water systems endorsed at TM IV 2013 and included in MOTA version 6.

We would like to thank all participants to this email consultation for the extensive responses we received from France, Germany (several times), Spain and experts of the RIVM and after TMI 2011 from Finland and UK. Below is included a short overview of the main conclusions and discussions held in an email consultation concerning biocides used in PT 11 cooling water systems and the follow up discussion at TMIII 2011. It should be emphasised that some of the discussions have larger implications.

The underlying consultation is subdivided in A. the risk evaluation for the terrestrial compartment and B. the risk evaluation for the aquatic compartment.

In the appendix a full overview is given of all discussions. Additionally at the end of the summary some notes are presented concerning bugs identified in EUSES for the ESD for cooling water and how to prevent them.

### Main conclusions are:

#### A: Assessment of drift from cooling water systems to the terrestrial environment

**A1:** It is mutually agreed upon to perform a risk assessment for spray drift to soil for once through systems (with cooling tower), large and small open recirculating systems.

The following parameters are agreed: AREAdepos of 75000 m<sup>2</sup> for once through, large and small recirculating cooling systems

#### A2: It is agreed to apply a tiered approach, first:

**first step** obtain transformation rates in air and on surfaces for rapidly degrading substances. An inventory of possible transformation tests and monitoring data is needed.

If from this analysis it appears that this exposure route is considered relevant then as a **second step** spray tests with surface living non-target arthropods and plants could be requested.

- For emissions on (bare) soil: e.g. *Aleochara bliineata*, *Poecilus cupreus*, *Pardosa* sp..

Especially *Pardosa* is known to be sensitive.

- For emissions to leafs are proposed tests with e.g. *Aphidius rhopalosiphi* and *Typhlodromus pyri*. *Coccinella septempunctata*, *Orius laevigatus* or *Chrysoperla carnea*).

- For exposure in soil: e.g. *Hypoaspis aquleifer* and *Folsomia candida*

If there is not enough data available to come to a conclusion about the transformation rates, the second step has to be done as well

It was acknowledged that the tiered approach is acceptable and should be addressed for all actives, not only rapidly reactive chemicals.

It remains open whether this type of data is required for the review programme or at product authorization.

#### A3 PNECsoil

It is agreed upon that for **all** substances with soil exposure via spray-drift. PNECterrestrial is derived based on mg a.s./m<sup>2</sup> (next to the default risk assessment). The risk assessment of substances that do not rapidly degrade should be based on PNECsoil (mg/kg soil ww and dw).

#### A4 Mitigation measures

It remains open in what extent drift reduction with drift eliminators is required in the different member states. Reduction of Fevap+drift from 1% to 0.01% is proposed as refinement. At

product authorisation phase more experience should be obtained and gathered for harmonisation.

**B: aquatic compartment**

**B1 dilution factors:**

It is generally agreed that direct emission to surface water of rapid reacting oxidizing chemicals – *but also other active substances used in cooling systems* must be assessed for open systems. For the emission to via the STP a dilution factor 10 is agreed for all discharges (of consumers and industrial waste water). This dilution factor should not be changed, considering that STPs can also discharge to small rivers, with sometimes even lower dilution factors. Higher dilution factors can only be obtained for those industries for which it is considered adequate that they discharge to larger rivers only.

For the risk assessment the following scheme of dilution factors apply:

	Dilution factors			
	ESD closed cooling system*	ESD small cooling system*	ESD large cooling system**	ESD once through**
<i>Discharge (m<sup>3</sup>/s)</i>	1.11E-07	5.56E-04	3.47E-02	6.67
TGD river 0.2 m <sup>3</sup> /s	1000	350	x***	x
rivers 0.5 m <sup>3</sup> /s	1000	1000	<b>10</b>	x
rivers 15 m <sup>3</sup> /s	1000	1000	200	x
rivers 100 m <sup>3</sup> /s	1000	1000	1000	<b>10</b>
rivers 1000 m <sup>3</sup> /s	1000	1000	1000	50

\* Closed and small cooling systems have the option to restrict emissions via the STP

\*\* Only option for restriction is the increase minimum flow rate of the receiving water

\*\*\* A dilution factor <10 is not considered realistic, nor acceptable and therefore not part of the risk assessment. Large cooling systems and once through cooling systems will not release treated cooling water to rivers with a too low flow rate, resulting in a dilution factor of <10..

**B2 regulated emissions from cooling water systems?**

This issue remains open for product authorisation. At present no information is available in what extent regulation of emissions for cooling water systems is possible.

**B3: PNEC derivation for rapid reactive substances?**

- Applying a factor 1000 to the acute toxicity of oxidizing chemicals may result in PNECs which may be below the LOQ. Considering that no real solution is available it is agreed that also for oxidative rapidly reacting actives the PNEC must be derived from ecotoxicity tests, even if it means that the resulting PNEC is below LOQ.
- It is proposed to perform chronic tests only if the observed acute effects are not related to a pH-decrease. Otherwise the acute tests should be repeated with pH-adjustment which should be done prior to the insertion of the test organisms.

**B4: Mitigation measures for reducing emissions to water**

Some options for risk mitigation are presented in the appendix with the full discussions. It should be noted that Annex I inclusion and biocidal product authorisations can only influence the use, possible emission of and exposure to a biocidal product. Other issues relevant for cooling water systems, such as energy consumption / water requirements / entrainment of organisms and noise emissions are not related to the use of a biocide and therefore not relevant for annex I inclusion of an active substance nor authorisation of biocidal products.

Please note that a some bugs were identified in EUSES 2.1.1 for shock dosing:

1. The total emission over 30 days from small systems is calculated correctly from the TWA Cbld as 0.64 kg, but this value is used as the *daily* emission to the STP, without first dividing by 30 to correct for the 30-days interval.
2. Our version of EUSES 2.1.1 failed to calculate the concentrations in surface water. The concentration in water should simply be calculated as the concentration in the blow down water, divided by the appropriate dilution factor. Calculations were therefore performed in Excel.

## Appendix with the full discussions

### Introduction

Starting point of the consultation are the dCARs rapid reacting oxidizing chemicals applied as pt11 cooling water preservatives. Examples are HOBr, BrCl, BCDMH, HOCl, NaBr with as major actives HOBr and HOCl. One of major issues is that acceptable aquatic and terrestrial ecotoxicity data on the reactive chemicals are hardly available and thus it is not possible to carry out a proper risk assessment.

The relevant ESD distinguishes 4 scenarios: Once-through cooling systems, large and small open recirculating cooling systems and closed recirculating cooling systems with volumes of water in the system of 6000, 3000, 300 and 30 m<sup>3</sup> respectively. The volume of cooling water discharged is 24000, 125, 2, 0.0004 (m<sup>3</sup>/h), respectively.

Most once-through systems have large cooling capacities (>200 MW) and are used by large scale power generators and petrochemical industries, which are - for this reason –often located close to large rivers and lakes.

Open recirculating systems are mainly used for industrial applications with a heat capacity ranging from 1-100 MWT, but also for power stations with larger capacities if insufficient water is available, or if the temperature of the receiving water is too high, a situation found alongside rivers with a low flow rate in warm summers.

In closed recirculating cooling water systems cooling water recirculates in a closed loop. The cooling water is not discharged after cooling. These systems have minimal loss of water, since there is no direct contact with the atmosphere. These systems can however be small and large and may have discharge of cooling water for maintenance.

In the ESD (Table 2) the following emission routes are identified:

*Table 1. Possible emission from the various systems*

	Once-through system	Open recirculating system	Closed recirculating system
Regular discharge of cooling water (blowdown)	+++	+	-
Spray/wind drift	+*	+	-
Evaporation	+	++	-
Discharge of cooling water for maintenance	1) (½ yr)	+2) (1 yr)	+2) (1 yr)

\* for system with air cooling tower. It should be noted that there are also once-through systems without cooling towers (see comments of Spain), but the ESD scenario applies with 2 cooling towers.

+ estimate of quantity of water released

1) treatment is stopped

2) under controlled conditions, sometimes de-activation is recommended

It should be noted that the table does not differentiate between large and small open recirculating systems.

The underlying consultation is subdivided in A. the risk evaluation for the terrestrial compartment and B. the risk evaluation for the aquatic compartment.

In the follow up of the e-consultation (Mai 2011) we received responses from Finland and UK with questions concerning the definition of rapidly degrading substances:

FI: Which substances are regarded as 'rapid reacting chemicals'? Does this term refer only to oxidizing chemicals or should for example glutaraldehyde be regarded as a rapid reacting chemical? The DT50 (primary degradation) of glutaraldehyde is 10.6 hours, but it may also disintegrate even faster by reacting with organic matter.

The UK considers that some initial considerations remain unaddressed in the document, and that without answers to the following questions it is difficult to give an overall opinion on the document.

What is the definition of a rapidly degrading compound? Big differences in the penetration of the soil surface could occur between compounds with DT50 values < 1-2 hours and compounds with DT50 value of 2 days. What are the tests/ studies required to show that a compound is rapidly degrading? How will longer lasting metabolites be addressed by the risk assessment procedure? How are metabolites relevant for ecotoxicological risk assessment identified if the route of degradation in soil and water is not investigated?

**Response NL:** The e-consultation has developed in such a way that it not only concerns “rapidly degrading” substances. We therefore propose to adapt the title of this document to “Consultation PT11 biocides in cooling water systems”.

#### **A. Evaluation of the terrestrial compartment**

In the present ESD is indicated that there will be emission to soil due to spray drift of treated cooling water.

It is to be expected that these rapid reacting chemicals in contact with soil immediately will react forming Br- or Cl-salts or organic bromine/chlorine compounds. So organisms living within the soil will hardly become exposed to the reactive substances and tests with treated mixed soil in e.g earthworm and plant tests may be not representative for the type of use. Thus a PNEC derived on basis of kg soil may be not relevant.

On the other hand surface living species (such as non-target arthropods, lichens and plants) may become directly exposed to the treated spray drift water, indicating that a PNEC derived on basis of m<sup>2</sup> may be more relevant. This type of exposure and related PNEC derivation is, however, not covered in the TGD.

A parallel can be found in agricultural plant protection applications where the risk of spray drift is assessed for non-target plants and arthropods under ESCORT2.

There are, however, some relevant differences in exposure frequency and duration to Plant Protection Products as compared to Pt11 Biocidal products:

Plant Protection Products are most of time applied during a short time period with possible retreatment with a certain frequency, whereas for the biocidal Pt11 there may be a with long term emission with a chance of chronic exposure (depending on the weather conditions and wind direction). Furthermore the distance and height of the emission source is different.

Within the plant protection framework short term single or repeated off-field exposure is compared with L(E)R50 values applying an assessment factor of 1 to 5, depending of the number of tests and their representativeness for the field situation.

**The following questions came up:**

**A1. Is the emission route to soil from spray drift of cooling water with rapid reacting chemicals: a. negligible for small open recirculating cooling systems, and b. relevant for large open recirculating and once through cooling systems?**

FR: We agree with your point to consider emission to soil negligible for small open recirculating cooling systems, and relevant for large open recirculating and once through cooling systems.

ES: a. Spray drift should be considered even for small open recirculating cooling systems. b. It is relevant for large open recirculating system and it is negligible for once through systems where no evaporative cooling tower is present.

DE: The various systems with their intrinsic properties (see table 1) used for water cooling in power plants and industrial processes need for adapted approaches to avoid scaling, growth of microorganisms and corrosion. Generally the potential release of treatment chemicals is system-specific and depends on maintenance, monitoring and operating procedures on site. In once-through cooling systems, because of the short retention time and the requirement for a rapid elimination, fast-acting oxidative biocides are used. In open cooling systems less or non-oxidative biocides and in closed cooling systems more stable organic biocides are called for.

Table 1: Properties of different water cooling systems

<b>Once-through cooling</b>	<b>Open recirculating cooling systems</b>	<b>Closed recirculating cooling systems</b>
<ul style="list-style-type: none"> <li>- use of cooling water without recirculation</li> <li>- residence time 2-15 minutes</li> <li>- direct discharge in surface water</li> <li>- application of biocides rather underpart</li> <li>- huge power plants (&gt; 100 MW), e.g. power plant of energy supply companies</li> </ul>	<ul style="list-style-type: none"> <li>- often in combination with cooling tower(s)</li> <li>- cooling circuit open to air, evaporation, droplet losses, spray drift</li> <li>- fresh water supply amounts to only 2-5 % of that from once-through systems (equal cooling capacity)</li> <li>- oxidative biocides</li> <li>- smaller power plants (ca. 20 MW), e.g. combined heat and power plant converting biomass</li> <li>Large systems: blow down rate 125 m<sup>3</sup>/h</li> <li>Small systems: blow down rate 2 m<sup>3</sup>/h</li> </ul>	<ul style="list-style-type: none"> <li>- almost without effluent, is expected to lose approximately 1 % of the system volume per month</li> <li>- residence time up to 6 months</li> <li>- non-oxidative and organic biocides</li> </ul>

However, we have identified a gap in the emission scenario document. The proposal of a harmonised emission scenario (European Commission, 2003) generically identifies 4 operating systems. The calculation optionally includes a degradation rate constant. For a worst case scenario we would assume no degradation, thus substance-specific parameters are neglected.

$$RELEASE_{air} = F_{evap} + drift \times Q_{circ} \times C_{proc} \times 0.001 \times N$$

$$DOSE_{pres} = F_{depos} \times Q_{circ} \times \frac{C_{proc}}{AREA_{depos}} \times N$$

According to the release estimation to air and soil a dose of the active substance deposited to soil is calculated for once-through and (small/large) open recirculating systems depending as well on the fraction deposited to soil as on the soil surface where deposition occurs (see equations above). Unfortunately, in case of the small open recirculating system default values are missing for the emission fractions ( $F_{evap}$ ,  $F_{depos}$ ). So here the issue is which default value to apply for an appropriate assumption. We would propose to set the default values equal to the given ones for the once-through and large recirculating system, because for these systems equal emission fractions were used supporting that these fractions are independent from the type of system. Furthermore the systems are distinguished by the volume of recirculating cooling water and the number of cooling towers per site as site-specific parameters.

#### Discussion A1:

Different views have been identified concerning the proposal to restrict the risk assessment of soil due to spray drift large open systems. In contrast with the ES observation the BREF indicates that “On a number of sites, once-through systems can be found combined with a cooling tower to precool the discharge before it is emitted into the receiving surface water”, indicating that spray drift may also be relevant for this type of cooling systems. Additionally in the ESD (page 23) was indicated that “A closed recirculating cooling system has no evaporation and wind- of spray losses.” NL considers it questionable to assume spray drift to soil from closed systems.

DE identified a gap for small open recirculating system. Default values are missing for the emission fractions ( $F_{evap}$ ,  $F_{depos}$ ) and suggested an equal set of parameters as for large recirculating systems. NL considers that exclusion of these default parameters in the ESD was a deliberate of the experts to address that spray drift is only relevant for large open systems.

**Response DE 1 Feb 2011: No specification of default values cannot justify the assumption that missing values hints that spray drift is only relevant for large open systems due to expert judgement.**

FI: We agree that same parameters for spray drift should be applied for all system types, but FI is of the opinion that the default values ( $F_{evap}$  of 1% ,  $AREA_{depos}$  of 100m<sup>2</sup>) might be too worst case. There seems to be doubts also in the ESD document regarding the releases to air: eg. on page 22 Figure 7 discharge to air from once-through system is stated to be 0.1% and in Figure 8 it is said that evaporation is 1 % (with 'no biocide') and wind losses and spray drift losses <0.2% to <0.01%.

The ESD for PT11 does not give guidance how to use these  $F_{evap}$  and  $F_{depos}$  values. It should be clarified and agreed how to use  $F_{evap}$  and  $F_{depos}$  for the calculation of  $PEC_{soil}$  (mg/kg and /or mg/m<sup>2</sup>) (e.g. in EUSES calculations).

At TMII 2011: it was concluded that each Member State has to decide them selves whether refinement of the  $F_{evap}$  and  $F_{depos}$  is relevant for their situation. Considering that in some Member states such as Fr and ES have strict mitigation measures with a drift reduction of 0.0001% therefore could support annex I inclusion if the mitigation measure results in an acceptable risk.

Response NL: the EUSES black list suggests two options: to set the calculated  $DOSE_{soil}$  to zero and to leave it out of the total deposition calculation. Which would mean that the risk of

spray drift would be removed from the risk assessment. Alternatively the blacklist suggests to adapt AREAdepos to 75,000 m<sup>2</sup> based on worst case assumptions. It is not fully clear to whether this area is relevant for both large and small open recirculating cooling systems. Further discussion on this issue is required.

At TMIII 2011 DE proposed to adapt the area to 60,000 m<sup>2</sup>. Additionally by email the following was indicated: First of all, we agree that a default AREAdepos of 100 m<sup>2</sup> given by the ESD PT 11 is too worst case. But the derivation of an AREAdepos of 75000 m<sup>2</sup> was not that clear to us. So, we thought on the following generic assumptions:

The TGD II (2003) describes an air emission with the following point source characterisations: source height 10 meters, the deposition flux to soil is averaged over a circular area around the source, with a radius of 1000 m to represent the local agricultural area (p. 73). With the formula to calculate the area of a circle which is  $AREA = 2\pi r$  the corresponding AREA is 6283 m<sup>2</sup>. In the "Reference Document on the application of Best Available Techniques to Industrial Cooling Systems" (IPPC, December 2001) the cooling tower height is considered to be 80-200 m (p. 47). If assuming an average height of 100 m for cooling towers as worst case all generic variables given by the TDG II (2003) were multiplied by a factor of 10. Then, the AREAdepos is exactly 62831 m<sup>2</sup> and was rounded to 60000 m<sup>2</sup> which was proposed by us to set as default.

Regarding your second question about the validity of this default area for the three scenarios our argumentation is the following:

It was mutually agreed that for all three types of systems spray drift is relevant. That would argue for the presence of cooling towers at these three scenarios, which is also in conformity with the ESD for PT 11 that set up the number of cooling towers per site for the scenarios once-through, large and small open recirculation. As the deposition area is mainly influenced by the cooling tower height in our opinion this parameter should not be dependent on the scenario. Hence, the conditions of default cooling towers should be defined based on realistic worst case situations and harmonised. From our point of view a cooling tower height of 100 m and a corresponding radius of 10000 m would represent a worst case in all scenarios.

After discussions with DE the following parameters are agreed: AREAdepos of 75000 m<sup>2</sup> for once through, large and small recirculating cooling systems

The 75000 m<sup>2</sup> proposal is part of the EUSES black list issues 23-12-2009. Possibly the larger area is selected because it concerns two towers close to each other, resulting in a larger area and double spray drift, but it is unclear whether this in fact is the reasoning. DE agrees on this suggestion.

24-10-2011 Regarding the different dimensions of the cooling towers and thus also different deposition areas DE proposes the following: In tier 1 the worst case will be a generic cooling tower height of for example 100 m for all types of systems where relevant and tier 2 would require for more site-specific conditions. Another thought is to define worst case cooling tower height for each type of system where relevant. But, in our opinion, this would also require real data from the industry. In context to that open issue the relevance of deposition from small system with probably less high cooling towers should also be clarified by industry data. DE plans to contact German Industry Associations concerning the still open issues on cooling water systems. It may take some time. Hopefully we get some information that would bring forward our discussions and may be useful to update the ESD for PT 11.

## **Conclusion A1**

The proposal is agreed to perform a risk assessment for spray drift to soil for once through systems (with cooling tower), large and small open recirculating systems. Further discussion is needed on the default parameters to be used for Fevap and Fdepos and AREAdepos  
DE 1-Feb-2011: We welcome the amendment.

If yes:

**A2. Should we request for soil tests and/or surface ecotoxicity tests in case of use in large open recirculating and once through cooling systems?**

FR: As classical tests with treated mixed soil will not be representative of the actual conditions of toxicity for this type of rapid reacting substances and in these particular conditions of release via the evaporation of droplets, studies with direct exposure of tested organisms by a treated spray drift seem to be more relevant. Nevertheless, we agree with NL that the application duration is an important parameter for a long term toxicity assessment which seems to be relevant for PT11 substances.

ES: As regards the large open recirculation systems, we consider that toxicity to soil organisms (soil and surface) should be addressed, earthworms could be exposed to some extent to the active ingredient and affect the structure of the ecosystem in this compartment. It is ignored the extent of the effects of this kind of active substance prior the substance is transformed to innocuous salts. However, regarding once through cooling systems, the exposition of soil organism can be considered as not relevant.

Response NL: This remark is not in line with the BREF, which indicates that also for once through cooling systems cooling towers are used to lower the temperature of the cooling water. This may result in similar emission routes for both recirculating and once through systems.

**Question to ES:** Can you solve / clarify the seeming discrepancy? (No further response received)

DE: Cooling systems with an open cooling tower have a high water discharge to air and to soil through deposition. As concluded under question A1 we think that this exposure path is relevant for all open recirculating systems (once through, large and small recirculating cooling systems). In this case the "TNsG on data requirements" recommends doing the following ecotoxicity tests:

- Inhibition to microbial activity
- Acute toxicity to earthworms or other soil non-target macro-organisms
- Acute toxicity to plants

We do agree with you that the rapid reacting substances might react very quickly when reaching the soil and will form salts. But this will also be the case in test systems so we think that these tests will be representative. The tests should be started with the plant test, we propose the OECD-guideline 227 (Terrestrial Plant Test: Vegetative Vigour Test). This test can be carried out with a spray application which would fit the presumed exposure path. Additional tests with earthworms and micro-organisms should be carried out afterwards if effects are discovered.

For the exposure assessment we recommend to take into account that the salts of the substances could be leached deeper into the soil by precipitation which would not be considered by looking only at a surface exposition.

#### **Discussion A2:**

DE and FR indicated that spray ecotoxicity tests are considered more relevant for PT11 applications, especially as if it concerns rapid degrading substances. DE and ES however considers that soil microbiology and earthworm tests are also valid for rapid degrading

substances because it represents the reality of organisms exposed via soil. DE proposes that the tests should be started with the terrestrial plant test OECD-guideline 227 (Vegetative Vigour Test).

As a follow-up the following questions we requested:

A. Do tests with earthworms and soil micro-organisms sufficiently represent species exposed to rapid reacting chemicals from spray drift? Alternative could be spray tests with non target arthropods and plants

Response DE 1 Feb 2011: As already proposed in the first answer, we support the tests with plants and non target arthropods, preferably with spray exposure.

B. Can we request for spray tests with for example non target arthropods and plants? Considering that the TNsG for data requirements does not provide guidance on this and the process of evaluating PT11 is already proceeding? – Alternatively can we ask these tests for the product authorisation stage?

Response DE 1 Feb 2011: If there might be risk, we think that the tests should be requested during this stage of the process and not at the product authorisation. The risk might be estimated with EPM (if you have the algae test to determine the PNEC correctly).

**Follow-up NL** proposes a tiered approach. The following question needs to be addressed first: Does emission of rapid degrading substances from cooling towers indeed result in exposure of surface living (and soil) living organisms?

To answer this issue as a **first step** NL suggests to obtain transformation rates in air and on surfaces for rapidly degrading substances. An inventory of possible transformation tests and monitoring data is needed.

Additionally further scenario development is required concerning the relevant surface exposed;

Response DE 1 Feb 2011: We would support this approach. Nevertheless, the first step will be very time-consuming in developing guidance to obtain transformation rates in air and surfaces. Further it would be difficult to implement such testings during the product authorisation stage due to the lack of time. Concluding, we urge to ask for these tests during the already proceeding review programme.

If from this analysis it appears that this exposure route is considered relevant then as a **second step** spray tests with surface living non-target arthropods and plants could be requested.

Within the PPP area the following arthropod species are recommended:

For emissions on (bare) soil: e.g. *Aleochara bliineata*, *Poecilus cupreus*, *Pardosa* sp.. Especially *Pardosa* is known to be sensitive.

For emissions to leaves are proposed tests with e.g. *Aphidius rhopalosiphii* and *Typhlodromus pyri* (*Coccinella septempunctata*, *Orius laevigatus* or *Chrysoperla carnea*).

For exposure in soil: e.g. *Hypoaspis aquileifer* and *Folsomia candida*

Below an overview of test guidelines for non target arthropods is included.

Response DE 1 Feb 2011: If there is not enough data available to come to a conclusion about the transformation rates, the second step has to be done as well.

Before deciding on requesting these tests and test organisms, it should be noted that in artificial surface tests a buffer period of one hour is included before introducing the test species. It should be checked if this buffer period is too long for rapidly degrading substances;

Response DE 1 Feb 2011: It has to be taken into account as well that the effects that might be seen during the test are not caused by the pH.

DE: The tiered approach proposed by NL is acceptable in this way.

FI: This is very late stage to require more data, and actually change data requirements. If initial terrestrial tests (as stated in the TNsG on data requirements) have been submitted and no risk is observed no further data should be required.

UK: It is agreed that if exposure of the terrestrial compartment is predicted then toxicity data on terrestrial organisms should be generated. These data should be generated as per the internationally agreed protocols. With regard to the discussion from NL, it is felt that producing all the data as suggested may be excessive and as such it is suggested that a screening stage to establish the sensitive groups/species could be included.

At the TMIII 2011 the following was discussed:

A2/A3 - Is it appropriate to perform soil risk assessment on an area basis? What about compounds with a high Koc that are immobile? Whether a compound is truly only ever available on the soil surface will depend upon its DT50 (see initial question on what is the definition of a rapidly degrading compound) in combination with its Koc. For compounds with a very low Koc penetration of bulk soil can occur rapidly following deposition on the surface under certain conditions (i.e. during periods of rain). As emissions are often continuous it is unlikely such worst case conditions would be avoided.

DE urges to ask for these tests during the already proceeding review programme. By contrast UK proposes a screening stage to establish the sensitive groups/species to prevent excessive data requirements. At the TM it was acknowledged that the tiered approach is acceptable and should be addressed for all actives, not only rapidly reactive chemicals.

**A3. Can we use assessment factors used for PNECsoil (expressed as mg/kg wet weight soil also for deriving PNECsoil (expressed as on mg/m<sup>2</sup> soil)?**

FR: For this type of rapid reacting oxidising substances, for which no toxicity will be demonstrated with classical tests with treated mixed soil, we favour the application of the assessment factors usually applied to derive a PNEC in mg/kg wwt, but based only on studies with an application of the substance via a spray drift. The PNEC would be expressed in mg/m<sup>2</sup> soil.

The extrapolation of the PNEC soil from the PNEC sw is also a possibility.

ES: Assessment factors are tools to deal with uncertainty. What values should be applied could be a matter of further discussion depending on data.

DE: Assessment factors are used to take uncertainties into account like:

- Intra- and inter-laboratory variation of toxicity data
- Intra- and inter-species variation of toxicity data
- Short-term to long-term/chronic toxicity extrapolation
- Extrapolation of mono-species laboratory data to field impact on ecosystems.

The mentioned uncertainties are the same, no matter whether you look at a PNECsoil [mg/kg ww soil] or a PNECsoil [mg/m<sup>2</sup> soil]. Hence we think that the assessment factors should be the same. But as stated under A2 we think that you should look at different soil depths to cover the possible entry into the soil layer by leaching through precipitation.

FI: At the moment we have no data available concerning risk mitigation measures for cooling towers in Finland.

**Discussion A3**

It was felt that the assessment factors used to calculate a PNEC soil (mg/kg soil) also can be used to calculate a PNECsoil (mg/m<sup>2</sup> soil). The height of the assessment factor depends on data available and the uncertainties covered. NL notes that the TGD only addresses the risk

assessment for soil exposure presented as mg a.s./kg soil. Additionally NL notes that in plant tests leaf surface is tested in stead of soil surface. Thus in fact not a PNEC<sub>soil</sub>, but a PNEC<sub>terrestrial</sub> (mg/m<sup>2</sup> surface) is derived.

DE indicated that different soil depths should be assessed covering the possible entry into the soil layer by leaching through precipitation. NL notes that especially for rapidly degrading substance leaching of the active substance is not relevant for PT11 applications, considering that the substance degrades at surface contact. For these substances leaching is relevant only for the salts/transformation products remaining.

### Conclusion A3

It is agreed that for rapidly degrading substances with soil exposure via spray-drift PNEC<sub>terrestrial</sub> is derived based on mg a.s./m<sup>2</sup>.

### A4. Is it possible to include mitigation measures? If yes, do you have suggestions?

FR: In France, within the framework of the rules to avoid dissemination of Legionella into the environment, a risk mitigation measure imposed on any cooling system is the limitation of the droplets drift during the evaporation of water. Drift eliminators have to be used in order to hold drift rates under 0.01% of the circulating flow rate. A typical drift eliminator provides multiple directional changes of airflow while preventing the escape of water droplets. A well-designed and well-fitted drift eliminator can greatly reduce water loss and potential for Legionella or therefore other chemical exposure.

ES: Our suggestions are:

- Installing high-efficiency drift eliminators.
- Maintaining a balanced water chemistry. Certain chemicals used specifically for cooling water treatment can reduce the water's surface tension, thus interfering with the normal agglomeration of water droplets that occurs in the drift eliminators. The result is that water droplets are smaller and more easily entrained in the exiting air stream. There is no substitute for a well-maintained water treatment program.
- Finally, periodic inspection of spray distribution systems and drift eliminators is recommended. A clogged spray nozzle, fouled drift eliminator or even an improperly installed drift eliminator can cause excessive drift in a cooling tower.

DE: According to the BREF-document (2000) the droplets in the discharge of **wet cooling towers can be contaminated with water treatment chemicals**, with microbes or with corrosion products. Drift eliminators are considered to be an important reduction measure. **All wet cooling towers nowadays are equipped with drift eliminators**, but still a small percentage of the circulated water stream may be dispersed as water droplets. These droplets containing dissolved particulate matter and chemical additives fall out of the exhaust airstream downwind of the cooling tower and can cause staining or scale deposits on building surfaces.

The quality and quantity of direct air emissions from cooling towers will be specific in each situation depending on the additives used for cooling water treatment, their concentration in the circulating water and the effectiveness of the drift eliminators. **The Standard droplet separators currently used in wet cooling towers make it possible to limit the loss of water by drift to 0.01 % or even less of the total flow rate.** An attempt was made to assess cooling tower emissions using a simplified model. From the data obtained it was concluded that emission concentrations are low (ug/m<sup>3</sup>), but not to be neglected, and that design and positioning of the cooling tower outlet are important to avoid inlets of air conditioning systems or other cooling installations.

In addition the BREF-document (2000) mentioned that plume formation is considered where the horizon-marring effect occurs or where risk exists of the plume reaching ground level. The shape and the extent of the visible plume are influenced by the temperature and the relative humidity of the atmosphere, and also by the wind.

Plume abatement is a technological integrated measure changing the configuration of the cooling system. Plume formation can be prevented, drying the wet exhaust air before it is discharged, by mixing it with some warm dry air. Open hybrid (or wet/dry) cooling towers and closed wet/dry cooling towers (or coolers) are designed in particular to prevent plume formation. Regulations sometimes distinguish between day and night operation and allow wet cooling (with a plume) during the night, whereas in daytime the tower must be operated in hybrid mode, preventing plume formation.

The application of drift eliminators and an optimized water treatment programme reduce potential risks.

Finally it is questionable if the mitigation measures were included by finding the emission fractions for evaporation and drift in the emission scenario document. If the factor does not consider these measures and the resulting emissions identify a risk for an environmental compartment the following options are possible:

- Refinement of Fevap+drift: 1 % -> 0.01 % (drift eliminator equates standards up to date)
- Prevention of the plume: give requirements for process operating.

#### Discussion A4

Mitigation measures suggested are:

- Installing high-efficiency drift eliminators.
- Maintaining a balanced water chemistry. Applying chemicals to reduce water's surface tension, resulting in smaller water droplets more easily entrained in the exiting air stream.
- Periodic inspection of spray distribution systems and drift eliminators. A clogged spray nozzle, fouled drift eliminator or even an improperly installed drift eliminator can cause excessive drift in a cooling tower.
- Plume abatement technology.

DE indicates that regulations sometimes distinguish between day and night operation and allow wet cooling (with a plume) during the night, whereas in daytime the tower must be operated in hybrid mode, preventing plume formation. NL notes that the latter mitigation measure reduces the exposure only for a fraction of the exposure period.

DE notes that the mitigation measures to reduce the fractions for evaporation and drift probably have not been distinguished during the development of the PT11 ESD and proposes the following options for refinements:

- Refinement of Fevap+drift: 1 % -> 0.01 % (drift eliminator equates standards up to date) as refinement for wet cooling towers
- Prevention of the plume: give requirements for process operating.

This popped up the following questions:

- Considering the expertise of DE and FR could they provide a discussion paper on the validity of these drift reduction measures.

Response FR 18-Nov 2010: Drift eliminators have to be used in order to hold drift rates under 0.01% of the circulating flow rate. The drift eliminators are used in France to prevent from *Legionella spp* risks in cooling water systems. This system allows the release of only water vapor (without *Legionella* and without biocide substance) and decreases the level of

contaminated droplet to 0.01%. This risk mitigation measure is imposed by regulations for all the cooling installations by water dispersion in the air flux

Response DE 1-Feb-2011:

We just followed the information given in the BREF-Document. The drift reduction measure can only be applied for wet cooling towers (see the bold marked text in our answer) and a standard cooling tower will be equipped by such a drift eliminator.

Further relevant information might become available by the linked publication of Vanderheyden and Schuyler (1994) "Evaluation and quantification of the impact of cooling tower emissions on indoor air quality". However, from our point of view, the applicant should provide such site-specific information. If they are considered in the risk assessment the Annex-I Inclusion should identify the restrictions made. If there is not enough information about the type of the cooling tower we would recommend to stick the default values given in the ESD for PT 11 (Fevap+drift = 1%).

- Can we assume that by default industry will implement these mitigation measures?

Response FR 18-Nov 2010:

In France, drift eliminators are imposed to all cooling installations using a system of water dispersion in the air flux. We are therefore not reluctant at French level to systematically apply drift eliminators as a risk mitigation measure (and to decrease the drift rate to 0.01% instead of 1%) in emission calculations.

Response DE 1-Feb-2011:

Since the BREF-Documents refers to the best available techniques that should be implemented by the default industry. "Precise information (size of the plant and the river it is located to) about the cooling systems the active substance is applied to will be needed proving the set up of refinements like differing the dilution factor. In Germany, further guidance is given by the national law WHG, which regulates the management of water bodies. For instance, we think it should be impossible to set up a once-through system to a small river "

DE, FR, NL, FI and ES did not provide evidence concerning the validity to reduce the Fevap+drift from 1% to 0.01% when mitigation measures are set in place.

In the product authorisation phase each member state should decide what Fevap+drift is relevant. The BREF of the IPPC refers to so-called drift eliminators. A description of these eliminators can be found in appendix 2.

Member states have to check at National level whether drift eliminators can be considered fully implemented, or not.

ES indicated that in Spain "it is mandatory to install high efficiency drift eliminators (droplet separator) with a resulting released water flow rate of **0.05%** of total recirculating rate". This would result in a Fevap+drift = 0.0005. Modern separators can have up to 0.002% of total recirculating volume of efficiency.

#### **Conclusion A4**

Risk mitigation measures as stated above are proposed by Fr and DE, resulting in refinement of the risk assessment, refining the Fevap+drift: 1 % -> 0.01 %, when implementing a Drift eliminator. Further validation of these values are needed

DE, FR, NL, FI and ES did not provide evidence concerning the validity to reduce the Fevap+drift from 1% to 0.01% when mitigation measures are set in place.

In the product authorisation phase each member state should decide what Fevap+drift is relevant. The BREF of the IPPC refers to so-called drift eliminators. A description of these eliminators can be found in appendix 2.

Member states have to check at National level whether drift eliminators can be considered fully implemented, or not.

ES indicated that in Spain “it is mandatory to install high efficiency drift eliminators (droplet separator) with a resulting released water flow rate of **0.05%** of total recirculating rate”. This would result in a Fevap+drift = 0.0005. Modern separators can have up to 0.002% of total recirculating volume of efficiency.

At TMIII 2011 it was concluded that this issue remains open. OMS need to submit information on this issue to NL. This should be the requirement at product authorisation stage.

## **B. Evaluation of the aquatic compartment**

It is to be expected that these rapid reacting chemicals will reduce compounds in surface water forming salts such as NaBr, NaCl or organic bromine/chlorine compounds.

The indirect emission route to surface water of treated cooling water via STP is relevant for open recirculating cooling systems. We consider that exposure of STP and surface water is not relevant for rapid reacting oxidizing chemicals.

### **DE: General Comment:**

In open cooling systems treatment plants are optional elements. The active substance may be eliminated by adsorption and degradation in the activated sludge unit. The elimination level will depend on the type of the treatment plant and the substance characteristic. However, it is unusual to discharge cooling waters from open cooling systems via e.g. an on-site or municipal STP because the high loads of water especially resulting from once-through cooling systems would have negative impacts on the treatment plant (e.g. limitation by capacity, high dilution rate in the STP). Nevertheless, we do not agree with your consideration that exposure of STP and surface water is not relevant for rapid reacting chemicals as the reactions forming salts could also have effects to the functioning in the STP. Although the treatment plant is just an optional part of the emission route to surface water for open cooling systems we think it should be taken into account for release estimation. At minimum a qualitative assessment should be applied for STP relevance. The recirculation water of closed cooling systems is often discharged indirectly via STP.

Response NL: Our consideration is pointing at the reactive substances, not possible “degradation” products” such as salts. NL agrees with DE that possible risks of salts from reactive chemicals should be assessed, although we doubt that this could cause any effect in a STP.

**The following questions came up:**

***B1. Is the direct emission route to surface water for rapid reacting oxidizing chemicals in treated cooling water: a. negligible for small open recirculating cooling systems and b. relevant for use in once-through cooling systems and large open recirculating cooling systems resulting in exposure of aquatic organisms?***

**FR:** We agree with your point to consider emission to the aquatic compartment negligible for small open recirculating cooling systems and relevant for large open recirculating and once through cooling systems.

- ES: a. In open recirculating cooling systems, part of circulate cooling water is discharged as blowdown water so it must be considered.  
b. Yes is relevant for once-through cooling systems and large open recirculating cooling systems

DE: Thus, we would propose a tiered approach in case of direct emission route to surface water. In a first tier releases will be estimated for the larger systems. If a risk is identified for the water compartment for the once-through cooling system or the large open recirculating cooling system we would switch to the small open recirculating system with respect to limitation of the use of the active substance in larger systems. If there is also a concern in the small system the option of the indirect emission route should be considered.

### Discussion/conclusion B1

It is generally agreed that direct emission to surface water of rapid reacting oxidizing chemicals must be assessed for large systems. DE proposed that in case of an observed risk for large systems also small systems should be assessed, with the possibility of restriction to the indirect emission route. DE proposes that for rapid degrading chemicals the emission route to the STP is assessed for the salts formed.

### Follow up:

NL: Complicating issues are:

1. For several dossiers with rapid reacting active substances a full ecotoxicity dataset (algae, daphnia, fish) on the reactive product is missing, with the waiving arguments that "algae are target species" and "the reactive product in contact with organic matter is immediately deactivated resulting in no emission". Additionally, because the ecotoxicity dataset was incomplete, no PNEC could be derived and thus no risk assessment performed. Because there was no risk assessment the applicant referred to EU Commission (e-mail 13/8/09) in which Pierre Chorain indicated: "The RMS must have identified an unacceptable risk\*\* with the use. Otherwise, if the concerns are only based on the lack of data (because data were only provided on uses in closed systems), the Annex I inclusion would indicate that when assessing the application for authorisation of a product in accordance with Article 5 and Annex VI, Member States shall assess, when relevant for the particular product, those uses or exposure scenarios and those risks to compartments and populations that have not been representatively addressed in the Community level risk assessment. In particular, where relevant, Member States shall assess use .....".

At present we do not know whether the commission's statement is also valid for the underlying case, but to prevent further discussions we alternatively have calculated a "preliminary PNEC" on basis of the available ecotox data for fish and Daphnia, we have identified risks and have proposed mitigation measures.

Response DE 1-Feb 2011: to \*\* We strongly disagree with this approach . The algae test is part of the core data set and has to be part of the risk assessment. Not every algae is a target species, the algae in the surface water have to be included into the risk characterisation as well. Maybe it is possible to use efficacy tests with algae for the risk assessment as well if they were conducted according to the guidelines?

Response NL 1-Feb-2011: Our experience is that efficacy tests with algae are of low quality invalid for PNEC derivation (this was the case for our dossiers). In those cases where no direct emission to surface water occurs we have accepted the lacuna considering that the active component is deactivated before emission into the environment. For those cases with direct emission an OECD test with algae is required including chemical analysis.

FI: We agree that direct emission to surface water of rapid reacting oxidizing chemicals should be assessed for large systems and that mitigation of risk using STP is improper for these large systems. Small systems could be assessed with STP connection.

NL proposal to use dilution factor 10 after STP and higher (site-specific) dilution factors for those large systems which discharge directly to larger rivers only is supported by FI.

UK: B1. The DE proposal for a tiered assessment scheme moving from once through cooling systems to large open recirculating systems to small open recirculating systems is supported by the UK as a risk assessment approach.

2. At present EUSES 2.1.1 requires input of a river flow rate to calculate the dilution factors to surface water for PT11 (and 12). These factors differ for each scenario, depending on the industry specific discharge flow relative to the river flow rate.

NL has carried out an evaluation of river flow rates and dilution factors and has added the following proposal to the CAR, which may influence other PT11 and 12 dossiers:

The ESD does not specify the flow rate of the receiving rivers. In section 2.3.8.3 of the TGD, it is stated that due to the different seasonal, climatic and geographical conditions in the Member States, dilution factors may vary over wide ranges. For consumer products and industrial discharges an average dilution factor of 10 is agreed for effluent from municipal treatment plants. Considering the discharge of the default STP (2000 m<sup>3</sup>/d), this factor relates to a default river flow rate of 18000 m<sup>3</sup>/d (0.2 m<sup>3</sup>/s).

**Amended 22 Feb 2011** NL emphasises that the dilution factor 10 should not be changed, considering that STPs can also discharge to even smaller rivers, thus with even lower dilution factors. Higher dilution factors can only be obtained for those industries for which it is considered adequate that they discharge to larger rivers only. It is considered not realistic that large cooling plants will discharge to relatively small rivers, see the river flow rates for selected European rivers presented in Table 1 below. Considering the fact that the water demand and discharge rate of cooling systems can be huge, larger flow rates have to be used for PEC-calculations in Pt 11. The data presented here are meant to give an indication of the river flow rates of (relatively) small, medium and large rivers on the basis of readily available information, rather than to present a precise overview of hydrographical data. It should further be noted that rivers can have lower flow rates of 1 to 5 m<sup>3</sup>.

The TGD also states that the dilution factor applied for site-specific assessments should not be greater than 1000 to account for mixing-zone effects (i.e. high concentrations occur in the mixing zone before complete mixing is achieved).

Table 1 River flow rates in selected European rivers

River	River flow rate [m <sup>3</sup> /s]			Reference
	low	Mean	high	
<b>Relatively small size rivers</b>				
Avon	7	16	26	NERC <sup>1</sup>
Danube	603	1430	4110	UBA Germany <sup>2</sup>
Ebro		426		Sanchez-Cabeze and Pujol (1999) <sup>3</sup>
Elbe	280	720	1900	UBA Germany
Ems	<b>15</b>	79	371	UBA Germany
Great Ouse		40		Prastka and Jickells (1995) <sup>4</sup>

<sup>1</sup> <http://www.nwl.ac.uk/ih/nrfa/webdata/054002/g2008.html>

<sup>2</sup> [http://www.umweltbundesamt.de/wasser-e/themen/oberflaechengewasser/ow\\_s1.htm](http://www.umweltbundesamt.de/wasser-e/themen/oberflaechengewasser/ow_s1.htm)

<sup>3</sup> doi:10.1016/S0043-1354(98)00467-9

River	River flow rate [m <sup>3</sup> /s]			Reference
	low	Mean	high	
Tyne	26		67	NERC <sup>5</sup>
<b>Medium size rivers</b>				
Ain		120		UNESCO <sup>6</sup>
Isère		350		UNESCO
Meuse		230		Cleven et al. (2005) <sup>7</sup>
Odra	248	540	1296	UBA Germany
Weser	119	325	1210	UBA Germany
Saône		410		UNESCO
<b>Large rivers</b>				
Rhine	1030	2290	6420	UBA Germany
Rhone		1700		UNESCO; Eyrolles et al, 2005 <sup>8</sup>
Waal		2200		<a href="http://www.rivierverruiming.nl/waal.pdf">http://www.rivierverruiming.nl/waal.pdf</a>

Response DE 1-Feb 2011: Thanks for that overview. However, please take into consideration that for instance rivers located in the Mediterranean area especially in summer time have probably lower flow rates. These rivers are not included. Further it is questionable if the rivers indicated by you as small ones are representative in this way.

Response NL 1- Feb 2011: This requires further elaboration and should be based on a representative data set. We welcome it if Member States could provide hard data on dilution rates for rivers in the Mediterranean with PT11 discharges.

Response DE 1-Feb 2011: We support to do a site-specific risk assessment for cooling systems. But please note the following point:

Precise information (size of the plant and the river it is located to) about the cooling systems the active substance is applied to will be needed proving the set up of refinements like differing the dilution factor. In Germany, further guidance is given by the national law WHG, which regulates the management of water bodies. For instance, we think it should be impossible to set up a once-through system to a small river (see also comment z27)

Response DE 1-Feb 2011: Unfortunately, it does not become clear how you extrapolate these dilution factors. Could you please explain in which way the dilution factors were obtained. Please refer also to our comments and calculations under your table in correction mode.

Response DE 1-Feb 2011: Since we can not reproduce your extrapolation of the dilution factor, we tried to obtain dilution factors by using the equation 46 of the TGD (section 2.3.8.3., p. 77). The parameter EFFLUENTstp was substituted by the blow down flow rate of the special type of cooling system. By calculating the different dilution factors for various systems (Vsyst and Qbld are default values according to the ESD PT 11) the following results were obtained:

System type	Type of river	River flow rate	Dilution factor	NL Proposal
Small open system: Vsyst = 300 m <sup>3</sup> Qbld = 2 m <sup>3</sup> /h = 5.56 x 10 <sup>-4</sup> m <sup>3</sup> /s	Small/Stagnant	0,2 m <sup>3</sup> /s acc. TGD	379	10*
	Intermediate/large	> 15 m <sup>3</sup> /s	27000	1000*
Large open system: Vsyst = 3000 m <sup>3</sup> Qbld = 125 m <sup>3</sup> /h =	Small/Stagnant	0,2 m <sup>3</sup> /s acc. TGD	7	10**
	Intermediate	> 15 m <sup>3</sup> /s	433	200**

<sup>4</sup> <http://www.springerlink.com/content/p2245567262h1n07/fulltext.pdf>

<sup>5</sup> <http://www.nwl.ac.uk/ih/nrfa/webdata/023001/g.html>

<sup>6</sup> [http://portal.unesco.org/science/en/ev.php-URL\\_ID=3791&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/science/en/ev.php-URL_ID=3791&URL_DO=DO_TOPIC&URL_SECTION=201.html);

<sup>7</sup> <http://www.springerlink.com/content/jlh0671325313193/fulltext.pdf>

<sup>8</sup> <http://www.radioprotection.org/index.php?option=article&access=doi&doi=10.1051/radiopro:2005022>

System type	Type of river	River flow rate	Dilution factor	NL Proposal
0.035 m <sup>3</sup> /s	Large	> 100 m <sup>3</sup> /s	2881	1000**
Once-through system: V <sub>syst</sub> = 6000 m <sup>3</sup> Q <sub>bld</sub> = 24000 m <sup>3</sup> /h = 6.67 m <sup>3</sup> /s	Intermediate  Large	> 15 m <sup>3</sup> /s  > 100 m <sup>3</sup> /s	3***  16***	

\* These values are agreed since they meet a conservative approach.

\*\* In our opinion the value for the lower rates **should be discussed at TM**. The dilution factor for large open cooling systems located at large rivers is acceptable.

\*\*\* These results of the dilution factor would indicate that once-through systems should be located at large rivers, otherwise a default dilution by 10 is not achieved and this will potentially lead to a risk. **To be discussed at TM**

**Response NL 22 Feb 2011:** Please find below our clarification of the selected dilution factors. It is noticeable that the calculated dilution factors calculated by DE differ from those from the NL experts. For this please find attached an excel sheet with our calculations



D:\TMI 2011\Fdilut  
calculations.xls

The dilution factors to be selected for the different cooling systems are identified in the table below.

**NL: Further clarification of the proposed dilution factors:** We made calculations for three different default river types, with flow rates of 15, 100 and 1000 m<sup>3</sup>/s, representing small, medium and large rivers. For each type of cooling system, the combination of blow down rate (Q<sub>bld</sub>) and river flow rate determines the dilution factor. The dilution factor is calculated as the sum of blow down rate and river flow rate, divided by the blow down rate. Note that in case of two towers, the total blow down rate has to be used. For example, for once through systems, Q<sub>bld</sub> is 24000 m<sup>3</sup>/h = 6.67 m<sup>3</sup>/s, with 2 towers this makes 13.34 m<sup>3</sup>/s. With a river flow rate of 100 m<sup>3</sup>/s, the dilution factor is (13.34+100)/13.34 = 8.5. In the table below, calculated dilution factors are presented for closed systems, open recirculating systems and once-through systems. For once-through systems, discharge to small rivers is not applicable, because it is not considered realistic that once through systems are located along small rivers.

Cooling System	Q <sub>bld</sub> [m <sup>3</sup> /s]	N <sub>tower</sub>	River flow rate [m <sup>3</sup> /s]	Dilution factor	Proposal
Closed	1.11 x 10 <sup>-7</sup>	1	0.2	1,8 x 10 <sup>6</sup>	
			15	1.4 x 10 <sup>8</sup>	<b>1000</b>
			100	>>>	“
			1000	>>>	“
Open, small	5.56 x 10 <sup>-4</sup>	1	0.2	340	
			15	27000	<b>1000</b>
			100	>>>	“
			1000	>>>	“
Open, large	3.47 x 10 <sup>-2</sup>	2	0.2	5.76 (not applicable)	-

			15	217	200
			100	1441	1000
			1000	>>>	“
Once through	6.67	2	0.2	0.03 (not applicable)	-
			15	2.13 (not applicable)	2?
			100	8.5	5?
			1000	76	50?

>>>: indicates that the calculated dilution factor is far over 1000. For the calculations however the highest TGD dilution factor of 1000 applies.

Based on the figures for low and mean flow rate, a flow rate of 15 m<sup>3</sup>/s (1.3 x 10<sup>6</sup> m<sup>3</sup>/d) is assumed for relatively small rivers such as the Ems in Germany, or the Avon, Tyne and Great Ouse in the United Kingdom. A flow rate of 100 m<sup>3</sup>/s (8.6 x 10<sup>6</sup> m<sup>3</sup>/d) is assumed for medium size rivers such as Ain, Weser, Elbe or Meuse. For large rivers such as the River Rhine or the Rhône, a flow rate of 1000 m<sup>3</sup>/s (8.6 x 10<sup>7</sup> m<sup>3</sup>/d) is used. These typical flow rates of 15, 100 and 1000 m<sup>3</sup>/s are used to calculate dilution factors, that will differ for each scenario, depending on the effluent discharge rate relative to the river flow rate. According to the TGD, the dilution factor applied for site-specific assessments should not be greater than 1000 to account for mixing-zone effects (i.e. high concentrations occur in the mixing zone before complete mixing is achieved).

FI: We agree that direct emission to surface water of rapid reacting oxidizing chemicals should be assessed for large systems and that mitigation of risk using STP is improper for these large systems. Small systems could be assessed with STP connection.  
NL proposal to use dilution factor 10 after STP and higher (site-specific) dilution factors for those large systems which discharge directly to larger rivers only is supported by FI.

UK: B1. The DE proposal for a tiered assessment scheme moving from once through cooling systems to large open recirculating systems to small open recirculating systems is supported by the UK as a risk assessment approach.

**DE:** We would appreciate the development of guidance on how to set up appropriate dilution factors. Please refer also to “Development of Standard Scenarios for Risk Evaluation of Cooling Water Additives”, listed in the references of DE (No.7): literature submitted with dossier of EUF (PT 11); the article considers also direct discharge to the sea what may be important for huge power plants. Please, take into account that a general guidance should offer room for flexible conditions since the data base on default industry is very rare.

Cooling System	Q <sub>blld</sub> [m <sup>3</sup> /s]	N <sub>tower</sub>	River flow rate [m <sup>3</sup> /s]	Dilution factor	Proposal
Closed	1.11 x 10 <sup>-7</sup>	1	0.2 (acc. TGD)	1.8 x 10 <sup>6</sup>	1000 ?
			15	1.4 x 10 <sup>8</sup>	1000 ? <sup>a</sup>
			100	>>>	“ ?
			1000	>>>	“ ?
Open, small	5.56 x 10 <sup>-4</sup>	1	0.2 (acc. TGD)	379	350 ?
			15	27000	1000 ✓ <sup>b</sup>
			100	>>>	“ ✓
			1000	>>>	“ ✓

Open, large	3.47 x 10 <sup>-2</sup>	2	0.2 (acc. TGD)	3.86	x
			15	217	200 ✓
			100	1441	1000 ✓
			1000	>>>	“
Once through	6.67	2	0.2 (acc. TGD)	1.03	x
			15	2.13 (not applicable)	2? x <sup>c</sup>
			100	8.5	5? x <sup>c</sup>
			1000	76	50 ✓

>>>: indicates that the calculated dilution factor is far over 1000. For the calculations however the highest TGD dilution factor of 1000 applies.

**<sup>a</sup> Dilution factors for emissions from closed systems**

**DE:** In the dossier of EUF in PT 11 the applicant used another approach to derive a dilution factor. In case of closed systems the release during complete drainage is considered as worst case scenario. Therefore, the dilution factor for direct discharge was calculated as follows (DILUTION= (Vsyst/Trel + Flow\_river)/ Vsyst/Trel). Thus, through the experience of evaluation EUF, in our opinion this approach based on Q<sub>bld</sub> seems not suitable for this type of system as the losses caused by dosing and design are rather low. A factor of 1000 would probably overestimate the realistic worst case. Furthermore, closed system are usually connected to a STP, direct discharge is of minor importance.

**<sup>b</sup> Dilution factors for open small recirculating systems:**

NL: Overestimation of the risk may also hold for direct emissions from open small recirculating systems (5.56 x 10<sup>-4</sup> m<sup>3</sup>/s) to receiving waters with a flow rate of 15 m<sup>3</sup>/s or more. Use of a dilution factor of 1000 for emissions that have a calculated dilution factor of 27000 and higher seems also over conservative. This is a new issue for discussion at the TM

**<sup>c</sup> Dilution factors for emissions from once through systems**

**DE:** From the calculations it becomes clear that once-through systems should only be placed at large rivers or on the sea. Otherwise the generic dilution factor of 10 given in the TGD has not been reached, which is also regarded as a default dilution value for other types of release scenarios if no specific data are available. Consequently, the larger the system the more specific information is needed about the surface water body the site is located. In our opinion, dilution factors lower than 10 would lead to a misbalance in the receiving water compartment even if no risk is identified through model estimations.

DE refers to rivers with low summer flows in Mediterranean countries. This requires further elaboration and should be based on a representative data set. We welcome it if Member States could provide hard data on dilution rates for rivers in the Mediterranean with PT11 discharges.

ES: 26-8-2011: New data concerning flow rates in main rivers in Spain are provided and in the attached document information is incorporated on mitigation measures such as “stabilization basins or settling ponds to collect a mix of blow down and treated water (e.g. from other sources of the industrial facility) to reduce the discharge of suspended solids by sedimentation. Evaporative ponds are also used to prevent heat emissions to surface waters. Sometimes cooling water is treated in a wastewater treatment installation (on-site STP) before discharge; however the effectiveness level is not known or publicly declared. “

River	River flow rate (m <sup>3</sup> /s)			Year	Reference
	Min	Mean	Max		
Segura	0.99	12.02	33.53	2010-2011	MARM
Miño	98.66	296.14	661.24	2010-2011	MARM
Guadiana	6.15	77.30	400.18	2010-2011	MARM

Guadalquivir	-	164.30	-		Wikanda
Jucar	2.14	14.45	37.26	2010-2011	MARM
Tajo	20.10	42.47	68.69	2010-2011	MARM
Ebro	1.35	105.24	456.93	2010-2011	MARM

29-8-2011 ES has added calculations of dilution factors from in field data and came to the following results:

Table: Actual data in Tajo river basin (cooling systems)

Type Cooling system	Industry	Discharge (m3/s)	River	Flow rate (m3/s)	River type	Dilution
>>large	Ercros	0.16	Río Tajo en Aranjuez	7.61	<small	48.6
large	Biodiesel	3.00E-02	Arroyo Salado	2.45	<<small	82.6
>>large	C.Química Sarasa	0.044	Río Tajo en Almoquera	10.3	<small	235
<large	Electrolux	1.50E-02	Río Henares en Alcalá	5.7	<<small	381
>large	Iberdrola	4.80E-02	Río Tajo en Toledo	35.71	small><medium	745
>large	Gas Natural	4.80E-02	Río Tajo en Toledo	35.71	small><medium	745
small	Wyeth Farma	8.70E-04	Río Jarama en Algete	5.73	<<small	6600

ES proposes to add a dilution factor of 50 in the calculations and suggests that lower values will be not realistic because it would be case of a very high volume discharged (maybe not compliant with temperature requirements) or very low river flow rates (perhaps with problems at the intake of water). The full text and calculations are added below. At TMIII 2011, however, ES indicated that in other rivers in Spain receiving discharges of cooling water, but not included in the table, may have flow rates. ES therefore proposed to lower the dilution factor from 50 to 10.

NL: We have added a new data set with flow rates of Dutch (state) rivers and canals a high variability in flow rates from 5 m<sup>3</sup>/s up to 12600 m<sup>3</sup>/s. The table also shows that flow rates as low as 0 m<sup>3</sup>/s do occur.



R:\Bureaublad\Spain info for PT11 rev.doc Spanish main rivers 110622-v2.xls

NL: 23-08-2011: As a follow up of earlier work NL did a search for flow rate data and came up with an extra summary table of flow rates in selected Dutch State rivers and canals (data for regional rivers and canals are not included in this database).

Flow rates: Average twenty-four hours period, values expressed as m3/s (Ref. RWS, waterbase)

Location (river/canal)	Lowest	Date lowest value	Summer average	Average	Highest	Measurement Period
Loozen (Zuid-Willemsvaart)	2	25-Mai-83		5	11	(1981...1990)
Bathse spuikanaal zuid (Volkerak-Zoommeer)	0	Several		14	120	(1988...1990)
Bunde (Julianakanaal)	1	14-Mr-85		15	71	(1981...1990)
Smeermaas (Smeermaas)	3	11-Jan-84		15	20	(1981...1990)
IJmuiden binnen (Noordzeekanaal)	0	Several		95	245	(1976...1990)
Schaar van Ouden Doel (Schelde)	18	Aug-73	85	127	719	(1958...1990)
Kornwerderzand buiten (IJsselmeer)	0	11-Dec-82		205	1353	(1976...1990)

Borgharen dorp (Maas)	0	Several	110	230	3000	(1911...1990)
Den Oever buiten (IJsselmeer)	0	Several		295	2359	(1976...1990)
Megen dorp (Maas)	0	Several	170	320	2800	(1911...1990)
Olst (IJssel)	unknown	1976	315	340	1907	(1976...1990)
Hagestein boven (Lek)	-6	26-Oct-90	320	395	2215	(1976...1990)
Haringvlietsluizen binnen (Haringvliet)	0	Several		785	6425	(1976...1990)
Maassluis (Nieuwe Waterweg)	-2744	12-Dec-90		1335	3843	(1981...1990)
Tiel Waal (Waal)	unknown	1976	1325	1470	6525	(1976...1990)
Lobith (Bovenrijn)	620	4-Nov-47	1985	2200	12600	(1901...1990)

The following questions were addressed at TMIII 2011:

- Can the TM accept to use the five levels of river flow rates 0.2, 2, 15, 100 and 1000 m<sup>3</sup>/s in the risk assessment?  
The TM concludes that 5 flow rates are acceptable.
- Can the TM agree on the dilution factors as proposed in the table above?  
The TM concludes that dilution factors should not be lower than 10.
- Can the TM agree that dilution factors below 10 or 50 (which one) are not realistic and that this type of emission should be excluded from the calculations?  
The TM concludes that dilution factors lower than are not realistic and should be excluded from the calculations.
- Can the TM agree that dilution factor of 1000 is the highest dilution factor acceptable for direct emissions?  
The TM concludes that dilution factors higher than 1000 will not be acceptable
- What dilution factor is required for emissions to (stagnant) large lakes?  
The TM concludes that dilution factors lower than are not realistic and should be excluded from the calculations that OMS may submit information on this to be incorporated in the table.

It is generally agreed that direct emission to surface water of rapid reacting oxidizing chemicals – *but also other active substances used in cooling systems* must be assessed for open systems.

Mitigating the risks identified for **large** systems due to direct emission to surface water by restricting the emission of treated cooling water to the STP is considered improper because the high loads of water especially resulting from once-through cooling systems would have negative impacts on the treatment plant (e.g. limitation by capacity, high dilution rate in the STP). **DE** proposed that in case of an observed risk for large systems also small systems should be assessed, with the possibility of restriction to the indirect emission route. **DE** proposes that for rapid degrading chemicals the emission route to the STP is assessed for the remaining transformation products (if any) formed.

#### Last discussions at TM2011

**NL** proposes a higher tier site specific assessment identifying dilution factors for small, intermediate and large rivers, depending on the type of cooling system. **NL** emphasises that the dilution factor 10 is agreed for all discharges (of consumers and industrial waste water) via the communal STP This dilution factor should not be changed, considering that STPs can also discharge to small rivers, with sometimes even lower dilution factors. Higher dilution factors can only be obtained for those industries for which it is considered adequate that they discharge to larger rivers only. **DE** finds the dilution factor for large open cooling systems located at large rivers acceptable. Furthermore **DE** concludes that the results of the dilution factor would indicate that once-through systems should be located at large rivers, otherwise a default dilution by 10 is not achieved and this will potentially lead to a risk. **NL** has added some further clarification and a calculation sheet .

Taking the information from ES on board, which shows that several cooling systems are larger than the ESD default large cooling system (Bld = 3.47E-02 m/s) and several river flow rates are smaller than the original suggested 15 m<sup>3</sup>/s, it is proposed to add a dilution factor of 10 for ESD large recirculating systems to the calculation scheme. Thus an extra river is added with a flow rate of 0.5 m<sup>3</sup>. For the risk assessment the following scheme of dilution factors apply:

	Dilution factors			
	ESD closed cooling system*	ESD small cooling system*	ESD large cooling system**	ESD once through**
Discharge (m <sup>3</sup> /s)	1.11E-07	5.56E-04	3.47E-02	6.67
TGD river 0.2 m <sup>3</sup> /s	1000	350	x***	x
rivers 0.5 m <sup>3</sup> /s	1000	1000	10	x
rivers 15 m <sup>3</sup> /s	1000	1000	200	x
rivers 100 m <sup>3</sup> /s	1000	1000	1000	10
rivers 1000 m <sup>3</sup> /s	1000	1000	1000	50

\* Closed and small cooling systems have the option to restrict emissions via the STP

\*\* Only option for restriction is the increase minimum flow rate of the receiving water

\*\*\* A dilution factor <10 is not considered realistic, nor acceptable and therefore not part of the risk assessment. Large cooling systems and once through cooling systems will not release treated cooling water to rivers with a too low flow rate, resulting in a dilution factor of <10..

**B2. In some Member States emissions to surface water from cooling water systems are regulated. Should we take these approaches into account for our risk assessment? If yes, can you provide information on these approaches in your Member State, for harmonisation purposes?**

FR: In France, emissions to water from cooling systems are regulated mainly in terms of temperature, pH, suspended matter and specific substances (like metals). The water releases from cooling systems do not necessarily pass through a sewage treatment plant according to the regulation.

ES: In Spain the document BREF <http://prtr-es.es/data/images/refrigeración-i-vacío.pdf> is the reference guidance regarding effluent control, according to the IPPC Directive.

DE: In Germany the discharge of cooling water is regulated in Annex 31 of the Framework Regulation for Wastewater. Here inter alia the following minimum requirements are given (Gartiser & Urich, 2002, IKSr, 2002):

- With the exception of phosphonates and polycarboxylates exclusively complexing agents which are readily biodegradable may be used,
- The wastewater must not contain chromium, mercury or organometallic compounds,
- The concentrations for chlorine, AOX, COD, phosphorus and zinc are limited,
- For fresh water cooling systems a shock treatment with microbiocidal substances is limited to oxidative biocides (chlorine, chlorine dioxide, hydrogen peroxide, ozone).
- After a shock treatment with a biocidal substance the blow down of recirculating cooling systems is only allowed if the luminescent bacteria toxicity does not exceed GL =12 (GL= Lowest ineffective dilution factor, LID).

In the BREF-document (2000) it is mentioned that the information exchange shows that in some Member States specific assessment regimes are in place for the application of cooling water additives. The discussion as part of the information exchange on industrial cooling systems resulted in two proposed concepts for cooling water additives, which can be used as a complementary tool by the permitting authorities:

1. A screening assessment tool based on the existing concepts, which allows a simple relative comparison of cooling water additives in terms of their potential aquatic impact (the Benchmarking Assessment).

2. A site specific assessment of the expected impact of biocides discharged in the receiving water, following the outcome of the Biocidal Products Directive and using the methodology to establish environmental quality standards (EQSs) of the Water Framework Directive as key elements (local assessment for biocides).

Based on the BREF-document (2000) Benchmarking Assessment can be seen as a method to compare the environmental impact of several alternative cooling water additives while local assessment for biocides provides a criterion for the determination of a best available technique compatible approach for biocides in particular (PEC/PNEC <1). The use of local assessment methodologies as a tool for controlling industrial emissions is already common practice.

More specific requirements on the chemical composition vary between the Member States, but generally cover requirements on the concentration of adsorbable organic halogens (AOX), dissolved oxygen, biological chemical demand (BOD), chemical oxygen demand (COD), chlorine substances and phosphorus compounds and the residual effect on luminescent bacteria. Some acts distinguish between different types of cooling systems (once-through or recirculating) or consider specific operations, such as shock treatment with microbiocidal substances.

European chemical legislation affecting the application of cooling water additives in particular can be found in:

- the Council Directive on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment of the Community (76/464/EEC),
- the Water Framework Directive,
- the Preparations Directive and
- the Biocidal Products Directive 98/8.

With reference to the BREF-document of the EU-Commission (2000) about “the application of the best available techniques to industrial cooling systems”, different approaches regarding selection and optimization of cooling water chemicals are described. A combination of emission- and water-quality-based criteria is recommended to assess cooling water chemicals. In our opinion a combined approach could indicate for an enlarged analysis of relevant parameters for the environment and should be taken into account for harmonisation purposes for environmental requirements. The more information is available about the used active substance, the more appropriate the qualitative risk assessment could be established. We would support the information exchange between the member states.

## **Discussion B2**

France indicates that “the water releases from cooling systems do not necessarily pass through a sewage treatment plant according to the regulation.

**Question to FR:** Does this indicate that “a restriction to applications with emission to STP only” is not possible?

**Response FR 18-Nov 2010:** In France, we cannot consider that there is systematically a STP at the outlet of the cooling systems as emissions to water from these installations are regulated mainly in terms of temperature (Dir. 78/659/CEE), pH, suspended matter and specific substances (like metals) but not for Biocides. We cannot therefore apply this risk mitigation measure in a first approach in emission calculations. Nevertheless we think that it is possible to accept a restriction to application with emissions to STP only if the risk is considered acceptable in this case. In fact, installations with direct releases to surface water are probably limited and well identified.

ES and DE refer to the BREF for cooling water systems. Interesting are requirements included in the BREF such as:

1. The concentrations for chlorine, AOX, COD, phosphorus and zinc are limited,
2. For fresh water cooling systems a shock treatment with microbiocidal substances is limited to oxidative biocides (e.g. chlorine, chlorine dioxide, hydrogen peroxide, ozone).
3. After a shock treatment with a biocidal substance the blow down of recirculating cooling systems is only allowed if the luminescent bacteria toxicity does not exceed  $GL = 12$  ( $GL =$  Lowest ineffective dilution factor, LID).

It should be noticed that a test with Luminescent bacteria is not an requirement for biocidal products. It is therefore impossible to conclude that the results of such a test is sufficient to identify a safe use.

**Question to DE:**

Considering the DE proposal to restrict to the use of oxidative biocides in freshwater cooling water systems. Is this restriction based on a risk assessment? If so could DE provide this information?

**Response DE 1-Feb 2011:** We assume that the substances put in brackets are examples and not a closed list. Nevertheless, it is obvious that for fresh water cooling systems (equated with once-through systems) only oxidative biocides (if necessary) should be used since the residence time is very short.

**Response DE 1-Feb 2011:** The information given in the bullet points are specific German regulation and not based on a risk assessment. In Germany the discharge of cooling water is regulated in Annex 31 of the Framework Regulation for Wastewater. Since there seem to be differences throughout the EU, we would support the information exchange between the member states.

**Additionally the following questions came up:**

For Annex I inclusion and product authorisation in case of an observed risk:

- Can we add a mitigation measure (e.g. to the label) that the use is restricted to once through and large recirculation cooling systems with emission to large rivers / sea (if these emission routes show no unacceptable risks)?

**Response DE 1-Feb 2011:** We agree with this approach.

*Alternatively:*

- Can we ignore risks identified from the risk assessment, because the effects are probably only local and mostly repeated short term?

**Response DE 1-Feb 2011:** We disagree with this approach. If a risk is identified and all possible mitigation measures were applied the active substance would have no "safe use" and therefore can not be included in Annex-I.

DE indicated that a combination of emission- and water-quality-based criteria is recommended to assess cooling water chemicals. They refer to an enlarged analysis of relevant parameters for the environment and should be taken into account for harmonisation purposes for environmental requirements.

**Conclusion B2:**

At present some guidance is presented in the BREF on cooling water systems, although it is not clear whether the BREF is applicable for the evaluation of chemicals within PT11 and product authorisation and the realism of certain restriction measures is unknown. Further harmonisation is considered preferable, but still under development. The RIVM indicated that a Directive under development which regulates risk mitigation measures. At TMIII 2011 UK indicates that in some member states emissions are regulated. This information could be helpful for member states with regulations. NL welcomes new information to be incorporated in this document.

**B3. The PNEC for these reactive substances is based on acute data with a large assessment factor of 1000. In most cases the PNEC will be below detection limit. Knowing the working mechanism of these reactive substances, is it possible to use the LOQ or a standard used in regulations in stead?**

FR: We agree with your position to use the LOQ or a standard used in regulations.

ES: For aims of risk assessment we do not envisage using LOQ instead of PNEC. We consider this topic very interesting for this particular case and it could be further discussed in technical meeting.

DE: We do not think that it is possible to use the LOQ or anything else instead of the calculated PNEC. This would mean that you are lowering the assessment factor without further testing. If the applicant thinks that the PNEC<sub>water</sub> is too low, they are free to perform additional long-term tests to lower the assessment factor. Besides the "TNsG on data requirements" requires chronic aquatic tests for active substances in PT11. We would therefore recommend doing these tests starting with the most sensitive species in the acute tests. Chronic tests would as well include the degradation products that will be formed in the water. Do you know whether the buffer capacity of the test water was considered during the acute testing? The test water might have had a lower buffer capacity than in the environment. This might have led to effects that were only related to the changed pH-value and not to the substance itself. This would overestimate the toxicity of the substances as the effects will probably not be observed in natural waters because of the larger water body. It is essential that the pH-values are monitored during the tests with these substances and are held on a constant level. A large pH-decrease would not be relevant for the environment. We would therefore recommend doing the chronic tests only if the observed acute effects are not related to a pH-decrease. Otherwise the acute tests should be repeated with pH-adjustment which should be done prior to the insertion of the test organisms.

Applying a factor 1000 to the acute toxicity of oxidizing chemicals may result in PNECs which may be below the LOQ. There is no consensus on how to deal with this issue. Further discussions are required. It is proposed to perform chronic tests only if the observed acute effects are not related to a pH decrease. Otherwise acute tests should be repeated with pH-adjustment which should be done prior to insertion of test organisms.

B3. The UK strongly agrees with the DE argumentation. Raising PNEC values on the basis of the LOQ would be a disincentive to performing additional ecotoxicological tests and would penalise those companies that took a more robust scientific approach and performed additional tests. It is also not immediately clear why having a PNEC lower than the LOQ is a significant problem in risk assessment when PECs are also calculated and can therefore also theoretically be lower than LOQ. If the LOQ does pose a problem it is also possible to amend tests in several relatively easy and justifiable ways to allow the LOQ to be reduced or to be reduced in terms of the % applied which can be detected (i.e. by increasing the absolute tested concentration while the LOQ remains the same).

The UK considers that this point should still be discussed at the TM.

DE: The LOQ should not be applied as PNEC as this would mean that the safety factor would be decreased without further studies. The acute tests have to be evaluated with regard to that the occurred effects are potentially generated by pH-shifting. The use of these results would be unrealistic since the buffering capacity of natural environments would minimise this effect.

As part of the discussion:

NL notes that the LOQ (or LOD) limit partially already is incorporated in the PNEC considering the TWA (CA-May08-Doc.6.5) document states “If analytical data indicates that the substance could not be quantified by the end of the study, the final concentration may be taken as half the limit of quantification (LOQ/2) (or LOD) to calculate mean (geometric) measured concentrations”. Additionally it should be noted that it is rather difficult for substances with PNEC values below LOQ to show a safe use using monitoring data.

### **Discussion B3**

Diverging viewpoints emerge. Use of the LOQ or standard instead of the PNEC for oxidizing substances is not generally accepted. DE refers to the TNsG on data requirements that chronic data are required. In response NL notes that chronic data are required “*unless the release is intermittent* or the intended use is limited to closed spaces with insignificant aquatic release.” Especially in case of shock dosing emissions which is the most appropriate use will result in “intermittent release”, thus according to the guidance chronic testing is not required. Furthermore the reaction product is the most toxic fraction and the TNsG on data requirements does not require chronic tests for (short living) reaction products.

DE recommends chronic tests only if the observed acute effects are not related to a pH-decrease. Otherwise the acute tests should be repeated with pH-adjustment which should be done prior to the insertion of the test organisms. NL supports this proposal.

### **Conclusion B3**

- Applying a factor 1000 to the acute toxicity of oxidizing chemicals may result in PNECs which may be below the LOQ. There is no consensus on how to deal with this issue. Further discussions are required. After TMIII 2011 the following is concluded: considering that no real solution is available it is agreed that also for oxidative rapidly reacting actives the PNEC must be derived from ecotoxicity tests, even if it means that the resulting PNEC is below LOQ.
- It is proposed to perform chronic tests only if the observed acute effects are not related to a pH-decrease. Otherwise the acute tests should be repeated with pH-adjustment which should be done prior to the insertion of the test organisms.

### ***B4. Is it possible to include mitigation measures? If yes, do you have suggestions?***

***E.g. License system (environmental permit) in combination with operational measures reducing harmful effects of cooling water discharge are the closing of the purge during shock treatment and the treatment of the blow-down before discharge into the receiving surface water.***

FR: In case of a non acceptable risk, we agree to propose a treatment of the blow-down before discharge into the receiving surface water as a risk mitigation measure.

ES: Dutch suggestion seems reasonable and achievable.

DE: In general, the applicant should have mentioned the substance- und site-specific requirements and these should be adjusted to the best available technique (please refer to the BREF-document and see also our answer under point B2). Reduction of:

- energy consumption
- water requirements
- entrainment of organisms
- emissions to water
- emissions to air
- noise emissions
- risk of leakage
- biological risk

FI: Operational measures e.g. the treatment of the blow-down before discharge onto the receiving surface water could be regarded as risk mitigation measures.

## Discussion/Conclusion B4

Some options for risk mitigation are presented above. It should be noted that Annex I inclusion and biocidal product authorisations can only influence the use, possible emission of and exposure to a biocidal product. Other issues relevant for cooling water systems, such as energy consumption / water requirements / entrainment of organisms and noise emissions are not related to the use of a biocide and therefore not relevant for annex I inclusion of an active substance nor authorisation of biocidal products.

## References referred to by DE:

1. European Commission DG ENV/RIVM, Harmonisation of Environmental Emission Scenarios for biocides used as preservatives for liquid cooling systems (product type 11), 2003
2. OECD Series on Emission Scenario Documents No. 4, Emission Scenario Document on Water Treatment Chemicals, 2004
3. Gartiser, S. and Urich, E., Environmentally compatible cooling water treatment chemicals, Research Report 200 24 233, 2002
4. Internationale Kommission zum Schutz des Rheins (IKSR), Synthesebericht Antifouling und Kühlwassersysteme, 2002
5. BREF, Integrated Pollution Prevention and Control – Reference Document on the application of Best Available Techniques to Industrial Cooling Systems, Joint Research Centre, European IPPC Bureau, Sevilla, November 2000; available in the internet (<http://eippcb.jrc.es/>)
6. AbwV – Verordnung über Anforderungen an das Einleiten von Abwasser in Gewässer (vom 17.Juni 2004), speziell Anhang 31 (Wasseraufbereitung, Kühlsysteme, Dampferzeugung)
7. Guhl, W. and Hater, W., Development of Standard Scenarios for Risk Evaluation of Cooling Water Additives, VGB Power Tech, International Journal for Electricity and Heat Generation, Volume 87, Issue 6/2007, p. 76-84

## NL added References with guidelines for non target arthropods

1. Nakker, F.M. Rik Feije, A.J. Grove, H. Hoogendoorn, G. Jacobse, E.D. Loose and P. van Stratum, 2003. A laboratory test protocol to evaluate effects of plant protection products on mortality and reproduction of the predatory mite *Hypaspis aculeifer* Canestrini (Acari: Laelapidae) in standard soil. J. Soils 7 sediments, 3 (2) 73-77.
2. Abel C. and Heimbach U., 1992, Testing effects of pesticides on *Poecilus cupreus* (Coleoptera, Carabidae) in a standardized semi-field test. IOBC/WPRS Bulletin XV/3: 171-175.
3. Bakker F.M., Aldershof S.A., Veire M. v.d., Candolfi M.P., Izquierdo J.I., Kleiner R., Neumann Chr., Nienstedt K.M. and Walker H., 2000: A laboratory test for evaluating the effects of plant protection products on the predatory bug, *Orius laevigatus* (Fieber) (Heteroptera: Anthocoridae). In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher
4. Bigler F, 1988, A laboratory method for testing side-effects of pesticides on larvae of the green lacewing, *Chrysoperla carnea* Steph. (Neuroptera, Chrysopidae): IOBC/WPRS Bulletin, XI/4, 71-77.
5. Bigler F. and Waldburger M., 1988. A semi-field method for testing the initial toxicity of pesticides on larvae of the green lacewing *Chrysoperla carnea* (Neuroptera, Chrysopidae). IOBC/WPRS Bulletin, XI/4, 127-134.

6. Blümel S., Bakker F., Baier B., Brown K., Candolfi M.P., Goßmann A., Grimm C., Jäckel B., Nienstedt K., Schirra K.J., Ufer A. and Waltersdorfer A., 2000: Laboratory residual contact test with the predatory mite *Typhlodromus pyri* Scheuten (Acari: Phytoseiidae) for regulatory testing of plant protection products. In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
7. Boller E.; Englert W.D.; Baillod M., 1988, Field test for *Typhlodromus pyri* (Phytoseiidae, Acari) in vineyards. IOBC/WPRS Bulletin XI/4: 139-143.
8. Grimm C., Reber B., Barth M., Candolfi M.P., Drexler A., Maus C., Moreth L., Ufer A. and Waltersdorfer A., 2000: A test for evaluating the chronic effects of plant protection products on the rove beetle *Aleochara bilineata* Gyll. (Coleoptera: Staphylinidae) under laboratory and extended laboratory conditions. In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
9. Hassan S.A., 1992, Guideline for the evaluation of side-effects of plant protection product on *Trichogramma cacoeciae*: In : IOBC/WPRS Bulletin, XV/3, 18-39.
10. Heimbach U., Wehling A., Barrett K.L., Candolfi M.P., Jäckel B., Kennedy P.J., Mead-Briggs M., Nienstedt K.M., Römbke J., Schmitzer S., Schmuck R., Ufer A. and Wilhelmy H., 2000a: A method for testing effects of plant protection products on spiders of the genus *Pardosa* (Araneae: Lycosidae) under laboratory conditions. In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
11. Heimbach U., Dohmen P., Barrett K.L., Brown K., Kennedy P.J., Kleiner R., Römbke J., Schmitzer S., Schmuck R., Ufer A. and Wilhelmy H., 2000b: A method for testing effects of plant protection products on the carabid beetle *Poecilus cupreus* (Coleoptera: Carabidae) under laboratory and semi-field conditions. In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
12. Louis F. & A. Ufer, 1995, Methodical improvements of standard laboratory tests for determining the side-effects of agrochemicals on predatory mites (Acari: Phytoseiidae). Anzeiger Schädlingskunde, Pflanzenschutz, Umweltschutz, 68,153-154.
13. Mead-Briggs M.A, Brown K, Candolfi M.P., Coulson M.J.M., Miles M., Moll M., Nienstedt K., Schuld M., Ufer A. and McIndoe E., 2000: A laboratory test for evaluating the effects of plant protection products on the parasitic wasp, *Aphidius rhopalosiphi* (DeStephani-Perez) (Hymenoptera: Braconidae). In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
14. Pinsdorf W., 1989 Auswirkung von Pflanzenschutzmitteln auf *Coccinella septempunctata* L., Richtlinie für die Prüfung von Pflanzenschutzmitteln im Zulassungsverfahren, Braunschweig.
15. Schmuck R., Candolfi M.P., Kleiner R., Mead-Briggs M., Moll M., Kemmeter F., Jans D., Waltersdorfer A. and Wilhelmy, H., 2000: A laboratory test system for assessing effects of plant protection products on the plant dwelling insect *Coccinella septempunctata* L. (Coleoptera: Coccinellidae). In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
16. Veire M. van de, 1992, Laboratory methods for testing side-effects of pesticides on the predatory bug *Orius niger* Wolff. IOBC/WPRS Bulletin XV/3: 89-95.
17. Vogt H., Rumpf S., Wetzler C. and Hassan S.A., 1992, A field method for testing effects of pesticides on the green lacewing *Chrysoperla carnea* Steph. (Neuroptera, Chrysopidae). IOBC/WPRS Bulletin XV/3, 176-182.

18. Vogt H., Bigler F., Brown K., Candolfi M.P., Kemmeter F., Kühner Ch., Moll M., Travis A., Ufer A., Viñuela E., Waldburger M. and Waltersdorfer A., 2000: Laboratory method to test effects of plant protection products on larvae of *Chrysoperla carnea* (Neuroptera: Chrysopidae). In: Guidelines to evaluate side-effects of plant protection products to non-target arthropods; IOBC, BART and EPPO Joint Initiative. Candolfi M.P., Blümel S. and Forster R. (eds.). IOBC publisher.
19. Wehling A. and Heimbach U., 1994, Proposed guideline for testing the effects of plant protection agents on spiders of the Genus *Pardosa* (Araneae, Lycosidae) in the laboratory. Draft BBA Guideline VI, 23-2.1.9.

## Appendix 2: Drift eliminators

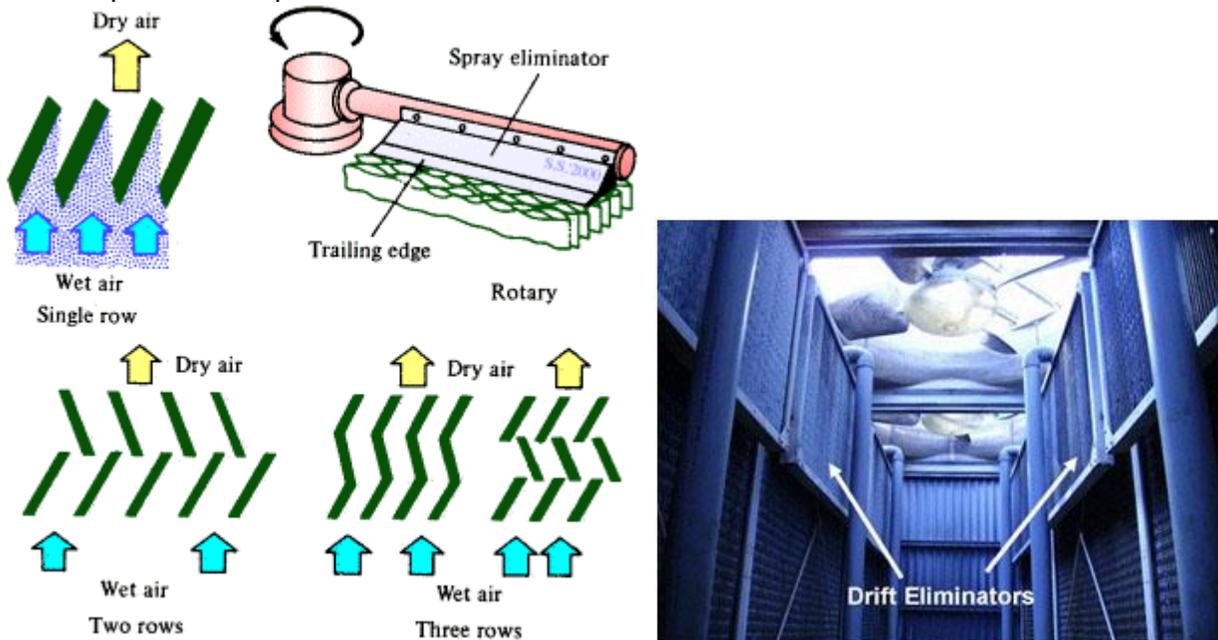
A search in the internet resulted in the following information: In principle there are 2 methods see the addition text below:

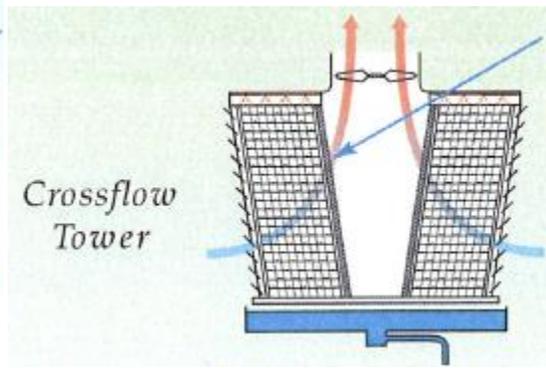
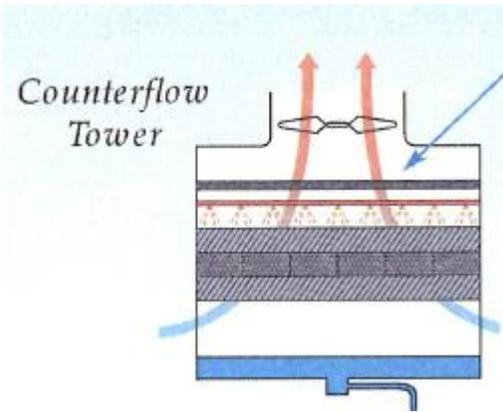
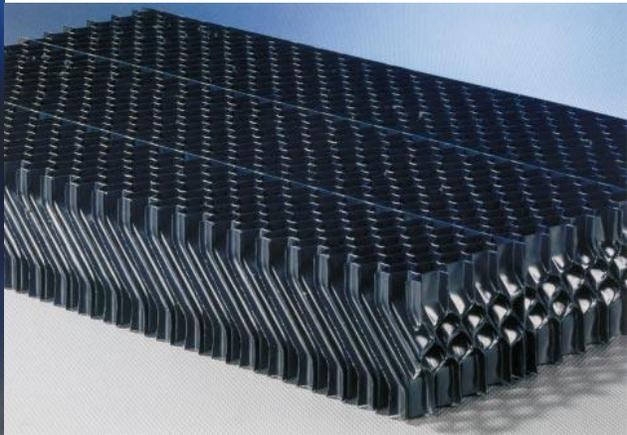
1. segmented / zigzag / wave plate eliminators in which the wet air condenses, the water is collected and removed.
2. a kind of wiper that removes droplets.

Different types of drift eliminator systems provide different drift reductions. An important issue is that gaps in the system may cause wet air to escape without passing the drift eliminator. Drift reduction percentages reported are 0.001% to 0.0005% mentioned for different types of systems. Probably the reduction percentage depends on how it is calculated (e.g. the size of the droplets taken into account) and the type of cooling system at hand. Two processes influence the working of a cooling tower: the velocity of air and the pressure drop due to the type of eliminator used.

### Drift eliminators

To save water, drift eliminators are installed above the water distributors to prevent the water droplets from being entrained by the airflow. Nowadays, drift eliminators are made of a number of materials, such as plastic or fibre cement, and designed in such a way that they cause minimal pressure drop.





Blue arrow indicates the drift eliminator

