

Topical Scientific Workshop
Risk Assessment for the Sediment Compartment
7-8 May 2013

Draft summary of Main Outcomes
compiled from the break-out groups' presentations to the plenary

Disclaimer: *This compilation has been prepared by ECHA in consultation with the Scientific Committee as a preliminary draft summary of the main workshop outcomes, this is for information only. Readers are reminded that only the Proceedings, to be published in due time, should be considered as the authorised Workshop's outcome. In addition, this document does not represent a position of the European Chemicals Agency.*

General elements including conceptual model and risk characterisation

Basic elements and conceptual model

- A clear presentation of the conceptual model is highly desirable. It should consider the traits, functions, services and their indicators for protection. Specific components of the Conceptual Model: Sources, transport, exposure and key receptors /effects. Generic models should also include a list of desirable traits to be protected. An adequate "suite" covering the "population diversity" that describes the structural and functional integrity of the sediments; including relevant communities that live within the gradient from the Pelagic-Epibenthic-Benthic community.
- Specific attention for the coverage of the different types of exposure pathways as all relevant sediment exposure routes should be considered in sediment assessment (Dissolved, contact and feeding). Main difference between the Pelagic and the Sediment compartment is the higher potential for oral uptake as well as mixed exposures. Both "aquatic ventilation" and "sediment ingestion" may contribute to the "body load" of a contaminant with potential different uptake kinetics for each of them. Assumptions of EqP can be inadequate beyond the screening and are not inclusive of dietary exposure.
- Sediment assessment should be triggered by a combination of specific factors instead of a single trigger. Triggering should include elements such as exposure routes not covered by the pelagic assessment, bioavailability (including sediment ingestion), partitioning and persistence
- It should be noted that some organisms (receptors) in both sediment and pelagic environments are exposed to contaminants from several or even all exposure pathways (overlying water, pore water, sediment contact and diet) receiving an aggregated exposure to the same chemical from different routes.
- The selection of the relevant receptors should consider taxonomic groups and their ecology and habitat/distribution/feeding strategy/ physiology as well as how the organism may influence their microhabitat impacting uptake and bioavailability. There is a need for higher species/taxa diversity in testing (plants, fish, biofilm, periphyton). Some relevant microbial functions should also be considered

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Freshwater vs. marine assessment

- There are different views regarding the extrapolation of freshwater ecotoxicity data for covering marine organisms (and the opposite). Some experts considered that this is simply not scientifically acceptable, while others accepted the extrapolation providing that differences between the two environments are addressed. For example: considering the role of phyla that are not represented in freshwater (or marine) environments; the differences in water composition affecting the chemical solubility, speciation, (bio)availability, etc..., and other relevant differences. Limited science on transitional water is available therefore not science based risk assessment for these waters is possible at this time

Equilibrium conditions and equilibrium partitioning approaches

- Equilibrium conditions in generic local and regional assessment can be used as a starting point, but should be improved through the use of probabilistic approaches of exposure and effects (and when relevant consider also other processes such as resuspension)
- One or more relevant K_d -values (overlying water – sediment) are needed for using EqP as a 1st tier. Transparency is important in the derivation of K_d values at any level. It is also important to make sure that there is equilibrium and that the relevant sorption processes are properly characterised (examples: PFOS – ionised/ ionisable compounds): consider other surfaces – clay minerals. It is recommended for generic assessments to make sensitivity analysis on the impact of K_d on the EqP or to employ a range of relevant K_d s for the substance.
- There are specific chemical groups for which EqP is not appropriate – like high MW-chlorinated paraffins, polymers, micelle forming chemicals. And also there are generic boundaries (lack of pelagic toxicity info, substances with metabolites toxic to sediments,...)
- At higher tiers, EPM is generally not applicable, but if it is, it should be accompanied with greater clarity (e.g., uncertainty analysis; speciation and/or probabilistic modelling)
- Kinetic processes should be considered in higher tiers, as well as: experimental K_d -values instead of generic ones, site specific information like sorption characteristics, and considerations of degradability.

Risk characterisation and impact assessment

- Water and sediment compartments are interrelated and should be evaluated together. We should consider sediment as a part of aquatic system as it provides structure/habitat for different organisms. However, for pragmatic point of view risk characterizations for prospective risk assessments should be done separately in order to facilitate the decision making

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- Even for screening purposes, a more integrated assessment than the current approach, covering diet exposure of benthic invertebrates and other taxonomic groups, is needed
- Test guidelines should be adopted to include the variability of taxonomic group, lifestyle, dietary route (including spiking of food when relevant) and feeding behaviour in ecosystem. Further tests need to be developed to cover a wide range of traits and functions. The need for sediment microbial inhibition standard guidelines/testing protocols should be considered
- In prospective risk assessment its difficult to include issues relevant for the impact assessment (such as biodiversity, species richness, endemism, etc.) due to the variety of systems that need to be covered – it may be more possible in retrospective where a specific system are being investigated. A relationship between ecosystem services and protection goals, including aesthetic values, is desirable. Under some conditions, the assessments may require special considerations in addition to standard risk paradigm; for example in some circumstances the bioaccumulation assessment (in addition to PBT assessment, secondary poisoning assessment etc.) may require additional BCF/BMF sediment organism testing (*Lumbriculus*), additional research is necessary for selecting triggers and conditions

Uncertainty assessment

- Uncertainty in the weight of evidence should include lack of knowledge; general biological variability and measured variability
- The options for supplementary or alternative analysis should be evaluated, these include methods currently developed for pesticides but potentially applicable to other substances (e.g., Spear, trait assessment, geometric means, etc.). Some recommendations are provided.
- Improved interactions between risk assessor and risk management are needed.

Exposure related issues

Exposure assessment principles and tools (scenarios and models)

- For prospective risk assessment available exposure assessment tools are sufficient for 'conventional' organic chemicals at the tier 1 level (see section 1 for exceptions). Pesticides: still a lot to be done for sediments. Often: models are not the problem, but parameterisation, validation, coverage of regional variability.
- Need for transparency whenever refinements are made (e.g., to allow others to evaluate/validate)
- Exposure scenarios for non-conventional uses need further development – biocides as an example.

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- Generic regional models scenarios sufficient for exposure estimation: the mass balance models used, are fit for purpose, but not spatial explicit. They are suited for 1st tier assessment.
- Models are also available for some metals (e.g., Ticket-UWM, BLM; AVS/SEM; Mineql; WHAM); as with most models, further refinement required (e.g., BLM for sediments), especially at higher tiers.
- For secondary poisoning, for most metals BSAFs are appropriate at the first tier; for metals that may biomagnify (e.g., selenium, mercury) additional processes (e.g., methylation) need to be considered
- There is a need for generic/more realistic models, e.g.:
 - biotransformation to be included as a further refinement.
 - Further improvement is needed to include regional variability.
 - Models need to be developed for non-conventional organic chemicals such as ionic compounds, surfactants, organometallics, etc. (see section 1), especially since a larger fraction of chemicals are non-conventional.
 - For metals:
 - Refining AVS concept to include oxic environments and non-AVS binding ligands
 - Metal remobilization potential and incorporation of hydrological settings
 - Determination of speciation and bioaccessible fractions
- Incorporate ecoregion/ecotype concept as it increases realism. Research need: reflect spatial and temporal variability in exposure assessment – one tool is Monte Carlo sensitivity analysis, assessment of 10 and 90 percentiles of environmental fate influencing physical-chemical factors and sensitivity analyses.
- TICKET-UWM can be used for regional modelling/scenarios of metals in lake settings (calibrate for regional variability); can be used in other hydrological settings (e.g., transitional waters), recognizing its limitations in these environments
- Difficult to develop a common set of regional scenarios for metals due to specificity; guidance needed to perform case-by-case assessments
- Diffusive sources to be considered.

Bioavailability

- Definitions for bioaccessibility and bioavailability are provided in the thought starter papers. Define availability from a physical-chemical angle (chemical availability) and then link this to different ecological receptors, taking uptake routes into account
- Recommendations regarding the use of passive sampling methods. Link to ecotoxicity data only possible when exposure parameter fits with how the test is done: matching data or a tool to recalculate measured concentrations.

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- Note of caution of regulator: avoid unnecessary complexity in RA.

Degradation (speciation, aging for metals) and assessment of metabolites

- Lab degradability data useful for modeling PECs – provided that the lab data can be extrapolated to real world; often degradability data are generated under 'ideal' conditions. Worst case not to consider degradation considered appropriate – refine in higher tiers, including the issue of extrapolation and long term processes. However, long term processes are to play a role in PBT assessment (persistence).
- For metals, speciation, aging, and burial are appropriate to consider. Metal reactions often reversible (versus organics which may not be). Mechanistic modelling (e.g., changes in speciation and potential for reversibility) can be informative (e.g., Ticket-WUM is a good framework – starting point). Aging processes generally reduce exposure risk (conservative at screening level if not considered)
- Metabolites: to be considered in RA as done in biocides and pesticides assessment. Recommendation to include information on metabolites in lower tiers whenever relevant and whenever information available.

Metrics

- Best metrics selection should be linked to effect consideration. Question is whether acute testing (<10 days) is of any relevance given typical limited dynamics of sediments, although peaks will be broader in time than in case of surface water. Predominantly chronic toxicity data needed – exposure less dynamic
- Best metrics from an exposure perspective are related to freely dissolved concentration as the basis, although this might not capture 'all'
- Measure tissue concentrations; and for metals speciation and distributions (intracellular) of biologically active/inactive metals

Effects related issues

Species (taxa/traids) selection and available tools

- In the identification of relevant ecological communities and endpoints in the risk assessment for the sediment compartment, exposure and possible exposure routes should be included in the assessment if possible (during the selection of species). Guidance and an integrated approach are better than a set of "mandatory" species/taxa
- Corrections (pH, hardness, OM, AVS, cation exchange capacity) were discussed and realized that this could be done

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- Organisms from different communities (both benthic and epi-benthic) should be considered as a test subject. The final selection depends on the predicted environmental fate/behaviour of the compound(s). Main issues:
 - There are not many OECD guidelines available
 - Organisms from different groups/traits should be tested
 - Microbes should be included but there is a need for further test methods
 - Sediment rooted plants
 - Early life stage fish test under way
 - Insects and molluscs are under represented in standard tests compared to their ecological relevance
- There is still need for standardized new tests but group also acknowledges the need for statistical methods for analysing the data
- Micro- and mesocosms testing allows the population and community level testing

Addressing interspecies variability

- Inter-species (or alternatively inter-trait) differences should be considered. An option for understanding/harmonisation is the critical body residues approach. Measuring internal concentrations in the ecotoxicity studies to be considered.
- It should be convenient to prepare a list of representative marine and freshwater species
- SSD approach can be used but issues of species coverage need to be addressed (ex. sensitive species are not always regulatory species; micro-habitat, feeding strategy coverage, etc). The number of data points available is often very low. There are uncertainties regarding the minimum number of species in the SSD, the coverage, and the consideration of different exposure routes. Alternatives: mechanistic effects models, population/community level models, new -omics (on developmental phase, results hard to interpret)
- Normalisation concepts are available for metals and non-polar compounds, but work need to be done for emerging contaminants

Minimum requirements for effect assessment

- Regarding minimum requirements EPM was seen as a useful tool for screening level. The AF of 10 above a single threshold is not appropriate, a logKow based magnification correction of the AF should be a better approach. In principle, a LogKow>5 should trigger some additional sediment tests (for example bioaccumulation studies where all exposure routes are considered). Organism selection: sediment ingestion, life strategy, "lab proof", well documented and ring-tested, suitable for different tests and different end-points, as a new tests organisms should have added value. In many regulatory schemes availability of adopted standard test guidelines (such as OECD TGs or ISO methods) is needed to request testing.

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Bioavailability

- Bioavailability should be included, and there is a need for standardized reference matrices for testing. (Bio)availability correction is absolutely recommended if feasible, for all type of chemicals. A tiered (bio)availability correction was suggested

Integrated testing strategies, use of existing information, EPM

- The use of all available evidence is essential for developing integrated testing strategies. Pelagic data is relevant for sediment. If new evidence is to be developed:
 - Ensure relevant exposure routes covered (sediment!)
 - Cover Important Functional groups/services (microbial,...)
 - Variability (phylogeny)
 - Put emphasis on differences in "uptake, metabolism, physiology & elimination"
- EPM paradigm does not work for low soluble organics or inorganics without aquatic toxicity effects, but potential loading of sediments is envisaged.
 - Recommendation: test sediment dwelling organism (minimum data point!), using appropriate spiking method
- Basis for and Integrated testing and assessment strategy
 - MIN: start from EPM from pelagic data (if applicable)
 - BASE for sed.: Add exposure route relevant organisms e.g.
 - Microbial (check relevance soil data (R&D check), and method?)
 - Plant with root uptake from sediment (Check relevancy species')
 - Worms feeding on sediments with "low metabolism"
 - HIGHER TIER: Investigate combined SSD Aquatic/Sed, by:
 - Testing additional species in complementary way
 - Covering: feeding patterns, phylogeny, traits, species relevant for sediment function (nematodes, ...)
 - SSD on exposure or even better "Internal dose" (or chemical activity)
 - EVALUATE SSD composition and eventually split