Work Group charge questions

Each work group will be asked to consider a set of “big-picture” questions (the same for each WG) and a set of more specific questions related to each scenario.

Generic questions

Each of the break-out groups will be provided the following "big-picture" questions to help guide discussions on developing specific framework guidance. It is likely the state-of-the-science precludes definitive solutions to many of these issues - but acknowledging them and their role in decision-making should result in a more scientifically-based framework being developed. These questions should be considered alongside the specific scenario questions.

1) Do previously constructed frameworks (e.g., WERF, ECETOC TF, CWN, etc.) serve as a starting point for Pellston Workshop discussions? What aspects of those are useful and not useful? Some of these approaches utilize "Weight-of-Evidence" based approaches, but WoE approaches can vary widely in their scope and usefulness. Can a basic WoE approach be recommended for higher Tier evaluations?

    a) A WoE approach will most likely be necessary to distinguish between the (potential) impacts of the mixture of trace organic chemicals (TOrCs) and the impacts of other stress factors (habitat alteration, eutrophication etc). **Rank stressors.**

    b) WoE may also be applied to determine the most influential chemicals in the environmental mixture. **Rank chemicals.**

    c) WoE evaluation may be used to indicate the most affected sites**. Rank sites.**

2) Habitat (or some aspects of habitat, e.g., flow, geomorphology, substrate) has been recognized as a common and often major stressor of biotic communities. How can assessments of mixtures best separate ecological impacts of habitat from chemical mixtures?

    a) This aspect has to do with gradient analysis. The impact of different stress factors can only be separated in a WoE or statistical way if the **gradients of different stress factors are long and independent** (not correlated).

    b) Problem generally is that chemical contamination is only **a minor stress factor**, as compared to e.g. habitat alteration, especially in the urban environment.

    c) Anyway, the evaluation of overall chemical mixture contamination is giving a **higher signal and thus a higher statistical power** than the evaluation of individula chemical

3) How is reference condition best established in human dominated waterways? There are approaches using AQEM and RivPACs for example that consider this, but it can be challenging in some regions where "natural" conditions do not exist.

    a) In those cases there is no other option than to go for **minimally disturbed sites** as a kind of "dirty" reference.

b) The only other option is to define a kind of **"green book list"** as we have done in NL, where we do not have any natural conditions left anymore. We made a **water typology** of 50 different water types, based on physchem habitat characteristics, and defined a set of key species that should be present, and a set of key species that may not be present for each of these water types. This seems to work in a plastic world like ours.

4) How is scale dealt with in the framework? For example, significant ecological impacts from mixtures are observed in a effluent mixing zone of 50 meters downstream - but are not significant elsewhere. How does one determine the ecological significance of this impact on the waterway's ecosystem? Is this a policy decision? On a related note - How are stressor inputs from upstream dealt with? How does one deal with fish migration and benthic drift between upstream and downstream reaches outside of the site-of-concern in regards to exposures and resilience?

a) The definition of an acceptable mixing zone where EQC's are exceeded is a **political decision**

b) Small mixing zones cause short adverse exposure potential. It is very much depending on local situations wheter the critters could take a **"deep breath"** to avoid damage.

c) Resiliency is very much depending on **stress duration** and on **inherent sensitivity** of key species

5) How can the cumulative effect of upstream discharges be dealt with? Could this be similar to the U.S. EPA's Total Maximum Daily Loading (TMDL) approach that considers waste load allocations?

a) TMLD is a concept that is only applicable on a **compound by compound** base. There is no easy way this concept could be applied for mixtures.

b) Maybe we could venture into some kind of **"impact allocation"** for mixtures

6) How can the "bad actors" in mixtures be determined and ranked in a manageable manner that does not require extensive research endeavors? Could a small number of "surrogate" chemicals be selected to more easily assess the loadings and significance of the "bad actors"?

a) We could go for some kind of **Threshold of Toxic Concern** (TTC)(both ecological and human), where the toxicity of new trace chemicals is read across from the known toxicity of similar chemicals for which we have toxicity information. The problem is here to **group chemicals according to similarity**.

7) How are stressors common in these exposure scenarios (e.g., nutrients and metals) best linked back to dominant source inputs? What are some useful chemical signatures (e.g., stable isotopes, chemical fingerprint) to help link to sources?

a) Indeed, **tracer** studies (isotopes, rhodamine, fingerprinting)

b) Alternatively, **upstream/downstream** comparison

c) Always start with a deskstudy on **"locally attached processes"**

8) While most regulatory focus on the water column, aquatic ecosystems have interacting compartments critically important to various communities, such as surficial sediments, periphyton/biofilms, flocs, hyporheic zones, and riparian zones. How are these compartments best integrated into a mixture based framework?

   a) Generally transfer of the chemicals from these compartments to the biota is **through the water phase**. Apart from bioavailability and transport issues, there is no need to assume that benthic species are **differently sensitive** than fully aquatic organisms. There are adequate **modeling posibilities** for tackling differences in bioavailability and transport between the compartments.

9) Instream-based approaches that acknowledge the importance of bioavailability, changing exposures, fate processes, and compensatory mechanisms for example, in the proper ecological context are superior to overly simplistic lab and literature based models. Can a framework be designed for different ecosystem-based exposure scenarios (such as headwaters vs. large river mouths - see AQEM classifications) that consider real-world conditions?

   a) One thing is certain here: There is **no simple method** to mimick and predict the complexity of real world phenomena. So, lets go for the **KISS** principle (keep It Stupidly Simple)