

Project: Direct Toxicity Assessment (DTA) of whole effluent
Client: British Nuclear Group Sellafield Ltd.

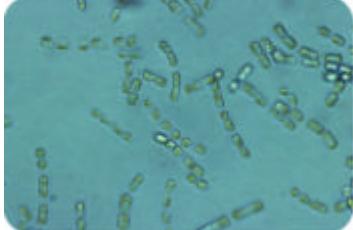
The Challenge

With advances in environmental legislation, there has been a realisation that single chemical environmental quality standards (EQSs) are not sufficient to maintain the desired quality of aquatic ecosystems. Chemicals can interact in effluent streams and may lead to the accumulation of toxic impacts that could not be predicted from single chemical toxicity. There is therefore a move towards the assessment of the toxicity of whole effluent streams to biota relevant to the aquatic environment receiving the discharge.

Complex effluents are discharged into the Irish Sea from the Sellafield plant. Our client wished to see the results of DTA on one effluent sample in order to evaluate the feasibility of setting up such a programme for the whole site.



Plankton sampling using a trawl net



The marine alga *Skeletonema costatum*



Tisbe battagliai, a marine copepod

The Solution

Laboratory culturing and testing was performed to GLP standards. The results enabled an evaluation of the risk to marine biota in the vicinity of the discharge point.

This was achieved by the following:

- Review of suitable tests and test organisms
- Selection of the most appropriate test. The *Tisbe battagliai* test was chosen as it is regarded as being one of the more sensitive DTA techniques.
- Set-up and maintenance of *Tisbe* cultures over several weeks
- Segregation of *Tisbe* into different life cycle stages over the course of the culture period
- Selection of copepodids for testing (6 ± 2 days old)
- Assessment of effluent toxicity conducted to BS6068 guidelines
- Use of probit analysis to determine the median lethal concentration (LC_{50}) after exposure times of 24 h and 48 h
- Derivation of a provisional EQS for the whole effluent sample
- Additional expertise in marine dispersion modelling was used to estimate dilution factors in the vicinity of the outfall
- Available dilution within the mixing zone suggested that the effluent would not have adverse toxic impacts in the receiving environment.

The Benefits

- As the authorisation of future liquid discharges from the site is likely to be governed by Toxicity Based Consents, our client is already able to provide evidence to the regulators that it is proactive in adapting to new assessment practices.
- Based on the effluent sample provided, we were able to demonstrate that adverse toxic impacts to marine biota are not anticipated in the receiving waters.

Our client is satisfied that a cost-effective and robust forward programme of work to characterise other effluents is achievable.



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