

DIRECT TOXICITY ASSESSMENT INFORMATION



ENVIRONMENT AGENCY



DIRECT TOXICITY ASSESSMENT: GENERAL INFORMATION

Direct Toxicity Assessment (DTA) provides a simple and easily understood measure for the protection of aquatic life arising from potentially harmful discharges. It allows for the control of toxic discharges, the setting of attainable toxicity reduction targets and provides for the assessment of improvements in the quality of receiving environments.

AIM OF THE NATIONAL CENTRE

To oversee and promote the introduction of Direct Toxicity Assessment for the regulatory control of toxic waste discharges and for environmental monitoring and assessment.

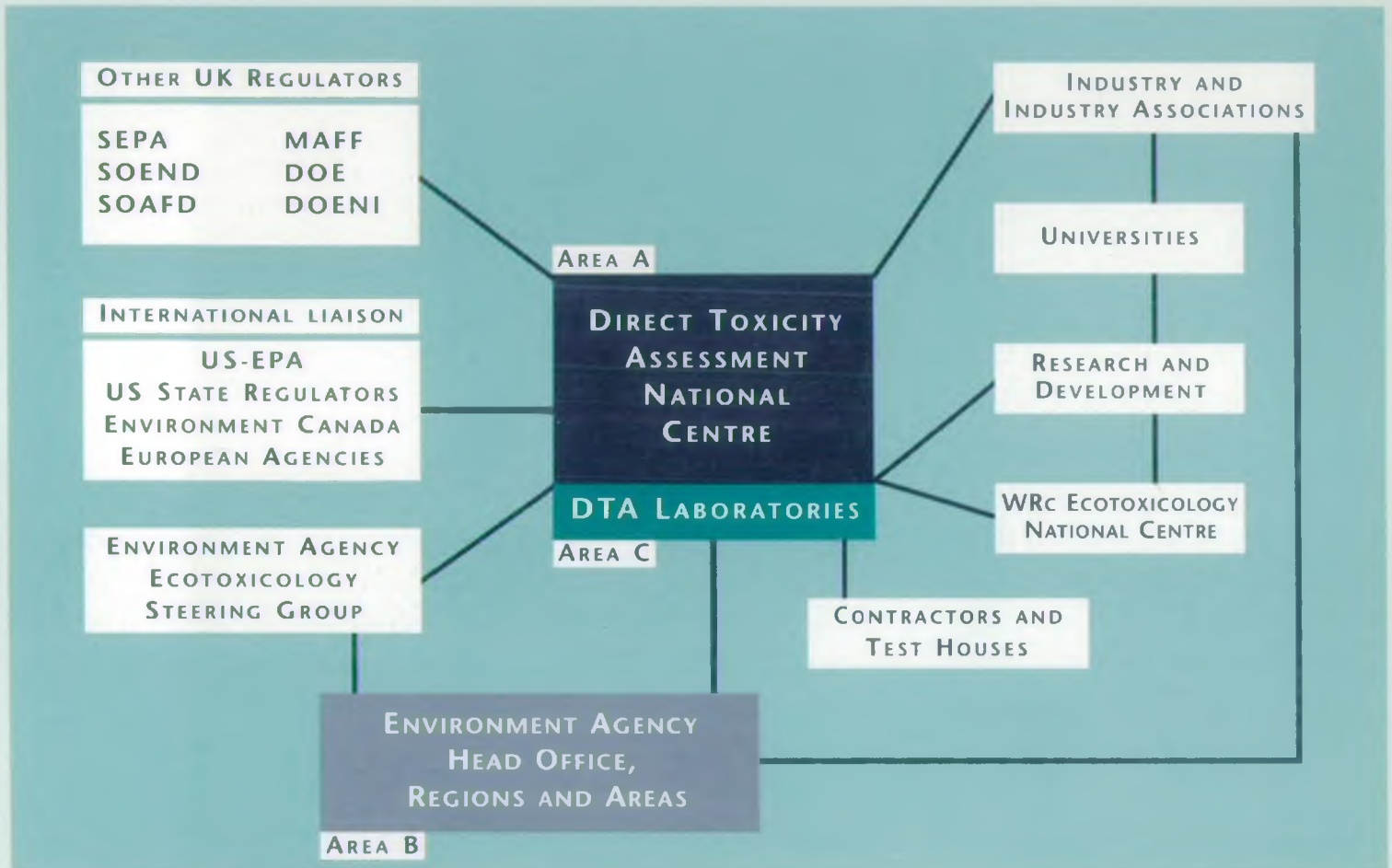
The DTA National Centre comprises a small expert group based at Worthing, and two toxicity testing laboratories based at Waterloo (near Portsmouth), and Newcastle. The centre has developed strong links with academia, industry and other regulators during the development of DTA.

OBJECTIVES

- To establish a centralised expert group within the Environment Agency for the formulation of DTA policy and operational procedures based on sound science.
- To provide advice and guidance to government bodies, national and international expert groups and the business community on DTA matters.
- To establish laboratory toxicity testing facilities and ensure the delivery of excellent information through good analytical quality control and audit.
- To select and promulgate toxicity test methods for regulatory control and environmental monitoring and to provide an 'Ecotoxicology Methods Manual' for regulatory testing.
- To provide a protocol for the introduction of a Toxicity Based Consent (or Authorisation) condition and to ensure enforcement procedures are applied consistently.
- To investigate the wider application of DTA procedures for environmental monitoring and assessment and to evaluate the best environmental option for waste disposal.
- To establish an R&D strategy for the continued development and application of DTA procedures and to ensure the wide dissemination of information.



The successful introduction and wider application of DTA procedures will depend on a concerted effort, with strong links between the centre and regions within the Environment Agency and externally with the business community. The diagram below shows the important links and the 3 key task areas.



AREA A
CONSISTENCY OF APPROACH
& EXCELLENCE OF DATA

- Implement DTA strategy
- Review protocols
- Provide technical advice and support documentation
- Ensure consistent application of enforcement procedures
- Maintain Environment Agency ecotoxicology databases
- Promote wider application of DTA procedures

AREA B
ENFORCEMENT

- Identify candidate discharges for toxicity based conditions
- Apply toxicity based consent (or authorisation) conditions
- Negotiate toxicity reduction programmes
- Enforce breach procedures
- Environmental toxicity monitoring and biological assessment

AREA C
TOXICITY TESTING AND
QUALITY ASSURANCE

- Establish core toxicity tests and culture facilities
- Conduct AQC and audit controls
- Undertake toxicity testing and method development programmes
- Maintain methods manual and register of toxicity testing facilities
- Promote national approvals scheme for ecotoxicology laboratories.



DIRECT TOXICITY ASSESSMENT: TOXICITY BASED CONSENT CRITERIA FOR THE REGULATORY CONTROL OF WASTE DISCHARGES

The Problem...

Water quality monitoring and the regulatory control of toxic discharges is currently based on the achievement of Environmental Quality Standards (EQSs) in receiving waters. The current approach would benefit from the inclusion of DTA since less than 0.1% of listed chemicals have an EQS, and they take no account of additive toxicity in complex mixtures.

Biological surveys only show damage after pollution has occurred but they can provide information to help assess the harmful effect of discharges and demonstrate environmental improvements.



The Solution...

Toxicity-based conditions can supplement current consents (or authorisations) and provide a proactive real-effect measure to control complex discharges. This will give the Environment Agency a measure of what is poisonous matter and provide an indication of risk from which potential 'harm' can be predicted. The toxicity condition will be set to ensure no detrimental effects at a point in the receiving water. This point depends on the sensitivity and use of the water.

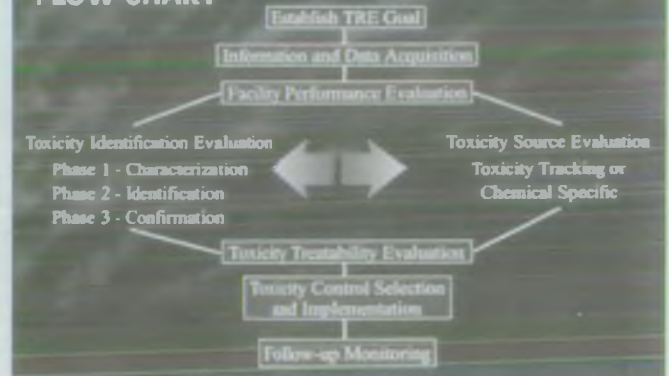
If the toxicity of an effluent is too high, after dilution in the receiving water, a toxicity reduction programme can be conducted by the discharger to reduce toxicity. Once the toxicity condition is achieved the discharger will undertake monitoring for compliance assessment. The Agency will promote partnerships with industry to achieve reductions in toxicity and to demonstrate environmental benefit.

It is an offence to cause or knowingly permit any poisonous, noxious or polluting matter... to enter controlled waters (Water Resources Act, 1991).

A person must use the best available techniques not entailing excessive cost for rendering harmless.... substances released into any environmental medium (Environmental Protection Act, 1990).

As far as reasonably practicable, the works shall be operated so as to prevent: any matter being present in the effluent which will cause the receiving waters to be poisonous or injurious to fish or their spawn, spawning grounds or food, or otherwise to cause damage to the ecology of the receiving waters and treated effluent from having any adverse environmental impact (Salmon & Freshwater Fisheries Act, 1975).

TOXICITY REDUCTION EVALUATION FLOW CHART





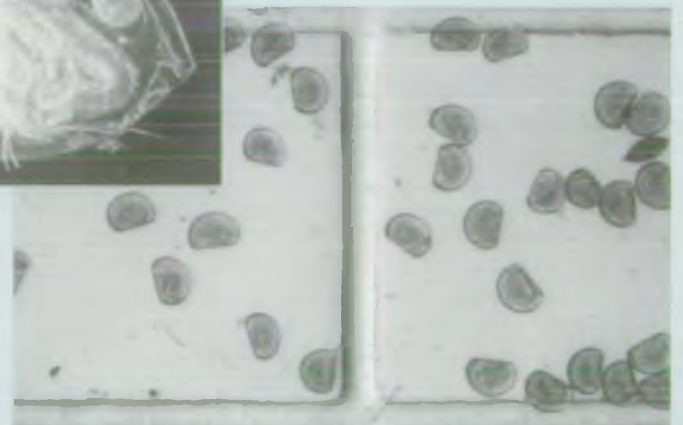
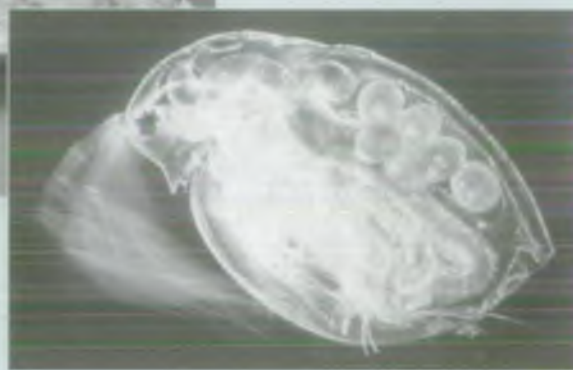
DIRECT TOXICITY ASSESSMENT: METHODS

Direct Toxicity Assessment is dependent on the ability of the toxicity tests to deliver scientifically sound and high quality data at reasonable cost.

Many methods are available but few are suitable for pollution control or environmental monitoring. Therefore, existing and new ecotoxicological methods are being evaluated and selected using criteria appropriate to their specific operational role. The result will be a small number of well tested methods with associated quality controls.

An 'Ecotoxicology Methods Manual' for regulatory purposes has been designed to provide test protocols and guidance on their use. The manual will be updated as protocols are improved and new methods are developed. The manual contains standard operating procedures for all tests detailing collection, storage and preparation of samples, cleaning and storage of apparatus and analytical quality control procedures.

Standard operating procedures will be developed for each test ensuring a consistent approach in all laboratories. To further reduce the risk of inter and intra laboratory variability a project is underway that will ensure quality criteria are met by laboratories undertaking toxicity testing for regulatory purposes. A register of approved laboratories will be maintained and facilities and test data will be audited.





DIRECT TOXICITY ASSESSMENT: RESEARCH & DEVELOPMENT

There are currently three main areas of research within the Environment Agency concerning Direct Toxicity Assessment;

Method Development: to develop a battery of tests for effluent control and environmental monitoring & assessment.



Consents & Authorisations: to develop a strategy for the regulatory control of complex discharges with the introduction of Toxicity Based Consent (or Authorisation) conditions.

Outputs

- Protocol & procedures for determining a toxicity based consent (or authorisation) condition
- Guidance on identifying and reducing toxicity
- Toxicity based criteria for the regulatory control of waste discharges



Outputs

- Method selection criteria & review of ecotoxicological methods
- Environment Agency/Scotland & Northern Ireland Forum for Environmental Research, 'Ecotoxicology Methods Manual' with Standard Operating Procedures
- Quality control procedures
- Toxicity testing laboratory audit scheme

Future

- Development of rapid and chronic tests for regulatory purposes.
- Development of *in-situ* and biomarker tests for environmental monitoring and assessment.



Environmental Monitoring & Assessment:

to evaluate ecotoxicology methods for assessment of environment quality, and to demonstrate sustainable environmental benefit.

Outputs

- Review of suitable methods
- Strategy for general quality and impact assessment

Future

- Application of DTA to all environmental media



DIRECT TOXICITY ASSESSMENT: LABORATORIES

The DTA National Centre laboratories at Waterlooville (near Portsmouth), and Newcastle each undertake a suite of toxicity tests for the assessment of effluent toxicity and for environmental monitoring.

Services

- Toxicity testing on freshwater & saline water samples
- Toxicity test method development
- Provision of emergency response toxicity testing



AIM: To provide expert toxicity testing facilities for the Environment Agency capable of generating high quality data, to undertake method development & contribute to a quality control programme.



Applications

- Toxicity screening of discharges
- Effluent toxicity characterisation for consenting purposes
- Receiving water monitoring
- Compliance monitoring
- Toxicity Identification and Reduction Evaluations (TIE & TRE)
- Environmental impact monitoring & assessment
- Operational Investigations

Tests include

Acute Tests

Daphnia magna immobilisation
Oyster Embryo-Larvae development
Tisbe battagliai lethal
Chironomus riparius sediment
Corophium volutator sediment

Chronic Tests

Daphnia magna reproduction
Tisbe battagliai reproduction
Lemna minor growth

Rapid Tests

Bioluminescence
Chemiluminescence