CEFAS SOLVING PROBLEMS IN FISHERIES AND THE ENVIRONMENT

Environmental Research, Monitoring and Assessment

THE CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE

Environmental Research, Monitoring and Assessment

CEFAS has a wealth of expertise and over 50 years experience in researching, monitoring and assessing the impact of potentially harmful substances or activities on the quality of the marine, coastal, estuarine and terrestrial environment.

We can advise clients on establishing monitoring and assessment programmes appropriate to their needs.

This might involve a targeted study to resolve a problem of special concern, monitoring compliance with regulation, or a broader survey to interpret trends in environmental quality.

Our expertise encompasses establishing the fate and effects of a broad spectrum of contaminants including radioactive and non-radioactive waste, organic and inorganic contaminants, and microorganisms and viruses. We also have experience in assessing the effects of other man-made changes such as those caused by exploitation of offshore reserves of gas, oil, sand and gravel, and the impacts of agriculture and aquaculture developments.

CEFAS is directly involved in advising on UK and international legislation and in developing policy to monitor and assess the aquatic environment. We apply this experience to assist Governments, enforcement agencies, and policy makers throughout the world in developing and implementing monitoring and assessment programmes and control measures. We also offer our industrial clients expert assistance in cost-effective compliance with their regulatory responsibilities.

Solving Clients Problems

Environmental Quality Assessment

- Design, implementation and evaluation of monitoring programmes
- Site specific analysis, bioassays and ecological studies
- Quality Status Reports
- Benchmarking and evaluation of assessments

Environmental Impact and Waste Assessment

- Hazard and risk assessments
- Ecotoxicology and fate studies
- Survey design
- Surveys and scoping studies
- Emergency response planning and impact management
- Operational audits and evaluation of reports
- Advice on complying with regulations

Food Safety Assessments

- Surveillance and monitoring
- Detection of microorganisms, toxins and other contaminants
- Quality assessment and certification
- Processing advice for shellfish production
- Benchmarking third party evaluations

Environmental impacts of products

- Hazard and risk assessments
- Support for product registration
- Advice on establishing monitoring programmes
- Product authenticity

Environmental Processes

- Oceanography
- Sediment dynamics and disturbances
- Nutrients and eutrophication
- Environmental change
- Coastal zone management and sustainable development

Training

- Development and delivery of customised training programmes

Environmental Quality Assessment

Environmental quality assessments provide baselines against which changes to the status of the aquatic and terrestrial environment can be evaluated.

Design, implementation and evaluation of monitoring programmes

CEFAS designs and undertakes monitoring programmes for a comprehensive spectrum of contaminants in a wide range of matrices, including water, sediments, biota and soil. We can advise on programme planning, implementation and data interpretation. We have high security archives for data storage, and apply GIS and statistical packages to provide specialised interpretation of data.

Site specific analysis, bioassays and ecological studies

CEFAS measures concentrations of organic contaminants, trace and heavy metals, nutrients and radionuclides at estuarine, coastal, shelf and offshore sites around the British Isles. We assess toxicity using sensitive bioassays, fish disease surveys and benthic studies. We assess the trophic state of the marine environment by monitoring nutrient concentrations and eutrophication symptoms, including the presence of noxious and toxic algae.

Quality Status Reports

CEFAS is experienced in implementing a continuous programme of monitoring potentially harmful substances in the marine environment and produces regular quality status reports. These provide the basis against which potential impacts of specific activities can be assessed or trends in environmental quality can be established.

Benchmarking and evaluation of assessments

CEFAS can provide independent and impartial evaluations of third party assessments to provide clients with assurance and evidence of the reliability and quality of their analysis and data interpretation. We regularly lead and participate in intercalibration exercises for both analytical methods and biological effects techniques.

Environmental Impact and Waste Assessment

Environmental impact assessments provide clients with advice on the potentially harmful effects of man-made and natural activities and events. Assessments may be required to determine the present effects of contaminants and natural processes or the suitability of proposed activities.

Hazard and risk assessments

CEFAS specialises in complete aquatic environmental impact assessments, from survey design and implementation through to data interpretation. Assessments are highly specialised and take into account location characteristics, production processes, and potential impacts on sediments, water quality and biological interactions. They can also detail measures that should be taken to avoid and remedy impacts where possible.

For predictive assessments, CEFAS is able to model a wide range of environments and conditions including water and leachate flow and pollutant transport, estuarine and coastal dynamics, water quality, dispersion of contaminants, and radionuclides. For standardised situations we apply turnkey models. Where more detailed appraisal is needed, we tailor models to the needs of the customer. This may involve developing source specific models drawing upon our applied research capability to back up existing data.

Toxicity in the environment can arise from contaminants acting alone or in combination. CEFAS uses toxicity based fractionation techniques to isolate and identify the causal contaminants in complex environmental samples. We combine specialist skills in environmental analytical chemistry, ecotoxicology and biodegradability to offer complete hazard and risk assessments of chemicals.

Ecotoxicology and fate studies

CEFAS is a leader in the development and application of methods used to detect the fate of contaminants in the environment and to measure their biological effects. Our ecotoxicology team specialises in assessing the risks associated with contaminated sediments and waters, and with individual chemicals and wastes. We offer over 30 different acute and chronic ecotoxicity tests with fish and invertebrates. We employ biomarkers which can be used as early warning indicators of the presence of specific contaminants, and have developed a system to map toxicity thresholds as a concentration factor on ambient values and to predict trends in water quality.

Survey design

We design sampling programmes for surveys to provide impact assessments tailored to our client's needs. By taking account of the nature of the problem, the degree of assurance which is needed, and the demands of legislation we define the amount of information required and so plan a cost effective sampling programme. We apply Geographic Information Systems (GIS) and robust statistical packages to provide specialised interpretation of data.

Surveys and scoping studies

CEFAS can undertake scoping studies and surveys to assess the impact of physical disturbances on the marine environment, contamination by chemicals, nutrients or radionuclides, or problems of contaminated soils and ground water.

Physical disturbances include mineral extraction and oil exploration, dredging and deposition of spoil, harbour works and constructions, laying pipelines and cables, underwater explosions, commercial fishing activity, shellfish cultivation and marine accidents such as oil and chemical spills. We have experience in assessing their impact on biological populations and can advise on strategies to monitor and manage them.

To solve problems of contaminated soils and groundwater we bring together our chemical and biological effects expertise and understanding of contamination migration to provide initial appraisals of likely pollution. We follow this up with detailed site investigations and recommend possible remediation options.

CEFAS can assess the impact of existing and proposed releases of radionuclide discharges and from direct radiation sources. We are experienced in identifying critical groups, establishing consumption habits and external exposure, and monitoring discharges.

Emergency response planning and resource management

CEFAS has experience in preparing and operating emergency plans, particularly in the aquatic environment, in response to both exercise scenarios and actual incidents. CEFAS can advise on the impact on the environment of pollution incidents, such as an oil or chemical spill or a leak from a nuclear facility. Our particular expertise lies in assessing the acute and chronic impact on marine life of contaminants and oil dispersants, and in understanding the mechanism of contaminant dispersal and metabolism. We assess the extent of contamination of marine resources and sediments and the risks to human health and advise on appropriate management and enforcement measures required to minimise risks to human health.

Operational audits and evaluation of reports

CEFAS has over 40 years experience of inspecting nuclear sites to assess compliance with statutory legislation. We are able to offer a complete operational audit service to advise clients on their waste management and environmental monitoring responsibilities and how to meet them.

Advice on complying with regulations

We can advise on Best Practical Environmental Options for waste disposal, how to monitor compliance with regulations in the most cost-effective way, and measures needed to comply with regulations controlling:

- discharges and disposals of liquid and solid industrial and radioactive wastes, dredged material and sewage sludge; and
- discharges due to exploitation of offshore oil, gas and mineral reserves.

Assessment of Food Safety

Surveillance and monitoring

Microbiological contamination of bivalve shellfish from sewage discharges poses a threat to human health. CEFAS has extensive expertise in detection of sewage-contaminated shellfish and in the establishment and implementation of appropriate monitoring programmes.

CEFAS is also very experienced in providing advice and developing policy and control measures, including legislation, to manage the risks to human health associated with eating raw or lightly cooked shellfish. We provide this expertise on a consultancy basis to Governments and statutory authorities world-wide.

CEFAS has developed and applied shellfish mapping programmes using GIS for managing shellfisheries. CEFAS can advise on the use of this approach to the development of shellfish contamination management strategies around the world.

Detection of microorganisms, toxins and other contaminants

CEFAS analyses fish and shellfish for a wide range of contaminants, including pollution indicator and food poisoning microorganisms, human enteric viruses, organic and inorganic contaminants and algal toxins.

CEFAS offers unrivalled expertise in the determination of viral contamination of shellfish and shellfish products.

We are leading the development of PCR-based techniques for the detection of Small Round Structured Viruses (SRSVs) responsible for many of the food poisoning outbreaks caused by eating shellfish. We have also pioneered the use of male specific bacteriophage as a more effective pollution indicator than E.coli. Male specific phage can be used for monitoring the pollution status of raw and processed products and for assessing the efficiency of shellfish processing procedures (such as purification and relaying).

Our expertise in sampling and analysis covers a wide range of inorganic and organic contaminants including radionuclides, heavy metals such mercury, persistent organic compounds such as PCBs and pesticide residues.

Quality assessment and certification

We are able to determine compliance with regulations or with purchaser's safety or quality specifications. We can also advise on export and import requirements and undertake analysis for certification.

Advice for shellfish processors and retailers

For shellfish producers, processors and retailers CEFAS can advise on appropriate processing procedures (such as purification or relaying) for the production of shellfish for live consumption, and for the production of processed shellfish products. We apply our knowledge and expertise of viral contamination to assess the efficacy of processing regimes. We can also advise retailers on setting safety and quality specifications for shellfish.

Environmental Impacts of Products

CEFAS specialises in the development of ecologically relevant techniques for chemical hazard and risk assessment in aquatic resources for agrochemicals, pharmaceuticals, and industrial chemicals. One of our major strengths is in the development and application of analytical methods and biological effects techniques for evaluating the quality of the aquatic environment. We can undertake site review, discharge modelling, impact assessment and toxicity assessment, treatability testing and evaluation.

Support for product registration

Laboratory-based toxicity studies on single species, and exposure predictions, cannot provide a full picture of the impact of pesticides and other hazardous chemicals on natural communities. Pond studies provide a more realistic measure of environmental risk, and pesticide regulatory authorities increasingly require data provided by such mesocosm evaluations.

CEFAS has unique mesocosm facilities with accurate dosing and environmental data logging. Combined with our expert analytical chemical support and taxonomic identification, and experience of the regulatory approvals process, they enable us to provide reliable and realistic assessments tailor-made to customers' requirements.

Advice on establishing monitoring programmes

We are closely involved in developing national and international monitoring programmes. Employing robust statistical approaches we devise cost-effective monitoring strategies to deliver the level of assurance our clients require.

Product authenticity

We can undertake analysis of agrochemicals, veterinary medicines, and industrial chemicals to establish their authenticity in terms of the presence and concentration of the active component.

Environmental Processes

CEFAS has comprehensive range of expertise in estuarine, coastal, shelf and oceanic processes including environmental change, nutrient and eutrophication issues and sediment transport.

Environmental change

Solutions to problems of environmental change are only likely to be effective if assessments of environmental impacts distinguish between changes that result from natural causes and those that result from manageable ones. CEFAS has an active research programme into environmental change. This expertise, combined with our international contacts, means that we are able to provide the most up to date and relevant advice on issues and concerns relating to environmental change. We are developing cost-effective instrumentation, towed and moored, to monitor long term changes in the physics, chemistry and biology of the seas.

We have expertise in reliably deploying complex instrumentation in hostile environments for long periods and a recovery record second to none. The instrumentation ranges from deep ocean current meter moorings to smart autonomous moorings and landers for detecting chemical and biological change and seabed impacts.

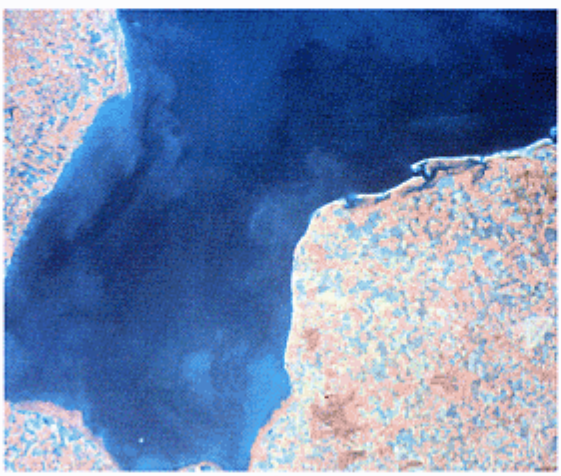
Oceanography

CEFAS conducts research to quantify processes in the physical environment to solve problems concerning the fate of contaminants, fisheries issues and developments on the continental shelf. Using a range of sophisticated moored and towed instrumentation and computer models we can provide a powerful management package for the marine and freshwater environment. We have a proven track record in the deployment of instrumentation and interpretation of data for studies of the deep ocean and its circulation.

Sediment dynamics and disturbance

CEFAS has developed a series of rugged, autonomous monitoring systems to determine the physical and biological factors controlling sediment transport in coastal and shelf seas. Using sophisticated modelling tools to interpret the data collected we can predict the fate of particle-associated contaminants, determine the impact of dredging, marine constructions or coastal defence works and the effect of physical disturbance on ecosystems.

CEFAS employs a variety of seabed investigation techniques such as benthic sampling and acoustic surveys, direct observations and remote monitoring. We can advise on sediment characterisation and sediment sampling programmes employing grabs, corers and remote measurements using video and sonar techniques.



Nutrients and eutrophication

CEFAS has a comprehensive understanding of the fate and impact of nutrients in rivers, estuaries and coastal waters. We advise on the impact of nutrients entering the aquatic environment due to loss from agriculture, direct discharge and as a result of the development of aquaculture. CEFAS can advise on the functioning of coastal wetland systems and on the health of coastal seas, including the major concerns of the changing occurrence of toxic algal blooms. We have considerable experience in sediment biogeochemistry and estuarine and marine primary production.

Environmental contaminant research

CEFAS has an active programme researching processes and mechanisms of contaminant distribution in, and impacts on, the aquatic environment. We have experience in the following specialist areas:

- binding properties of contaminants to sediments;
- contaminant speciation, migration and modelling;
- contaminant particle-water interactions;
- use of radionuclides to measure sedimentary processes - deposition, chronology and diagenesis;
- biological uptake and accumulation of contaminants;
- resuspension and remobilisation of deposited sedimentary contaminants.

Coastal zone management and sustainable development

The demands of industrial, commercial and leisure activities on the coastal zone are increasingly in conflict with the interests of fish and shellfish stocks, fisheries and the coastal environment. CEFAS has the multi-disciplinary knowledge and expertise required to provide assessments of the impact of fishing and other human activities on marine and estuarine ecosystems, and advise on management strategies encompassing all uses of the coastal zone.

We can advise on the best way to achieve sustainability in the use of mineral and biological resources and ensure that activities may be conducted without harm to the wider environment.

Training

CEFAS can create training or consultancy programmes on any aspect of our work tailored to customer's specific needs. These may take the form of dedicated short courses or a series of training days at our own training and laboratory facilities or delivered by our expert scientists at a customer's own site. We can prepare a single days tuition for an individual or develop a long-term training programme for an organisation entering a new field. CEFAS can also undertake project management and project supervision.

Quality Policies

All of our work is conducted under formal quality policies.

The analytical data produced by CEFAS are amongst the most reliable produced by expert laboratories anywhere in the world. Our quality assurance programmes ensure that we perform consistently well in competence exercises, and we design and lead international intercalibrations to bench mark the quality of other laboratories.

Our work is progressively being accredited to appropriate quality standards.

Resources and Facilities

About one third of our staff of qualified scientists and supporting technical staff are engaged upon environmental research, monitoring and assessment activities.

We have invested in modern instrumentation and employ expert practitioners to provide the analytical and technical support essential to delivering a comprehensive and responsive research, monitoring and assessment service.

Contaminants and matrices

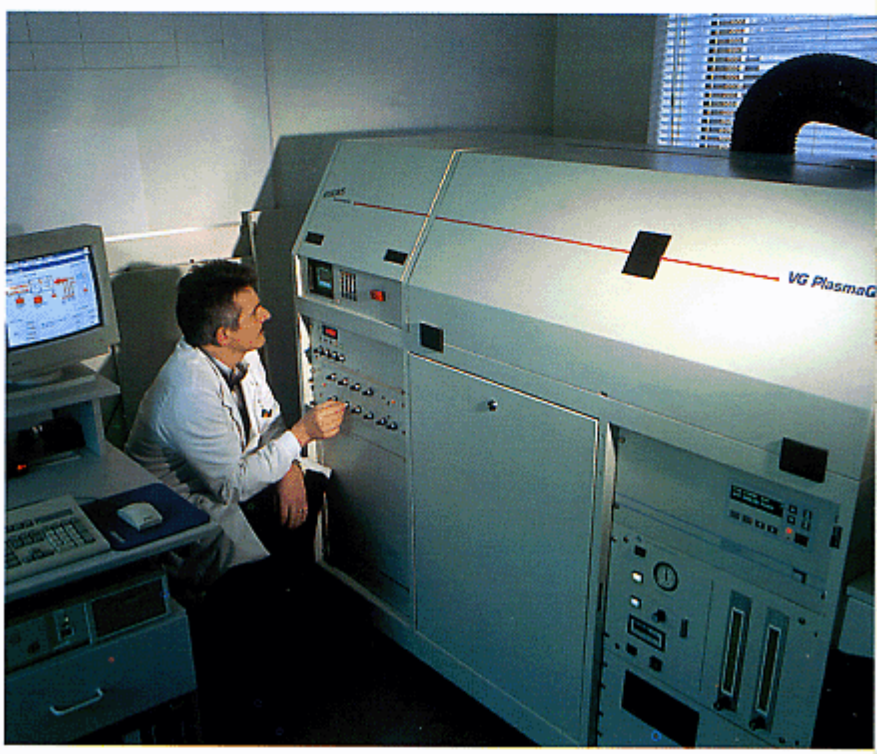
- heavy metals, industrial chemicals, hydrocarbons, pesticides, trace elements, organo-metals, major ions, nutrients, radionuclides
- rain, river, lake, marine, drinking and ground waters, industrial and sewage effluents, sediments, soils, plant and animal tissues, food products.

Instrumentation

- sample preparation systems including super-critical fluid extraction
- infra-red, ultra-violet/visible, fluorescence and atomic fluorescence spectrometry
- inductively coupled plasma/mass spectrometry (ICP/MS) with a range of sample introduction techniques including HPLC
- GC and LC systems with a range of detection techniques including MS
- alpha, beta and gamma radiation counting systems
- sedimentology techniques including laser particle sizing

Research vessels

CEFAS operates two sophisticated ocean-going research vessels with accreditation to ISO 9000 and IMOs International Safety management Code.



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Successful track record

CEFAS has a successful track record in delivering a highly focused, confidential service in a reliable and responsive way. Our existing customers are drawn from a broad spectrum with wide ranging interests. They include UK and international government departments, the EU, industry (oil, water, chemical, pharmaceutical, agro-chemical, aggregate, marine), non-governmental and environmental organisations, regulators and enforcement agencies, local authorities and other public bodies.

Further expertise

CEFAS has complementary expertise in aquaculture and aquatic animal health, and in fisheries science and management. For further information about any of our services, or more information about CEFAS's other activities please contact:

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