

International Workshop on Post-Accident Food Safety Science,
Fukushima City, Japan, November 2016

Best-Practice Management of Measurements of Radionuclides in Fishery Products

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Centre for Environment
Fisheries & Aquaculture
Science



Cefas

<https://www.cefas.co.uk/>

Cefas – A brief history

- Radioactivity studies by the Ministry of Agriculture, Fisheries and Food (MAFF), at **Lowestoft**, was established in 1947 to investigate the potential effects of radioactive waste discharges to the Irish Sea from Sellafield (Windscale)
- The Laboratory on Hamilton Dock became known as the '**Fisheries Experimental Laboratory**

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.Fisheries Experimental Laboratory



Cefas – A brief history (cont.)

tory on Hamilton Dock became known as the Experimental Laboratory

- Radiological work at Hamilton Dock was incorporated into the **Directorate of Fisheries Research** (DFR) and relocated to the Pakefield site in 1981



- In 1997, DFR was established as a net Executive Agency of the Ministry of Agriculture, Fisheries and Food (MAFF) and renamed as **Cefas**. 1997 also marked the golden jubilee (50 Years) of the start of radiological work at Lowestoft
- In 2002, MAFF was absorbed into the **Department for Environment, Food and Rural Affairs** (Defra), thus making Cefas an Executive Agency of Defra



Cefas radiological monitoring

Managing the risk from radioactivity

Components of managing risk; Cefas capabilities

- Design and implementation of complex sampling and analytical programmes
- Environmental sample collection and preparation
- Quantitative radioanalysis (radiometric and radiochemistry) over a range of activity concentrations (mBq to MBq)
- Radiological dose assessment
- Habits surveys
- Emergency response capability (laboratory including a mobile monitoring unit)
- Predictive incident modelling (e.g. Rad-Spill)
- Quality Standards - Cefas' Lowestoft Laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2010

RIFE - 21

Radioactivity in Food and the Environment, 2015



2016



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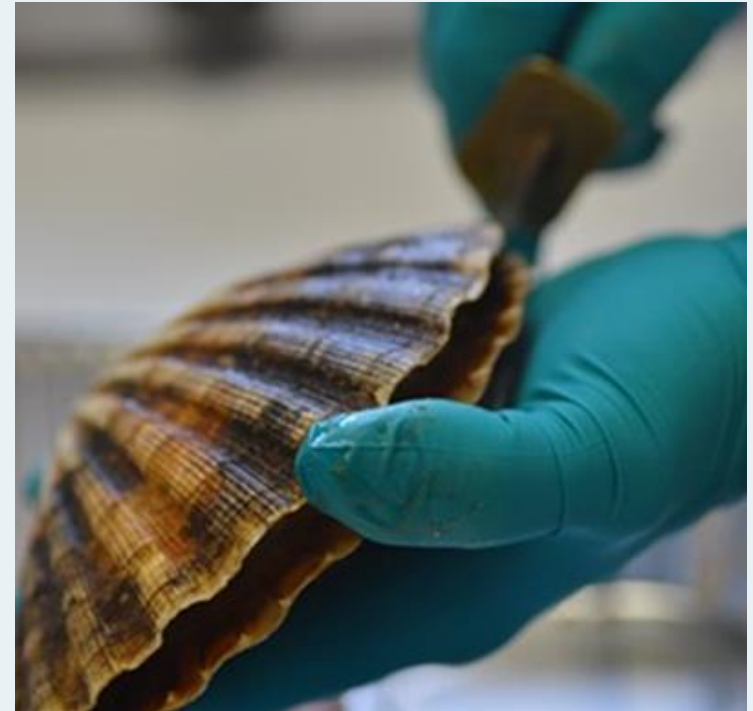
Best-practice guidelines - A UK review



Best-practice guidelines (cont.)

The work carried out for this study included:

- reviewing the literature on guidance and standards on sample collection protocols and radiological monitoring of the environment
- identifying best practice techniques for individual environmental media and monitoring tasks
- preparing guidance notes to implement these techniques



Best-practice guidelines (cont.)

Critical evaluation of the literature revealed that:

- the majority of references were quite generic
- although they provide important background, the references do not offer sufficient detail nor provide scientific validation (for example, by experimental evidence) to enable step-by-step instruction to be cited in the style of a Standard Operating Procedure (SOP)
- protocols were not necessarily developed or described for the specific objectives required



Best-practice guidelines (cont.)

Table 4a: Continued – Inter-tidal monitoring

Sample type	Objective	General	Sampling/Monitoring	Sample preparation
Fish	<ul style="list-style-type: none"> • Critical group dose – To monitor the radiological exposure pathway from consumption of radioactivity in fish. • Reassurance – Provide reassurance through the detection and monitoring of abnormal releases, contaminated foodstuffs. • Environmental indicator - Monitor the long-term behaviour of radionuclides in foodstuffs arising from routine authorised releases. • Baseline – To provide a baseline in the event of a radiological incident. • Distribution – Determine the spread of radionuclides through foodstuffs/the environment from radioactivity arising from routine authorised releases • Model check – Provide data that, along with other monitoring of sediment and seawater, may be useful to check reported discharges and dispersion and transfer models. 	<ul style="list-style-type: none"> • Select species to meet monitoring objective (for example, benthic versus pelagic, stage of growth, availability in the fishing ground). • Report results as Bq/kg (fresh weight). 	<ul style="list-style-type: none"> • Correctly identify species caught by net or line. • Store the sample to prevent deterioration in transit to the lab (for example in cool, dark conditions, cool box). 	<ul style="list-style-type: none"> • Store samples at laboratory to prevent degradation and loss of volatiles, if appropriate (e.g. chill at about 4°C or freeze). • Prepare the raw edible fraction for analysis. Culinary preparation may need to be taken into account. • Dry sample to constant weight (e.g. oven dry 40 – 105°C, freeze-dry), but analyse fresh for volatile radionuclides. • Record dry/wet ratio. • Select a representative sub-sample for analysis (for example, by homogenising dry sample in mill or blending fresh samples. Cone and quarter if appropriate).



Best-practice guidelines (cont.)

Objectives that influence management:

- Critical group dose: including determining the group of people who consume the most fisheries products (quantity and type, from habits surveys)
- Environmental indicators: establishing species that are the most prolific, good adsorption rates of radionuclides and can be used as tools
- Establishing baseline: determining existing “contamination” levels to assess the magnitude of increase from incidents
- Distribution: mapping of radionuclide concentrations in different marine species in time and space (including model predictions)



Best-Practice Management of Measurements of Radionuclides in Fishery Products

What was Best-Practice ?

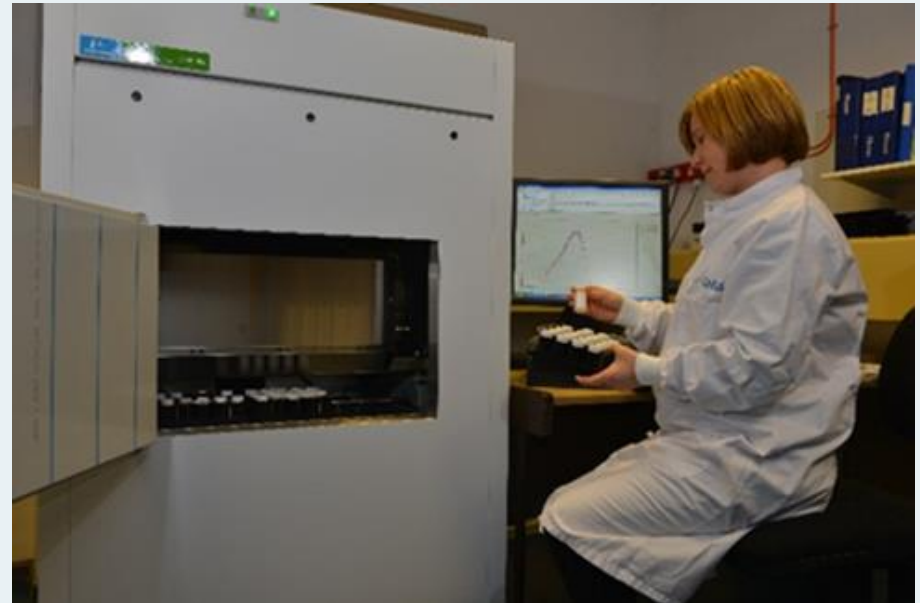
- **Best-practice** – having the fundamental capability (methods instruments, tools, resources, skills, supporting knowledge etc.) securely in place and fully operational
- **Best-practice** – the ability to adapt (sometimes very quickly) existing fundamental capability to suit the specific requirements of the accident/incident scenario
- **No such single Best-practice** – that covers all eventualities in the event (response phase) – as singularly unique



Best-Practice Fundamentals

Capability and responsiveness:

- Laboratory facilities (infrastructure)
- Specialist staff (various disciplines)
- Laboratory equipment including specialised instruments
- Radiological Assessment and habits knowledge
- Financial resources



Best-practice Fundamentals (cont.) 2nd Tier

Objectives:

- Routinely used methods
- SOPs (sampling and analysis)
- Staff expertise to adapt methods quickly
- *In-situ* dose assessment for review purposes and planning (interpretation)
- Ability to continuously optimise methods (limits of detection, counting times, sample size, etc.) based on available information from the incident
- Fisheries database (farm data e.g. Starfish)



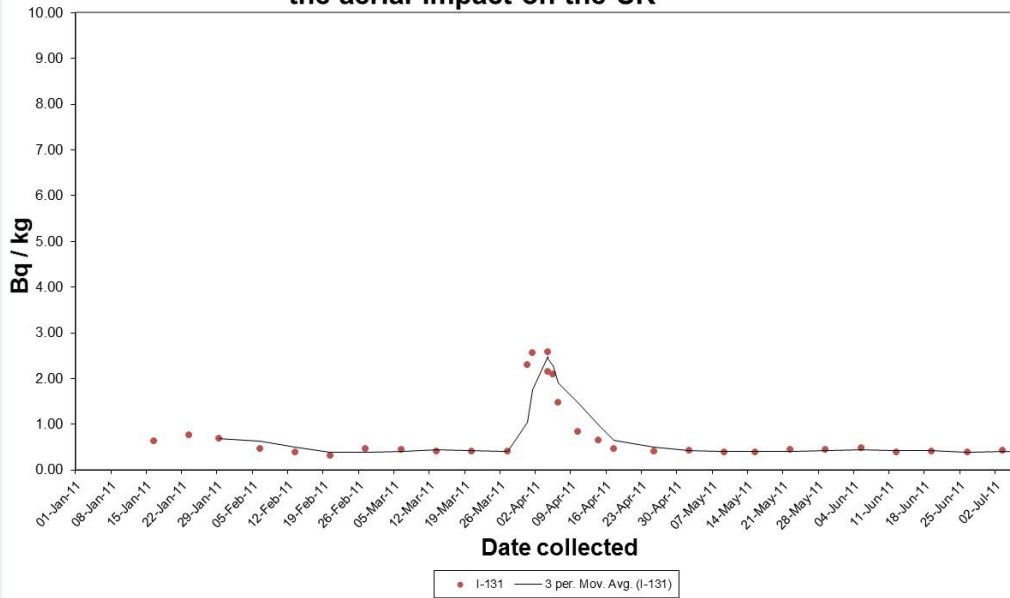
Alexander Litvinenko



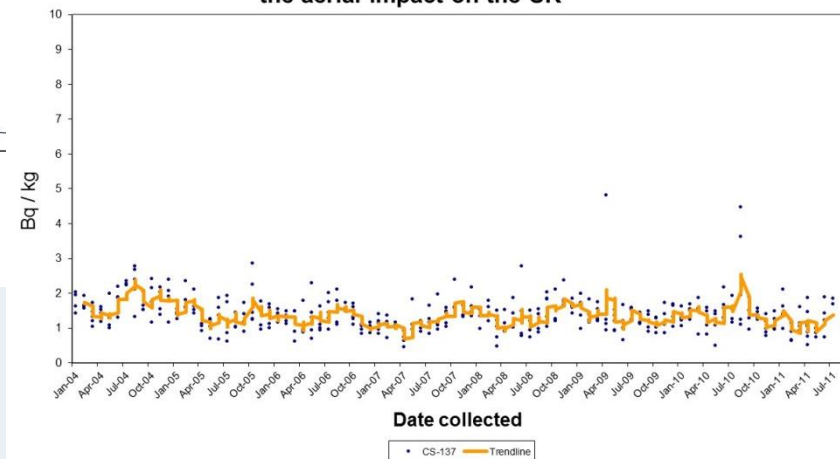
Best Practice Examples - Response Phase

- Activities involving testing and review until levels return to acceptable levels

Detection of I-131 from Fukushima to determine the aerial impact on the UK

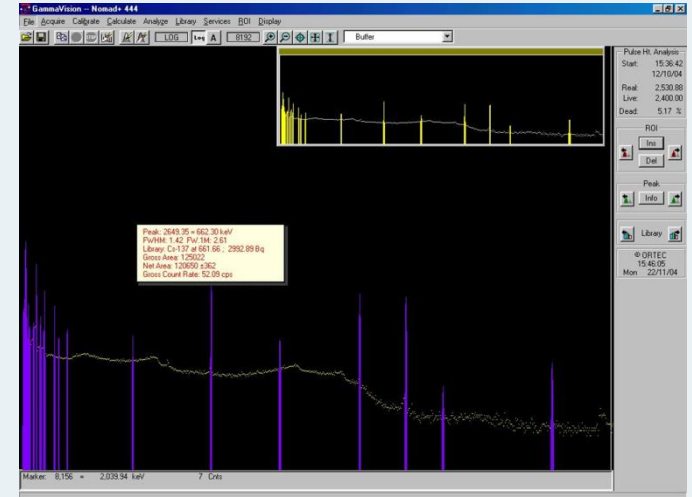


Detection of Cs-137 from Fukushima to determine the aerial impact on the UK



Best Practice Examples - Response Phase (cont.)

- Mobile monitoring Unit (Gamma-ray)



Best Practice Examples - Recovery Phase

- Activities involving risk evaluation, planning, testing and review

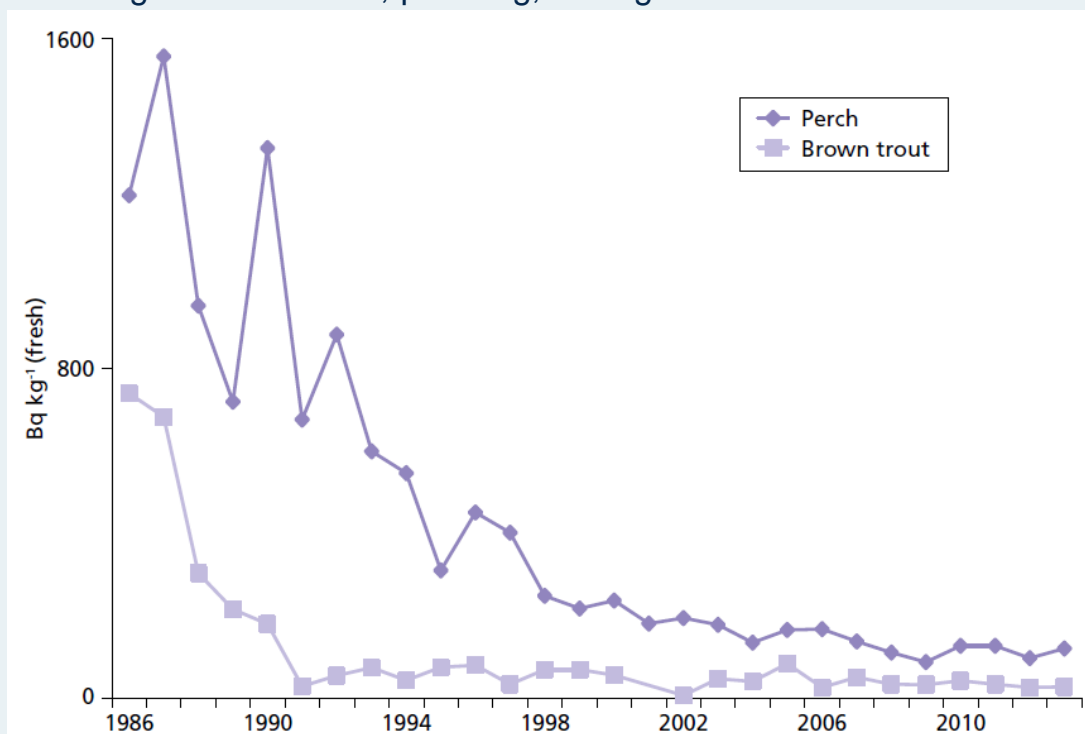


Figure 8.3. Caesium-137 concentrations in freshwater fish from Devoke Water, Cumbria 1986-2013

Best Practice Summary

Management Requirements:

- Radioanalytical laboratory(s) infrastructure(s) that is sustainable and robust
- A proven track record of on-going, large-scale routine monitoring (year-on-year), with well established and reliable procedures/supporting instrumentation for the determination of a large variety of environmental radionuclides
- Emergency response capability that can be;
 1. mobilised for recovery phase (mobile monitoring unit)
 2. enhanced in terms of scale of monitoring (laboratory capacity and throughput)
 3. expanded by experienced staff, to adapt routinely used methods (and interpret data) to specific requirements of the incident (recovery phase)



Thank you for the invitation, And for your attention

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