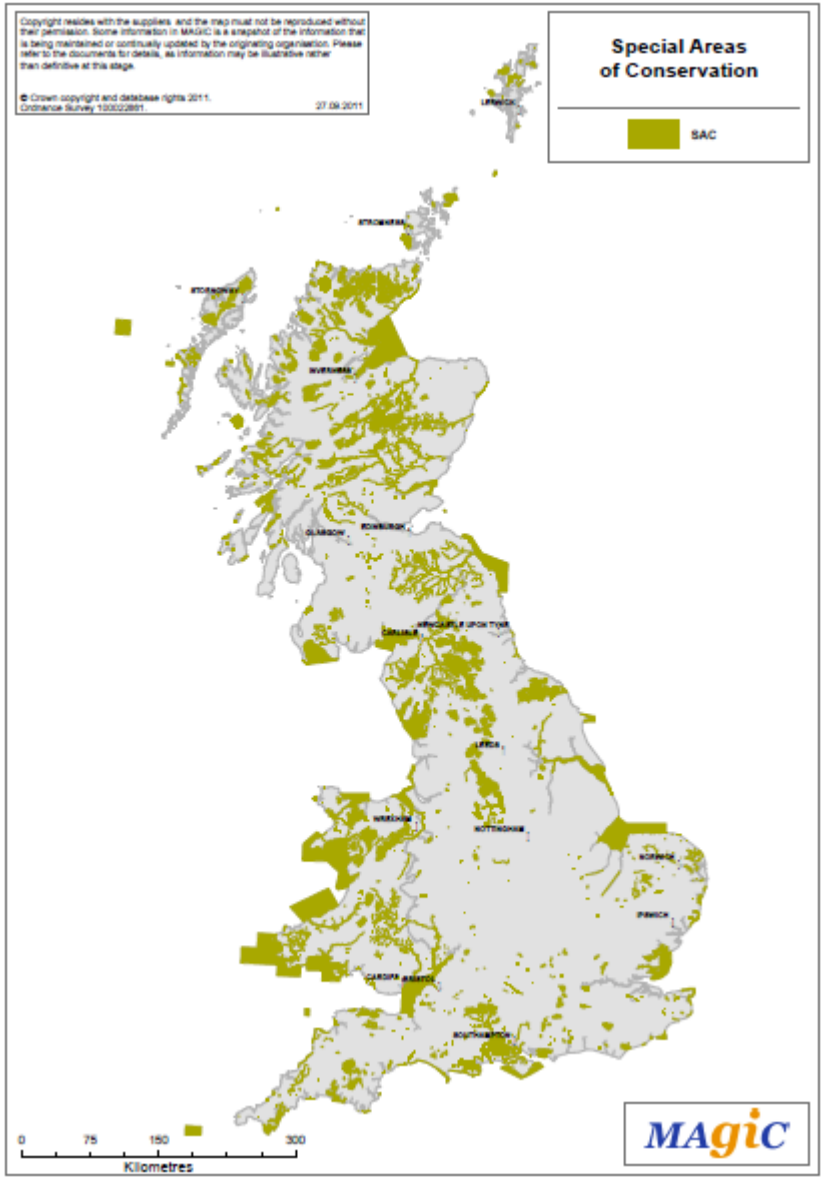
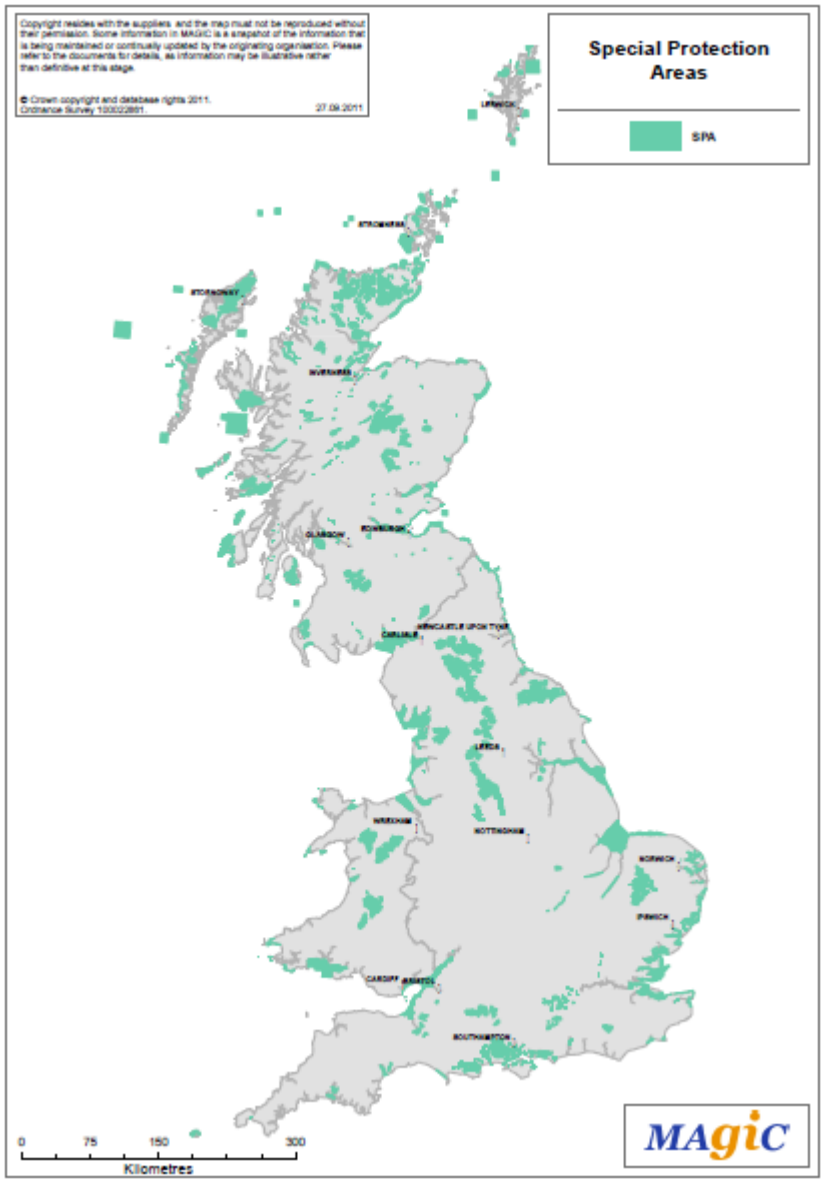
UK Habitat assessments for radioactive substances

Legislative Framework

- **Europe: Habitats & Birds Directives**
  On the conservation of natural habitats and of wild flora and fauna

- **UK**: **Conservation (Natural Habitats) Regulations 1994**
  Implements the Habitats Directive in the UK.
  Requires steps to maintain and restore to favourable conservation status of habitats and species of Community level interest


Copyright resides with the suppliers, and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the documents for details, as information may be illustrative rather than definitive at this stage.
© Crown copyright and database rights 2011. Ordnance Survey 100032661.
27.09.2011
Special Areas of Conservation
SAC
0
75
150
300
Kilometres
MAGIC

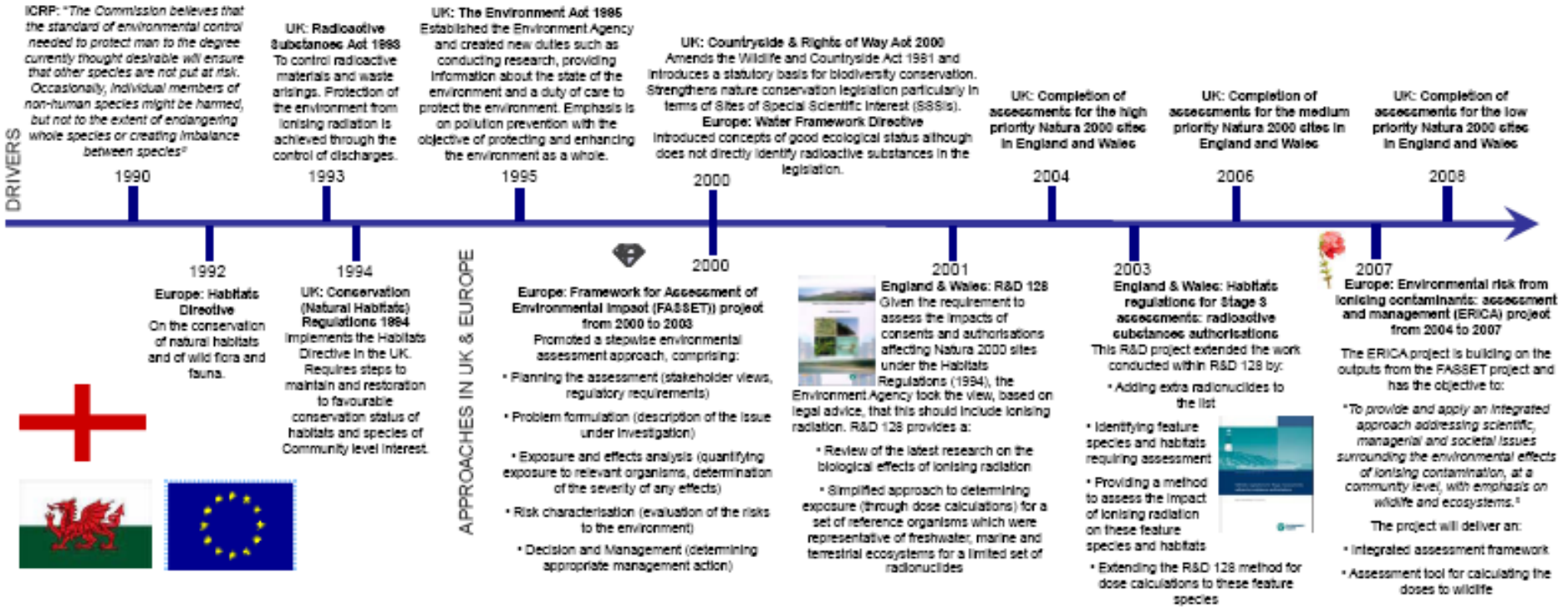

Copyright resides with the suppliers, and the map must not be reproduced without their permission. Some information in MAGIC is a snapshot of the information that is being maintained or continually updated by the originating organisation. Please refer to the documents for details, as information may be illustrative rather than definitive at this stage.
© Crown copyright and database rights 2011. Ordnance Survey 100032661.
27.09.2011
Special Protection Areas
SPA
0
75
150
300
Kilometres
MAGIC

The Environment Agency's Role

- Has a duty to comply with the E[illegible]ds and Habitats Directives
- Obligations are to review
  - Existing authorisations [illegible]sents, licences and permissions for ch[illegible]s
  - All requests fo[illegible]ations to existing or new applicatio[illegible]
  - Ensur[illegible]no Agency-authorised activity or pe[illegible]on results in an adverse effect, either directly or [illegible]irectly on the integrity of identified European sites (Natura 2000 sites)

Pressure is from conservation legislation

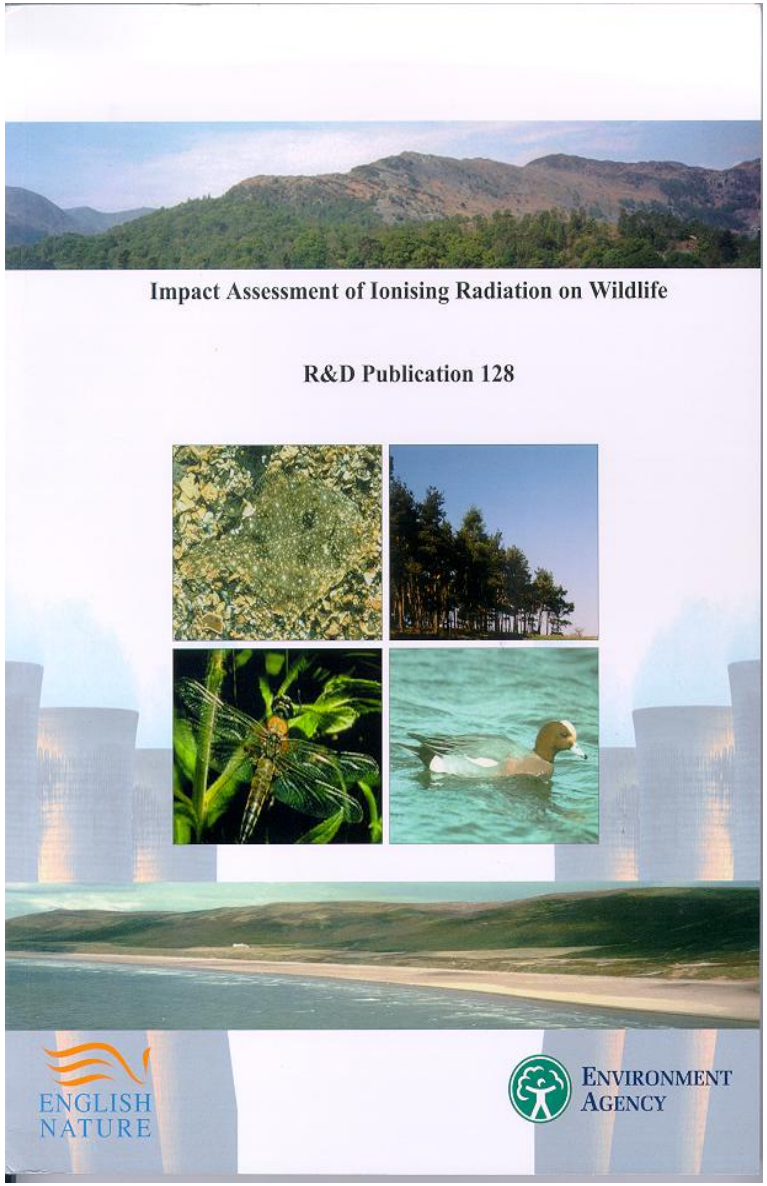
Timeline


DRIVERS
APPROACHES IN UK & EUROPE
ICRP: "The Commission believes that the standard of environmental control needed to protect man to the degree currently thought desirable will ensure that other species are not put at risk. Occasionally, individual members of non-human species might be harmed, but not to the extent of endangering whole species or creating imbalance between species"
1990
1992
Europe: Habitats Directive
On the conservation of natural habitats and of wild flora and fauna.
UK: Radioactive Substances Act 1993
To control radioactive materials and waste arisings. Protection of the environment from ionising radiation is achieved through the control of discharges.
1993
1994
UK: Conservation (Natural Habitats) Regulations 1994
Implements the Habitats Directive in the UK. Requires steps to maintain and restoration to favourable conservation status of habitats and species of Community level interest.
UK: The Environment Act 1995
Established the Environment Agency and created new duties such as conducting research, providing information about the state of the environment and a duty of care to protect the environment. Emphasis is on pollution prevention with the objective of protecting and enhancing the environment as a whole.
1995
2000
Europe: Framework for Assessment of Environmental Impact (FASSET)) project from 2000 to 2003
Promoted a stepwise environmental assessment approach, comprising:
• Planning the assessment (stakeholder views, regulatory requirements)
• Problem formulation (description of the issue under investigation)
• Exposure and effects analysis (quantifying exposure to relevant organisms, determination of the severity of any effects)
• Risk characterisation (evaluation of the risks to the environment)
• Decision and Management (determining appropriate management action)
UK: Countryside & Rights of Way Act 2000
Amends the Wildlife and Countryside Act 1981 and introduces a statutory basis for biodiversity conservation. Strengthens nature conservation legislation particularly in terms of Sites of Special Scientific Interest (SSSIs).
Europe: Water Framework Directive
Introduced concepts of good ecological status although does not directly identify radioactive substances in the legislation.
2000
2001
England & Wales: R&D 128
Given the requirement to assess the impacts of consents and authorisations affecting Natura 2000 sites under the Habitats Regulations (1994), the Environment Agency took the view, based on legal advice, that this should include ionising radiation. R&D 128 provides a:
• Review of the latest research on the biological effects of ionising radiation
• Simplified approach to determining exposure (through dose calculations) for a set of reference organisms which were representative of freshwater, marine and terrestrial ecosystems for a limited set of radionuclides
UK: Completion of assessments for the high priority Natura 2000 sites in England and Wales
2004
2003
England & Wales: Habitats regulations for Stage 3 assessments: radioactive substances authorisations
This R&D project extended the work conducted within R&D 128 by:
• Adding extra radionuclides to the list
• Identifying feature species and habitats requiring assessment
• Providing a method to assess the impact of ionising radiation on these feature species and habitats
• Extending the R&D 128 method for dose calculations to these feature species
UK: Completion of assessments for the medium priority Natura 2000 sites in England and Wales
2006
2007
Europe: Environmental risk from ionising contaminants: assessment and management (ERICA) project from 2004 to 2007
The ERICA project is building on the outputs from the FASSET project and has the objective to:
"To provide and apply an integrated approach addressing scientific, managerial and societal issues surrounding the environmental effects of ionising contamination, at a community level, with emphasis on wildlife and ecosystems."
The project will deliver an:
• Integrated assessment framework
• Assessment tool for calculating the doses to wildlife
UK: Completion of assessments for the low priority Natura 2000 sites in England and Wales
2008

Assessment Approach

R&D 128 (2001)

- ^{3}H, ^{14}C , ^{32}P, ^{35}S, ^{60}Co, ^{99}Tc, ^{90}Sr, ^{106}Ru, ^{125}I, ^{129}I, ^{131}I, ^{137}Cs, ^{210}Po, ^{226}Ra, ^{234}Th, ^{238}U, $^{239+240}Pu$, ^{241}Am, ^{85}Kr, ^{41}Ar
- Advice on use of methodology, states assumptions and constraints
- Spreadsheet tools - enter water, air, soil or biota concentrations to calculate dose rates (μGy/h)
- Uses concept of “reference” organism



Reference Organism Concept

"*a series of entities that provide a basis for the estimation of radiation dose rate to a range of organisms which are typical, or representative, of a contaminated environment. These estimates, in turn, would provide a basis for assessing the likelihood and degree of radiation effects*"

Strand and Larsson, 2001

Reference Organisms in R&D 128

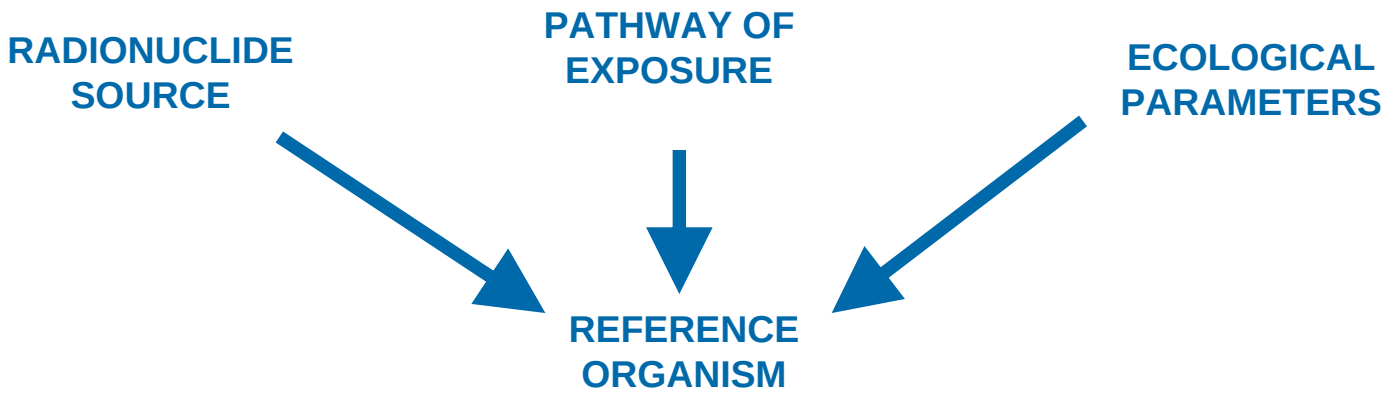
Freshwater	Estuarine/marine	Terrestrial
Bacteria	Bacteria	Bacteria
Macrophyte	Macrophyte	Lichen
Phytoplankton	Phytoplankton	Tree, Shrub, Herb
Zooplankton	Zooplankton	Seed
Benthic Mollusc	Benthic Mollusc	Fungus
Small Benthic Crustacean	Small Benthic Crustacean	Caterpillar
Large Benthic Crustacean	Large Benthic Crustacean	Ant
Pelagic Fish	Pelagic Fish	Bee
Benthic Fish	Benthic Fish	Woodlouse
Amphibian	Fish Egg	Earthworm
Duck	Seabird	Herbivorous Mammal
Aquatic Mammal	Seal	Carnivorous Mammal
	Whale	Rodent
		Bird & Bird Egg
		Reptile

Assessment Methodology

REFERENCE ORGANISM

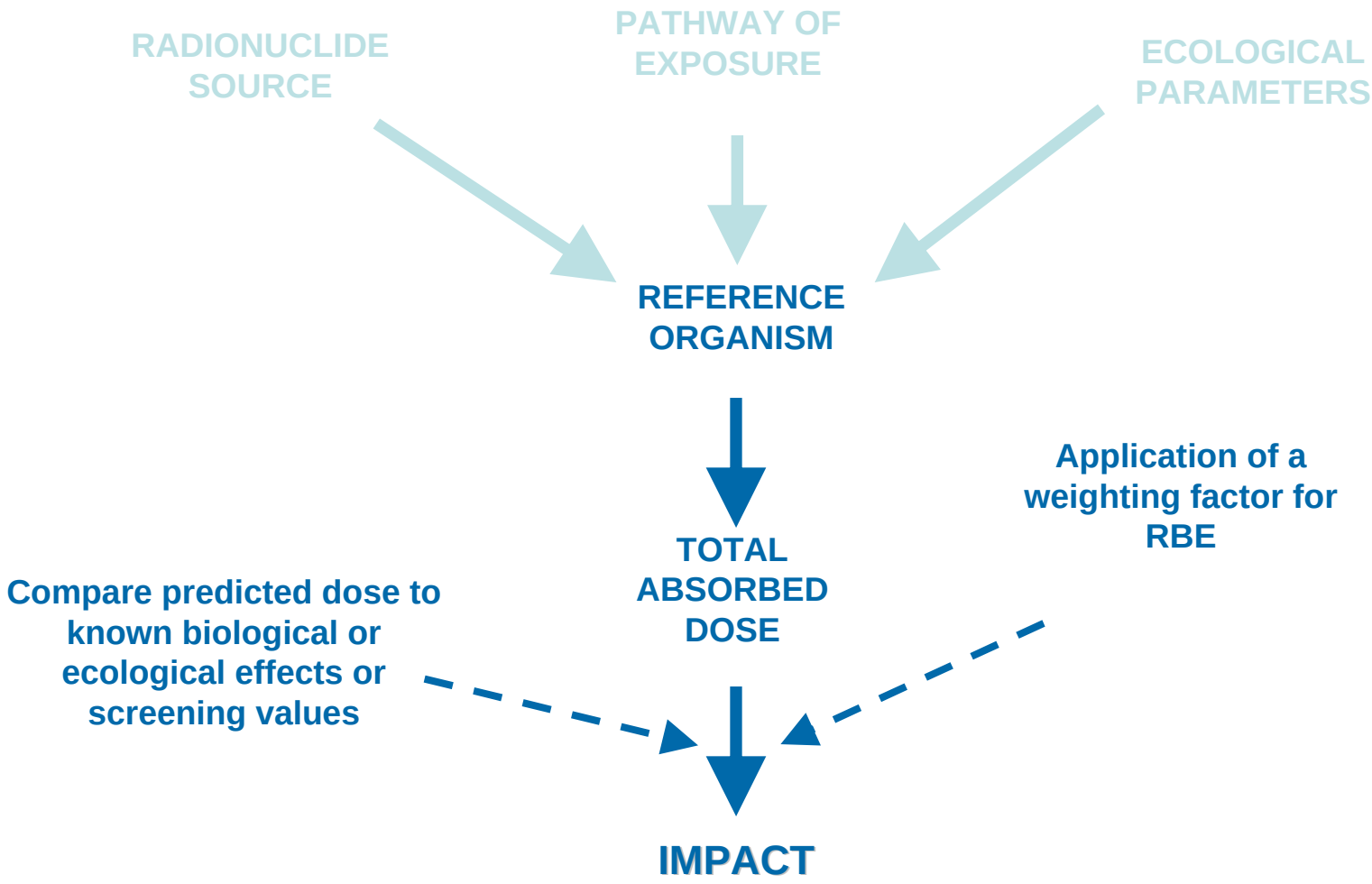
IMPACT

Assessment Methodology



IMPACT

Assessment Methodology



Staged assessment application

- Stage 1 – determine link between discharge and Natura 2000 site
- Stage 2 - R&D 128 used to calculate dose per unit release values for reference organisms (µGy h^{-1} per TBq)
  - Assume discharge at permit limits and impact from combined discharges (air, sewer, river, coastal waters) and sources
- Resulting doses compared to screening level of 5 µGy h^{-1} as agreed with (then) English Nature

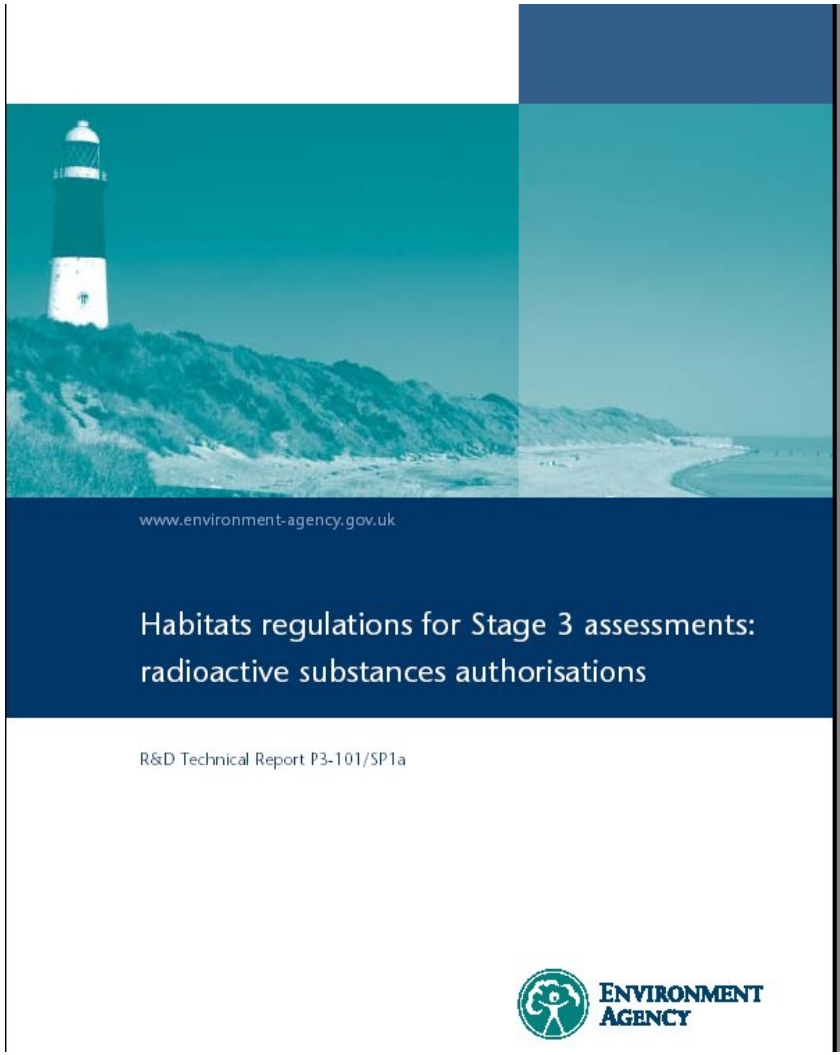
Stage 1 and 2 assessment outputs

- Approximately 100 authorisations exceeded the **screening level** at 51 Natura 2000 sites & thus required further assessment

- Note this was mainly due to choice of analogue
  - Initial use of “other alpha” and “other beta/gamma” categories
  - Limited choice of analogues from the R&D128 radionuclide list

Stage 3 assessment

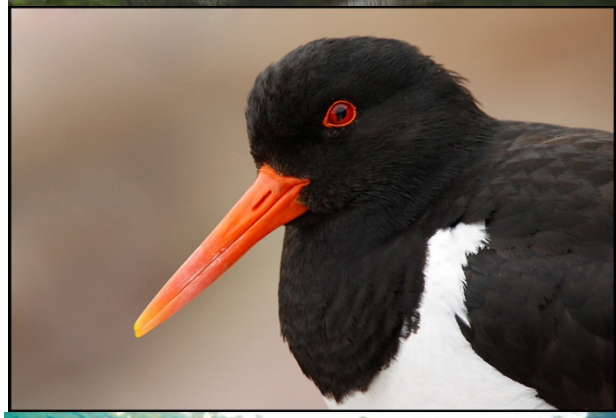
- Dose per unit release values calculated for reference organisms and **feature species and habitats**
- Threshold of 40 μGy h^{-1} agreed with English Nature, below which it can be concluded that there will be no adverse effect on habitat site integrity

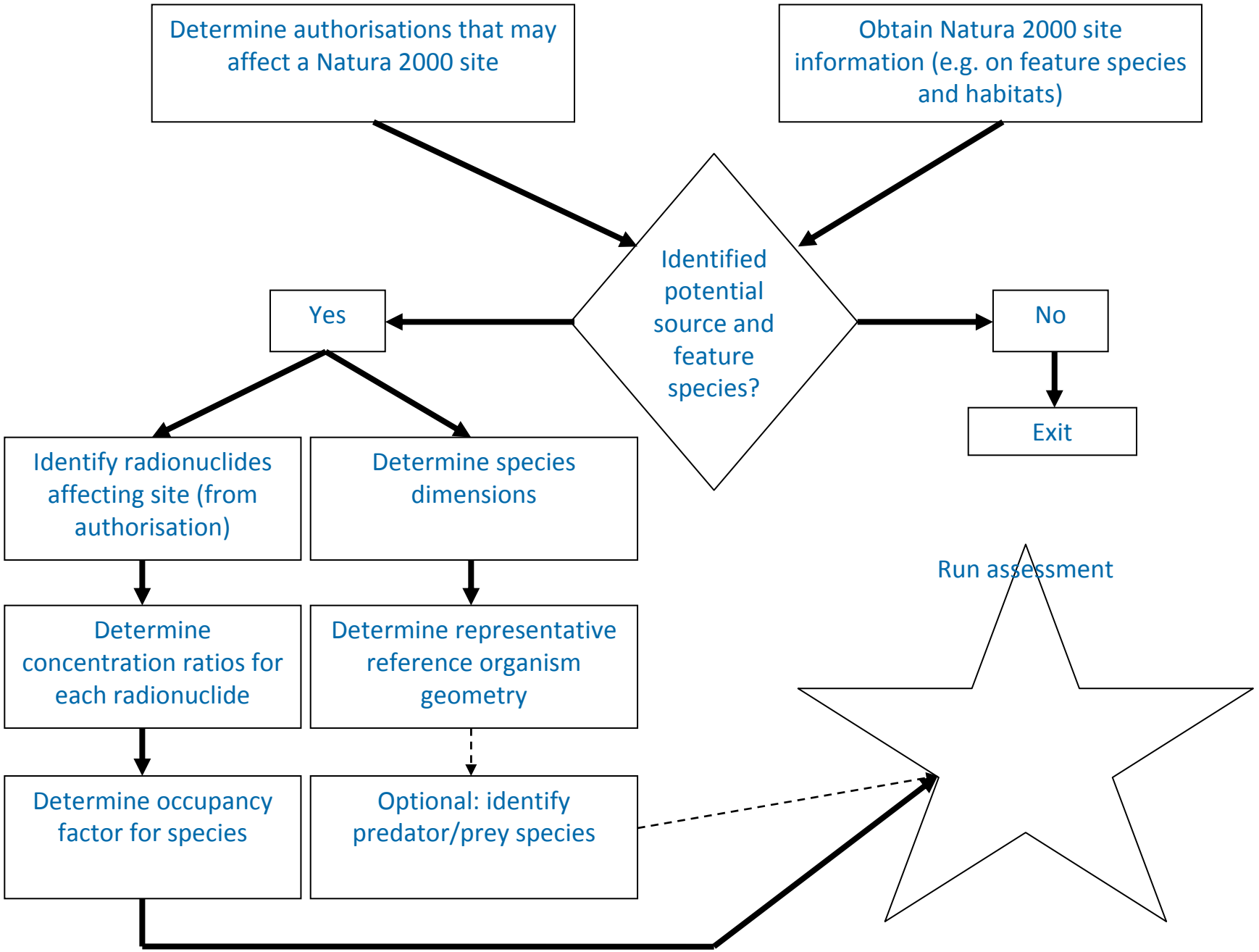


Feature species & habitats

- **Feature Species (e.g.)**:
  Avocet, Bar-tailed Godwit, Bittern, Black-tailed Godwit, Curlew, Dunlin, Gadwall, Golden plover, Grey plover, Hen Harrier, Knot, Lapwing, Little tern, Marsh Harrier, Oystercatcher, Redshank, Ringed plover, Ruff, Sanderling, Scaup, Shelduck, Snipe, Tufted duck, Wigeon

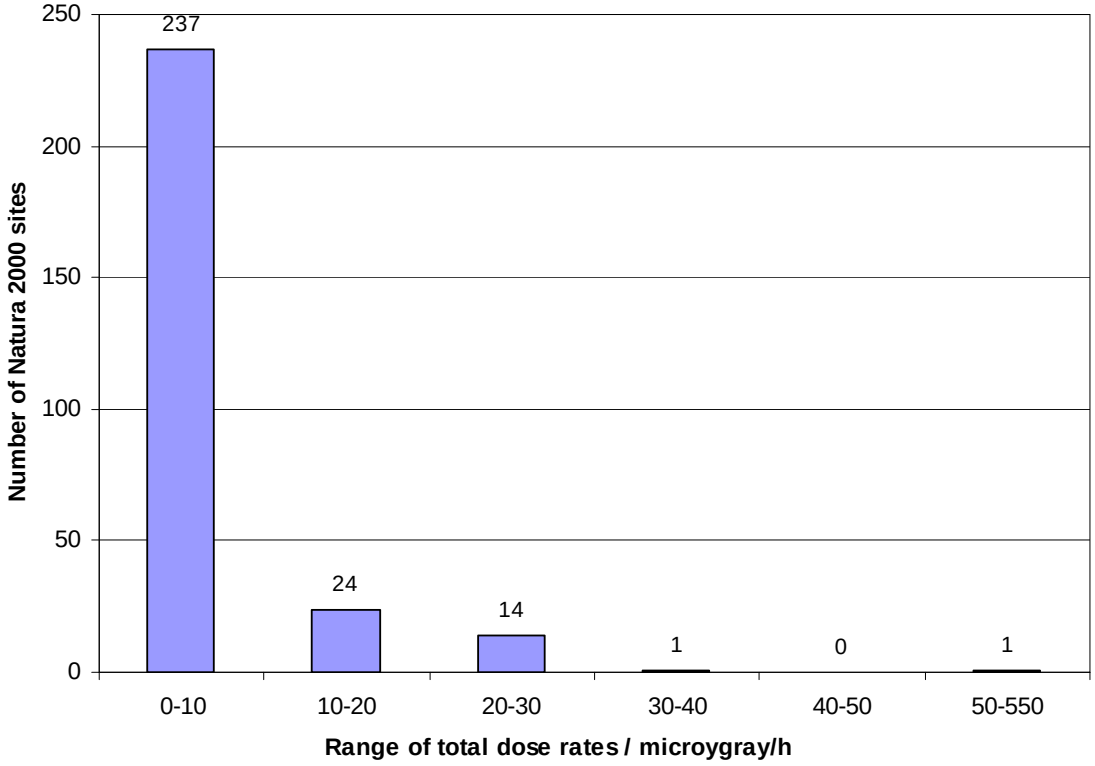
- **Feature Habitats (e.g.)**:
  Birds of uplands, Birds of lowland heaths and brecks, Birds of lowland freshwaters and their margins, Birds of open sea and offshore rocks, Birds of lowland wet grasslands, Birds of farmland, Birds of coastal habitat, Birds of estuarine habitats




Determine authorisations that may affect a Natura 2000 site
Obtain Natura 2000 site information (e.g. on feature species and habitats)
Identified potential source and feature species?
Yes
No
Exit
Identify radionuclides affecting site (from authorisation)
Determine species dimensions
Determine concentration ratios for each radionuclide
Determine representative reference organism geometry
Determine occupancy factor for species
Optional: identify predator/prey species
Run assessment

Assessment results

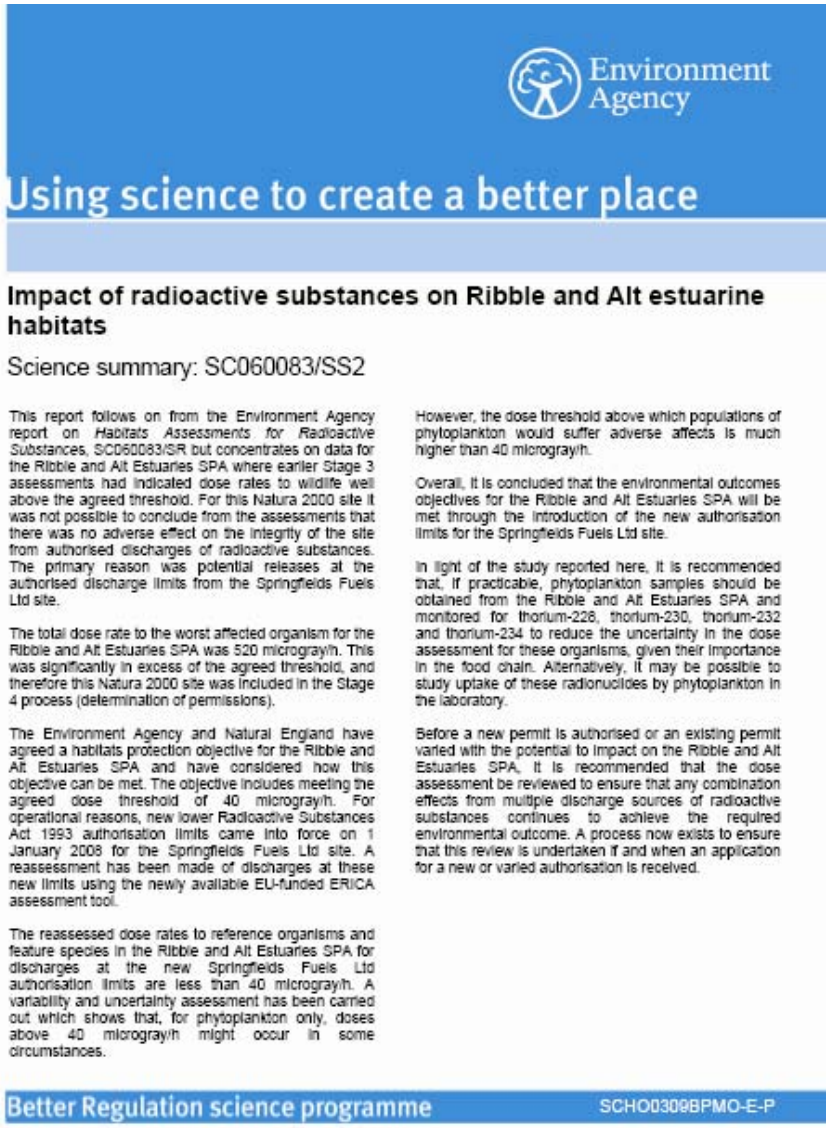
Habitat assessment results



- All but 2 Natura 2000 sites assessed were below 40 μGyh^{-1}

Ribble and Alt Estuaries Assessment

- Initial assessment 520 μGyh^{-1}
- Radionuclides giving dose associated primarily with discharges from Springfields Fuels Ltd



Environment Agency

Using science to create a better place

Impact of radioactive substances on Ribble and Alt estuarine habitats

Science summary: SC060083/SS2

This report follows on from the Environment Agency report on *Habitats Assessments for Radioactive Substances*, SC060083/SR but concentrates on data for the Ribble and Alt Estuaries SPA where earlier Stage 3 assessments had indicated dose rates to wildlife well above the agreed threshold. For this Natura 2000 site it was not possible to conclude from the assessments that there was no adverse effect on the integrity of the site from authorised discharges of radioactive substances. The primary reason was potential releases at the authorised discharge limits from the Springfields Fuels Ltd site.

The total dose rate to the worst affected organism for the Ribble and Alt Estuaries SPA was 520 microgray/h. This was significantly in excess of the agreed threshold, and therefore this Natura 2000 site was included in the Stage 4 process (determination of permissions).

The Environment Agency and Natural England have agreed a habitats protection objective for the Ribble and Alt Estuaries SPA and have considered how this objective can be met. The objective includes meeting the agreed dose threshold of 40 microgray/h. For operational reasons, new lower Radioactive Substances Act 1993 authorisation limits came into force on 1 January 2008 for the Springfields Fuels Ltd site. A reassessment has been made of discharges at these new limits using the newly available EU-funded ERICA assessment tool.

The reassessed dose rates to reference organisms and feature species in the Ribble and Alt Estuaries SPA for discharges at the new Springfields Fuels Ltd authorisation limits are less than 40 microgray/h. A variability and uncertainty assessment has been carried out which shows that, for phytoplankton only, doses above 40 microgray/h might occur in some circumstances.

However, the dose threshold above which populations of phytoplankton would suffer adverse affects is much higher than 40 microgray/h.

Overall, it is concluded that the environmental outcomes objectives for the Ribble and Alt Estuaries SPA will be met through the introduction of the new authorisation limits for the Springfields Fuels Ltd site.

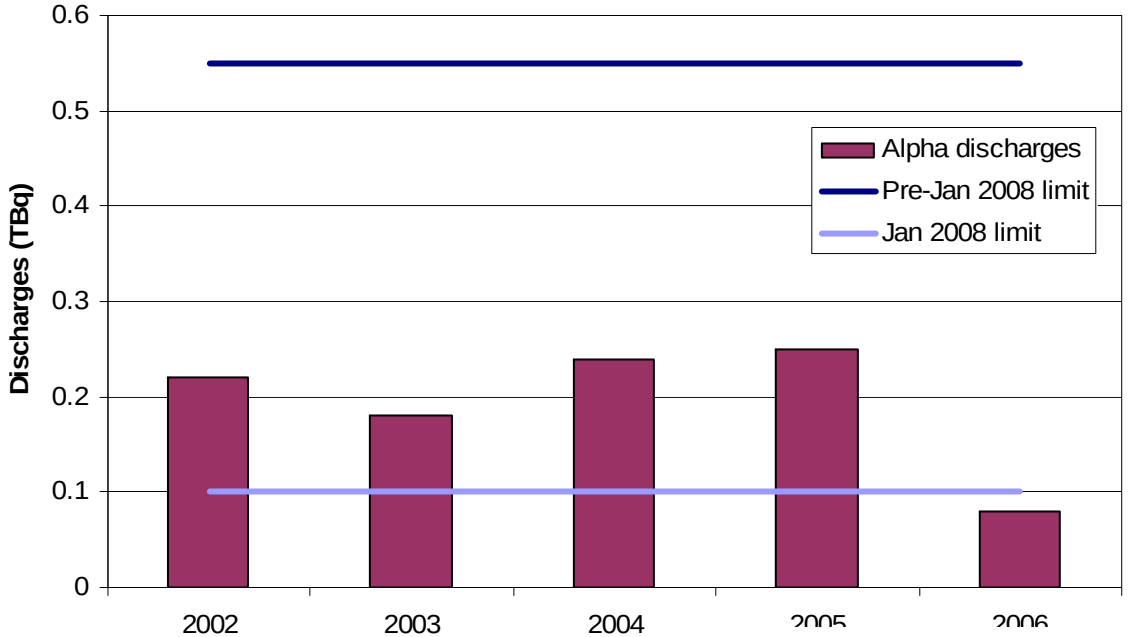
In light of the study reported here, it is recommended that, if practicable, phytoplankton samples should be obtained from the Ribble and Alt Estuaries SPA and monitored for thorium-228, thorium-230, thorium-232 and thorium-234 to reduce the uncertainty in the dose assessment for these organisms, given their importance in the food chain. Alternatively, it may be possible to study uptake of these radionuclides by phytoplankton in the laboratory.

Before a new permit is authorised or an existing permit varied with the potential to impact on the Ribble and Alt Estuaries SPA, it is recommended that the dose assessment be reviewed to ensure that any combination effects from multiple discharge sources of radioactive substances continues to achieve the required environmental outcome. A process now exists to ensure that this review is undertaken if and when an application for a new or varied authorisation is received.

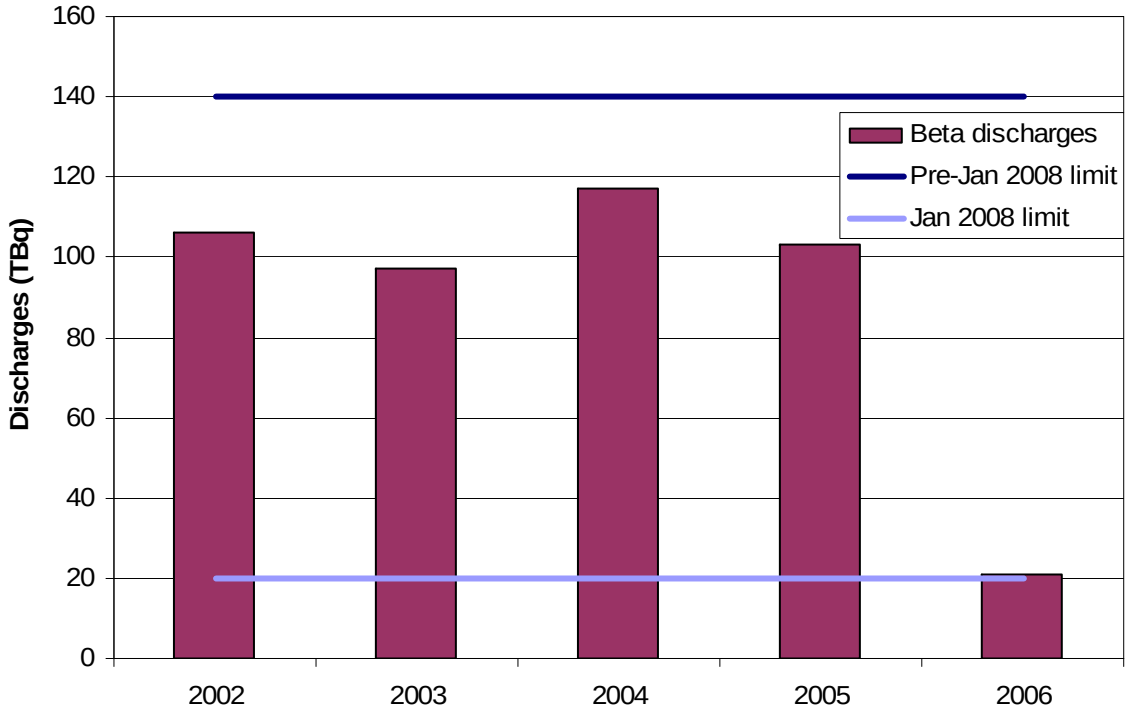
Better Regulation science programme SCHO0309BPMO-E-P

Ribble and Alt Estuaries Habitat Objective

- *To ensure that radioactive substances **do not accumulate** in Littoral Sediment (Coastal Saltmarsh), Littoral Sediment (Mudflats), Coastal Grazing Marsh (Reclaimed Saltmarshes) at levels which compromise the **supply of invertebrate prey** used by birds identified as SPA interest features in English Nature's Regulation 33 (2) advice, or which pose a significant **risk of direct toxicity** to these birds. **The agreed radioactivity dose rate threshold levels should not be breached**.*



- Operational reasons, Springfields permits reduced 1 Jan 2008



Ribble and Alt Estuaries Assessment

- Reassessed using monitoring data & ERICA Tool
- Variability and uncertainty assessments conducted
- All below 40 μGyh^{-1}

Current situation and next steps

Current procedure

- All existing applications reviewed by 2008
- Procedure for all new or variations to permits
- Spreadsheet tools combining human and wildlife assessments available
- Screen against 1 μGy/h triggers central review
- Annual update and check still in compliance

ERICA Tool uses in the UK

- Advised use of ERICA Tool within the Generic Design Assessment (against a 10 μGy/h screening value)
- Updated Sellafield Habitats Assessment (2011)
- Proposed assessment for Dounreay for SEPA

Transfer to ERICA Tool

- 2009 Project (Marie Sanchez)
- Reassessed the original 2004/6 & 8 assessment outputs using DPUC values derived using ERICA Tool
- Comparison of results
  - ERICA generally superior to R&D128 (> number of radionuclides, more robust CR databases, more appropriate levels of conservatism etc.)
- BUT identified problems with freshwater CRs
  - Awaiting publication of IAEA Wildlife CR handbook

Summary

- Need for habitats assessments identified following legal review
- Science development of approach to demonstrate environmental protection
- Results highlighted some sites needing further attention
- Overall dose rates to wildlife are acceptable but are kept under review

Acknowledgements

- Rob Allott, Peter Merrill, Clive Williams, Steve Oliver, John Titley, Marion Dunn, Steve Jones, Jordi Vives, Nick Beresford, Sally Bielby, Deborah Patton, Paul Daniels, Irene Gize, Mike Wood