



Protection of the environment
in normal (planned) situations

Legislative Framework

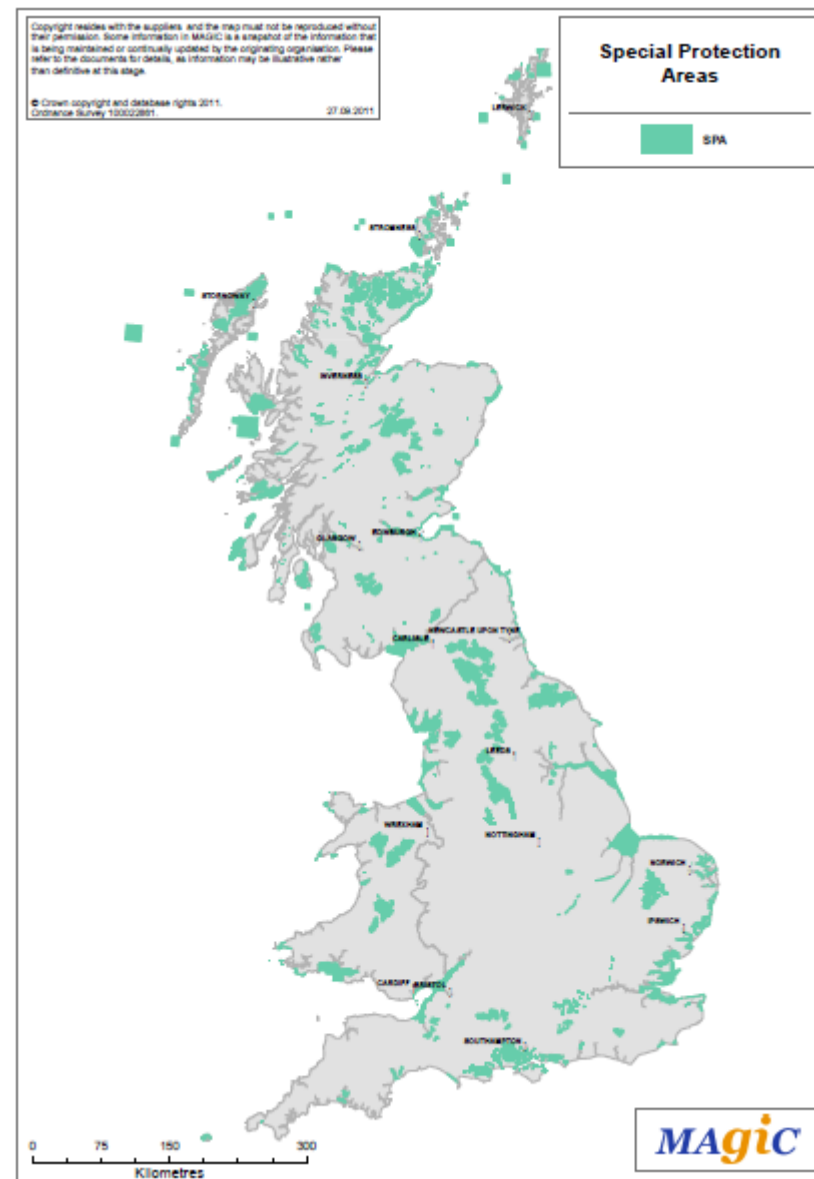
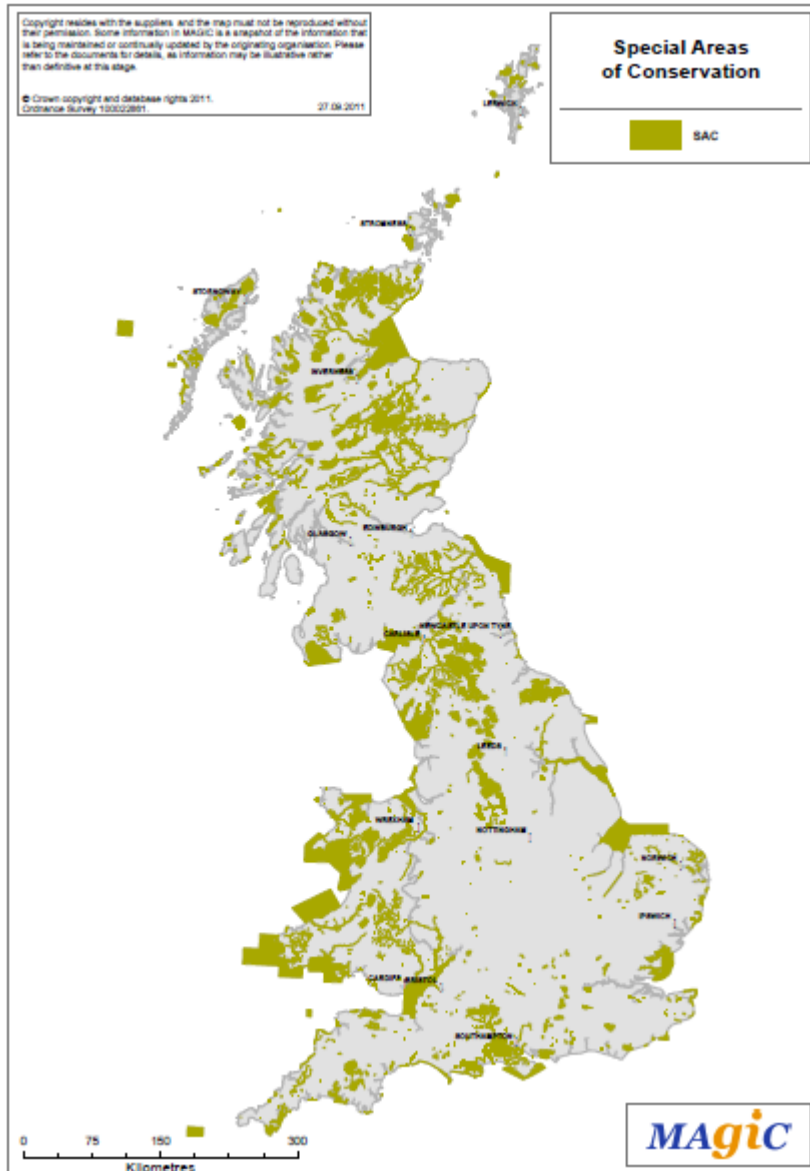
➔ Europe: Habitats & Birds Directives

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

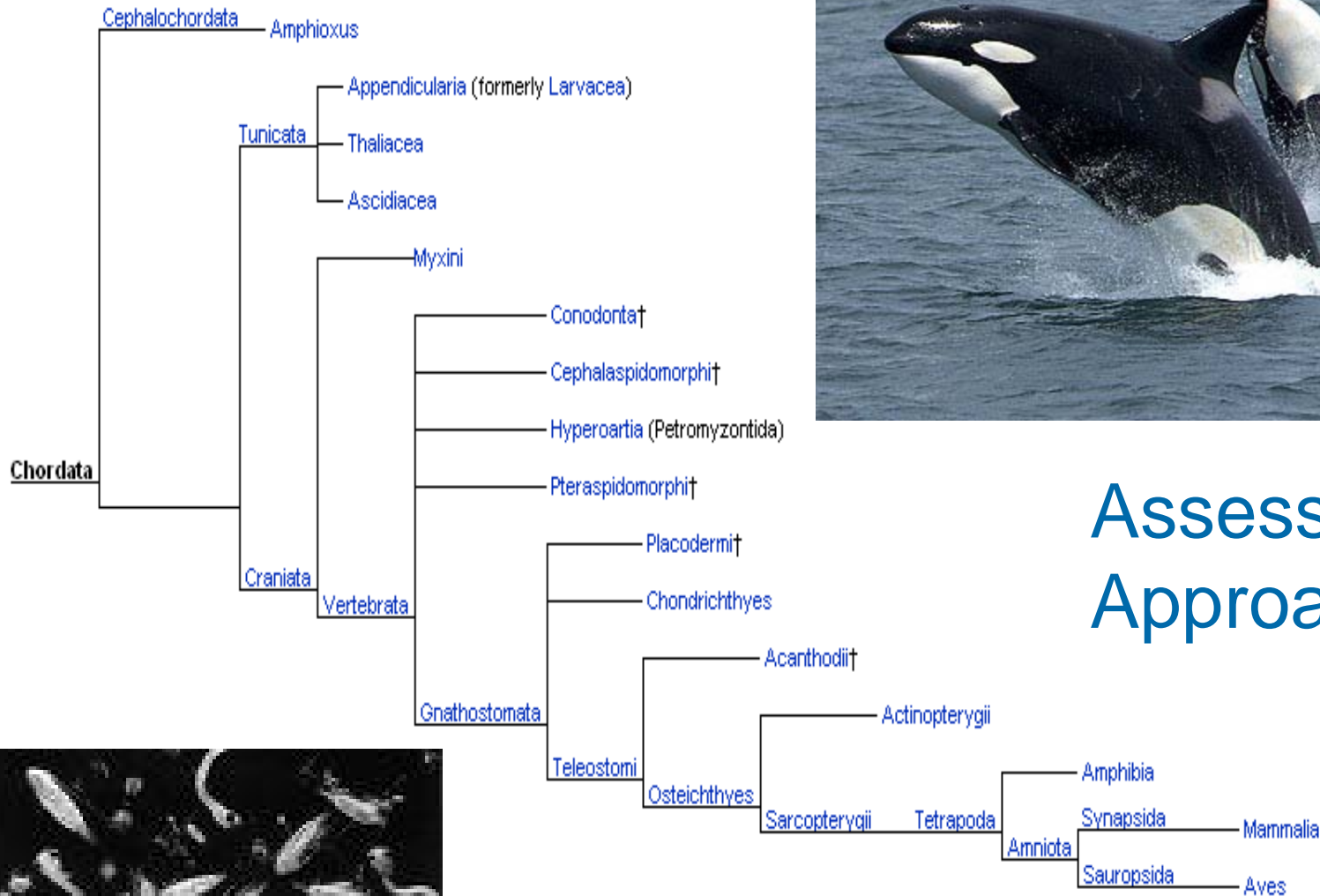


The role of the environment agencies

- ➔ They have a duty to comply with the EU Birds and Habitats Directives
- ➔ Obligations are to review
 - ➔ **Existing** authorisations, consents, licences and permissions for developments
 - ➔ All requests for **variations** to existing or **new** applications
 - ➔ Ensure that no agency-authorized activity or permission results in an adverse effect, either directly or indirectly on the integrity of identified European sites (Natura 2000 sites)

Pressure is from conservation legislation

Phylogeny

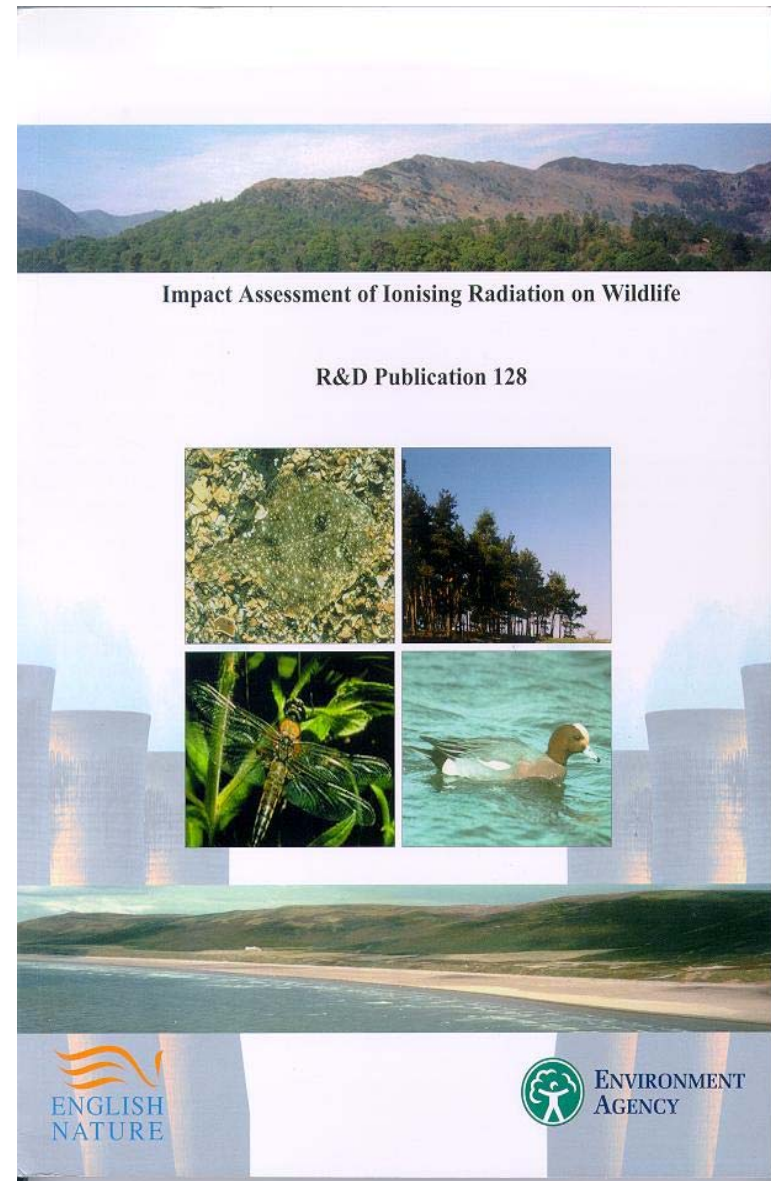


Assessment Approach



R&D 128 (2001)

- ⇒ ^3H , ^{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 , $^{239+240}\text{Pu}$, ^{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 ($\mu\text{Gy/h}$)
- ⇒ 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

Bacteria
Macrophyte
Phytoplankton
Zooplankton
Benthic Mollusc
Small Benthic
Crustacean
Large Benthic
Crustacean
Pelagic Fish
Benthic Fish
Amphibian
Duck
Aquatic Mammal

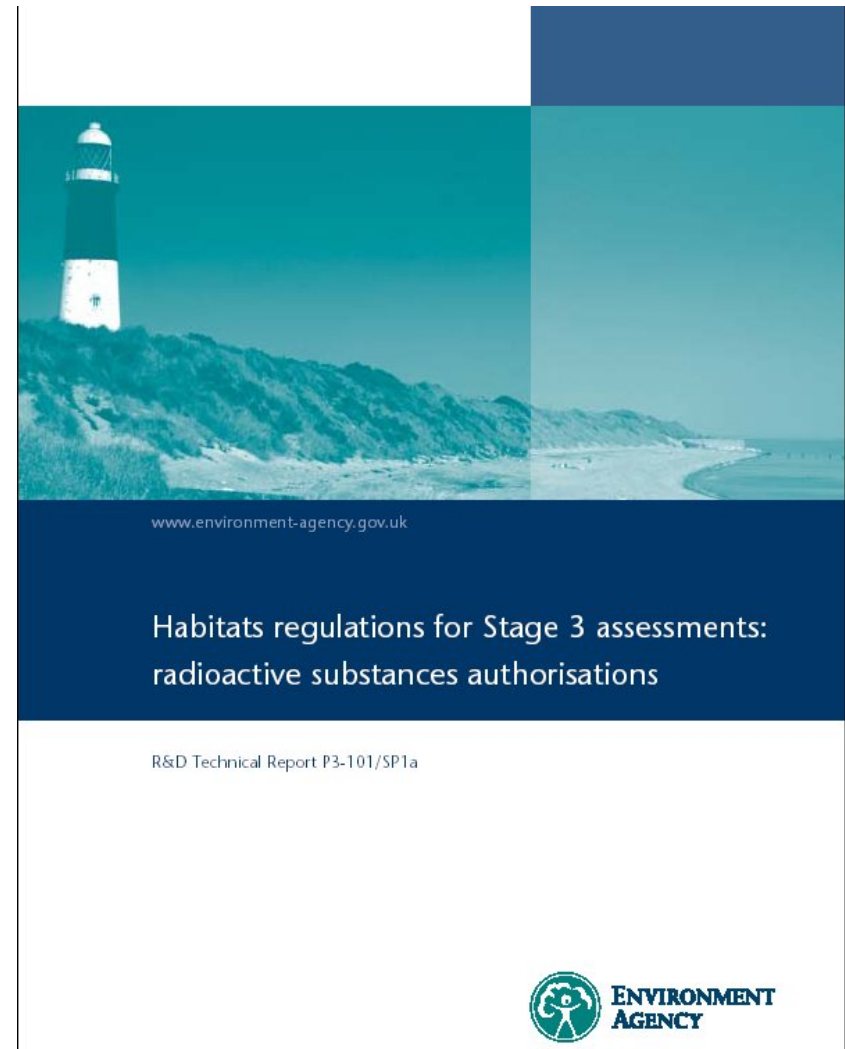
Estuarine/marine

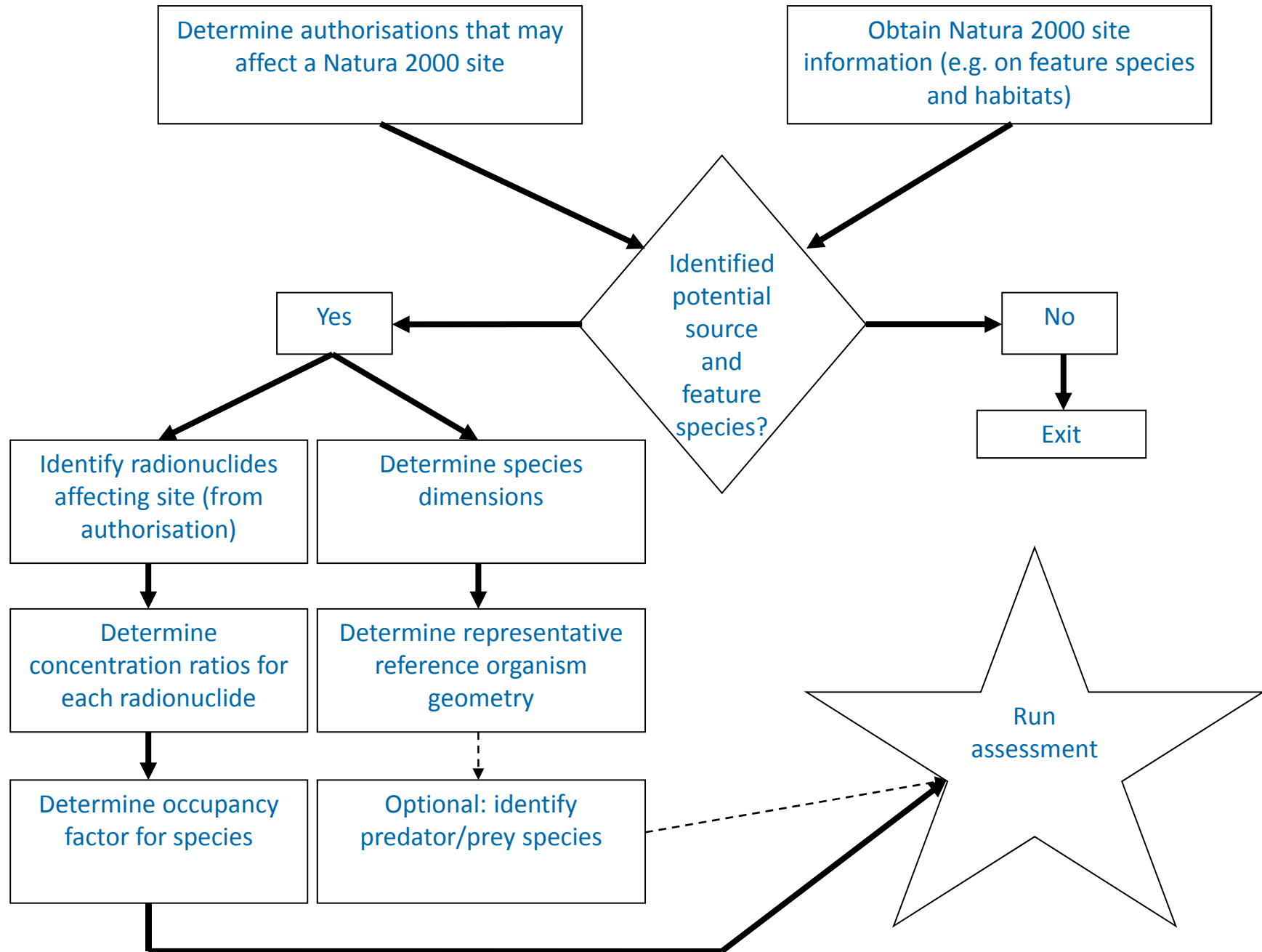
Bacteria
Macrophyte
Phytoplankton
Zooplankton
Benthic Mollusc
Small Benthic
Crustacean
Large Benthic
Crustacean
Pelagic Fish
Benthic Fish
Fish Egg
Seabird
Seal
Whale

Terrestrial

Bacteria
Lichen
Tree, Shrub, Herb
Seed
Fungus
Caterpillar
Ant
Bee
Woodlouse
Earthworm
Herbivorous Mammal
Carnivorous Mammal
Rodent
Bird & Bird Egg
Reptile

**Staged
assessment
application
for radioactive,
chemical
or other stressor**





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

➔ Terrestrial: 55 birds, 4 plants, 2 invertebrates, 2 amphibians, 4 mammals

➔ Aquatic: 3 mammals, 1 invertebrate, 8 fish, 2 reptiles



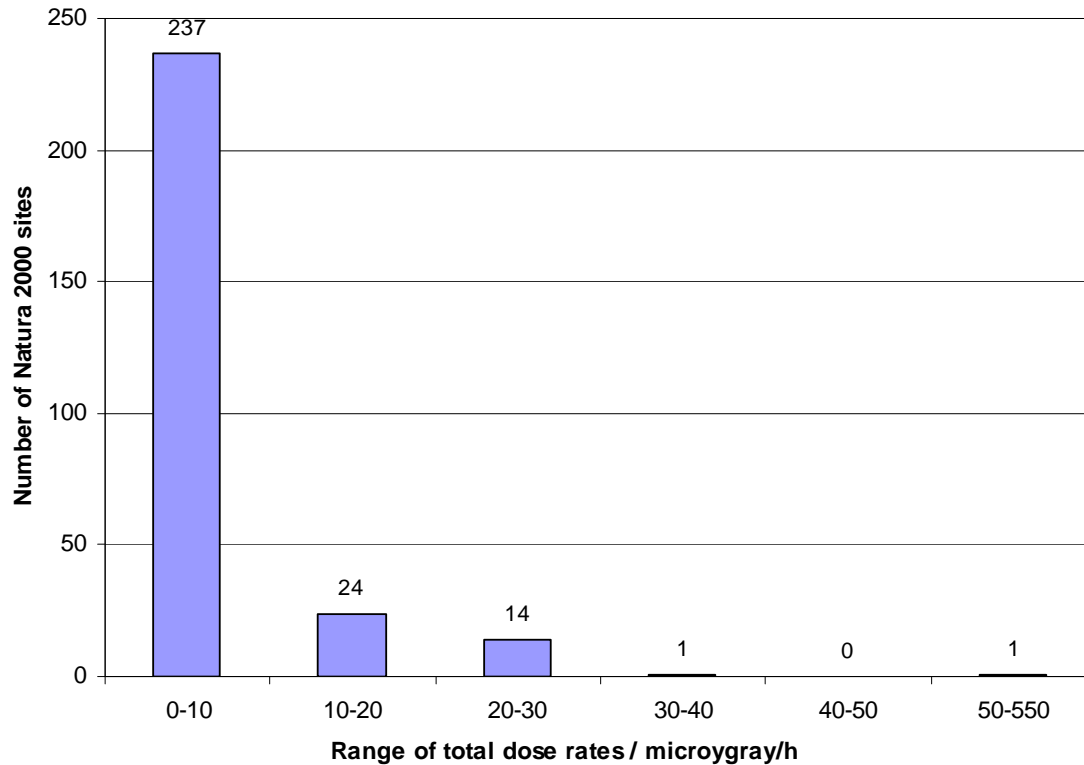
Assessment results



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
 - ➔ Note ERICA compatibility with ICRP RAPs and more radionuclides

Habitat assessment results



➔ All but 2 Natura 2000 sites assessed were below 40 $\mu\text{Gy h}^{-1}$



Habitats assessment for radioactive substances

Better regulation science programme
Science report: SC060083/SR1

Ribble and Alt Estuaries Assessment

➔ Initial assessment 520 $\mu\text{Gy}\cdot\text{h}^{-1}$

➔ Radionuclides giving dose associated primarily with discharges from Springfields Fuels Ltd



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 effects is much higher than 40 microgray/h.

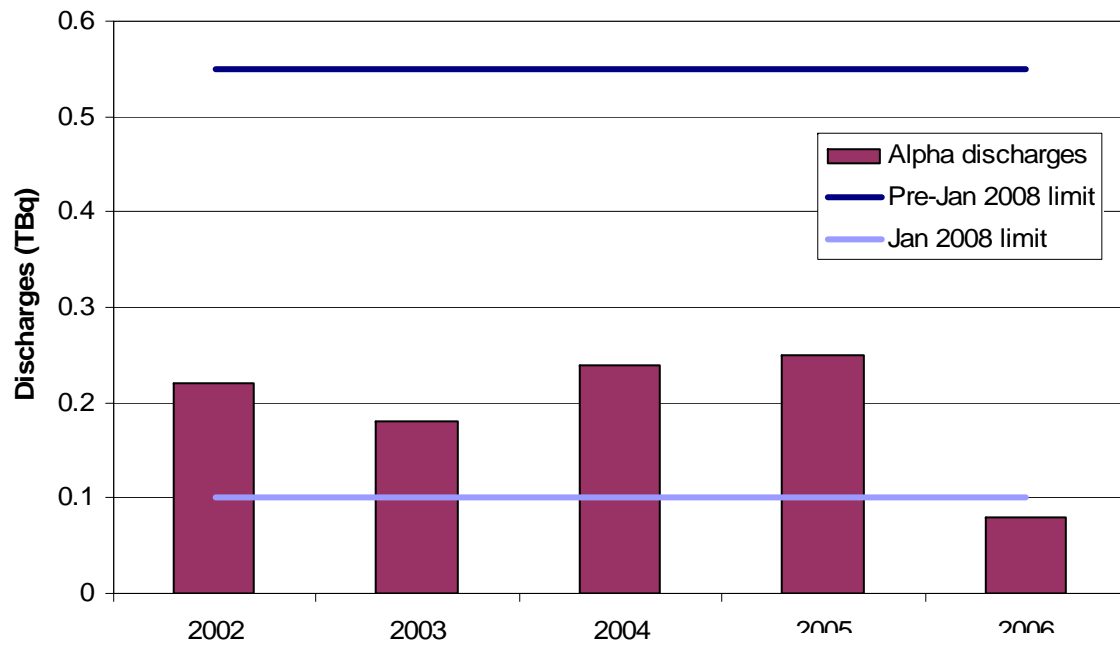
Overall, it is concluded that the environmental outcomes objectives for the Ribble and Alt Estuaries SPA will be met through the introduction of the new authorisation limits for the Springfields Fuels Ltd site.

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.

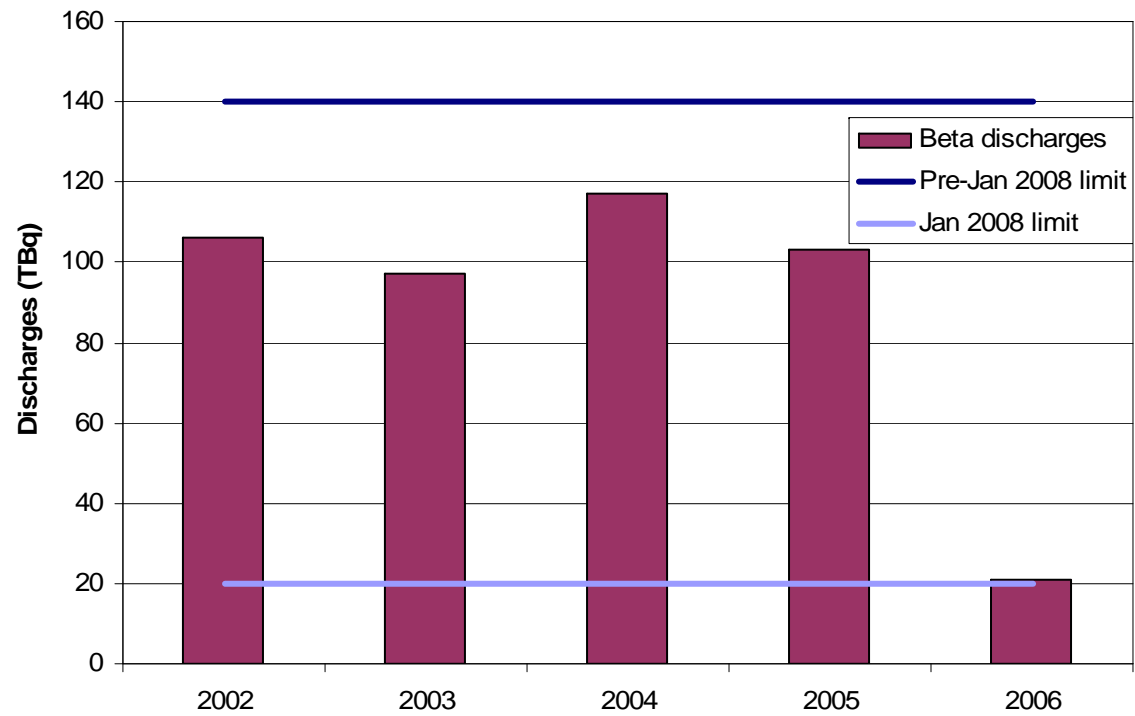
Before a new permit is authorised or an existing permit varied with the potential to impact on the Ribble and Alt Estuaries SPA, it is recommended that the dose assessment be reviewed to ensure that any combination effects from multiple discharge sources of radioactive substances continues to achieve 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.

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 $40 \mu\text{Gyh}^{-1}$



Current status

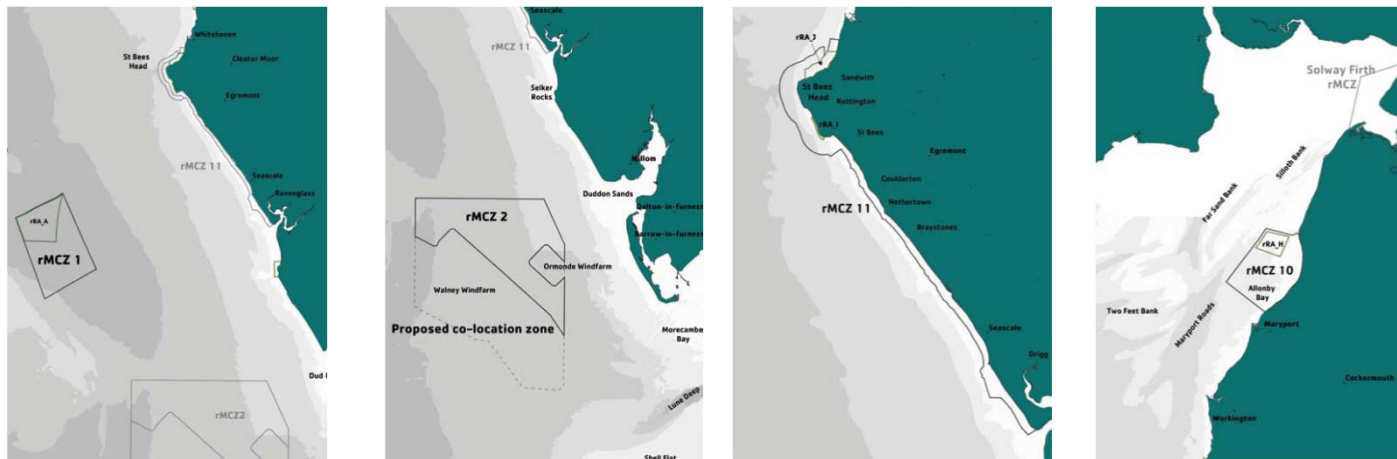
- ⇒ All existing applications reviewed by 2008
- ⇒ Procedure for all new or variations to permits
- ⇒ Spreadsheet tools combining human and wildlife assessments available
- ⇒ Screen against 1 $\mu\text{Gy}/\text{h}$ triggers central review
- ⇒ Annual update to check still in compliance
- ⇒ Levels of naturally occurring radionuclides
- ⇒ Training courses

Use of the ERICA Tool in the UK

- ➔ ERICA Tool used within the Generic Design Assessment (against a $10 \mu\text{Gy/h}$ screening value)
- ➔ Plan to adopt ERICA and replace R&D128
- ➔ SEPA assessments for offshore oil and gas
- ➔ Proposed assessment for Dounreay for SEPA
- ➔ Updated Sellafield Habitats Assessment (2011)

Sellafield wildlife dose re-assessment

- ➔ Original review of Natura 2000 in 2004
- ➔ 2011 update considered:
 - ➔ developments in published guidance
 - ➔ changes in conservation areas



- ➔ targeted dose re-assessments using the ERICA tool in conjunction with
- ➔ recent environmental monitoring data, and the importance of new numeric criteria

Targeted Reassessments - Calculated total dose rates [$\mu\text{Gy h}^{-1}$] to reference organisms

Organism	rMCZ 1 Mud Hole	rMCZ 2 West of Walney	rMCZ 10 Allonby	rMCZ 11 Cumbria Coast
(Wading) Bird	-	-	-	0.2
Benthic fish	0.1	0.1	2.3	7.9
Benthic mollusc	0.2	0.1	1.4	10
Crustacean	0.5	0.02	3.1	7.0
Macroalgae	0.7	0.1	0.7	23
Mammal	0.01	0.01	0.05	0.3
Pelagic fish	0.06	0.1	0.8	0.1
Phytoplankton	2.2	3.7	42	192
Polychaete worm	0.6	0.1	4.6	27
Reptile	0.01	0.01	0.06	0.3
Sea anemones or true corals - colony	0.5	0.1	1.9	17
Sea anemones or true corals - polyp	0.5	0.1	2.8	19
Vascular plant	0.7	0.1	2.4	21
Zooplankton	0.1	0.2	2.0	4.1

Acknowledgements

- ➔ Rob Allott, Nick Beresford, Sally Bielby, Paul Daniels, Marion Dunn, Irene Gize, Steve Jones, Paul McDonald, Peter Merrill, Deborah Patton, Steve Oliver, John Titley, Jordi Vives, Clive Williams, Mike Wood and many others!
- ➔ The Sellafield 2011 re-assessment work will be in proceedings of European Nuclear Conference 2012, Manchester 9 – 12 December 2012