

.....

**UK Food Standards Agency's approach to
monitoring around nuclear sites**

.....

SELWYN
RUNACRES@FOOD.GOV.UK

Overview

- Why do we carry out monitoring?
- How do we chose what to monitor?
 - Habit survey
 - Risk assessment using mathematical models?
 - Consider dose to representative person
- How much?
 - Risk-based approach

.....

WHY?

.....

Why FSA carry out surveillance?

- Ensure food safety
- Reassure the public
- Check against statutory limits and targets
- Make dose assessments
- Look for long-term trends in radioactivity in food
- Look for early signs of changes
- Test predictive models
- Role as a consultee for permits
- Comply with Articles 35 and 36 (Euratom Treaty)
- **BSSD**

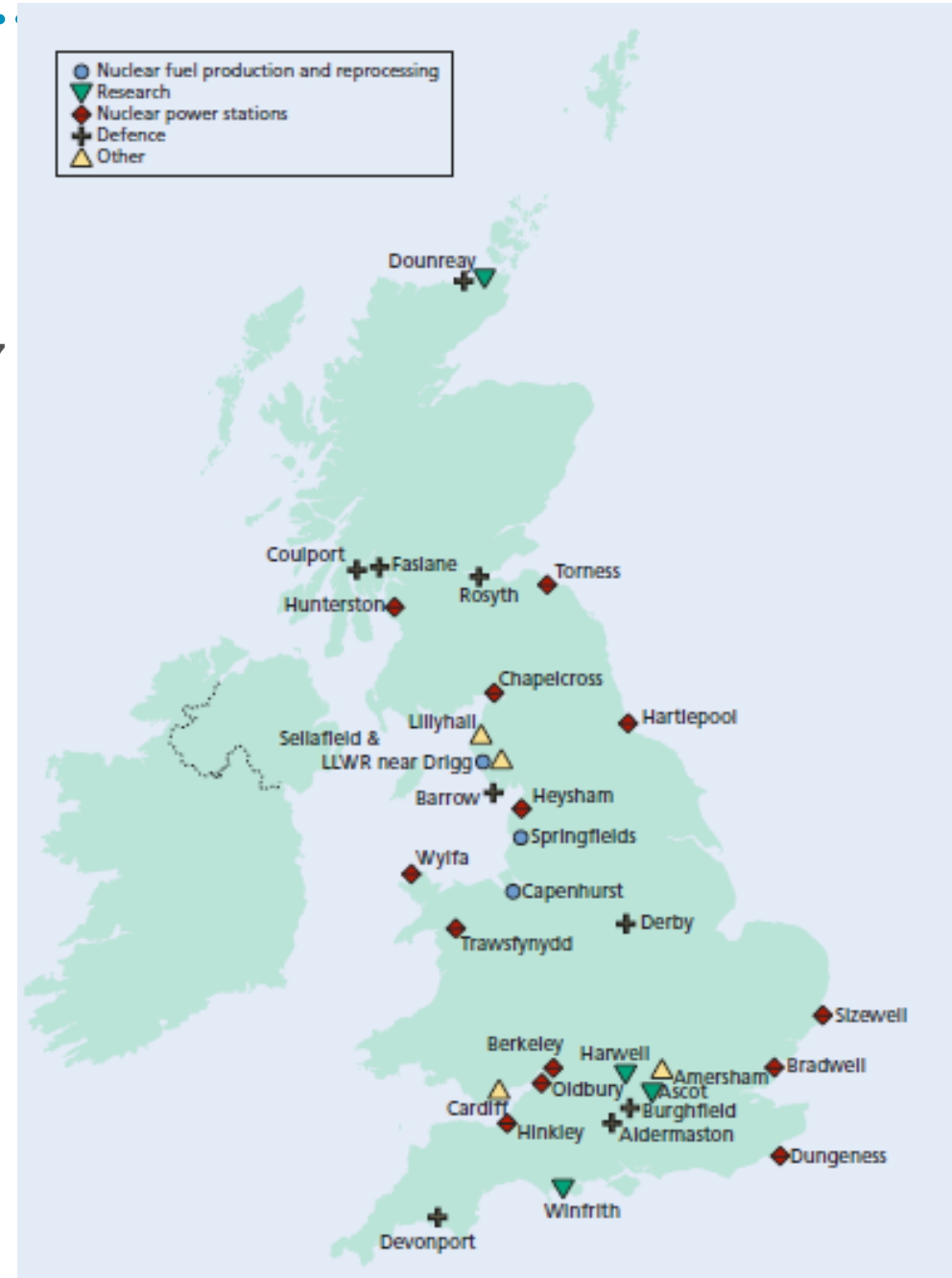
Nuclear sites and key radionuclides of interest

◆ Nuclear power stations

- Operational – I-131, Cs-134/137
- Decommissioning – Cs-137.

● Nuclear fuel cycle

- Springfields / Capenhurst – uranium hexafluoride (UF₆)
- Sellafield – Cs-137, Sr-90, Am-241, U, Pu..



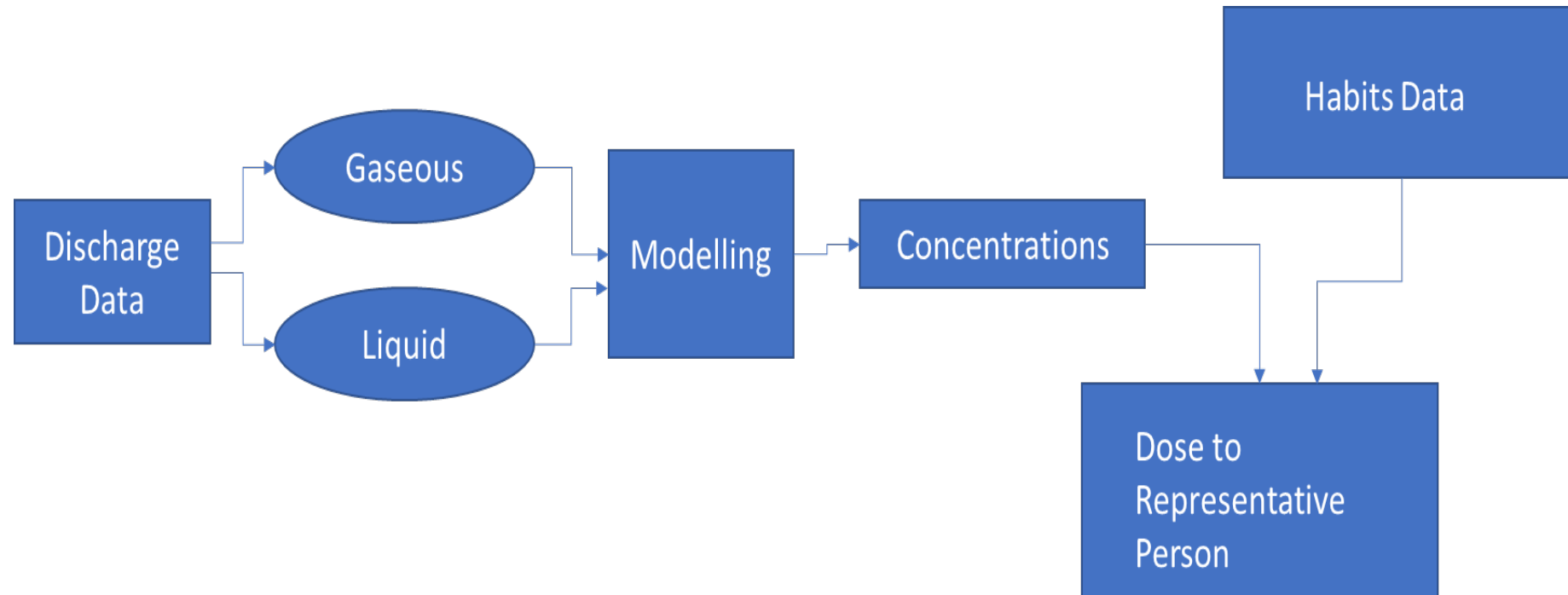
.....
**HOW DO WE CHOOSE
WHERE?**
.....



Assessing the impact of radiological release into the environment

- When a nuclear facility releases radioactive material into the environment (as part of routine operations or an accidental release), it has the potential to contaminate food.
- Radiological protection is based on the assessment of dose from all pathways.
- The Environment Agencies (EA, NRW, SEPA) is the UK's environmental regulator for radioactive discharges.
- The Environment Agencies consult the FSA on the proposed emissions.
- The FSA has a number of models to assess the impact on food safety.

Overview of risk assessment



.....

HABIT SURVEYS

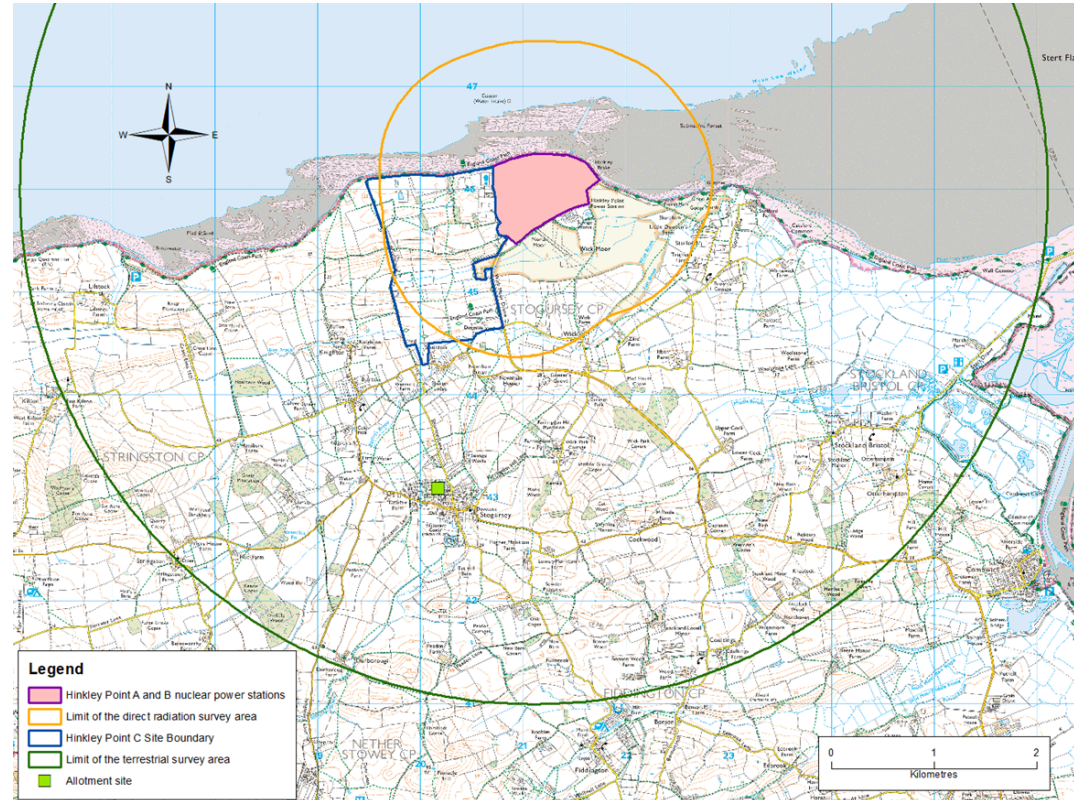
.....

Habit Surveys

- Terrestrial Survey area vary depending on site. Within that zone are conducted interviews (door to door).
- Within a 1km radius of the site perimeter fence, gamma readings are also taken in addition to the interviews



Terrestrial and Direct Radiation Survey Areas



Aquatic Survey Area



Habit surveys (cont)



- Investigation into Aquatic food sources
- The survey is undertaken by questions, which should take about 15-30mins
- Participation is completely voluntary.

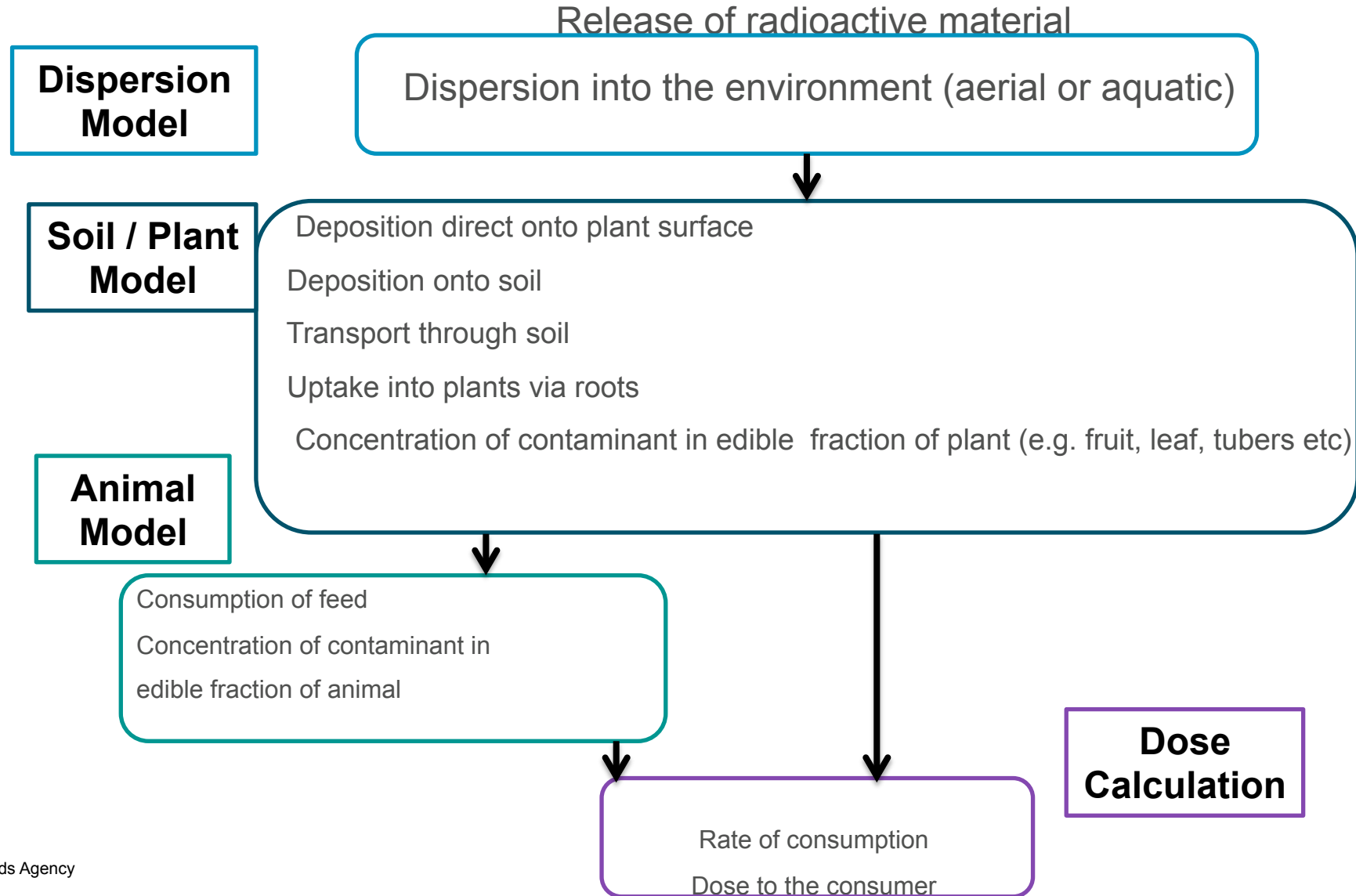


.....



Risk assessment using mathematical models

.....

Mathematical models used



FSA Modelling Assessment

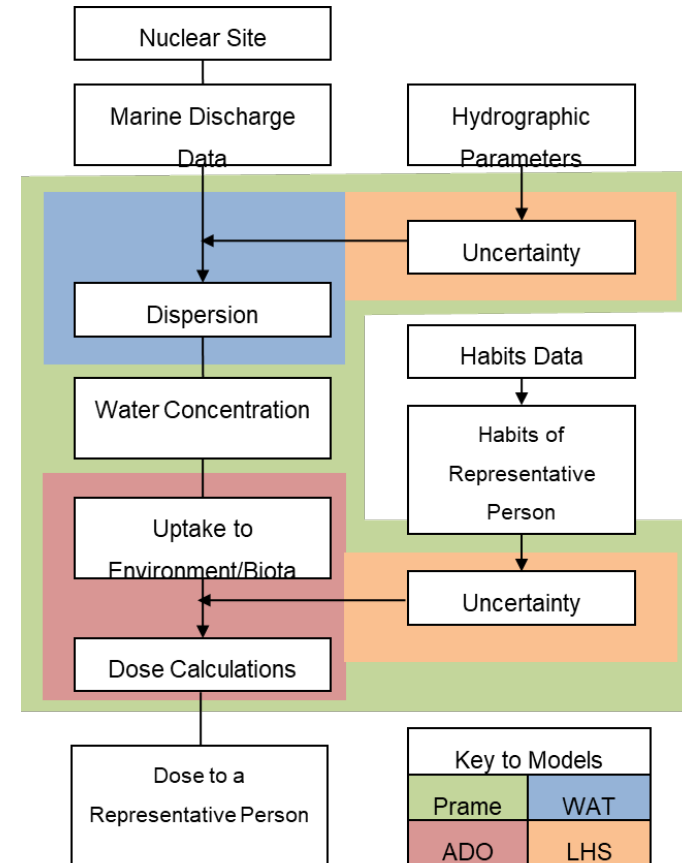
- Terrestrial modelling
 - ADMS5
 - Long term  ground depositions
 - Amber & PRISM
 - Ground deposition  concentration in food.
- Aquatic modelling
 - Assessment spreadsheets
 - Radspill
 - PRAME

PRISM model

- Probabilistic dynamic models
- AMBER compartment modelling code www.quintessa.org/amber/
- Data inputs to PRISM are air concentrations (Bq m^{-3}) or deposition flux rates to ground ($\text{Bq m}^{-2} \text{ s}^{-1}$).
 - Range of soil types
 - Plant model
 - Animal
- Output is in the form of concentrations (Bq kg^{-1} fresh weight).

PRAME

- Water concentration model (WAT) & ADO
 - Advection-Diffusion method, for open coastlines, or
 - Single Compartment method, for use in estuaries or enclosed coastal areas.
- Fish, crustacean and mollusc consumption and exposure over mud pathways are used.
- The distance between the discharge point and the representative person is assumed to be 0m.



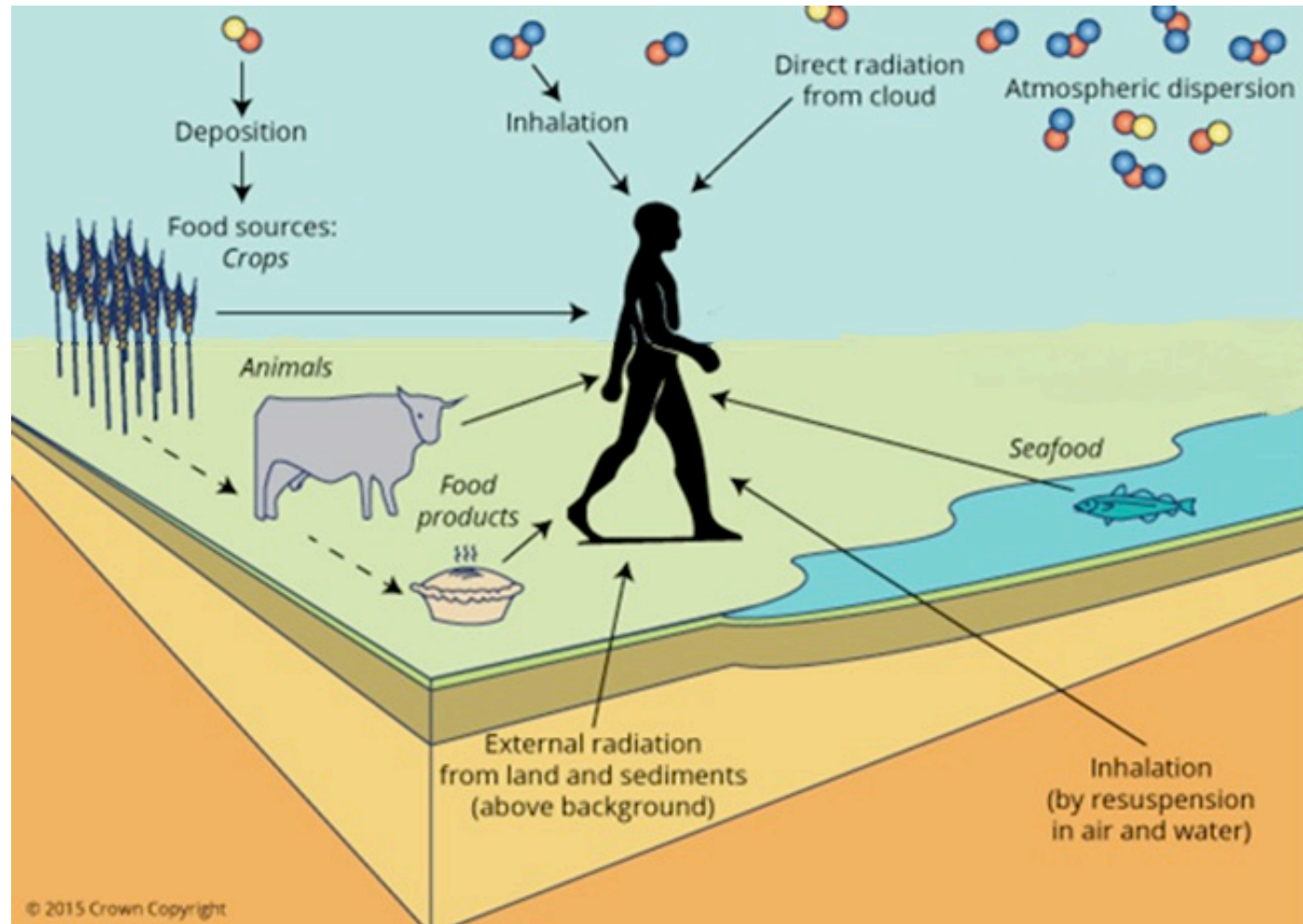


.....

**DOSE TO REPRESENTATIVE
PERSON CONSIDERATION**

.....

Holistic dose assessments (Total Dose approach)



Simple measure of harm (food)

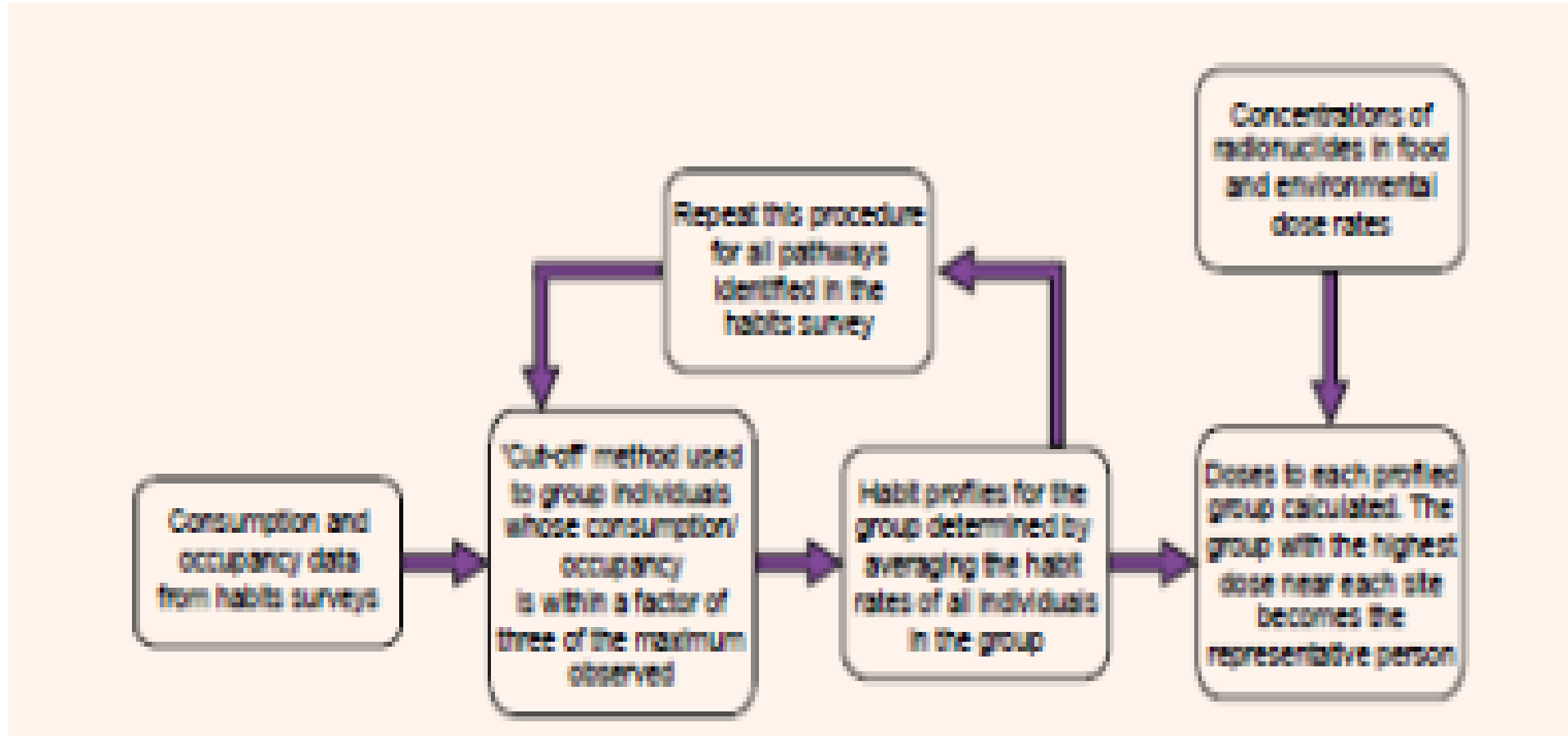
Levels of radioactivity in food (Bq per kg)

X Amount of food eaten (kg per year)
(from survey of local people's diet)

X Dose Coefficient (μSv per Bq)
(measure of harm to the body)

= **Estimated Dose**
(μSv per year)

Adjusted profile method



Adjusted profile method

Profile Name	Pathway Name	Crustacea	Fish	Mollusca	Gamma ext - Sediments	Direct	Plume (0-1km)	Meat - Cow	Eggs	Fruit - Domestic	Vegetables - Green	Vegetables - Other Domestic	Milk	Meat - Pig	Vegetables - Potatoes	Meat - Poultry	Vegetables - Root	Meat - Sheep	Meat - Offal
	Units	h	h	h	h	-	h	kg	kg	kg	kg	kg	l	kg	kg	kg	kg	kg	kg
Crustacean Consumers		4.04	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Sea Fish Consumers		1.23	11.05	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Mollusc Consumers		1.23	4.03	4.41	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Occupants over Sediment		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Occupants for Direct Radiation		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Local Inhabitants (0 - 1km)		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Cattle Meat Consumers		1.23	4.03	1.25	2000	1	7880	13.29	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Egg Consumers		1.23	4.03	1.25	2000	1	7880	4.04	16.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Domestic Fruit Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	46.38	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Green Vegetable Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	17.63	3.92	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Other Domestic Vegetable Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	14.38	130.87	4.34	15.01	3.86	6.49	3.77	0.82
Milk Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	292.51	4.34	15.01	3.86	6.49	3.77	0.82
Pig Meat Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	13.75	15.01	3.86	6.49	3.77	0.82
Potato Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	45.95	3.86	6.49	3.77	0.82
Poultry Meat Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	12.50	6.49	3.77	0.82
Root Vegetable Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	21.96	3.77	0.82
Sheep Meat Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	12.20	0.82
Meat - Offal Consumers		1.23	4.03	1.25	2000	1	7880	4.04	5.50	14.43	4.76	3.92	130.87	4.34	15.01	3.86	6.49	3.77	2.32

Summary

What person/activities are most likely to be affected?

Where is the monitoring best done?

Which food is the most likely to have radionuclide in it?

What nuclides to be looking for?

.....

HOW MUCH MONITORING ?

.....

Policy on monitoring programme (risk based approach)

Tier	Dose criteria for inclusion to tier	Aquatic dose	Terrestrial dose
Top	Food component of dose pathway under consideration has exceeded 100 μ Sv for one or more of the previous 3 reported years	Sellafield	None
Middle	Food component of dose pathway under consideration has been at least 20 μ Sv for one or more of the previous 3 reported years but not above 100 μ Sv for any of those 3 years	None	Sellafield
Bottom	Food component of dose pathway under consideration has not exceeded 20 μ Sv within previous 3 reported years and there are no indications that the food dose is likely to increase the next year	All other sites	All other sites

Thoughts on applying the Policy

- Public consultation
 - Local /national

- Applying the policy
 - How much data do you already have from the sites?
 - How much will the industry produce and is it sufficient for monitoring purposes?

What does this mean for the UK?

Tier	Site	Fish	Crustaceans and molluscs	Aquatic vegetables	Seaweed
Top	Sellafield	10	20	1	0
	N/A	5	10	As identified by habit surveys	
Middle	Dungeness, Bradwell, Heysham and Springfields	2	2	1	0
	Trawsfynydd	2	0*	0	0
Bottom	All other sites (except sites listed under "Other")	2	2	0	0
	Combined sampling for "Thames sites"	1	1	0	0
Other		0	0	0	0
		0	0	0	0
Total	All Sites	45	53	5	0

Radioactivity in Food and the Environment report

The FSA regularly monitors food produced around nuclear facilities in the UK.

Data from the FSA is combined with the environment agencies (EA, SEPA, NIEA) and published annually in the Radioactivity in Food and Environment Report.

These results confirm that the levels of contamination in the environment are low and the dose to consumers is far below legal and safe limits.

More details can be found on the FSA website:

<http://www.food.gov.uk/science/research/radiologicalresearch/radiosurv/>



Surveillance of food - what is done

- Over 5,500 samples of foods from 26 sites
- Over 10,000 analyses or measurements undertaken by accredited laboratories
- Total cost £1.7M [aquatic & terrestrial]
- 80% is recouped from industry under the 'polluter pays' principle
- Totally independent of industry
- All calculated doses are below limits

