



Regulatory and practical approach for the management of sheep in the UK

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Outline

- Impact of Chernobyl deposit in the UK in 1986
- Regulatory approach for managing sheep-restricted areas
- First major review of the approach – 1996
- Second major review of approach – 2010
 - New dose-based methodology
 - New survey design
 - Public consultation
- Release of final restrictions 2012



Impact of Chernobyl deposit in UK

1986

- 26 April – Accident at Chernobyl
- May – Plume passed over UK
- Coincided with heavy rainfall in upland areas
- Peat soils – low mineral content
- Radiocaesium readily available for uptake by plants
- Sheep farming predominant activity
- June – Restrictions on sheep put in place

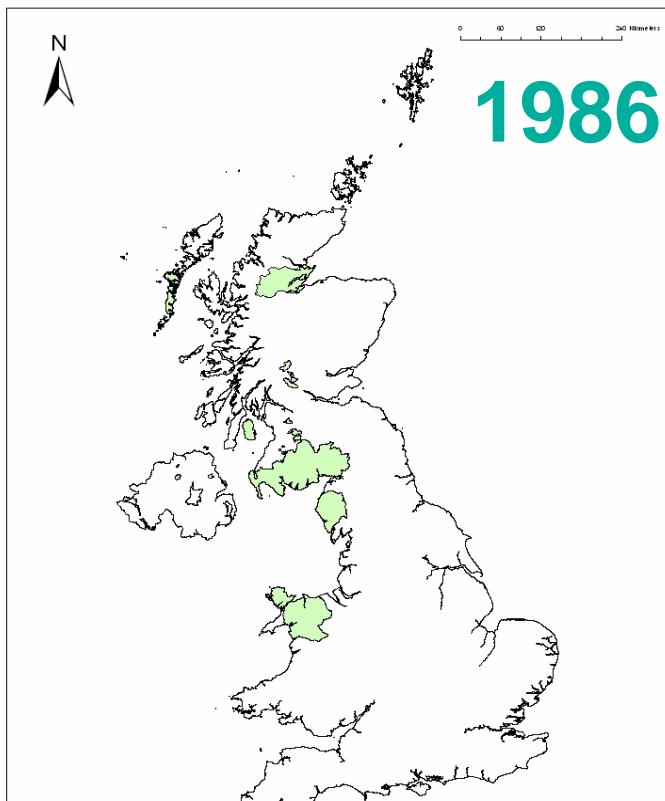


Regulatory approach

- Restrictions were put in place using powers under the Food & Environment Protection Act 1985 (FEPA Orders)
- Defined geographic areas
- Prohibited the slaughter of sheep within the area or the movement of sheep out of the area if $^{137}\text{Cs} > 1000\text{Bq kg}^{-1}$
- Gave Food Standards Agency powers to issue “Consents” to permit movement of sheep



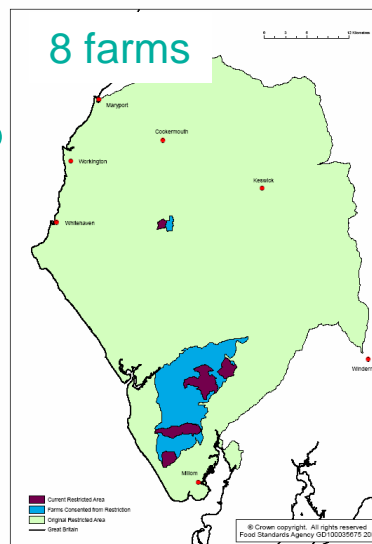
Extent of sheep restrictions



1986

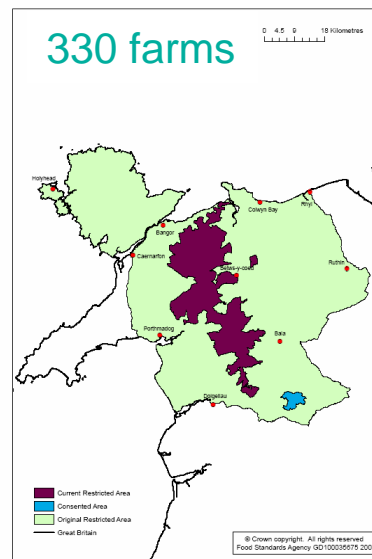
9,792 farms / 4.3 million sheep

Permit ID 60081 Based upon the 2006 Ordnance Survey of Northern Ireland 1:50,000 scale map with the permission of the Controller of Her Majesty's Stationery Office, © Crown Copyright 2006 All rights reserved Food Standards Agency GD100035675 2006



8 farms

2010

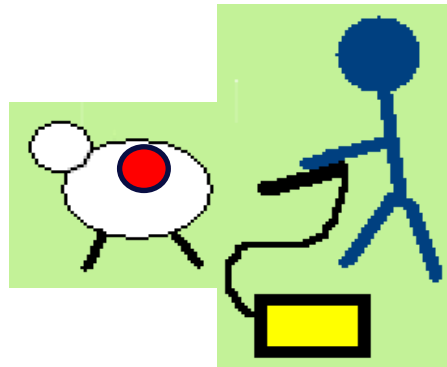


330 farms



‘Mark and Release’ monitoring

- Sheep must undergo ‘M&R’ before being sold/slaughtered
- Each sheep monitored 3 times (3 x 10s count): If average below 1000 Bq kg⁻¹ of ¹³⁷Cs (at 97.5th% confidence level), sheep released



- If assessed above 1000 Bq kg⁻¹, sheep marked and prevented from going to slaughter for minimum 3 months



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Sheep monitoring





Typical farming practices in uplands

- Upland lambs fattened on lowland pasture for 1-2 months
- Lambs slaughtered late summer / autumn
 - Biological $t_{1/2}$ of ^{137}Cs = 10 -12 d lambs
 - Lower activity concentrations in lamb after fattening



Review of regulatory approach -1996*

- Practice as of 1996
 - Use improved land for 'clean' grazing + M&R
- Alternatives
 - Use improved land for 'clean' grazing (no M&R)
 - Improve unimproved land for 'clean' grazing
 - Provide housing and clean feed
 - Administer AFCE (Prussian Blue)
 - Monitor at the market place

*[\(Nisbet and Woodman \(2000\), J Environmental Radioactivity 51:239 -254\)](#)



Findings of the 1996 review

- Wales (350 restricted farms)
 - No alternative strategy was practicable due to scale of the restrictions
- Cumbria (10 restricted farms)
 - Use improved land for 'clean' grazing
 - Monitor at the market place
 - Other options would have a high impact, low acceptability and would not be cost effective
- **MAFF* decided to retain the current M&R scheme**

*Ministry of Agriculture, Fisheries and Food



De-restriction of farms

- De-restriction of farms required two consecutive years of zero failures from full flock summer surveys.
- A cautious approach
- Ensured that it was extremely unlikely that any sheep exceeding the 1000 Bq kg⁻¹ limit entered the food chain



Disadvantages of de-restriction approach

- Monitoring is resource intensive
- 1000 Bq kg⁻¹ limit does not consider ingestion dose to consumers and gives impression of step-change in risk
- Does not account for the distribution of contamination within a flock
- Consumers do not (in general) eat from single sheep so true intake is closer to mean levels in sheep not the extremes
- **De-restriction monitoring continued until 2009**



New survey design

- Survey to establish more realistic doses to consumers
- Surveys in summer 2010 and 2011
 - NW England – 6 out of 8 farms (all sheep)
 - N Wales – 72 farms - random selection (at least 10% of flock (min 40 sheep) monitored or greater where resource permitted)
- Targeted when levels of ^{137}Cs in sheep peak
 - Late spring / early summer
 - 24 - 48 h of sheep being gathered from uplands



Probabilistic dose model

- Assessment of data from individual farms
- Established probability distribution considering two categories of variability:
 - Radiocaesium concentration within a flock
 - Consumer characteristics (age, consumption rates, purchasing habits)
- Doses to the more highly exposed individuals (i.e. Representative Person)



Selection of Representative Person (1)

- Source meat from single farm
- Three exposure groups identified:
 - “Farmer” – Annual consumption sourced from single animal (n = 1)*
 - “Bulk Buyer” – Purchase “freezer packs” four times per year (n = 4)*
 - “Frequent Buyer” – Purchases fortnightly (n = 26)*

*Number of animals represented by purchasing habit



Selection of Representative Person (2)

- For each exposure group doses were calculated based on age category and consumption rate

Age category	Consumption mean (kg yr ⁻¹)	Consumption 95.0 th % (kg yr ⁻¹)	Consumption 97.5 th % (kg yr ⁻¹)
Infant (1y)	0.8	2.0	3.0
Child (10y)	4.0	10	10
Adult	8.0	20	25

- Doses to infants and children never exceed those to adults (because consumption rates and dose coefficients are lower in all cases)



The Representative Person

- After careful consideration of consumption rates and purchasing scenarios, the Representative Person is:

An adult frequent buyer who sources all their meat from the monitored farm and who consumes a high level of sheep meat per year (i.e. 20 kg, 95.0th percentile) at the 97.5th percentile of the radiocaesium distribution in their sheep meat intake.

- Probability is < 5% that a person drawn at random from the population will receive a higher dose



Reference Levels of dose

- Reference levels (ICRP Publication 111)
 - 1 to 20 mSv yr⁻¹ for existing exposures
 - Typically lower end of range used
- Comparison to 1000 Bq kg⁻¹
 - Controls assume all meat could be safely consumed just below 1000 Bq kg⁻¹
 - Representative person (consuming 20 kg yr⁻¹) could receive theoretical dose of 0.26 mSv yr⁻¹

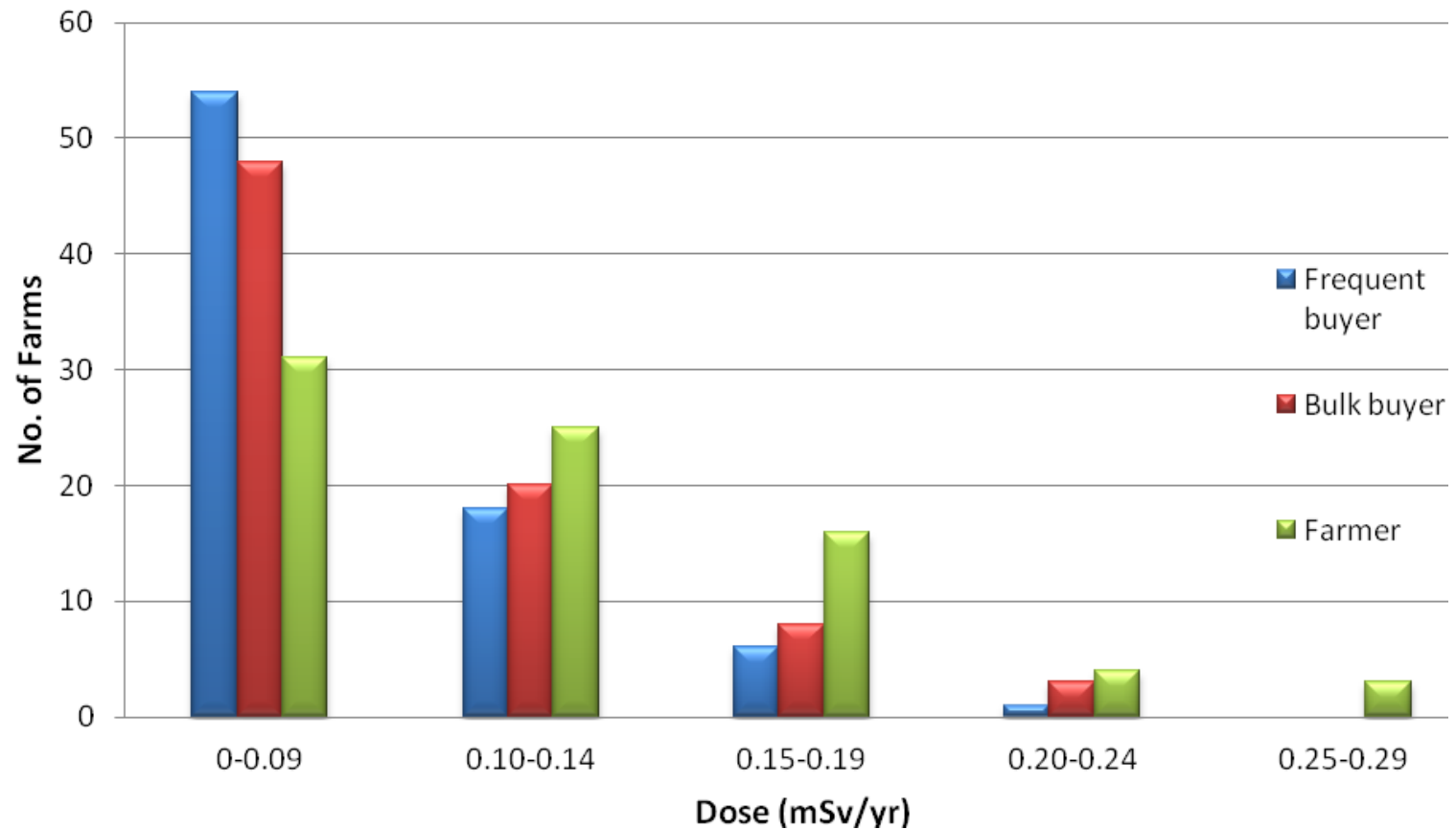


Results

- Doses to the representative person
 - Range <0.05 to 0.21 mSv yr^{-1}
 - Mean $<0.09 \text{ mSv yr}^{-1}$
- All doses less than 1 mSv yr^{-1}
- All doses less than 0.26 mSv yr^{-1} – “tolerated dose” of 1000 Bq kg^{-1} policy



Results





Public consultation

“by maintaining this system (that has existed for 20 years) the consumer will still have confidence and faith in the produce”

“by not continuing to scan there would be a 100% chance that a lamb with radiation would be allowed into the food chain”

“this proves there is still a risk and though it can be argued that the risk is small, it must be asked if it is a risk worth taking in the name of Welsh lamb?”

“the difference in ‘low’ versus ‘no’ risk must be considered”

“the monitoring system in place for the last 25 years, on the whole, has worked well, ensuring that no unsafe sheep or lamb meat enters the food chain”



Conclusions

- Majority of sheep in the Chernobyl-restricted areas contained ^{137}Cs well below 1000 Bq kg^{-1}
- Level of risk with restrictions removed in 2012 was less than that tolerated by the 1000 Bq kg^{-1} controls that were implemented in 1986
- Removing restrictions would not increase risk
- **Therefore, Food Standards Agency removed all Chernobyl restrictions in UK on 1 June 2012**



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Thank you for listening!

Feel free to contact me if you have further questions or wish to discuss the work further

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