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**Rose Energy Biomass Fuelled Power Plant Health
Impact Assessment with Human Health Risk
Assessment (HIA-HRA)**

HIA-HRA ADDENDUM 2

**Review of the BSE Risk and Prion Exposure
from the Proposed Rose Energy Biomass
Fuelled Power Plant**

FINAL

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Rose Energy Biomass Fuelled Power Plant Health Impact Assessment with Human Health Risk Assessment

HIA-HRA ADDENDUM 2:

Review of the risk of BSE and Prion Exposure from the proposed Rose Energy Biomass Fuelled Power Plant

Introduction

A2.1 Transmissible Spongiform Encephalopathies (TSEs) and Bovine Spongiform Encephalopathy (BSE) or 'Mad Cow Disease' are now known to be caused by prions. Prions are misfolded proteins which affect the structure of neural and brain tissue and can be passed on through eating brain and neural tissue from infected animals who in turn have eaten infected brain and neural tissue. People infected by prions can go on to develop a degenerative brain disorder called variant Creutzfeldt-Jakob Disease (vCJD).

A2.2 The Eastern Social Services Board raised the issue of the risk of BSE through prion exposure from the proposed Rose Energy Power Plant. A rapid review was undertaken to identify the probability of prion exposure and hence the likely TSE/BSE health risk from the operation of the proposed Rose Energy Power Plant.

A2.3 Some sentences in the following sections have been written in bold to highlight key points in relation to the proposed power plant.

Current BSE and vCJD context

A2.4 The current figures for identified TSE/BSE and related diseases, e.g. scrapie in sheep and goats, in 2008 in Northern Ireland are as shown in Table A2.1.¹

¹ Veterinary Laboratory Agency, DEFRA, Transmissible spongiform encephalopathy (TSE) surveillance statistics; http://www.defra.gov.uk/vla/science/docs/sci_tse_stats_ireland.pdf (Last accessed 1st December 2008)

Table A2.1: Numbers and percentage of TSE/BSE and related diseases in Northern Ireland

Surveillance type	Total number of animals tested	Number of animals in which disease confirmed	Percentage of confirmed cases
2002 Scrapie survey in sheep and goats	1960	0	0%
2008 Scrapie survey in sheep and goats	1,783	1	0.06%
2002 BSE survey in cattle	59,813	70	0.1%
2008 BSE survey in cattle	138,090	4	0.003%

A2.5 In terms of vCJD there was 1 confirmed human death out of 124 referrals in the UK in 2008. There has therefore been a steady decline from a peak in the year 2000 when there were 28 deaths associated with vCJD out of 178 referrals.²

A2.6 The incidence and prevalence of BSE and of vCJD are therefore extremely low and have declined significantly over the last ten years.

Environment Agency Studies³

A2.7 Though now dated, a number of key studies were commissioned by the Environment Agency in the late 1990s at the height of the BSE crisis. The estimates of risk were based on England and Wales but are applicable to the Northern Ireland context.

A2.8 These studies are still relevant today because they were conducted at a time when the levels of BSE cases were high and the assumptions that were used for the assessment were therefore extremely cautious. They used a cautious best-estimate of the infective oral dose of BSE-infected material and assumed that there was no safe threshold level of infection.

² The National Creutzfeldt-Jakob Disease Surveillance Unit (NCJDSU), University of Edinburgh; CJD Statistics; <http://www.cjd.ed.ac.uk/figures.htm> (Last accessed 1st December 2008).

³ DNV Technica. (1997). An overview of the risks from BSE via environmental pathways. Environment Agency. Extract can be found at: http://www.mad-cow.org/~tom/burning_study.html#Overview (accessed December 2008)

A2.9 These seminal studies were commissioned by the Environment Agency from DNV Technica and provided an overview of the risks of BSE from a range of environmental pathways. The studies were:

- *An overview of the risks from BSE via environmental pathways*
- *Risks from burning rendered products from the Over Thirty Months Scheme (OTMS) in Power Stations*
- *Risks from disposing of BSE infected cattle in animal carcass incinerators (This report also considered incineration OTMS carcasses)*
- *Assessment of risk from BSE carcasses in landfills*
- *Thruxted Mill rendering plant; risk assessment of waste water disposal options*

A2.10 In relation to the incineration of infected material they estimated that the **societal (population) risk for all the population of England and Wales** from the 20,000 infected cattle alive in 1996 was approximately 3 ID₅₀ units⁴ and that the maximum individual exposure was less than one millionth of an infective dose per year. **They assessed the societal risks as negligible and their best-estimate of the risk of death was zero.**

A2.11 The largest contributor to the risk was the ingestion of infected water abstracted from the ground with the infection originating from excreta from infected cattle and the blood from the slaughter of the Over Thirty Months Scheme cattle. No BSE infectivity has ever been detected in either blood or excreta but for the purposes of the assessment it was assumed that some infectivity is present well below the current limits of detection.

A2.12 They conducted an assessment of the risks of disposing of BSE infected cattle in animal carcass incinerators and estimated that the societal risk, i.e. the total human ingestion of infectivity from incinerating all 1997 BSE carcasses in incinerators, was approximately 0.005 human ID₅₀ units. **Thus even on the pessimistic assumption of no safe threshold and that risk would be proportional to dose, i.e. the worst case scenario, it was estimated that there would be only a 1 in 200 societal risk of human infection due to incineration and the most likely result would be no**

⁴ There are two units to define amount of infection in some animal tissue: the LD50 (lethal dose) unit per gram and the ID50 (infective dose) unit per gram. One LD50 unit is defined as the dose necessary to give a 50 per cent probability of killing an animal, while one ID50 unit is the dose necessary to give a 50 per cent chance of infecting an animal. Since infection with BSE and TSEs invariably leads to death, these are effectively the same thing for these diseases.

infections at all at the height of the BSE crisis. This compares to the background societal rate of approximately 50 sporadic cases of Creutzfeldt-Jakob Disease (CJD) cases in England and Wales every year.

A2.13 The maximum individual risk i.e. the ingestion of infectivity by the most exposed person from incinerating all the 1997 BSE carcasses in incinerators was estimated to be approximately 0.0000000006 (6×10^{-10}) human ID₅₀ units. **This equates to a less than 1 in a 1 billion risk (1,000,000,000, actually 6 in 10 billion risk) of individual level infection per year which compares favourably with the 1 in 1 million risk per year threshold that is used by the Health and Safety Executive (HSE) below which a risk is deemed negligible.** The individual risk from groundwater is also of a similar order of magnitude, 0.0000024 (2.4×10^{-6}) human ID₅₀ units per year.

A2.14 The above figures are based on estimates of infectivity at the height of the BSE crisis in 1997. The current actual rate of BSE in cattle is 3% of the level found in 2002 as shown in Table A2.1. The rate in 2002 is also likely to have been significantly less than the rate prevalent in 1997, at the height of the BSE crisis, though of course no actual rates are available for 1997. Even taking 2002 as the baseline rate for the above assessment the current estimate of infectivity at a societal level would be 0.00015 human ID₅₀ units which would equate to **a societal level risk of infection of 1 in 6,666 and an individual infectivity risk of 0.00000000018 which would equate to an individual level risk of infection of less than 1 in 60 billion (actually 18 in 1000 billion).**

A2.15 These estimates demonstrate that the health risks from prion exposure from meat and bone meal incineration under current UK regulatory measures is effectively zero.

Spongiform Encephalopathy Advisory Committee (SEAC) Statement⁵

A2.16 SEAC was set up in 1990 and also conducted a number of studies and assessments in relation to BSE and the risks to human health.

⁵ Spongiform Encephalopathy Advisory Committee (SEAC). (1996). Recommendations on the handling of waste material from cattle. Statement can be found at: <http://www.seac.gov.uk/statements/state07jun96.htm> (Last accessed December 2008)

A2.17 The following is an extract from a Statement made by the Committee titled 'Recommendation on the Handling of Waste material from Cattle' and published in June 1996. This continues to be their most current Statement on BSE and incineration.

A2.18 “The Committee concludes that incineration either in power stations or cement kilns (in which temperatures could reach at least 1400°C) or in dedicated incinerators which reached 850°C would be sufficient to ensure that there was no risk either to those exposed to the smoke plume e.g. those living in the neighbourhood or those living downwind of the plant or in relation to the ash which could be safely landfilled.”

A2.19 “The Committee noted that that some ash from power stations was used in aggregate and that the method of firing cement kilns inevitably resulted in some ash being incorporated into the final product. The Committee concluded that given the nature of these processes, these and any other uses of ash are perfectly acceptable even for ash from MBM (and tallow) derived from SBM⁶.”

A2.20 **“In summary, the Committee did not feel that there were any reasons related to BSE which militated against the use of tallow and MBM as a fuel source for either the power generation or cement industry or that required any special precautions to be taken in relation to the protection of the environment either from smoke discharges or from the resulting ash.”**

Rapid review of bibliographic databases

A2.21 A rapid review of Pubmed, Highwire, Ingenta Connect and Ovid using search terms 'BSE incineration' 'Prion incineration' and variants of these was undertaken.

A2.22 Only one recent and relevant article was found in the Journal of Agricultural Safety and Health (J Agric Saf Health. 2002 Nov;8(4):365-83) on the '*Quantitative exposure assessment for the combustion of meat and bone meal derived from specified risk material in the context of BSE in Ireland*'.

⁶ meat and Bon Meal and Specified Bovine Material (now referred to as Specified Risk Material) e.g. the head (including brain), spinal cord, spleen, thymus, tonsils, intestines and other key parts of cattle that have been linked to BSE.

A2.23 Cummins, Grace et al used quantitative exposure assessment (QEA) to model the human health risks associated with the combustion of specified risk material (SRM) derived meat and bone meal (MBM) in a combustion facility. They used a stochastic (Latin Hypercube sampling) simulation model to assess the exposure and hence the risks associated with the use of SRM-derived MBM in a combustion facility. The model simulated the potential infectivity pathways that SRM-derived MBM follows, including its production from animals potentially infected with sub-clinical BSE and subsequent processing of the material with segregation and heat treatments. A failure probability was included to take account of sub-optimal operating conditions. Two scenarios, reflecting the infectivity risk in different animal tissues as defined by the European Commission's scientific steering committee (SSC), were performed with 100,000 iterations of the model.

A2.24 The model results showed that the societal exposure to humans resulting from the combustion of SRM-derived MBM is extremely small (mean values ranging from 7.57×10^{-6} ID₅₀/year to 8.38×10^{-5} ID₅₀/year). **The authors conclude that the resulting societal risks were significantly less than the background societal risk of approximately 2.5 cases of sporadic CJD in Ireland each year.**

Conclusions

A2.25 In the context of the proposed Rose Energy Power Plant, the risks of exposure to TSE/BSE and infection by prions is so small as to be effectively zero. This includes the case of spillage of meat and bonemeal onto local roads as the most likely source of contamination in such an event would be via groundwater and direct contact. The Environment Agency DNV assessments found the potential health risks to be very low for all environmental pathways at a time when BSE/prion exposure was very high. Similarly, the SEAC Statement on incineration and the modelling research in the context of Ireland also identified that there was no risk of prion exposure from a modern incineration process. Overall, these three sources provide robust and credible evidence that there would not be any adverse effects on the health of local residents from TSE/BSE/prion exposure from the meat and bonemeal fuel used by the proposed power plant.

References

DNV Technica. (1997). An overview of the risks from BSE via environmental pathways. Environment Agency. Extract can be found at:

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