Consequences of Burying or Cremating Radioactively Contaminated Fatalities

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Introduction

The Health Protection Agency was commissioned by the UK's Home Office to provide advice and guidance on the safe handling of fatalities contaminated with chemical, biological or radiological (CBR) agents. The main findings of this study, published in 2009[(1)], considered exposures from the different pathways by which a fatality contaminated with a CBR agent would reach their final resting place. This poster focuses on the exposures to professionals (eg, funeral directors) and members of the public resulting from the burial or cremation of radioactively contaminated fatalities. These exposures were modelled for twelve radionuclides mainly used for industrial purposes.

Methodology

Calculations were made for unit activity of contamination in or on the fatality. Doses to funeral directors, embalmers, crematorium staff, pall bearers and family members of the deceased were estimated. The following pathways were considered:

- inhalation of resuspended material
- inadvertent transfer of contamination from hands to mouth
- external exposure of skin from contamination
- external exposure of whole body (non-contact)

For cremation, doses to members of the public were estimated from activity released from the crematorium stack using the atmospheric dispersion model ADMS[(2)].

The exposure pathways considered were:

- inhalation of the material released from the stack
- external irradiation from material deposited on the ground
- inhalation of resuspended material deposited on ground
- ingestion of locally grown food

For burial, doses to members of the public from drinking water contaminated through the migration of water through the unsaturated zone and into the groundwater was considered. Modelling of the movement of the radionuclides was done using the models FEMWASTE[(3)] for the unsaturated zone and TROUGH[(4)] for the saturated region. Doses to construction workers and residents resulting from inadvertent intrusion into the site as a result of redevelopment for housing 100 years after burial were estimated based on the HPA methodology[(5)].

Sensitivity of the doses to variations in important parameters was also investigated.

Comparison of Disposal Methods

The calculated doses to crematorium workers and the general public suggest that cremation may be a suitable option for radioactively contaminated fatalities. It will be advisable, particularly for certain radionuclides and high levels of contamination, to give guidance to family members on the handling of the ashes. If it were proposed to cremate a number of heavily contaminated fatalities at a single crematorium then the potential doses to the workers would need to be considered. Residual contamination of the crematorium equipment and stack would need to be considered for long-lived radionuclides.

The estimated doses suggest that burial is also a suitable method of disposal for radioactively contaminated fatalities. For most radionuclides, typical burial sites (ie, those which are not prone to waterlogging) would contain the radionuclides for sufficient time for them to have decayed to negligible levels in the ground. For the very long-lived radionuclides and high levels of contamination it would be advisable to use a burial site with good containment, either natural or by engineering, and take measures to reduce the chance of intrusion into the site in the future.

Conclusions

The study concluded that in terms of radiological protection either method would be suitable for radioactively contaminated fatalities but burial is the preferred option for the following reasons:

- The overall dose to funeral directors, burial and crematorium staff and members of the public was estimated to be slightly lower for burial rather than cremation.
- Burial of the fatality would allow greater radioactive decay to occur before likely contact with members of the public.
- There is the potential for exposure of family members from the cremated remains.
- Decontamination of the crematorium liner for long-lived radionuclides could be costly and inconvenient.

It is important to note there may be other issues which need to be taken into account at the time of any incident, such as religious or cultural considerations.

References

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