Systems Safety and Reliability

MINUTE

To: **R Cameron, A/g Executive Director**

From: **A Willers**

Date: 20 February 2004

Subject: **LLW Transport: Doses arising as a result of fire**

I have investigated the doses to persons in the vicinity arising from a fire which has resulted in the release of radioactive LLW material. The radioactive material is encased in concrete and is being transported in 50 200L drums contained within an ISO container.

The typical inventory of radioactive material within the ISO container is given below.

Nuclide	Inventory/MBq	Nuclide	Inventory/MBq
Cs 137	125	Cd 109	5
U 238	150	Ru 106	3.3
Sr 90	125	H 3	120
Co 60	55	Am 241	21.5
Ra 226	25	Np 237	1
Sb 125	5	Cs 134	1.15
Eu 152	6.5		

The heat generation rate of the fire will determine the degree of damage to the ISO container and the drums and, as a consequence, the amount of radioactive material released. It will also determine the height to which the plume containing the radioactive material rises. A large fire will be capable of causing significant damage to the container and the drums releasing a significant fraction of the radioactive material. It will also loft that material high above the ground, resulting in significant dispersion. A small fire will be incapable of causing damage to the container and drums and hence release insignificant quantities of radioactive material. However, what material is released will not be lofted high and will not undergo significant dispersion. Thus a large fire will result in low doses owing to atmospheric dispersion of the radioactive material and a small fire will result in low doses owing to a small source term. In this work the very conservative – indeed unrealistic - assumption has been made of a small fire that results in the complete destruction of the ISO container and drums and release of the entire radioactive inventory. The small fire results in lofting the radioactive material a short distance into the air (nominally 10 m). This will result in very conservative doses to members of the public.

The wind conditions were taken as typical Pasquill ‘D3’, which corresponds to neutral weather conditions (neither excessively stable nor unstable) and a wind speed of 3 m/s.

The code used to determine the doses was PC COSYMA. COSYMA is an integrated atmospheric dispersion and consequence assessment code whose development was sponsored by the European Union for safety assessment and emergency planning relating to nuclear sites. It has been the subject of successful international validation and intercomparison exercises and is used by the European Commission countries for accident consequence analyses.

The maximum effective dose to an individual of a little under 4 microSv occurs some 400 m downwind of the release site. It is dominated by alpha emitters, with U 238 contributing some 50% to the overall dose, Am 241 30% and Ra 226 16%. Inhalation is the dominant pathway, accounting for some 85% of the effective dose.

A Willers
20 February 2004