A REVIEW OF THE DISPOSAL OF MISCELLANEOUS RADIOACTIVE WASTES IN THE UNITED KINGDOM

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In the United Kingdom there are about 25 major nuclear establishments such as reprocessing plants and power reactors, which produce radioactive waste. There are about 1500 other establishments, such as hospitals, universities, research establishments and commercial firms which also produce radioactive waste. The problems of the first of these classes, the enormous research and development programmes being carried out to achieve acceptable disposal routes for the wastes at present stored and the effect of the wastes which are disposed of, are well documented elsewhere. This paper deals with the second of the classes, those which can perhaps conveniently be called "minor users" although some establishments in this class discharge more radioactive waste to the environment than a nuclear power station. The whole of the United Kingdom radioactive waste management policy has recently been reviewed by an expert group [1]; this present paper looks at current practices for waste disposal from the minor users and indicates where the expert group endorses these or recommends changes.

LEGISLATION AND STANDARDS

In the United Kingdom, disposals of radioactive waste are subject to the Radioactive Substances Act, 1960 (RSA 60). Waste can be disposed of only in accordance with the conditions and limitations contained either in an authorisation which is specific to the disposer or, in the case of certain very low level wastes, in one of a series of Exemption Orders made under the Act. The Act covers the disposal of radioactive waste of all forms, solid, liquid or gaseous; there are no lower limits on radioactivity except for the natural radionuclides at levels found in nature; it removes the control of radioactive waste disposal from local authorities and places it in the hands of central government. United Kingdom standards for radiological protection are based on the system of dose limitation recommended by ICRP. In the case of radioactive waste disposal this is achieved by a case by case approach, a practice endorsed by the expert group.

EXISTING DISPOSAL PRACTICE

The following are the practices whereby all the wastes from the minor users are disposed of: where appropriate these practices are also used for wastes from the major nuclear establishments.

(i) SOLID WASTES

Solid waste of activity less than 10^{-5} μCi/g (0.4 Bq/g) is currently regarded as insignificant and it has not been the practice

for this to require authorisation. The expert group agreed with this and recommended it should be formalised in an Exemption Order.

Low Level Wastes in Domestic Refuse

Small amounts of solid radioactive waste are authorised for disposal with ordinary refuse. The limits applied for such "dustbin disposals" are 10μCi (400 kBq) in 0.1m^3 and 1μCi (40 kBq) per article. It is also usual to exclude alpha emitters and strontium-90 and to raise the first limit to 100μCi (4000 kBq) in 0.1m^3 for the weak beta-emitters carbon-14 and tritium which are in common use. The expert group considered all the implications of this method of disposal and concluded that it represents no hazard. They therefore endorsed the practice.

Private Incineration

This method of disposal is useful for wastes which are unpleasant to handle; it also reduces the volume of waste requiring disposal. Separate authorisation is required for the disposal of the ash. The radionuclides and activities permitted for disposal this way are generally authorised on a case by case basis, taking all the local circumstances into account. However, it is usual to permit disposals of up to 100μCi (4 MBq) a day of the commonly used tritium and carbon-14 without this detailed examination. The expert group find this practice acceptable.

Special Precautions Disposals

Where solid radioactive waste arises which is not suitable for dustbin disposal, disposal at a landfill tip is still permissible provided certain precautions are taken. Authorisations for such disposals specify the tip which is chosen after consideration of its management, its expected life, the probable subsequent use of the land, whether the tip is liable to catch fire, whether there is unauthorised salvage, drainage and any other special features. The two classes of waste suitable for such disposals are:

(a) Packaged Wastes: The limits and conditions normally imposed are:

a. Waste shall be conveyed to the tip in a sealed, plain, unlabelled plastic or multilayer paper sack in a closed metal bin;
b. At the tip, the sack shall be removed from the bin and placed either at the foot of the tipping face or in a hole dug for it and immediately covered with inactive refuse to a depth of 1.5m;
c. No sack shall contain more than 100μCi (4 MBq) of radionuclides of half-life greater than one year and one mCi (40 MBq) of others, except that in the case of tritium and carbon-14, up to 5 mCi (200 MBq) per sack is permitted.

(b) Bulk Loads: Radioactive waste consisting of relatively lightly contaminated rubble and soil frequently arises as a result of the demolition of premises in which work with radioactive substances has

been performed. Typical examples are luminising works, gas mantle factories and ore-processing factories. Demolition and subsequent site decontamination often produce thousands of tonnes of lightly contaminated waste. When waste of this type is authorised for special precautions disposals, a limit of 10^{-4} μCi/g (4 Bq/g) is placed on it. This corresponds to a surface dose rate about 10 times the background level; when buried to 1.5m it cannot be detected on the surface and if care is taken not to concentrate the waste in one part of the tip the dispersion reduces radiation virtually to background level and subsequent disturbance can create no hazard.

The expert group endorsed all these conditions and practices but recommended in addition that in the case of packaged wastes, radionuclides with half-lives greater than one year (except tritium and carbon-14) should be limited to 10 μCi (400 KBq) per individual article. They also described this method of disposal as a valuable, and with the safeguards described, a radiologically sound method for the disposal of low-activity solid waste. They deplored the uninformed opposition to which these disposals are becoming increasingly subject and recommend that the duty already placed by RSA 60 on waste disposal authorities to accept radioactive waste should be extended to the operators of all landfill tips.

Disposal on Site

Disposal on the site on which the waste arises appears an alternative to special precautions burial on a landfill tip, but the expert group noted objections to this method and only recommended it provided certain conditions, including an assurance of ownership of the site for an appropriate period, could be met.

The National Disposal Service (NDS)

This is available for radioactive wastes not suitable for disposal by the means so far discussed. Generally, if the waste is bulky and within the authorised limits it goes for burial at Drigg, the site in Cumbria operated by British Nuclear Fuels Ltd, and individual items or small quantities go to the United Kingdom Atomic Energy Authority, Harwell where they are drummed for sea disposal. Full details of the operations at Drigg and Harwell are contained in "A Review of Cmnd 884", together with a description of the authorisation under which Drigg works and the international constraints on sea-dumping. In view of the fact that material from the minor users contributes only about 4% of the wastes disposed of by these routes, which have their main use in dealing with wastes arising from the nuclear fuel cycle, they are not considered further here.

(ii) LIQUID WASTES

Liquid radioactive discharges from the major nuclear establishments are, for the purpose of granting authorisations, evaluated individually against Government policy relating to disposals. The principles relating to the exposure of individuals and populations have been rigorously observed and discharge limits have been

assessed quantitatively, often with high precision. But these sophisticated techniques, involving a knowledge of environmental pathways, habit surveys, members of critical groups etc, are rarely necessary for the discharges from minor users.

Drain Disposals

Disposal directly to the drains, without prior collection or storage in hold-up tanks, is the most convenient and radiologically safe method of disposal of relatively small amounts of low activity liquid radioactive waste. Authorisations are usually given in terms of activity per month with limits on individual radionuclides where this is necessary. A few Ci (several GBq) a month, more for tritium, have been authorised for some establishments; others are able to operate with much smaller limits. Hospitals discharging the excreta of patients who have been given therapeutic or diagnostic doses of radioactive substances are amongst the premises having the largest authorisations. The radioactive waste is diluted immediately with other waste waters and in most cases the average concentration in the effluent from the establishment is orders of magnitude below the permissible level for drinking water. There is no formal upper limit for the average concentration of radioactivity in liquid effluents. Each case is considered on its merits: taking account of the toxicity of the radionuclides discharged; the possibility that they may settle out in the sewerage system; their behaviour in the sewage treatment process and ultimately in the effluent, whether discharged to a soakaway, stream, river or the sea. The expert group endorsed these practices with the proviso that the authorising departments should continue to check their assessments by monitoring a few of the most important cases.

(iii) AIRBORNE DISCHARGES

In the case of the minor users, the authorisation contains a specified limit on the activity which may be discharged in a given period. The radionuclides and activities permitted for disposal this way are, as in the case of all authorisations, based on the need of the user to have a particular level of discharge and are granted on a case by case basis taking all the local circumstances into account. The expert group are satisfied that existing controls over emissions to atmosphere are adequate for the time being.

THE EFFECTS OF RADIOACTIVE WASTE DISPOSAL

The effects of all disposals are assessed by the appropriate Inspectorate before authorisations are given, premises are inspected to ensure compliance and any necessary environmental monitoring is carried out. It is therefore possible to say with confidence that the effects of disposals from minor users are insignificant.

REFERENCES

[1] A Review of Cmnd 884: "The Control of Radioactive Wastes". A Report by an expert group made to the Radioactive Waste Management Committee. Department of the Environment (1979).