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WASTE ARISING FROM THE CONTROLLED AREAS OF NUCLEAR POWER PLANTS: EXEMPTION FROM REGULATORY CONTROL FOR DISPOSAL

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1 GENERAL

A considerable part of the waste that is generated in the controlled area of a nuclear power plant is so low-active that its handling, storing and disposal as radioactive waste is not practical in view of principles of radiation safety. On certain conditions, waste of this kind can be exempted from control and disposed of as ordinary waste, for instance in a landfill or in a special waste disposal facility.

As there can be considerable variations in the properties of the waste to be exempted, in the methods that are needed in determining their activity, and in the method of disposal, it is not possible to give a general definition of the requirements to be set on the exemption, but the Finnish Centre for Radiation and Nuclear Safety grants its approval on a case-by-case basis, usually as concerns a certain type of waste and manner of disposal. The restrictions concerning the activity of the exempt waste are derived by applying the radiation safety principles given in this guide, taking into account the method of disposal and the conditions in the surroundings of the disposal site. One prerequisite for the exemption of waste from control is that the activity can be measured or otherwise reliably estimated.

If the restrictions that are set for the activity and disposal method of the waste to be exempted are followed, the radiation harm to the waste management personnel and to the population in the environment of the disposal site remains insignificant. Furthermore, in the disposal one shall follow good handling hygiene and the general regulations concerning waste disposal.

2 SCOPE

This guide presents the general principles which are applied when waste is taken away from the controlled area of a nuclear power plant to be disposed of as ordinary waste. The guide can also be applied to other nuclear facilities, such as research reactors. It does not deal with the removal of materials, objects or equipment from the controlled area of a nuclear power plant if the main purpose is to recycle them.

3 RADIATION SAFETY REQUIREMENTS

With the purpose of limiting the radiation exposure of the waste-handling personnel and the population in the environment of the disposal site, a design limit of 0.01 mSv/a is laid down as the maximum individual dose (effective dose equivalent). The limit is applied to the dose commitment caused to the individuals of the critical group by all the waste that is exempted from control in the course of one year.

However, the above limit to the individual dose is not applied to the personnel handling the exempted waste when the disposal site is at the power plant site and the persons are subject to the dose control systems of the power plant.

In addition, the Finnish Centre for Radiation and Nuclear Safety pays attention to the collective doses caused by the waste and may establish restrictions to them in connection with the case-by-case investigations.

4 SAFETY ASSESSMENTS

The restrictions concerning the activity of the waste to be exempted from control are derived by means of safety assessments starting from the established dose limits and

taking into account the restrictions placed on the the disposal site and the manner of disposal.

In the safety assessments, one shall pay attention to the most significant exposure pathways. Where applicable, the same principles shall be followed as are presented in Guides YVL 7.2 and 7.3 for the evaluation of population doses in the environment of nuclear power plants. If it is not practical to use detailed dispersion models, the safety assessments shall utilize such assumptions that the radiation doses that are induced when the calculated activity limits are applied are with a high degree of confidence smaller than the established maximum doses.

In estimating the radiation doses induced by the exempt quantities within a long time span, one shall take into account the possibility that certain future changes in residential and industrial activities in the surroundings of the disposal site may increase the exposure of the population to the radiation emitted by the waste. In the case that the occurrence of such changes is regarded to be possible only after a certain time, the so-called period of administratively restricted land use, the effects of these changes can be considered in the safety assessments only when calculating the radiation doses that are induced after the period of restricted land use. These restrictions mean, for instance, town planning regulations, which can limit the future uses of the land.

5 REQUIREMENTS CONCERNING WASTE PROPERTIES

The wastes that are to be exempted from control shall meet the following requirements:

- The material properties and chemical composition of the waste is such that the intended manner of disposal can be accepted.

- The waste does not include any so-called other nuclear material referred to in section 1 of the Atomic Energy Decree.
- The waste has been packed in such a way that it cannot spread during the handling and transport prior to its disposal.
- Objects and materials with a considerable use value have been rendered unusable to such an extent as is practical.
- It can be shown on the basis of the origin of the waste that it does not include significant amounts of such nuclides that are impossible to measure or reliably evaluate for activity.
- The nuclide-specific activity of the waste in units defined separately (e.g. activity/sack, activity/kg, activity/m^2) does not exceed the limits established in each case.
- The amount or nuclide-specific activity of the waste that is disposed of in one year does not exceed the limits established in each case (if such limits exist).

6 REQUIREMENTS CONCERNING DETERMINATION OF WASTE ACTIVITY

The origin of the waste is decisive when selecting the method(s) of measurement to determine the activity of waste. It depends on the homogeneity of activity distribution how small quantities are measured for activity or how frequently the samples are taken. The Finnish Centre for Radiation and Nuclear Safety accepts the methods to be used for determining or estimating activities, the measurement procedures, and the maximum size of the waste packages to be measured or the sampling frequency. This happens on a case-by-case basis, usually as concerns a certain type of

waste and manner of disposal.

The methods that are used for determining activity shall with a high degree of confidence ascertain the upper limits for the activity of all significant nuclides in the waste. To prevent component failures and human errors, one shall apply redundant methods and calibrate the measuring equipment often enough. The determination of activity shall be so planned that if any fraction of the activity is not detected due to a single component failure or a human error, there is a high degree of confidence that this fraction does not exceed the established annual activity limit or the annual activity used as a design basis.

Below there are some examples of the applicable methods for determining activity as concerns some types of waste:

- Solid, low-active maintenance waste, which can be assumed to contain principally the same nuclides as the primary water. The activity is measured in sufficiently small quantities when the waste has been packed, for instance, in sacks or drums. At the first stage, a rough dose rate measurement is used to distinguish those waste packages that have a surface dose rate clearly in excess of the background radiation. At the second stage, the most important nuclides contained in the waste are measured with a gamma-spectrometric measuring device with a sufficient sensitivity (no more than approximately 10 kBq/waste package). The activity of those nuclides that cannot be detected with the measuring equipment shall be estimated with indirect methods by using such assumptions that it is possible to get an upper limit for the activity of these nuclides.

- Contaminated large metal components. The most important nuclides and the homogeneity and range of variation of the activity distribution are estimated on the

basis of the origin and surface dose rate measurements. The principal method for the determination of activity is either a gamma-spectrometric measurement (taking into account the self-shielding in the source) or sampling and a gamma-spectrometric analysis of the samples. The latter method is more suitable especially when the nuclide composition of the surface contamination is essentially different from the nuclide composition of the primary water.

- Activated large metal components. The most important nuclides and the homogeneity and range of variation of the activity distribution are estimated on the basis of the origin and dose rate measurements. The activity of the most important gamma emitters is estimated conservatively with gamma-spectrometric measurements, taking into account the self-shielding in the source. The activity of the most important pure alpha and beta emitters is estimated with calculational methods, taking into account the material composition, origin and detected gamma activity of the object.

- Air filters. The nuclide composition of the waste is estimated on the basis of the origin and the dose rate measurement. The activity of the most important nuclides is determined by analyzing the samples taken from the filter, provided that sampling is possible. If sampling is not possible, the activity of the filter is estimated with gamma-spectrometric measurements on the outside of the packages and by using supplementary indirect methods.

- Contaminated oils and chemicals. The nuclide composition of the waste is estimated on the basis of the origin and the dose rate measurement. The activity of the most important nuclides is determined by analyzing samples. The analysis of other emitters besides gamma

emitters is necessary only if it is suspected that the nuclide composition of the oil or the chemical is essentially different from the nuclide composition of the primary water.

7 OTHER REQUIREMENTS CONCERNING EXEMPTION FROM CONTROL

The waste that is exempted from control can be disposed of in a suitable landfill or in a special waste disposal facility. The landfill or facility intended for waste disposal shall have the approvals required in the Waste Management Act (673/78), in its Amendment (117/81) and in the pertinent regulations.

Before it is decided whether a landfill is suitable for the disposal of wastes exempted from control, there are several factors to be considered: possession of the site, restrictions to access, controllability, residential and industrial activities in the surroundings, as well as regulations and prospects concerning the future land use.

The wastes shall be transported to the landfill in fairly large quantities and they shall be so packed that they cannot spread into the environment during the transport. In the landfill, the waste shall always be covered with a soil layer without delay.

Suitable waste disposal facilities include large incineration plants and plants that are appropriate for the handling of various hazardous wastes, e.g. waste oils and chemicals.

8 SUPERVISION PERFORMED BY THE REGULATORY BODY

An application shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for the exemption of each waste batch from control. However, it is also possible to grant a standing license for the exemption

of a certain annual quantity if the waste is accumulated regularly and the manner of disposal, the methods for the determination of activity and the other prerequisites for exemption remain unchanged. The application for the exemption of waste from control shall at least include a description of the waste with its nuclide composition, an account of the methods used for the determination of activity, a description of the intended disposal method and the site or facility, and a safety assessment of the exposure caused by the disposal to the site personnel and to the population in the environment of the disposal site.

The Finnish Centre for Radiation and Nuclear Safety shall be informed of the removal of waste from the controlled area not later than 72 hours before the planned date. In this connection, information shall also be given of the quality, quantity and activity of the waste to be removed.

To ensure compliance with the conditions concerning the determination of the activity of the exempt quantities or the manner and site of disposal, the Finnish Centre for Radiation and Nuclear Safety can take control measures or have these measures taken at the disposal site, if deemed necessary.

There shall be directives for the procedures that are followed in the exemption from control. These directives shall pay attention to the special requirements concerning the determination of activity, record-keeping, and the site and method of disposal. The directives shall be submitted to the Finnish Centre for Radiation and Nuclear Safety for approval.

A summary of the exempt quantities and activities, including a description of the sites and methods of disposal, is presented as per Guide YVL 1.5.

9 LITERATURE

/1/ De Minimis Concepts in Radioactive Waste Disposal, IAEA-TECDOC-282, Vienna 1983

/2/ The Derivation of Exempt Quantities for Application to Terrestrial Waste Disposal, IAEA Consultants' Working Document, Vienna 1984.

In the event of any differences in interpretation of this guide, the Finnish version shall take precedence over this translation.