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DEVELOPMENT OF A METHODOLOGY FOR THE SAFETY ASSESSMENT OF NEAR SURFACE DISPOSAL FACILITIES FOR RADIOACTIVE WASTE.

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Abstract

The Project on the Environmental Radiological Impact in CIEMAT is developing, for the Spanish regulatory body Consejo de Seguridad Nuclear (CSN), a methodology for the Safety Assessment of near surface disposal facilities. This method has been developed incorporating some elements developed through the participation in the IAEA`s ISAM Programme (Improving Long Term Safety Assessment Methodologies for Near Surface Radioactive Waste Disposal Facilities). The first step of the approach is the consideration of the assessment context, including the purpose of the assessment, the end-points, philosophy, disposal system, source term and temporal scales as well as the hypothesis about the critical group. Once the context has been established, and considering the peculiarities of the system, an specific list of features, events and processes (FEPs) is produced. These will be incorporated into the assessment scenarios. The set of scenarios will be represented in the conceptual and mathematical models. By the use of mathematical codes, calculations are performed to obtain results (i. e. in terms of doses) to be analysed and compared against the criteria. The methodology is being tested by the application to an hypothetical engineered disposal system based on an exercise within the ISAM Programme, and will finally be applied to the Spanish case.

1. INTRODUCTION

The Project "Environmental Radiological Impact" in CIEMAT is developing, for the Spanish regulatory body Consejo de Seguridad Nuclear (CSN), a methodology for the safety assessment of near surface disposal facilities. This method has been developed incorporating some elements developed through the participation in the IAEA`s ISAM Programme (Improving Long Term Safety Assessment Methodologies for Near Surface Radioactive Waste Disposal Facilities).

The safety assessment of the disposal facilities allows to demonstrate the compliance with previously established regulatory criteria, the establishment of waste acceptance criteria as well as the optimisation of the engineered barriers design. These evaluations should be structured in a way such that the decisions and hypothesis would be easily identified and allow to follow in detailed the various ways of reasoning.

2. ASSESSMENT METHODOLOGY

The first step of the approach is the consideration of the assessment context [1], including the purpose of the assessment, the end-points, philosophy, the disposal system, the source term and temporal scales as well as the hypothesis about the critical group.

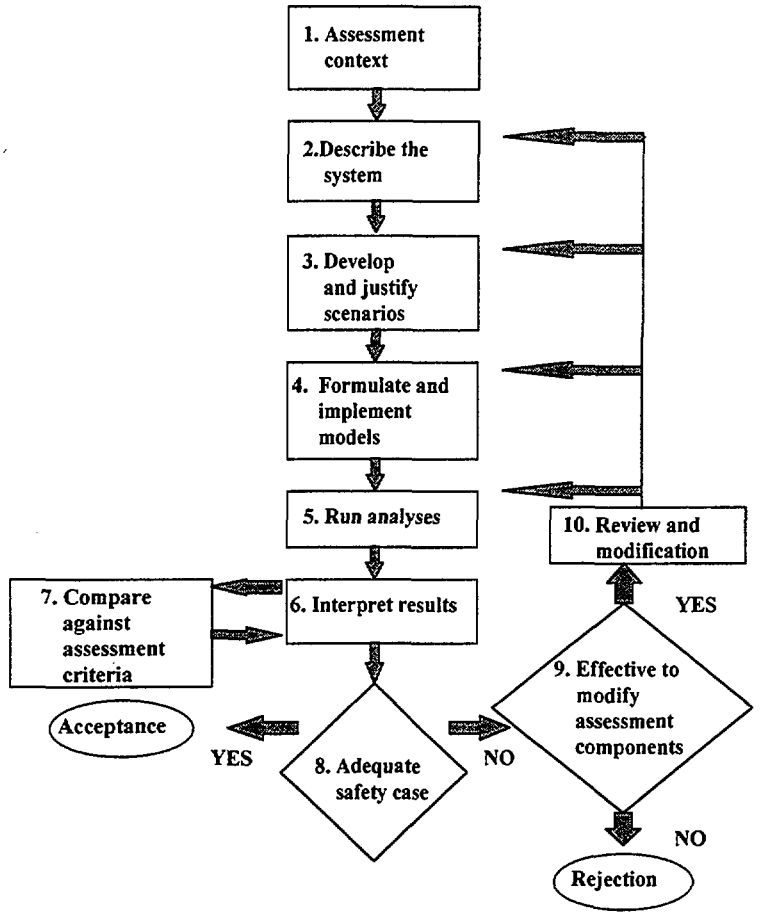

FIG. 1. The Safety Assessment process

Once the context has been established (see Figure 1), and considering the peculiarities of the system, an specific list of characteristics, events and processes (FEPs) is generated. These will be incorporated into the assessment scenarios. The set of scenarios will be represented in the conceptual and mathematical models. By the use of codes, calculations are performed to obtain results (i. e. in terms of doses) to be analysed and compared against the criteria.

3. ASSESSMENT CONTEXT

The main components of this are:

(a) Purpose of the assessment
The safety assessment of the Spanish disposal facility will allow the revision of the waste acceptance criteria, taking into account the current operation of the facility. The evaluation will be structured in a way such that the decisions and hypothesis would be easily identified and allow to follow in detailed the different ways of reasoning.

(b) Assessment end-points
Taking into consideration the purpose previously given, the total amount of radioelements to be accepted in the facility and the maximum limits of activity concentrations in the disposal units as well as in each cell will be calculated.

(c) Disposal system description
The facility is a near surface disposal, with two platforms which constitute a total of 28 cells, to allocate solid and solidified radioactive wastes of low and intermediate level which proceed from radioactive and nuclear installations in Spain. The maximum capacity of the facility is 35 000 cubic meters of conditioned wastes. The drums are disposed of in a cubic concrete container of 25 tonnes. The voids between drums are filled with mortar. The containers are disposed of in cells, which have the capacity for 320 each. For the closure of the facility, it will be protected with a low permeability cover formed with impermeable and draining materials, which will protect the wastes and assure the durability of the concrete containers. The mean annual rainfall is about 653 mm. The main surface water is formed by a river where some smaller streams discharge to.

(d) Source term
The low and medium wastes to be accepted are those with beta and gamma radionuclides, of short to medium half life (to the order of 30 years) and which have limitations in the content of long lived radionuclides [2].

(e) Time scales
The Spanish regulation does not establish any specific requirement in terms of time scales to be considered in the assessment. An institutional control period of 300 years has been proposed and accepted. This looks to be adequate for the Spanish case to be analysed.

(f) Critical group
The critical group is defined, according to the 77 ICRP Publication [3] as an homogenous group in terms of diet, age and those aspects of behaviour that affect the dose; it will be representative of the individuals in the population who receive the maximum doses. With these premises, the critical group will be defined based on real data from the population in the area.

4. IDENTIFICATION AND JUSTIFICATION OF SCENARIOS

The procedure developed for the definition of the scenarios to be considered in the safety assessment establishes the following steps:

1. Structuring the information related with the waste, the engineering system and the site, as well as the assessment context. It looks convenient the use of a FEPs list, as an structured panel against which the evaluator will present the available information.
2. Definition of components and the design conditions, based on the objectives and criteria for the system safety.
3. Analysis and description of the system behaviour and evolution, according to the design characteristics.

3.1. Design Scenario Description.

3.2. Identification and description of Alternative Scenarios.

5. SUMMARY AND CONCLUSIONS

The methodology here described has been defined taking into considerations the new developments under the international context, mainly in the IAEA ISAM Programme. The approach is sufficiently flexible and adaptable to a wide range of contexts and end-points. The assessment approach should not been seen as a unidirectional, once through process, iterations between elements in the approach is needed. A specific application is being tested in the ISAM vault exercise prior to the application to the Spanish situation.

The structured process will allow to increase the understanding of the confidence building process as well as of which approaches and tools are most appropriate to the specific purposes.

References

[1] ISAM, 1997. ISAM, the International Programme for Improving Log Term Safety Assessment Methodologies for Near Surface Radioactive Waste Disposal Facilities: Objectives, content and work programme. IAEA. ISAM document. Final version 18 April 1997.

[2] BOE 255. Orden de 8 de octubre de 1996 por la que se otorga a la Empresa Nacional de Residuos Radiactivos Sociedad Anónima (ENRESA), prórroga del permiso de explotación provisional de la instalación nuclear de almacenamiento de residuos radiactivos sólidos de Sierra Albarrana. Martes 22 de Octubre de 1996.

[3] ICRP, 1998. Radiological Protection Policy for the Disposal of Radioactive Waste. ICRP Publication No 77. Annals of ICRP.