

DEVELOPMENT OF RELEVANT ACCIDENT DATA FOR QUANTIFYING RISKS ASSOCIATED WITH THE TRANSPORT OF RAM

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ABSTRACT

The world-wide production and use of radioactive materials (RAM) and radiation sources in various facets of modern life (e.g., energy production, industry, medicine, science, and technology) involves, inevitably, their transportation in the public domain. The hazards of RAM transportation may be characterised by two distinct conditions of transport and the subsequent risks associated with such transport: i.e., risks associated with incident-free transport as well as that resulting from possible incidents and accidents and the potential to affect people, property, and the environment. Transportation risk assessments require many different and complex subjects to be addressed, including (a) shipment information, (b) the radiological characteristics of the packages and their conveyances, (c) exposure parameters for the transport workers, (d) routing data and population characteristics, (e) the frequency and severity of accidents for a given mode of transport, (f) package response and release behavior, and (g) estimation of the dose to members of the public and transport workers. A technical document has been prepared within the framework of the IAEA's Co-ordinated Research Project (CRP) on "Development of Relevant Accident Data for Quantifying Risks Associated with the Transport of Radioactive Materials". This CRP was established as a continuation of the CRP on "The Probabilistic Safety Techniques Related to the Safe Transport of Radioactive Material". Within that CRP, a computerised package for risk assessment on transportation of RAM was developed. This package contains computer codes and some advisory documentation, called the INTERTRAN2 package. The primary objective of this technical document is to assist the risk analyst by providing support on assessment techniques and potentially relevant information resources available internationally that may be employed in addressing the complex tasks involved in transportation risk assessment.

INTRODUCTION

The world-wide production and use of radioactive materials (RAM) and radiation sources in various facets of modern life (e.g., energy production, industry, medicine, science, and technology) involves, inevitably, their transportation in the public domain and therefore the hazards and the risks associated with RAM transportation.

In 1959 the United Nations Economic and Social Council (ECOSOC) charged the International Atomic Energy Agency (IAEA) with the task of establishing recommendations on the transport of radioactive material. More specifically, the Agency is authorized, under Article III.A.6 of its Statute:

"to establish or adopt,...standards of safety for protection of health and minimization of danger to life and property...and to provide for the application of these standards..."

services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision.

The assessment and the analysis of the risks have always been a preoccupation of the Agency. At the beginning of the nineties, a Co-ordinated Research Project (CRP) on “The Probabilistic Safety Techniques Related to the Safe Transport of Radioactive Material” was established. Within that CRP, a computerised package named INTERTRAN2 for risk assessment on transportation of RAM was developed.

At the eleventh meeting of SAGSTRAM in 1995, to cover the maintenance of the software but mainly to deal with data collection issues, it was decided to start a new CRP which was called “Development of Relevant Accident Data for Quantifying Risks Associated with the Transport of Radioactive Materials”.

The last meeting concerning this CRP was held in August 2000. A technical document (TECDOC) represents the final outcome of the work done in the course of these five years.

The primary objective of this TECDOC is to assist the risk analyst by providing support on assessment techniques and potentially relevant information resources available internationally that may be employed in addressing the complex tasks involved in transportation risk assessment.

SUMMARY

The hazards of RAM transportation may be characterised by two distinct conditions of transport and the subsequent risks associated with such transport: i.e., risks associated with incident-free transport as well as that resulting from possible incidents and accidents and the potential to affect people, property, and the environment.

Transportation risk assessments require many different and complex subjects to be addressed, including (a) shipment information, (b) the radiological characteristics of the packages and their conveyances, (c) exposure parameters for the transport workers, (d) routing data and population characteristics, (e) the frequency and severity of accidents for a given mode of transport, (f) package response and release behaviour, and (g) estimation of the dose to members of the public and transport workers.

The typical approaches available for collection, compilation, and evaluation of input data for transportation risk assessment may be broadly categorised in the following way:

- Use of empirical data collected from national and international experience of transporting radioactive material
- Use or synthesis of data from a wide range of technical disciplines (e.g., science, technology, and economy) with relevance to the study
- Use of scenario specific data that provide a basic description of transportation operation (e.g., size of the package, number of drivers, radiation dose rate).

It is essential that the risk analyst conveys an understanding of the potential uncertainty implicit in the risk estimates and other related issues to assist in establishing confidence (by decision makers and the public) in the evaluation of risks associated with the transportation in the public domain.

The risk analyst must be aware of the limitations of transportation risk assessments, both in terms of the inherent assumptions upon which the computational models were developed, as well as limitations associated with the input data needed by the computational models

Relative to the task of preparing input data for risk assessment calculations, the risk analyst must collect, generate, or synthesise a great deal of information in order to correctly evaluate the radiological risks associated with the transportation of radioactive materials

The risk analyst must be aware that the computational algorithms, in many cases, apply simplifications to model the transportation operations, and require generalised (average) input parameters. Even if more precise data are available, it may be impractical for the analyst to use this information explicitly, without first calculating an average value of the subject parameter

The risk analyst must also be cognisant of the many sources of data that are available. Some input data that describe the package and transportation operations, such as the package size, number of crew members, velocity of the transport vehicle, and the length of the route, can be readily determined as part of the definition of the problem. Other data, such as that describing the population density along the route, and certain characteristics about the transportation system (e.g., traffic volumes, vehicle occupancies, and number of pedestrians) must be derived from experience and careful examination of the transportation system.

The risk analyst must be familiar with certain terms associated with transportation risk assessment: package, mode, conveyance, incident-free, accident (or incident), probability, consequence, risk, severity, .etc....

In view of helping the risk analyst, the INTERTRAN2 transportation risk assessment package has been assembled to provide a calculation tool for estimating the risks from both the incident-free transportation of radioactive materials as well as the risks associated with conceivable incidents and accidents that may occur during the shipment by land, air or sea.

The INTERTRAN2 package is fully explained in the TECDOC but its presentation is developed in an other section of this conference.