Italian TRARAD Database for Radioactive Material Shipments

P. Caporali, C. Faloci, M. Paganelli, G. Palmieri
ANPA—National Agency for Environmental Protection

INTRODUCTION

The primary role of the Competent Authority in transportation of radioactive materials (RAM) is to ensure the safety of humans, the environment, and property against possible hazards involved in the transport of RAM. To verify that all activities involved in transportation are carried out in compliance with the Regulations and to perform safety assessment, risk analysis, and inspections, it is very important to know in depth the data regarding the transport of RAM. The database TRARAD (TRAnsport RADioactive) contains data regarding the transport of radioactive material (except for rail mode) since 1987. At the present about 2,700,000 records are stored in TRARAD (each record contains data regarding a single shipment of one or more packages). The aim of this paper is to present the work done to develop the database TRARAD.

ORIGIN OF DATA

In Italy the transport of radioactive materials is performed by authorized carriers only. The authorization is issued by the Minister of Industry together with the Minister of Transport. According to the authorization Decree, the carriers have to provide, to the Ministry of Industry and to ANPA (Italian Competent Authority for the transport of radioactive materials), on a quarterly basis, the data of the shipments performed. The data regarding each shipment are collected by the carrier with specific format issued by the Ministry of Industry. Last year (1994) about 400,000 records were sent to ANPA. Some carriers with a large number of shipments are able to provide data on magnetic support (tape or diskette) and on sheets; other carriers provide data only in written form by the standard sheet. The data provided on magnetic support, about 85 % of all data, are structured according to nonstandardized formats, while the data into TRARAD are structured according to a standard format. To adapt the data provided by these carriers to the standard format of TRARAD, it was necessary to develop some ad hoc programs (there are about 20 different programs) to store the data into TRARAD.

The data provided only in written form (about 15 % of all data) need to be transferred onto a magnetic support before being stored into TRARAD. To avoid this phase of transfer of data from sheet to magnetic support, that involves time, money and probability of mistakes, ANPA has developed an input processor program, called TRIME. The purpose of the TRIME program is to make the data management easy for those carriers with their own personal computer but without the capability to develop such a program. The program allows minor carriers to input and store data according to a standard format, and to printout and make a copy on diskette of the file data to be sent to the Competent Authority. TRIME is distributed, on request, free of charge to all carriers.

ANALYSIS, DESIGN, DEVELOPMENT, AND VALIDATION OF TRARAD

The development of TRARAD started with an analysis of the functions and requirements that this database had to perform. This first phase allowed a design to develop and to select the hardware and software resources for the database.

The goals of TRARAD were:

- to perform investigations for information retrieval about specific shipment;
- to have a complete information on transport activity of each authorized carrier for compliance assurance actions;
- to publish the annual report on national transport of radioactive materials and to perform statistical elaboration and trend analysis;
- to select data to be used for risk analysis and dose evaluation of transport workers and persons with INTERTRAN computer code.

As a second step it was necessary to design the structure of the database that could achieve the goals fixed in advance. Therefore, regarding the hardware resources, it was decided to use a computer system available in ANPA Emergency Center (VAX VMS Digital system). The choice was made to plan an emergency situation during transport of radioactive materials. Regarding the software resources, it was decided to use the database management system VAX Rdb/VMS with the interface SQL (Structured Query Language) to define and access TRARAD. The SQL interface allows to operate with interactive modality or to ad hoc programs. About 20 programs (FORTRAN 77 with SQL commands) were developed to read the data provided on magnetic support by the carriers and to transfer the data into the database TRARAD. A lot of elaborations were made to check the quality of the data and to discover mistakes in the data provided by the carriers, to find systematic and random errors.

Structure of TRARAD

TRARAD is a relational database. The data are therefore organized in a collection of tables and each table contains sets of similar data. This structure allows to establish some relationships among records of different tables and offers a great flexibility in accessing database.

Figure 1 shows the TRARAD structure. It is formed by a main table containing shipment data and four tables containing the information regarding consignors, consignees, and carriers and the radionuclides of Table I of IAEA S.S.6.

Figure 1. Structure of TRARAD database.

TRA Rev.6 Table contains the data for each shipment provided by the carriers:

Progressive number
Identification number of carrier
Identification number of consignor
Identification number of consignee
Identification number of previous carrier
Identification number of following carrier
Packages Numbers
Height of package
Length of package
Width of package
Mass of package
Type of package
Category of package
Transport Index
Radionuclide and mass number
Physical state of source
Activity
Shipment date (start)
Shipment date (end)
Identification mark (IAEA Certificate)
Mass of source
Flag data input
Various code
Quality index of Transport Index
Quality index of Activity
Quality index of number of packages
Warning code

The TRA Rev.6 table contains some fields (grey area) used to facilitate elaboration carried out by TRARAD.

The scope of these fields is detailed as follows:

- a progressive number (variable called KEY) identifying the record;
- a flag input data (variable called PROT) identifying if the data are provided by sheet only;
- various code (variable called CODICE), the identification code provided by the carriers to identify the shipment;
- three quality numbers (QUA_AT, QUA_IT, QUA_CO variables) used for resetting values of some data found to be wrong. These quality numbers can be very useful in case of elaboration (for example, the average transport index) and also to maintain unchanged the data provided by carriers (legal value);
- a warning code (variable called MOD) identifies if the original record of the data has been modified before being stored in TRARAD.

MITT Rev.0 and DEST Rev.0 tables contain the information regarding the consignors and consignees. The contents are shown below:

MITT Rev.0 Table

Identification number of consignor
Company name of consignor
Address of consignor
City of consignor
Province of consignor

DEST Rev.0 Table

Identification number of consignee
Company name of consignee
Address of consignee
City of consignee
Province of consignee

The VETT Rev.0 table contains information regarding all authorized carriers. The contents are shown below:

VETT Rev.0 Table

Identification number of carrier
Type of carrier
Mode of transport
Company name

The ISO Rev.0 Table contains the list of radionuclides from Table I of "IAEA Safety Series n. 6 1985 Edition as Amended 1990" with the values of A1 and A2. This table is used to verify the name of radionuclide provided by the carriers and for other elaboration. For example, we can calculate for each radionuclide the ratio between A2 and the activity contained into the package. Moreover the Table contains the half-life and the specific activity for each radionuclide.

ISO Rev.0 Table

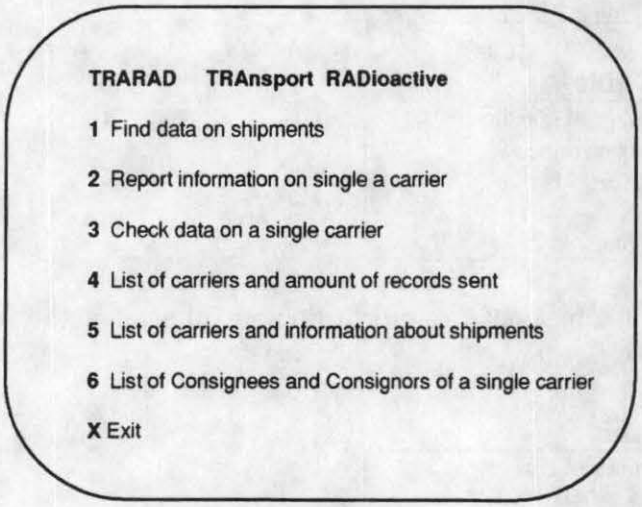
Radionuclide
A1 (Value in Bq)
A2 (Value in Bq)
half-life (second)
specific activity (Bq/gr)

ACCESS TO TRARAD, QUERYING DATA

TRARAD database can be accessed through simple interface menu or using SQL (Structured Query Language) both in interactive mode and through application programs written by FORTRAN including SQL commands. The first mode to access the data is guided through an interface menu that allows you to retrieve information about a particular shipment and to obtain detailed information regarding the transport activity of all carriers. This access mode is useful for ordinary surveillance.

Menu interface to TRARAD

The simple system to retrieve data through TRARAD is formed by easy-to-understand masks. Retrieved data can be displayed on the terminal video, printed, or copied to a file; the main menu is shown below.



Choice 1 can be used to retrieve information regarding the shipments. The information, extracted by TRARAD, are:

- shipment date (start)
- identification number of carrier
- identification numbers of previous carrier and following carrier
- company name and address of consignor and consignee
- radionuclide, physical state and activity
- type of package
- transport index and category of package
- number of packages

Choice 2 can be used to obtain a report regarding the shipments performed by a single carrier. The report contains:

- number of packages shipped each year;
- number of packages shipped each month;
- total, average, maximum activity shipped;
- average, maximum and minimum transport index;
- number of packages as function of transport index;
- number of packages as function of package category;
- number of packages as function of package type;
- list of radionuclides shipped and their values (min, max, average of transport index and activity);
- list of previous and following carriers.

Choice 3 can be used to retrieve information about data of shipments not in agreement with the applicable requirements of the Regulations. The check is performed for a single carrier and the elaboration is carried out taking into account the following data:

- package category and transport index;
- package type and source activity (comparison with A1 and A2 value of Table I IAEA S.S. 6 ed.1985 as Amended 1990;)

Choice 4 can be used to obtain a printout of the records provided by all carriers (on yearly and monthly base).

Choice 5 can be used to retrieve information about all carriers and to find errors on data. The printout gives the following information:

- total number of records;
- total activity;
- activity transported by a single carrier referred to the total activity transported by all carriers (percentage value);
- transport index (maximum and average);
- activity (maximum and average);
- number of records with quality index of transport index = 0;
- number of records with quality index of activity = 0;
- number of records with quality index of numbers of package = 0.

Choice 6 can be used to obtain information (total activity and total number of packages) for each consignors and consignees that are in relationship by a single carrier.

INTERFACE WITH TRARAD BY SQL (Structure Query Language)

The second mode to access TRARAD is the ANSI (American National Standards Institute) interface SQL, useful to operate with the database and to produce specific reports. SQL contains functions called statistical expression or aggregate expression.

CONCLUSIONS

The use of TRARAD gave an improvement in compliance assurance actions and for the inspection of carriers, consignors, and consignees and allowed achievement of the main goals, but put in evidence some problems correlated to the quality of the data provided by the carriers.

It was noted that some mistakes (for example the data regarding the number of packages for a single shipment, the amount of activity, the transport index, etc.) could have a strong influence on the results of the elaboration.

Much work was necessary to improve the quality of the data, and in this direction is the work regarding the standardization of the format of the data provided by the major carriers and the effort to develop TRIME program distributed with a user guide to the minor carriers.

Session VIII-1: Transportation Package Development I