Supporting System in Emergency Response Plan for Nuclear Material Transport Accidents+

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INTRODUCTION

The development and use of nuclear energy have progressed steadily in Japan, and especially the nuclear power generation has taken an important part of electric power supply. As the nuclear power generation capacity increases, the amount of transportation of nuclear materials such as uranium hexafluoride, uranium oxide, fabricated nuclear fuel and spent fuel increases more and more. In Japan, all such transportations are controlled by domestic regulations which have completely adopted the IAEA regulations (1985 Edition). In particular, type B and/or fissile nuclear packages should be certified by the Competent Authority (Science and Technology Agency (STA) or Ministry of Transport (MOT)) to be satisfied the safety requirements of the IAEA Regulations. Although there has never been a serious accident nor incident which has led to radiological impact to the public until now, an emergency response planning is needed to secure safe transportation.

In Japan, the Emergency Response Council for Radioactive Material Transport Accidents, which consists of the staffs of STA, MOT, National Police Agency, Maritime Safety Agency and Fire Defense Agency, is organized immediately in case of serious accidents. The Council measures an adequate emergency response by correcting detailed information concerning the package itself and the circumstance of accident site.

In order to provide the detailed information concerning nuclear material transport accidents and to plan the information communication means by using computers, the Supporting System Research Committee has been established in the Nuclear Safety Technology Center (NUSTEC). In this paper, we describe the general concept of the emergency supporting system and the detailed contents of the system, which have been prepared in the research committee of NUSTEC.

EMERGENCY RESPONSE AND SUPPORTING SYSTEM

The purpose of the Emergency Response Supporting System (ERSS) is to supply valuable data and information which are necessary for the competent authority

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and the Council to determine the measures for accident. The general concept of communication chain of the system is shown in Fig.1. The Information Service Center, in which the ERSS is provided, is located in NUSTEC. After an accident or incident occurs, the transport head, the vehicle crew or a public finder will contact a near-by local fire department and/or police station. At the same time, the initial report is to be reported to the competent authority through the consignor and the carrier. The Council or the competent authority requires the necessary information to the Information Service Center.

According to the IAEA recommendations for an emergency response planning(IAEA 1988), the response actions in any accident can be divided into three phases: the initial phase, the accident control phase and the post-emergency phase. The initial phase includes immediate report and temporary action by carrier and local government organizations. The supporting system starts after the competent authority receives the initial report of an accident. On the viewpoint of ERSS, we divided the initial phase recommended by IAEA into two phases: the priority response phase, and the initial response phase. The priority response phase includes emergency action only required by the transport head of carrier or the vehicle crew. Therefore, ERSS supports the competent authority for measuring adequate response to the initial response phase and the following phases.

The relationship between the response of each phase and the function of ERSS is described below.

(1) Priority Response Phase
After the accident occurs,
Accident Site: Transport head or vehicle crew has to take the following actions;
to report to the local fire department and police station and the consignor,
to save lives,
to attend to the injured,
to prevent or put out fires,
to control traffic,
to identify the package condition.
ERSS Function: No response.

(2) Initial Response Phase
After the competent authority receives the initial report of accident,
Accident Site: Consignor has to take the following actions;
to set a emergency response organization and,
to continue the action mentioned in the priority response phase in cooperation with the fireman and/or police,

to determine a temporary cordoned off area,
to perform a visual inspection of package,
to execute radiological monitoring,
to judge whether the contamination or leakage of radioactive material occurs or not.
Competent Authority : STA and MOT have to take the following actions;
to collect information,
to measure the initial response,

to make contact with relevant organizations and personnel,
to judge whether the accident is serious or not.

ERSS Function: The system starts and,
retrieves the package information,
outputs the procedures of initial response, and
lists up the name of organizations and personnel concerned.

(3) Accident Control Phase

In case of occurrence of contamination and/or leakage of radioactive material, the Emergency Response Council for Radioactive Material Transport Accidents (the Council) will be organized, and

Accident Site: Consignor's emergency response organization has to take the following actions;
to perform the monitoring precisely,
to change the cordoned off area, if necessary,
to prevent to spread the radioactive contamination,
to collect or remove the radioactive material and the packaging,
to conduct the public to a safety area, if necessary.
Competent Authority's Emergency Response Headquarters may be set.

Competent Authority : STA and MOT call the Council, and the Council has to take the following actions;
to dispatch experts and/or necessary resources to the accident site,
to ask near-by nuclear facilities to support,
to collect the detailed information,
to evaluate the accident,
to indicate the appropriate response measures to the Emergency Response Headquarters at accident site,
to review and indicate the cleanup procedures.

ERSS Function: The system outputs the member list of the Council,
outputs the member list of experts to be dispatched,
outputs the list of nuclear facilities which should have access to expert advice and resources, and
outputs the decontamination procedures and the list of necessities of decontamination.

(4) Post-Emergency Phase

In case of no contamination or no leakage of radioactive material, or after the accident control phase,

Accident Site: The Consignor's Emergency Response Organization has to take the following actions;
to evacuate or remove the damaged packages, if necessary,
to decontaminate any radioactive material, if necessary,
to recover the accident area to its original state.

Competent Authority : The Emergency Response Headquarters at accident site has to take the following actions;
to confirm no radioactive material contamination,
to evaluate the radiological exposure dose,
to decontrol the cordoned off area,

to release the public from evacuation,
to declare completion of the accident.

ERSS Function: Recording any accident data to the system.

COMPOSITION AND FUNCTION OF SUPPORTING SYSTEM

The supporting system, ERSS, is composed of four subsystems and four data bases. The relationship among the subsystems is shown in Fig.2. The General Control Subsystem, a key subsystem of ERSS, controls and handles the other subsystems and the data bases. As shown in Fig.3, the Transport Information Control Subsystem has four display functions which are Transport Information, Area Information, Nuclear Material Information and Initial Response Procedures. Each information display function has its own data base. The Accidents Evaluation Subsystem has an Accident Data Display/Record function and its data base. In near future, a Radiological Assessment function shall be joined in the Accidents Evaluation Subsystem. The Information Communication Control Subsystem has three functions which are Communication with Distant Area, Users' Qualification Control and Data Transmission.

ERSS starts just after any initial information such as name of package, date of accident, name of accident site or name of carrier/consignor, is input. The computer easily searches the concerned package and outputs the initial response procedures, since the data bases of information display function of the Transport Information Control Subsystem are communicated with each other (See Fig.3). The output data and information are offered to the competent authority or the Council by an on-line computer system.

Transport Information Control Subsystem

Prior to the transport of type B or fissile nuclear package, the transport application must be done to STA or MOT by the consignor. All information including the application, such as application number, date, applicant's name, name of nuclear material and its weight, are input into the Transport Information data base.

The Area Information display function can display the environmental map of the accident site, location of near-by fire department and police station, names and location of near-by hospitals and nuclear facilities, names of concerned local and prefectural organizations. Also, the ability of fire service, the capacity of hospital beds, and the available number of supporting persons and resources has been stored in the Area Information data base. The names and phone numbers of the Council members and the experts to be dispatched are displayed by this function.

The physical and chemical properties and the characteristics of nuclear materials which are transported very often with vehicles in Japan have been stored in the Nuclear Material Information data base. The behavior of nuclear material released from the damaged packagings and the emergency measures are also displayed. All information of nuclear material is stored with two levels, the first level (minimum information for deciding the initial measures) and the second level (detailed information).

The above three information display functions are controlled by the Initial Response Procedures display function.

Accidents Evaluation Subsystem

The data base of the Accident Data Display/Record function stores the records of international and domestic nuclear transport accidents. The information of initial response procedures and another measures taken in the accident is useful to decide the measures. After the completion of accidents, the detailed report shall be submitted to the competent authority. All information and data in the report are recorded in the data base of the Accident Data Display/Record function. These data shall be helpful in future.

Information Communication Control Subsystem

The purpose of the subsystem is to transmit the initial response procedures, nuclear contents information, area information and transport information to the accident site and relevant organizations by using communication means (See Fig.4). However, this subsystem has not completed yet.

The function of Communication with Distant Area can connect a terminal of the accident site with ERSS. The communication means may be telephone cables or wireless.

In order to protect ERSS from use by disqualified persons, the Users' Qualification Control function checks the qualification of users and restricts outputs of data.

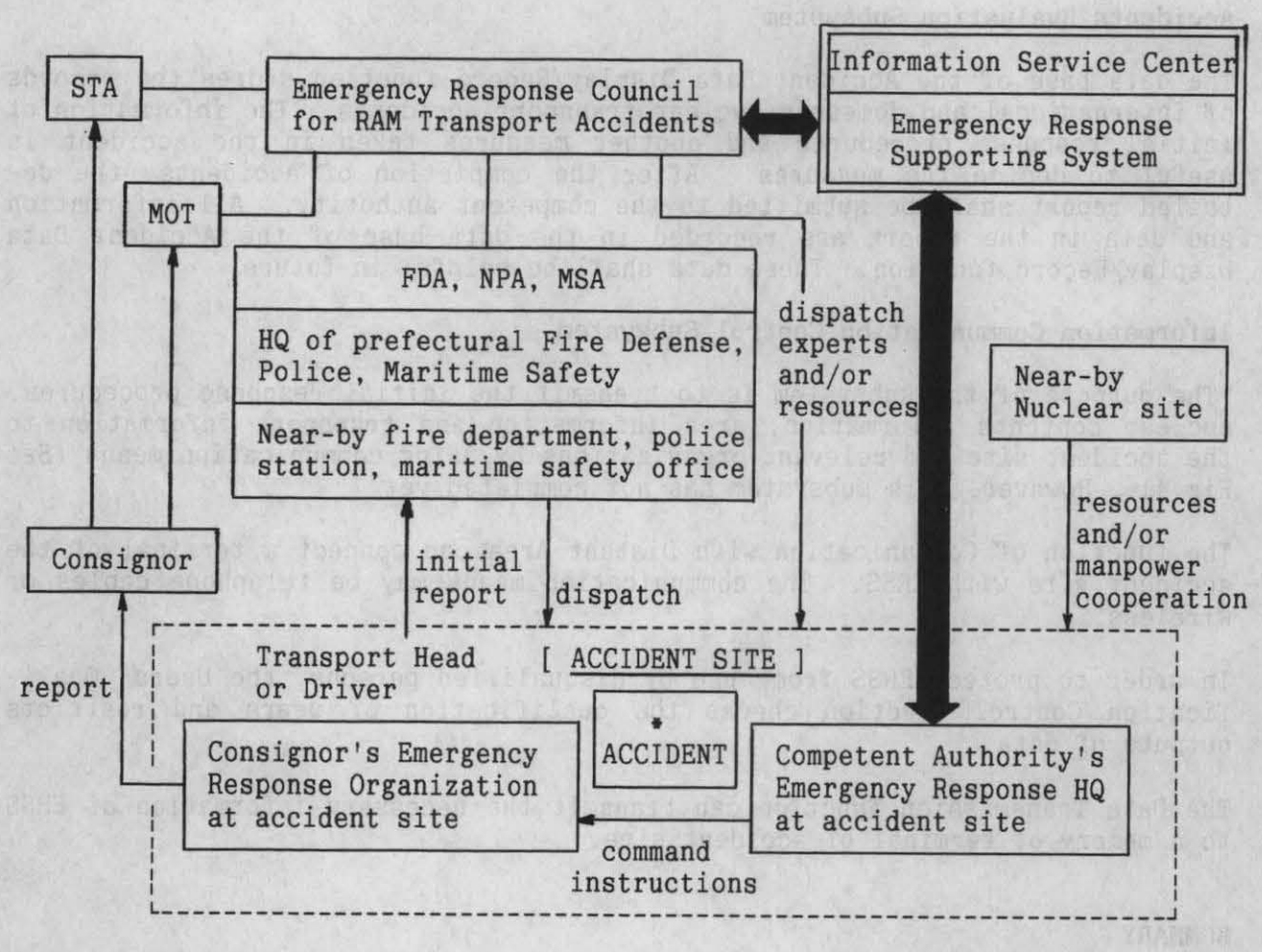
The Data Transmission function can transmit the necessary information of ERSS to a memory of terminal of accident site.

SUMMARY

As aiming to provide the detailed information concerning nuclear material transport accidents and to supply it to the concerned organizations by an on-line computer, the Emergency Response Supporting System has been constructed in the Nuclear Safety Technology Center, Japan. The system consists of four subsystems and four data bases. By inputting initial information such as name of package and date of accident, one can obtain the appropriate initial response procedures and related information for the accident immediately. The system must be useful for protecting the public safety from nuclear material transport accidents. But, it is not expected that the system shall be used in future.

REFERENCE

INTERNATIONAL ATOMIC ENERGY AGENCY, Emergency Response Planning and Preparedness for Transport Accidents Involving Radioactive Material, Safety Series No.87, IAEA, Vienna (1988).



STA:Science and Technology Agency, MOT:Ministry of Transport, FDA:Fire Defense Agency, NPA:National Police Agency, MSA:Maritime Safety Agency

Fig. 1. Communication chain of the supporting system in emergency response planning.

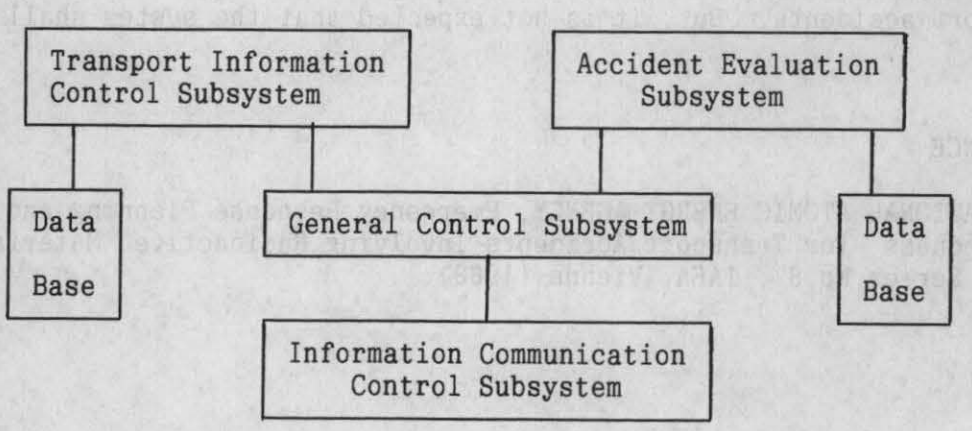


Fig. 2. Relationship among subsystems in the Supporting System.

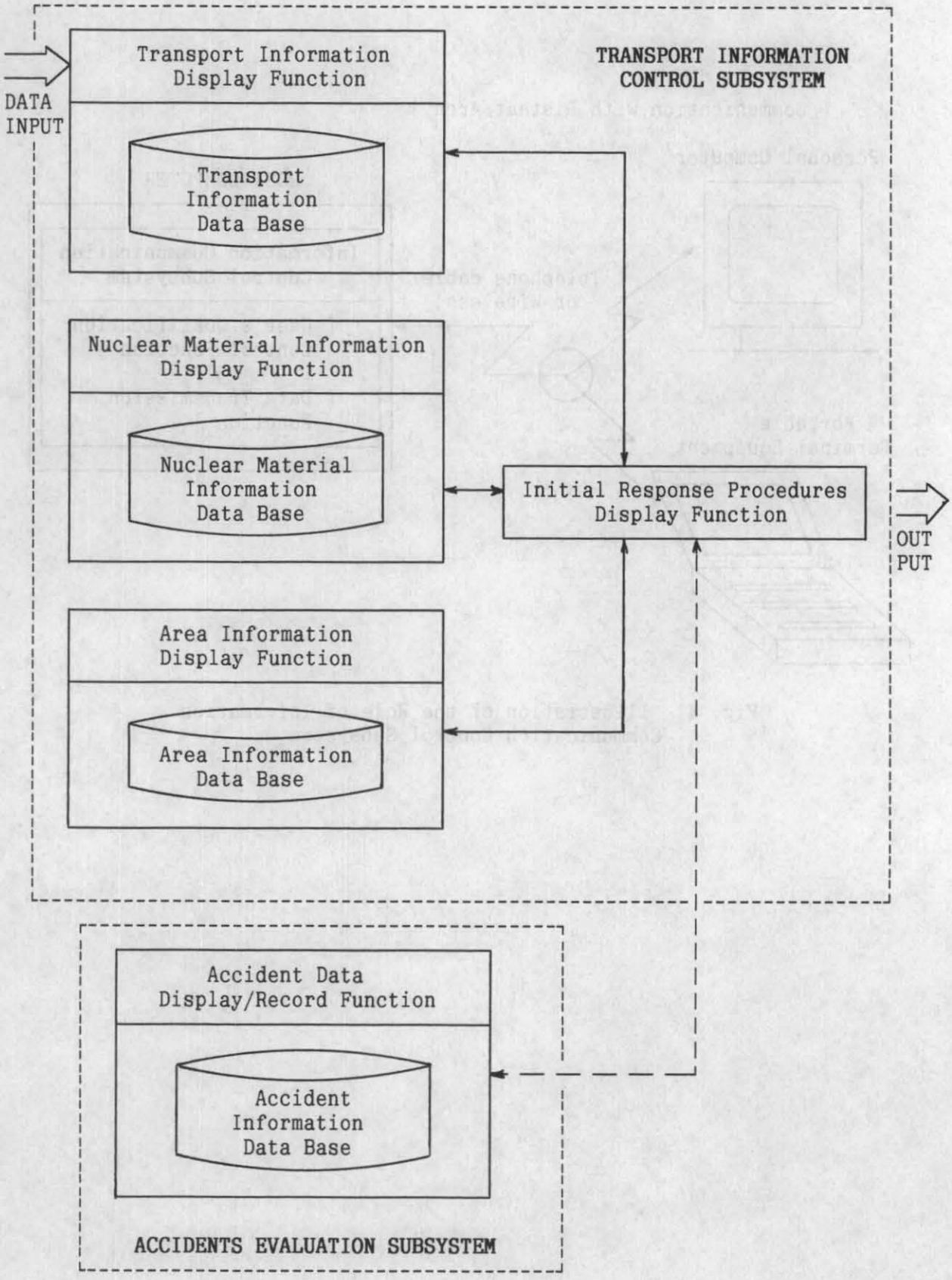


Fig. 3. Communication among the data bases

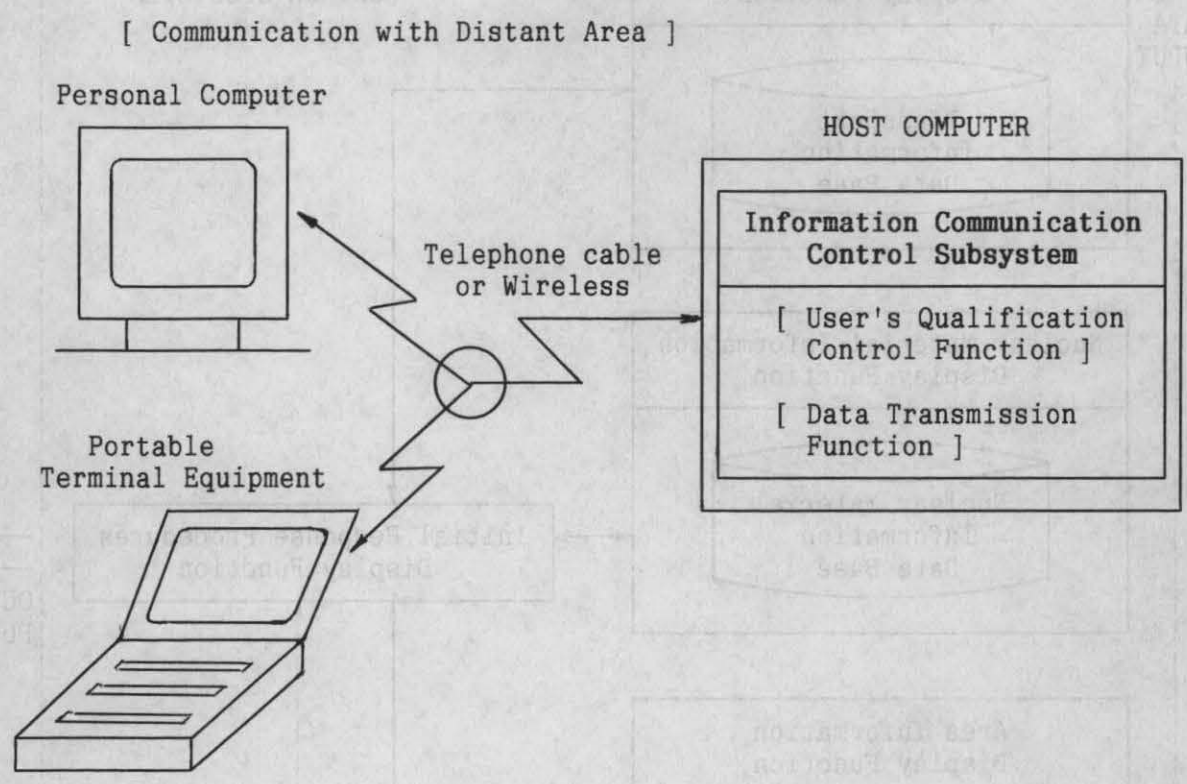


Fig. 4. Illustration of the Role of Information Communication Control Subsystem