EMERGENCY INTERVENTION PLAN FOR

14 MW TRIGA - PITESTI RESEARCH REACTOR

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Abstract. A 14 Mw TRIGA research reactor is operated on the Institute for Nuclear Research site. In the event of a nuclear accident or radiological emergency that may affect the public the effectiveness of protective actions depends on the adequacy of intervention plans prepared in advance. Considerable planning is necessary to reduce to manageable levels the types of decisions leading to effective responses to protect the public in such an event. The essential structures of our on-site, off-site and county emergency intervention plan and the correlation between emergency intervention plans are presented.

INTRODUCTION

The Institute for Nuclear Research (INR) Pitesti is located at 20 km far from Pitesti city and 5 km from Mioveni (NE). It is the largest Institute in Romania, whose main role is to develop research products and services to ensure technical support for nuclear power in Romania.

The Research Reactor facility in Romania is a dual core TRIGA reactor containing a 14MW TRIGA for steady-state operation and an ACPR TRIGA for pulse operation until 20,000 MW pulses. Both reactor cores are installed in a large pool containing 300 m3 of demineralized water, connected to the primary cooling system (see Figure 1).

Adjoining the reactor building there is the Post-Irradiation Examination Laboratory. On the same area there is the division for low and intermediate level radwaste collected from the reactor and post-irradiation examination laboratory. Other on-site installations are High Capacity Gamma underwater irradiation, department for out-of-pile testing of some Candu power equipments, departments of physics and safety, materials investigations, corrosion, electronics, health physics and environment, etc.

The 14MW TRIGA R.R. is a unique design of TRIGA conception. Both reactor cores have individual Safety Analysis Reports, operational procedures, licensed operators and are authorized by the regulatory body, CNCAN, for continuous operation.

The Steady State core was fully converted in May 2006 to use LEU fuel. The core contains 29 fuel assemblies, 8 control rods and beryllium reflector, associated instrumentation and controls. The Annular Core Pulsed Reactor (ACPR) TRIGA is fueled for life. This reactor is mainly used at a low power level, i.e., 500 kW max. for NAA, beam application and primarily in the pulse mode to simulate transients and accident conditions RIA and LOCA type, when fuel consumption is not significant. This reactor is also used for training, education and demonstrations.

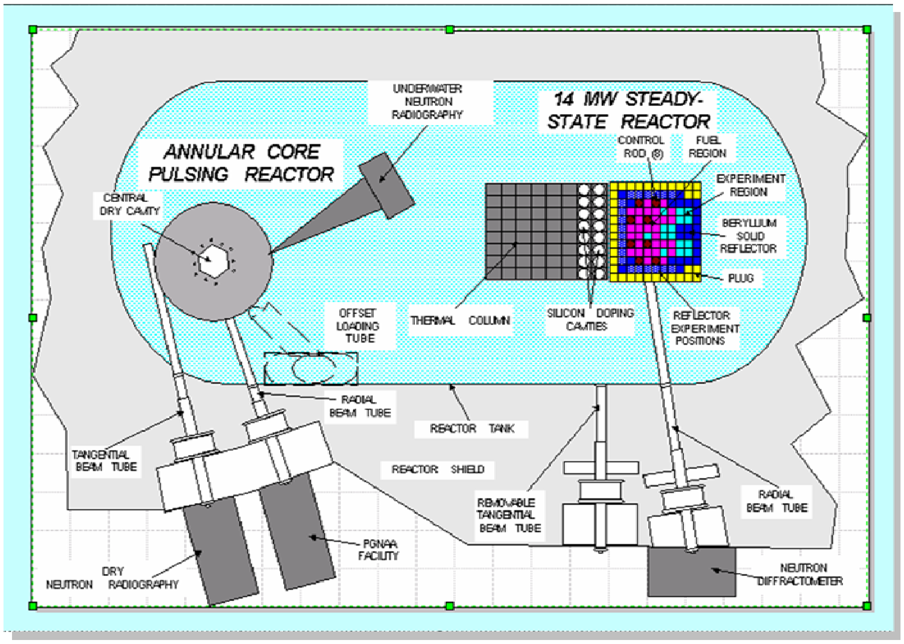

FIG. 1. The layout of the dual core TRIGA Research Reactor

The decision to initiate a protective action in the case of nuclear accident or radiological emergency is a complex process. The benefits of taking the action is weighed against the risk and constraints involved in taking the action. In addition the decision will be made under difficult emergency conditions, probably with little detailed information available. Therefore, considerable planning is necessary to reduce to manageable levels the types of decisions leading to effective responses to protect the public in the event of a nuclear incident.

The sequence of events for developing emergency plans and responding to nuclear incidents[1][2] will vary according to individual circumstances, because the international recommendations and site-specific emergency plans cannot provide detailed guidance for all accident scenarios and variations in local conditions. Flexibility must be maintained in emergency response to reflect the actual circumstances encountered[3] (e.g. source term characteristics, the large number of possible weather conditions and environmental situations such as time of the day, season of the year, land use and soil types, population distribution and economic structures, uncertainties in the availability of technical and administrative support and the behavior of the population). This further complicates the decision-making process, especially under accident conditions where there are time pressures and psychological stress.

Therefore one of the most important problems in the case of a nuclear emergency is quantifying all these very different types of off-site consequences.

ACCIDENT SCENARIOS

The nuclear risk sources on the ICN site are:

- TRIGA Research Reactor
- Post Irradiation Experiments Laboratory
- Radwaste Treatment Station
- Out of Pile Testing Facility
- Power Gamma Irradiation Facility
- Nuclear Fuel Factory

For all these facilities were developed accident scenarios and emergency intervention procedures were established. The main source of risk is the TRIGA Research Reactor. For the Steady State core were identified both internal and external events leading to an emergency situation, and are presented in Table 1.

Table 1. The list of events leading to an emergency situation for the steady state core

Event type:		**Event name:**
Internal	Design Basis Accidents (DBA)	Damage of a single pin fuel in water with TRIGA specific release factors
		Damage of a 25 pin fuel bundle in air with total release
		Accidental reactivity insertions
		Loss of flow due to the damage of main coolant loop pump
		Interaction between the 2 cores
	Beyond Design Basis Accidents (BDBA)	Damage of a 25 pin fuel bundle in water with total release
External	Fire	
	Earthquake	
	Airplane crash	
	Terrorist attack	
	Armed Conflicts (terrestrial or aerial)	

Last years, and in particular since the Chernobyl accident, there has been a considerable increase in the resources allocated to development of computerized systems which allow for predicting the radiological impact of accidents and to provide information in a manageable and effective form to evaluate alternative countermeasure strategies in the various stage of an accident. In this way, we have developed at INC-Pitesti a computer code namely DOZIM.

Table 2. Computerized support for nuclear accident management at ICN Pitesti

Computer codes	**Site Specific Databases**
DOZIM (developed in ICN)	Population
COSYMA (EU)	Meteorological
MACCS (USA)	Agricultural production
	Animal production
	Food consumption rates

EMERGENCY INTERVENTION PLAN STRUCTURE

The objectives of Emergency Intervention Plan are[4]:

- to protect employees, first aid for injured personnel and treatment for contaminated personnel
- to operate the installations in order to ensure the best safety status, safe shutdown and to limit the consequences of the incident or accident
- to assess the radioactive release, the doses and the contamination degree
- to inform the local and national authorities

The emergency plan is structured on 4 sections: Section I: General data on INR site, Section II: On-site intervention procedures in event of nuclear accident having off-site consequences, Section III: Specific intervention procedures for INR nuclear facilities having strictly limited consequences on facilities or site and Section IV: Procedures for beta and gamma radioactivity determination

During the normal operation of the nuclear facilities, the sources are under control. The effects on the population health are in the stochastic range, and the radiation protection has the role to maintain the probability of consequences at a low range.

In case of a nuclear accident the sources are no more under control. The reduction of doses – and the implicit reduction of health risks – is done by taking measures in what concerns the employees, the population and certain environmental factors.

The dose that the INR personnel can bear in case of a hypothetical foreseen accident (destruction of a cassette or of the active zone) varies among a few mSv and Sv. The effects on their health belong as much to the probabilistic domain as to the deterministic one. Few persons in the reactor's building may get lethal doses.

The intervention's management must be as well organized as to prevent serious deterministic effects; this is why the on-site emergency plan has a modular structure. The structure of management for an emergency situation is presented in Figure 2.

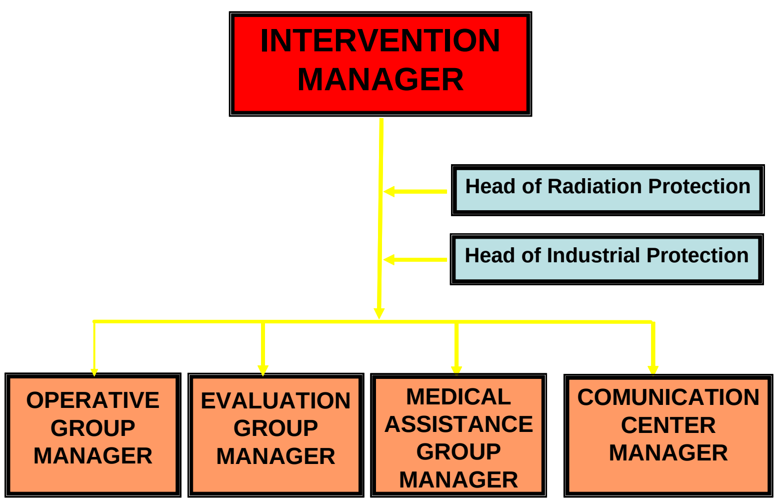

FIG. 2. The decisional structure for an emergency situation on ICN Pitesti site

The procedures included in the different sections describe the way of operating in case of certain possible accidents at the nuclear installations of ICN and NFP (nuclear fuel plant). The foreseen events may have consequences on the installations and maybe on the personnel. It is unlikely that the effects of these events have off-site consequences. For every foreseen event a procedure has been settled. These procedures have a strong technical character, specifically describing the maneuvers that must be accomplished on the installations.

The procedures from the last section are the monitoring procedures for radiation levels during emergency and fallow- up. These procedures establish the way of sampling and the preparation of samples for beta measurements and for the gamma spectrometry analyses of the radioactive content in air, soil, vegetation, foodstuff etc. The procedures from the fourth section have the role of providing integrated methods of sampling, preparation, measurement, interpretation and recording of the results for each laboratory and for all the people involved.

The schematic structure of activities covered by emergency intervention plan is presented in Figure 3.

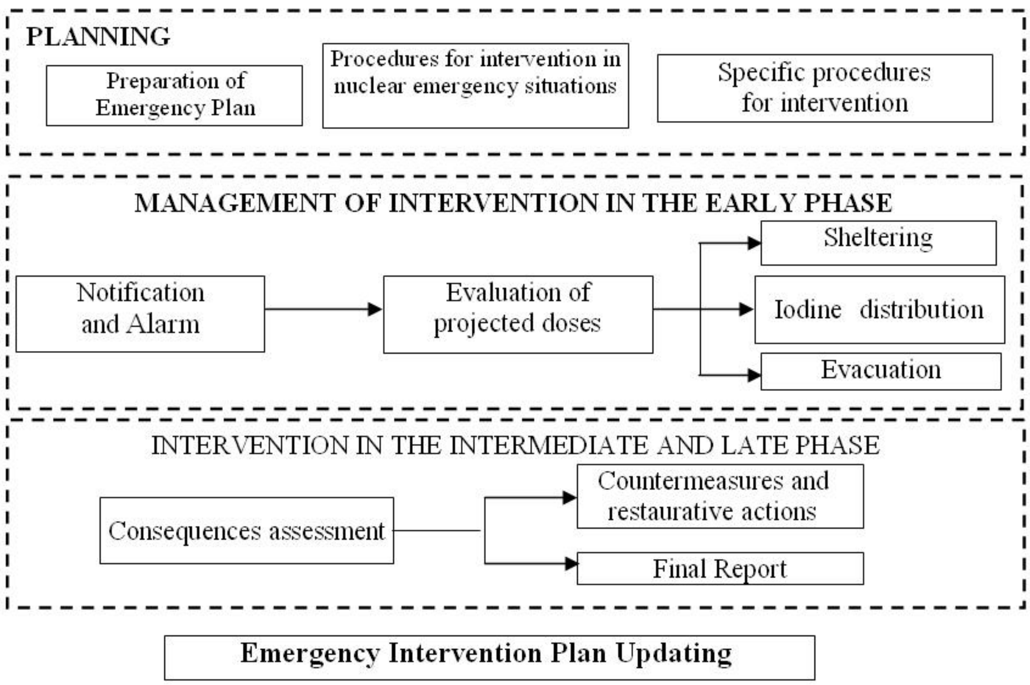

FIG. 3. The schematic structure of activities covered by emergency intervention plan

The consequences of a nuclear accident will affect a large area including Argeş county and possibly the neighboring counties. This is why a link between on-site emergency intervention plan and both the Argeş county emergency intervention plan and national emergency intervention plan must be created. The flow chart of the national and county organizations and institutions involved in nuclear accident management are presented in Figure 4. Specific intervention procedures for all listed organizations and institutions were created and included in the national and county emergency intervention plans.

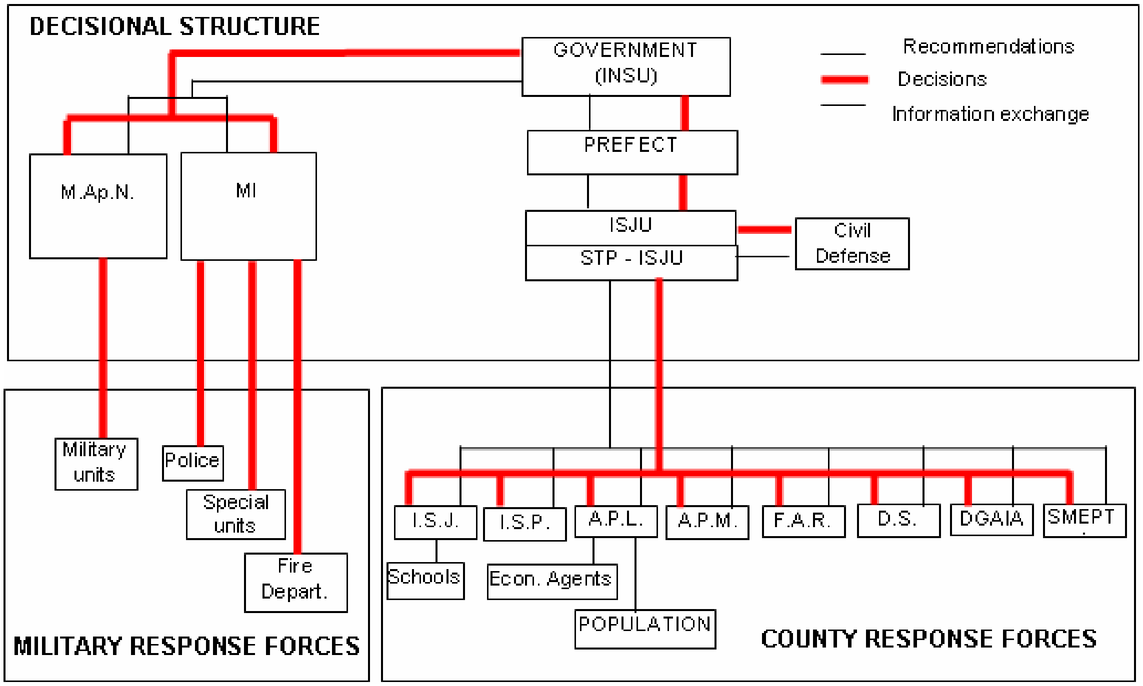

FIG. 4. The flow chart of the national and county organizations and institutions involved in nuclear accident management

CONCLUSIONS

The paper briefly presents the organization of emergency intervention in a case of nuclear accident at ICN site.

The present emergency intervention plan is the result of international guidance and national legislation, and also on local experience in planning, development of instrumentation and computing methods accordingly with quality assurance system.

I must emphasize that each year; we have an emergency intervention exercise for a nuclear accident situation at our TRIGA reactor. The main objective of such an exercise is to test the response capability in a nuclear accident situation for all the institutions and organizations from all levels and to test the implementation of the specific procedures.

REFERENCES

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