SAFE MANAGEMENT OF RESEARCH REACTOR MARIA WITH SPECIAL EMPHASIS ON SAFETY CULTURE ENHANCEMENT PROCESS

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Abstract

This paper is focused on the presentation what is the role of the State, Regulatory Body and Operating Organization in the assurance of research reactor MARIA safety. Also the significance of high level of safety culture for safety assurance and the process of its improvement has been highlighted. The process of development and improvement of safety culture contains the issues described in this paper, which we're considerated as the most important and our efforts are focused on their achievement.

1. INTRODUCTION

High Flux Research Reactor MARIA is operated in National Centre for Nuclear Research from December 1974. This is a pool type reactor, operated with nominal power 30 MW.

Assurance of research reactor MARIA safety is provided by three organizations: National Atomic Energy Agency (NAEA), Regulatory Body and Operating Organization (National Centre for Nuclear Research). Management of safety is performed on the basis of the following IAEA documents: Code of Conduct, Safety Fundamentals, Safety Requirements, Safety Guides and finally on Polish Atomic Law.

High level of reactor safety is reinforced by high level of safety culture. The process of safety culture is continuously verified and improved.

2. ROLE OF THE STATE, REGULATORY BODY AND OPERATING ORGANIZATION IN THE ASSURANCE OF REACTOR SAFETY

2.1. Role of the state in the reactor safety assurance

NAEA assures reactor safety by following activities:

— Establishing and maintaining a legislative and regulatory framework;
— Providing the Regulatory Body;
— Licensing of research reactor operation and operational personnel;
— Establishing a system of governmental emergency response;
— Verification that the operating organization has adequate financing system for safe reactor operation.

The basic law related to nuclear field is Atomic Law established by Act of Parliament of 29 November 2000 and updated in 2011. In addition to this law many specific regulations concerning nuclear installations were edited by the Council of Ministers. Very important role of NAEA is the licensing of research reactor operation and operational personnel. The license on reactor operation is issued for 5 years and its edition is conditioned by updating of many

safety documents such as: Safety Analysis Report, Emergency Plan, Operational Procedures and so on.

The licensing of operational personnel is performed by NAEA for the following post: reactor manager, shift supervisor, reactor operator, health physics. The license is valid for 3 years and after that the relicensing is necessary. The licensing for the post: operator mechanic, operator electric, instrumentation and control operator, hot cell operator, reactor chemist is performed by the commission brought into being by the Director of Institute. At the level of NAEA has been established Radiation Emergency Centre for monitoring and prognosis of radiological situation in the country. This centre is operating 24h per day and is able to give immediate estimation of radiological hazard in emergency situation.

2.2. Role of the Regulatory Body in reactor safety assurance

The regulatory body ensures assessment and verification of safety by following activities:

— Assessment of safety related documents such as: Safety Analysis Report, Quality Assurance Program, Emergency Plan, and Reactor Personnel Training Program;
— Assessment of quarterly reports on reactor operation;
— Performing of inspections (at least 3 per year);
— Assessment and acceptance of the projects on reactor system upgrading and new devices to be installed in reactor.

2.3. Role of the Operating Organization in the reactor safety assurance

NCNR assures reactor safety by following activities:

— Establishing appropriate organizational chart, promoting high level of safety and ensuring continuous control of reactor operation;
— Ensuring adequate reactor operation financing;
— Ensuring sufficient numbers of qualified staff;
— Performing systematic safety assessment (Elaboration of Quarterly Reactor Operational Report);
— Elaboration of the documents ensuring safe reactor operation such as: Safety Analysis Report, Quality Assurance Programme, Emergency Plan, Reactor Personnel Training Program, Procedures and Instructions;
— Ensuring the continuous training;
— Appointment of Safety Committee.

Important role in ensuring of high level of reactor safety at the level of Director of Institute fulfills Deputy Director for Nuclear Safety and Radiological Protection who approves all safety related documents and perform internal inspections. In case of constated inconvenient practices he makes the report for the Director of Institute. Also important role at the level of Director of Institute fulfills Quality Assurance Inspector who performs inspections in the Reactor Operation Department from the view point of respecting the Quality Assurance Program. In case of detected faults he also makes report for the Director of Institute. Second Quality Assurance Inspector is appointed at the level of Reactor Operation Department. His role is to approve all safety related documents and procedures. He also performs internal inspections and prepares report for Reactor Manager.

Big self-assessment activity is performed each quarter because after each quarter the Quarterly Reactor Operation Report is elaborated. The content of this report is very comprehensive and it contains the following items: general information on reactor operation

(number of hours of reactor operation, power, reactivity distribution, safety and control rods reactivity), reactor core configurations, performed irradiations, unplanned scrams, components and systems failures observed, maintenance tasks and reparation works performed, list of verifications and calibrations of systems and devices, measurements and scientific examinations, chemical measurements and analysis, utilization of horizontal beam tubes, vibration measurements, list of performed trainings and relicensed persons, radiation protection activities, estimation of radiation hazard of operation activities, estimation of radiation hazard of operational personnel, releases of radioactive products to the atmosphere, eventual releases to the secondary cooling system, volume of radioactive effluents and solid waste. This report is approved by Deputy Director for Nuclear Safety and Radiological Protection and is estimated by Regulatory Body.

2.3.1. Role of the safety committee

Very important role in ensuring reactor safety fulfills the Safety Committee which is established to advise the Director of Institute on following items:

— Modifications of reactor systems and components which operation is important to safety;
— Implementing new experiments, and tests that are significant for safety;
— Evaluation of the proposed design for new type of the nuclear fuel elements and the control rods;
— Proposed procedures that have significance for safety, for example procedure of reactor core conversion and so on.

Members of the Safety Committee are the experts in different fields related to operation, design and analyses of the reactor. There are 18 permanent members at the Safety Committee elected by the Director of Institute. Sometimes some special guests are invited on Safety Committee sittings.

3. SAFETY CULTURE AS AN IMPORTANT FACTOR OF REACTOR SAFETY ASSURANCE

Beyond organizational measures, assuring high level of safety it is supported by high level of safety culture.

The most important factor in creation and development of safety culture is influencing on people awareness and its modification allows to increase the safety culture understanding and creates the processes which help people to achieve this goal.

By the conventional training, system of motivation it is possible to create some attitudes, to respect the procedures, and the principle of behavior i.e. the factors increasing the nuclear plant safety but they are only derivative issues of safety culture.

The process of development and improvement of safety culture contains the following issues, which we've considered as the most important and our efforts are focused on it achieving it, i.e.:

— Visible commitment of the management of the Reactor Operation Department to the improvement of safety culture;
— Involvement of the co-operating groups (project office, safety analyses and reactor measurement service, maintenance group) to increase their safety improvement;
— Improvement of co-operation with supervising and advising organizations such as: Regulatory Body, Safety Committee, Deputy Director for Nuclear Safety and Radiological Protection, Inspector of Quality Assurance;

— Involvement of operational personnel to improve the safety;
— Adequate training;
— Introduction of the broad self-assessment process;
— Improvement of teamwork.

3.1. Commitment of the top management of the Reactor Operation Department to the improvement of the safety culture

The top management must show the personnel why the improvement of safety culture is very important, what negative consequences can be created as the results of low level of safety culture. As often as possible should to be underlined the high significance of safety culture in the time of training, exams, organization of work and so on. Senior manager is a member of examination commission for requalification of personnel, which gives him an opportunity to verify the meaning of the safety culture concept and to record these questions which weren't properly understood. After they are being discussed in the time of training sessions.

3.2. Involvement of the co-operating groups (project office, safety analyses and reactor measurement service, maintenance group) is to increase their safety improvement

The good practice performed in Reactor MARIA Operation Department is to invite the personnel of these groups to training meetings where the safety related problems are discussed. Such common meetings help the people to aware the importance of well performed work and it influence on safety. It's very important to aware what can be the consequences of badly done even the small work.

3.3. Involvement of operational personnel to improvement of safety culture

Engagement of operational personnel to improvement of safety culture is very important and without it the process of safety culture change is unrealistic.

For this item we dedicate many efforts and time.

— Promotion of openness attitudes which help to avoid the cases of hiding the errors and events. Errors related to safety are considered as an opportunity to improve the safety through experience feedback. All detected defects and organizational errors have to be reported, after their analyzing the lessons learned must be drawn. To obtain this goal it is necessary to aware the people that even small error if it has been analyzed can be the source of knowledge which can be useful in development of safety. The error hidden by one person can be repeated by the second person. The important item of this question is of course the adequate system of reward and sanctions. The sanctions provoke to hiding the errors;
— Taking into account the themes of training to be requested by employees. This gives us an opportunity to clarify the questions bothering the employees. Each training is ended by discussion which will create the opportunity to compare different points of view on safety culture and to choose the optimal solutions;
— Performing the requalification process. All licensed personnel: shift supervisors, reactor operators, health physicists, I&C operators, mechanics, electricians have to pass the requalification exams. Requalifications are performed in every three years. The exams are oral, because this gives the excellent opportunity to verify the understanding by employees the safety problems and the relations between their work and the reactor safety. Only the oral exams give this possibility. For shift supervisors, reactor operators and health physicists additionally the test exams are performed.

3.4. Open and partnership co-operation with supervisory organizations

The role of Regulatory Body and others supervisory organizations is important to improve safety culture but the co-operation between these organization have to be correct.

There are three external bodies supervising the reactor MARIA:

— Regulatory Body (Level of National Atomic Energy Agency);
— Deputy Director for Nuclear Safety and Radiological Protection (Level of National Centre for Nuclear Research);
— Inspector of Quality Assurance (Level of NCNR).

We promote on open and partnership co-operation with this bodies, they are invited to discuss all problems related to safety, all new projects and modernization plans are negotiated with them. The inspections are always announced and their program is determined.

3.5. Adequate training as an important factor improving safety

Training is performing in such a way that it enables to increase not only the knowledge but also to change the personnel understanding on safety, attitudes and behaviours. To realize this goal it's very important to have the high level trainers who can not only transfer the knowledge but also are the agents promoting safety culture. The trainers have to be an authority on nuclear safety. To underline the importance of safety quite often the members of Nuclear Safety Committee are the trainers.

Very important item is also an adequate composition of training program. The themes of training are chosen in such way that they enable to increase an understanding of the safety culture.

Frequent themes of training are:

— Accidents which happened in nuclear reactors and analyzing the reasons of these accidents, particularly if the human error was involved;
— Unplanned shut-down in our reactor with detailed analyses;
— Disturbances and defects in our reactor;
— Presentation of new projects and modifications.

3.6. Broad self-evaluation process

The managers of services analyse disturbances and unplanning shut-down occurred and highlights this in the time of training. Lessons learned serve to undertake the actions which resolve the problems before they will appear. Errors are also an opportunity to improve safety. The Inspector of Quality Assurance verifies the reports of performed verifications, tests, calibrations of measurement devices and their accordance with the schedule contained in Quality Assurance Programme. He verifies the registration in the cards of disturbances, the safety documentation, updates of procedures and so on.

3.7. Improvement of teamwork

Correct preparation of tasks is one of many important factors influencing the safety culture. Each task is based on standard procedure or if it is relevant to unusual task or project it must be realized according to the individual Quality Assurance Plan. In these documents the detailed organization plan is presented and the responsibility for each employee is clearly determined.

It is the first, essential step which have to be fulfilled if we want to achieve satisfactory teamwork, particularly when a task is complex. The second step it is to make an appointment of all employees involved in execution of the task before the task has been performed. In the time of this appointment the task and the way of its realization is presented, all unclear issues are discussed and first of all these related to safety. This gives a guarantee that all employees properly understand their role in execution of the work. These two steps are essential in achieving the high level of teamwork and in consequence high level of safety culture in performing the task.

The additional measure in improvement of teamwork will be the training on understanding of group behavior, interpersonal relations and the means of resolving the conflicts inside the group. This training should especially be addressed to managers.

3.8. Continuous improvement of safety culture

The continuous improvement of safety culture can be realized only when both the management and the employees are aware of the issue. This gives the guarantee for the better engagement of employees in safety improvement process. The man who sees that his initiative is appreciated and realized will be more committed in performing his tasks.

Important aspect, applied in our reactor to motivate the employees to creative attitude for safety culture is an appropriate system of rewards (bonus, foreign mission for training and technical visit). Also the paths of promotion, depends on employee attitude and his commitment to improvement of safety culture.

4. CONCLUSION

The high level of research safety is assured by: clear and adequate administrative and legislative system, adequate reactor financing, sufficient number of well trained operational personnel, good reactor technical state, continuous reactor supervision and inspection by external and internal bodies. This measures have to be completed by high level of safety culture which have to be continuously developed.