12. SAFETY MANAGEMENT AND PLANT OPERATION

12.1 OPERATIONAL ORGANIZATION

The Ignalina NPP organizational chart is given in Fig. 12.1. Operating functions involve the executive decision making and actions relating to the operation of the plant both during normal operation and in emergencies. General management activity at Ignalina NPP is the function of Director General who is the manager of the utility. He carries personal responsibility for the safe operation of the plant. The following officials are responsible directly to the Director General: plant technical director, manager of Safety and Quality Assurance department, deputy director for logistics, deputy director for personnel, deputy director for economy, deputy director for security (physical protection) and manager of the department of international projects.

The Plant Board is created at Ignalina NPP according to existing Lithuanian legislation. The following officials are member of the Board:

- Director General,
- Deputy Economic Minister (Parent representative),
- Technical director,
- Deputy director for economy,
- Deputy director for personnel.

Along with the Ignalina NPP administration the Board is the managing body of the enterprise, and the Director General is the Chairman of the Board. The Board performs policy making functions such as setting management objectives and making decisions on financial and manpower resources. The Board reports to the Ministry of the Economy.

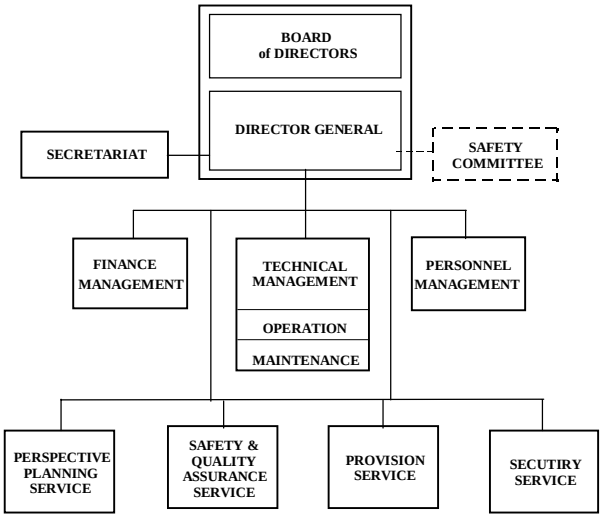

Fig. 12.1 The Ignalina NPP organizational chart

The responsibility for direct administration and technical management of the key operations departments are delegated to the technical director. The technical director bears ultimate responsibility for making decisions essential to plant operation, maintenance, and technical support. The technical director deputy for operations provides technical control over the key plant departments involved in on-line operations. He is also in charge of industrial, radiological and fire safety in operations. All operating staff is under his authority. The plant shift supervisor provides the administrative control of the composite shift staff consisting of control room operators and shift operators in workshops.

Operating service organization chart is shown in Fig. 12.2. Organization is based on the established clear-cut interaction of different structural levels. The said interaction can be divided into:

- operating control over the shift staff by the plant shift supervisor,
- administrative and technical management of the shift staff by department managers.

The nature of interactions between administrative units are specified in administrative procedures. Rights and responsibilities of each component of the organization structure are specified for all operating modes.

Organization of operational responsibilities at the Ignalina NPP are based on the workshop system, in which responsibility for the various systems and equipment in the plant, excluding the main control room, are assigned to different units called “equipment workshops”. There are eight workshops: Reactor, Turbine, Electrical, Instrumentation and Control, Chemical, Process Nitrogen and Oxygen, District Heating and Underground Communication Services, and Decontamination workshops. The control room operating staff can be considered to be a ninth “workshop”, whose equipment responsibility includes all the central control logic and equipment, the control rooms, the control panels, and which has the key function of controlling all operational, maintenance, and testing interventions to the operating plant. Each workshop is led by a manager, who reports directly to the plant technical director. Each workshop is technically responsible for the safe operation and maintenance of the equipment and systems assigned to it, and each workshop is a true organization with its own shift supervisor, in additional to functional manager. Field operators are part of the operating shift organizations within workshops, while the main control room operators

report directly to the plant shift supervisor.

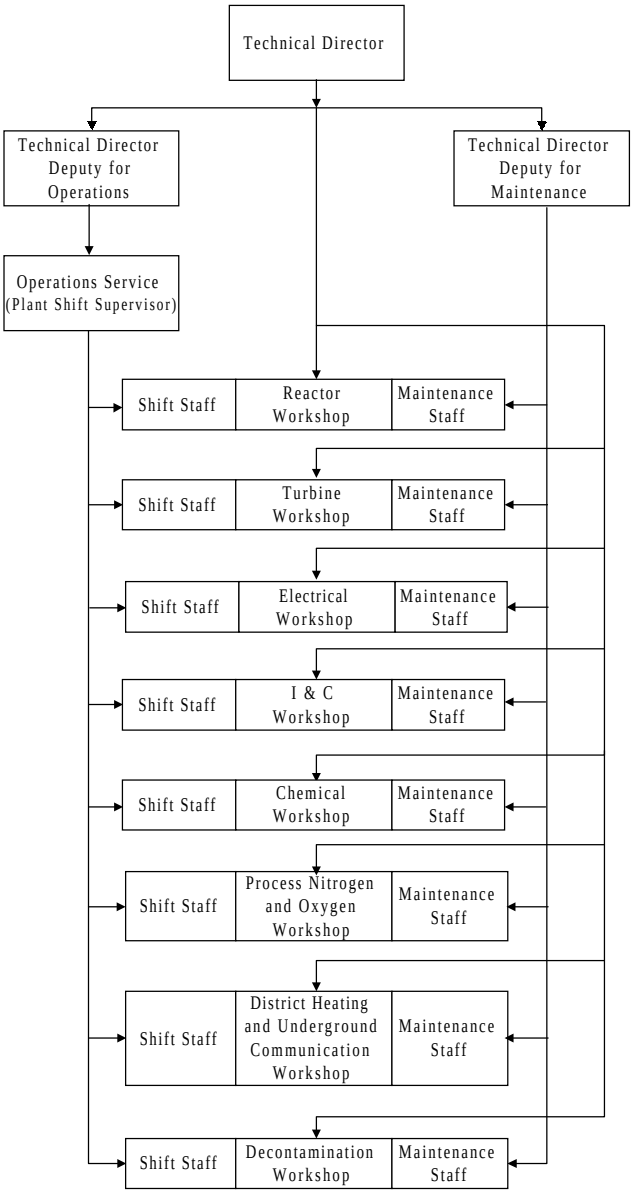

Fig. 12.2 The Ignalina NPP operating service organization chart

The organization and management of the maintenance function parallels that described above for operations. Maintenance service is charged with maintenance including all types of repairs, equipment upgrading, testing and field adjustment. Maintenance personnel are located in the equipment workshops. Coordination and management of their maintenance activities is the responsibility of technical director deputy for maintenance. He reports directly to the plant technical director.

Plant organization was evaluated in the "In-Depth Safety Assessment of the Ignalina NPP" [62] study completed in 1996. The Ignalina Safety Panel criticized plant management for lack of direction and failure to promote a proper safety culture. As one of the most important safety issues needing immediate resolution it is recommended that the Ignalina NPP should commit to an appropriate management structure to ensure safe operation of the plant, efficient implementation of necessary safety improvements and adequate support of the licensing process.

The Lithuanian Ministry of the Economy established a coordination group for the preparation and guidance of the Government strategy to address the recommendations of the ISP. This coordination group has proposed and the Government endorsed the proposal, that the existing Lithuanian company law is completed so that a Board of Governors of the Ignalina NPP can be established and the Director General can be given full authority for safe operation of the plant.

12.2 ROLE OF OPERATOR

Operation is a complex of activities performed by the operating staff to ensure safe and reliable operation of the plant equipment. The operating staff is an authorized shift of personnel on duty, including managers, operators and technicians who maintain operational control over technological processes at the plant and configuration change-over. The operating staff is managed by a head of operation services who is a technical director deputy for operations. The head for the operation services administers activities of the operational personnel of the plant: directly administers control room personnel and through the deputy heads for workshops for operation, operational personnel of the workshops. The plant shift supervisor is the senior operational principal of the shift. During his shift, the plant shift supervisor, through the deputy and heads for workshops, performs general technical and operational management of the Ignalina NPP. From the operational point of view, the plant shift supervisor reports to the Lithuanian State Power System dispatcher. He must receive permission from the Lithuanian State Power System dispatcher to perform planned changes in operational conditions of equipment, for which the dispatcher is responsible. The plant shift supervisor subordinates to the plant technical director, technical director deputy for operation (head of operation service) and deputy head for operation service. The deputy plant shift supervisor is a senior operational leader for the shift at the unit. During his shift, the deputy plant shift supervisor, through heads of workshops and operational personnel of the control room, performs technical and operational management of the unit. On the operational level, all on-duty shift personnel report to the plant shift supervisor through heads of workshops shifts and the deputy plant shift supervisor. They must follow the orders of the plant shift supervisor with respect to operation of the plant, excepting only situations where the operator believes that the order will affect the safe operation of the reactor or safety of personnel. During mitigation of accident consequences

at the unit (plant), all workshop personnel present at the plant become subordinate to the plant shift supervisor regarding the issues related to the accident. In case of the illness or injury of plant shift supervisor, coordination of work at the units is the responsibility of the deputy plant shift supervisor of unit 1 until another plant shift supervisor arrives at the plant. During his shift the orders of the plant shift supervisor can be recalled only by decision of the plant technical director or his deputy for operation. In case of errors or inappropriate actions, the plant shift supervisor can be relieved of his responsibilities by the plant technical director or his deputy for operation. In that case, management of Ignalina NPP performance will be responsibility of the plant technical director or his deputy for operation.

The head for each workshop shift administers the entire on-duty personnel at that workshop. He reports administratively and technically to the head of workshops and his deputy for operation, the plant shift supervisor and deputy plant shift supervisor. Orders issued by the administrative-technical personnel of workshops and divisions to his own operational personnel on issues under plant shift supervisor jurisdiction are to be performed only with the agreement of the plant shift supervisor.

The key responsibilities of the on-duty shift include control of all plant activities, both safety and non-safety, to the extend that the activities affect plant operations in all modes of operation. Within the plant organization, all workshops must obtain control room authorization to perform work that may affect plant operation. The primary responsibilities of the on-shift control room staff and the distribution of duties includes the following:

- safe operation of equipment,
- nuclear and radiation safety assurance,
- implementation of the dispatcher center schedule for electric load,
- placing equipment in a maintenance status,
- placing equipment in operation after maintenance,
- testing of equipment after maintenance and acceptance for operation,
- implementation of schedules of equipment, pumps and improvements of protection systems, normal operation systems and safety-related systems' tests,
- implementation of schedules for operating equipment walkdowns.

Operating personnel is provided in accordance with industrial standards. The operating staff is grouped into seven shifts. Five shifts work on regular basis. The sixth shift is a back-up for the main shift and the seventh shift undergoes periodic training and review operating procedures. Each shift consists of 137 persons. For each shift job description an initial and advanced training program, including emergency training, is established. The program includes theoretical training, training in the use of plant systems, simulator and on-the-job training. Up to 1997 the full-scope simulator at Smolensk NPP was used for basic training of operators, but from 1998 the full-scope simulator at the Ignalina NPP will be employed. A program is provided for the enhancement of professional skill enabling the personnel to promoted.

Before a shift starts working, operational personnel involved in key positions must pass alcohol level and physical tests at the plant medical office.

Operational personnel carry out duties according to the schedule, approved by the Director General. It is prohibited to be on duty for the duration of two shifts or within a time which is more than two shifts. In exceptional cases, operator replacement is possible under a written decision of the plant shift supervisor or the technical director deputy for operation. Operator replacements must be registered in a special record-book.

The plant shift supervisor is authorized to implement the following objectives:

- during his shift, he possesses authority to require that personnel carry out urgent and precise actions while undertaking their duties,
- to slow down any activities at the plant if non-compliance with norms, rules and instructions have been identified,
- to recall from his post any operational personnel who cannot perform his duties,
- to control personnel performance during planned and accident switching, place in operation or shutdown units,
- to supervise accident mitigation activities at the plant units and fire extinguishment,
- to control integrated radiation doses for shift workers and to take measures to reduce these doses,
- to disregard orders of higher ranking authorities if they lead to a predicted reduction of safety of personnel and hazard to equipment,
- to summon operational and maintenance personnel to secure normal plant performance.

The plant shift supervisor must bear disciplinary, judicial and administrative responsibilities in accordance with the Laws of the Republic of Lithuania for the following:

- accidents, malfunctions of equipment, accidents due to his fault or due to the fault of subordinated personnel,
- incomplete instructions provided by the higher ranking administrators well as consequences related thereto,
- implementation of requirements as set forth in the normative-technical documentation, rules and norms on nuclear and technical safety, Technical Regulation [72], employees statue and operational instructions,

inspection schedules and orders and decrees of the plant,
- violation of labor and production discipline.

The plant shift supervisor controls on-duty personnel activities as well as equipment status (faults, deviation from normal conditions for equipment operation, place in operation, place in maintenance status) at the beginning and end of the shifts. During accident mitigation the plant shift supervisor must first secure operation of electricity supply of plant's demand and residual heat removal. In case an accident occurs at the plant which leads to the release of radiation, the plant shift supervisor must direct the accident mitigation activities before the plant technical director or technical director deputy for operation arrives.

The key responsibility of the main control room operators is to assure normal safe operation of all equipment in compliance with requirements of official instructions, including operational instructions, nuclear and radiation norms, and normative-technical documentation, Technical Regulation [72] under normal and accident conditions. For normal operation the duties of the control room operators include:

- supervise of the normal operation parameters on the signal monitors, indicative instruments, displays of "TITAN" system, on base of reports delivered by the subordinated personnel, who walkdown to review working equipment,
- supervise of the prepare to place in operation protection and safety-related systems on the pumps feasible-to-operate, reinforcements status, parameters of the systems on the information signal board, displays from "TITAN" system and mnemoschemes at the control room,
- supervise of protection sound systems automation and blocking,
- implementation of schedules for testing and switching to standby equipment,
- implementation of all technologic operations according to the check lists for switching,
- identification of faults on the operating equipment, appraisals of influence on equipment operational capabilities, requirements to settle faults by the workshop personnel or equipment owner,
- implementation of instructions received from higher ranking plant administrators.

An operator from control room has the authority to perform the following:

- to disregard orders received from higher ranking administrators, if these are clearly mistaken and might impair the safety of personnel and equipment,
- prohibit activities of any kind on operating equipment, if these activities can lead to accidents or incidents,
- independently carry out operations to alter a condition of the operating equipment, even to shut down a reactor in case of a clear threat to personnel and the main equipment,
- reject implementation of any activities if it is not described in the operational instructions or there are deviations from existing procedures.

In case of significant events in the operating condition are identified or equipment damages occurs, a control room operator must urgently take measures to restore operational conditions or mitigate the abnormal conditions and stop unfavorable events. He must then immediately inform his superiors. In the event of an accident control room operator must follow the "Technical Regulation" [72], "Instruction for Elimination of Accidental Situations at the Ignalina NPP" [80], "Instruction for Elimination of Nuclear Accident at Ignalina NPP" [81], "Temporary Guidance for Management of Beyond Design Loss-of Coolant Accident with Loss-of-Off-Site Power at Ignalina NPP" [82]. Division of responsibilities during accidents elimination at Ignalina NPP include the following:

- deputy plant shift supervisor - elimination of the accident situation at the unit,
- leading engineer for unit control - elimination of accident consequences in the zone of his responsibility for the thermal equipment of the unit. Securing of cool down of the reactor core,
- leading engineer for reactor - maintenance of nuclear safety of the reactor and control of the process occurring in the reactor,
- leading engineer for turbine - elimination of the accident conditions for the turbines and auxiliary equipment.

Each control room operator is responsible for:

- failure of equipment and malfunctions due to his fault or due to the fault of operational personnel because of incorrect instructions delivered by him,
- failure to stop the development of an accident or improper mitigating actions initiated by himself or by subordinate operational personnel.

Regardless the unit status, control room operators, must stay at their work places. It is prohibited for them to perform activities which do not relate directly to processes occurring at the unit. Access to the control room is restricted and entrance is permitted only with permission of the deputy plant shift supervisor. The list of persons having the right to enter control room under normal operation and of persons having the right to stay in control room during abnormal conditions must be approved by the plant technical director. When the alarm actuates, the operator must:

- clarify the cause of the alarm, checking instrument indications, mnemoschemes, display from "TITAN" system, and information on computers,
- inform the deputy plant shift supervisor of its occurrence,

- restore equipment to normal operation parameters,
- delegate tasks to subordinated personnel, inspect equipment,
- if there is a failure to restore equipment to normal operation conditions, or if personnel report equipment failure, then a switch to the standby equipment or a shutdown of the faulty equipment must follow.

All operations at the unit such as preparation of equipment to be placed in operation, the placement of equipment into a maintenance status, re-activation of equipment after maintenance, testing and switching on of standby equipment, must be recorded on the equipment check list attached to the operational instructions. Operations must be performed by a control room operator and documented with signature. A control room operator must record the following references of equipment operation and status:

- operations during the shift, switching of equipment and other work accomplished according to the operational instructions and under instructions of higher ranking operational personnel,
- any changes in the electric systems,
- operating conditions and observation re. equipment faults, stating the number of a fault regardless of unit status,
- failure of equipment operation and deviations from pre-set parameters,
- cases when automatic protection devices switched-on,
- instructions received from higher ranking operational, administrative personnel and instructions directed to the subordinate personnel.

Operating procedures are used to guide control room operator activities under normal conditions, incidents and accidents. Operating procedures are designated to cover all aspects of operation and ensure reliable, efficient and safe operation of the plant. Four types of operating procedures are employed:

1. Normal Operating Procedures.
2. Abnormal Operating Procedures.
3. Operator Response Procedures.
4. Emergency Operating Procedures.

Normal Operating Procedures describe the actions required during normal operation of the plant systems and its components, they specify tests, configuration control, removal and restoration of equipment. Abnormal Operating Procedures have been developed for coping with deviations from normal operating modes. Operator Response Procedures specify main control room operator actions in response to small deviations. The Emergency Operating Procedures currently used at the plant make use of an event-based approach to accident management. The new symptom-based emergency operating procedures are being developed at the plant in 1998.

12.3 SAFETY MANAGEMENT

The provision of an appropriate framework for operational safety is provided through the plant management system. This system covers all aspects of plant operations both on day to day and long term basis. In May 1995 the Director General defined the safety and quality assurance policy of the plant. The following is stated in the declaration:

- the Ignalina NPP management bears full and formal responsibility for the plant safety,
- plant safety has a top priority which supersedes economic and production requirements,
- plant management pledges to ensure maximization of efforts related to plant safety and will strive for the improvements in this area.

The technical director deputy for operation is in charge of engineering, radiation and fire safety in operation. The plant shift supervisor is charged with engineering, radiation and fire safety on shifty basis. The responsibility for industrial radiological and fire safety within plant department lies with heads of departments. Radiation Protection and Industrial Safety department is responsible for managing activities aimed at safe and healthy labor conditions at the plant, prevention of accidents, limiting personnel exposure to radiation, and control of environmental effects. About 80 specialists are working with radiation protection related problems.

The technical director deputy for operation, the state inspector from VATESI, the deputy head of Nuclear Safety division and the inspector from the Safety and Quality Assurance department inspect performance of the operational personnel daily. Inspection objectives include:

- surveillance over implementation of the plant requirements, norms and rules as regards nuclear safety, and regulations and procedures which secure nuclear safety required to be followed by operators,
- control over protection and safety-related systems,
- control over performance of the on-duty shift and its compliance with the requirements as set in the employees statute and operational instructions,
- account of significant operational events and failure of equipment,
- control over shift tasks and inspection schedules.

Comments received from plant workers are recorded in the operational record-books. Comments provided by the VATESI state inspector must be recorded in the “Record-Book of VATESI” with an obligatory written confirmation of the plant technical director and the deputy

plant technical director for operation. The remarks state scope of the work to be accomplished, the responsible persons and procedures dealing with the completion of these tasks.

Equipment malfunction and significant events occurring at the Ignalina NPP are reported and investigated. The key tasks in the investigation of significant events are as follows:

- identify the causes for significant events,
- establish organizational and technical measures required to restore normal conditions,
- evaluate methods which would lead to the avoidance of significant events and to improved equipment performance.

Heads of workshops and divisions performing the analysis of significant events for normal conditions must take necessary measures for timely preparation of measures as well as measures to eliminate the identified deficiencies in the performance of operative and maintenance personnel, to remove equipment defects, and to improve quality of equipment maintenance. Investigation of workshop malfunctions must be started immediately after occurrence. Identification of primary causes as well as collection of descriptive notes from personnel in charge of equipment operation and personnel who were operating the specific equipment prior to the failure, must be made by the plant shift supervisor, the deputy plant shift supervisor and heads for workshop shifts. Investigations of workshop failures must be completed within 10 days of the occurrence of the failure. Under emergency conditions, investigation time can be extended by the plant technical director, but not for longer than 15 days from the date of the malfunction. The Commission to study malfunctions is established and headed by the workshops head or his deputy for operation. The Commission must investigate the failure and prepare a report. The outcome of investigation and proposed measures must be included in the "Record-Book for Workshop Malfunctions". Report copies are distributed to the appropriate affected groups and to the Reliability Group. Proposed measures indicated in the report must approved for future application.

Equipment failure and significant events at the Ignalina NPP are also analyzed by the Safety and Quality Assurance department. When investigations on significant events at the Ignalina NPP are undertaken by the Safety and Quality Assurance department, a "Report on Violation at the Ignalina NPP Operation" is issued in which cases are analyzed and parallel analysis on behavior of the operational personnel is performed. The report must be studied by operational personnel.

Review functions are those involving critical monitoring of the performance of the operating and supporting functions, such as quality assurance and safety review. The responsibility for quality assurance rests with all managers. The Safety and Quality Assurance department is responsible for development and implementation at the Ignalina NPP of the effective quality assurance program. Safety review of operational safety at Ignalina NPP includes activities of

the line organization, supplemented by the Safety and Quality Assurance department and the newly formed plant Safety Committee. Both organizations report directly to the Director General.

At the beginning of 1995 the Safety and Quality Assurance Department was established at Ignalina NPP. The Director General delegated to that department the responsibility for monitoring and evaluation of safety of the plant. The department is responsible for the elaboration and adoption of the safety assurance program for the plant. The department must submit its independent evaluations of plant safety directly to the Director General, and will focus on the requirements set forth in nuclear power engineering and industrial safety standards, regulations, instructions dealing with problems of operation, upgrading, maintenance, testing of plant equipment and systems important for safety. The Safety and Quality Assurance department performs independent safety reviews of specific activities and reviews work completed by workshops, departments and plant services. It suggests revisions and improvements to these organizations. The department is involved in the independent assessment of plant modifications.

The new Ignalina NPP Safety Committee was formally established on February 15, 1996 by the plant Director General, to provide advice to the Director in implementing his basic responsibilities for plant nuclear safety. The Committee is composed of 9 experienced individuals from the plant organization and outside experts. Committee members and the Chairman are appointed by the Director General. The Committee functions as an independent reviewer. It will meet regularly, once a month as a minimum, to discuss safety issues arising from its review of various plant reports and observation of activities. Emergency unplanned sessions will be held if required. Appropriate plant staff will participate to present safety issues. The plant Safety Committee performs more strategic reviews of the plant safety-related activities. The Committee is particularly interested in the following areas:

- Plant modifications.
- Revisions to “Technical Regulations” [72] and limits and conditions for operation.
- Revisions to procedures and safety rules.
- Operating experience and event reports.
- Quality Assurance program.
- Safety Improvement Program.

Safety and Quality Assurance Department functions as Committee secretariat. Formal agendas and protocols with tractable formal recommendations are employed.