THAI - CANADIAN
NUCLEAR HUMAN RESOURCES DEVELOPMENT
TRAINING PROGRAM

# EFFECTIVE TECHNIQUES
# IN
# CONTROL OF PLANT ACTIVITIES
# IN
# NUCLEAR POWER PLANTS

## LECTURE NOTES FOR THE COURSE ON

# PEER EVALUATION TECHNIQUES

**BY: R.B.TAYLOR**

November 1997

# CONTROL OF PLANT ACTIVITIES

## 1.0 OBJECTIVE OF PRESENTATION

The objective of this lecture is to discuss the elements necessary in a corporate and plant organization in order to achieve good control of plant activities with respect to nuclear safety. The importance of policy making, supporting and reviewing functions in the corporate structure, with clear delineation of responsibilities between the plant and corporate organization, is emphasized. At the plant management level, the importance of setting goals and objectives based on the corporate policy and effectively using these goals and objectives is discussed. The need for effective interfaces with other groups including the regulator is discussed. The required elements of an organizational structure are identified. The general status of this subject area as indicated in OSART findings and good practices is summarised

## 2.0 GENERAL

There are many different organizational structures used to operate nuclear power plants. The specific structure used will depend on the culture of the organization and on the degree of responsibility and accountability exercised by the central corporate structure, as compared to the plant management. Additionaliy, when the corporate leadership is changed, this frequently results in a change in the organization.

There is the endless and probably irresolvable debate on whether to centralise, or decentralize. Successive leaderships tend to swing first one way then the other as advantages and disadvantages of each option come into focus.

Optimizing the organizational structure is only part of the requirement to ensure that the organization is effective. Another very important part is to ensure that the right people are in the right jobs. One will not work well without the other.

The safe and efficient operation of a nuclear power plant requires the establishment of the general policy of the operating organization, the setting of management objectives and goals, trending and analysing the degree to which these goals and objectives are achieved and taking subsequent corrective actions where goals are not met. The provision of appropriate financial, technical, material and human resources to achieve the goals is also essential. The organization and administration are the means by which policies are decided, objectives set and appropriate resources provided, controlled and reviewed. The structure of the operating organization and station organization, as well as the allocation of responsibilities and the delegation of authority within these organizations is important. The Quality Assurance programmes, the regulatory interface, industrial safety, fire protection, physical protection and plant security, and document control are all part of effective control of plant activities. Each of these programmes assists the management in administering or monitoring the operation of a nuclear power plant.

## 3.0 CORPORATE ORGANIZATION AND MANAGEMENT

The size and structure of the operating organization will vary and so will the extent to which services are provided on or off the site and from within or outside the organization. Irrespective of these variations, a documented organizational structure should be established with clearly defined functional responsibilities. Adequate and timely services and facilities

should be made available to the site/plant manager for the safe and efficient operation of the nuclear power plant. In examining the structure of the operating organization and its relationship with the site/plant management, consideration should be given to management functions in the following areas:

- Policy making functions involve setting management objectives, defining nuclear safety and quality policy, deciding on the allocation of finances, providing material and human resources, approving the contents of management programmes, setting policies on drug and alcohol use, and providing an overview to make the necessary changes to any of these items on the basis of information on the overall performance in achieving the objectives
- Operating functions involve executive decision making and support actions for operation of a nuclear power plant, both during normal operation and during emergencies
- Supporting functions relate to the provision of technical and administrative services and facilities required to perform the operating functions both from on-site and off-site organizations
- Reviewing functions include critical monitoring of the performance of the operating and supporting functions and design review. The purpose of monitoring is to check compliance with the stipulated objectives for the safe operation of the plant, to reveal deviations, deficiencies and equipment failures, and to provide information for timely corrective action including the need for plant modifications.

Policy making functions should effectively set management objectives, decide resource allocations, approve management programmes, communicate high ethical standards and ensure that safety issues receive appropriate attention and priority, i.e. the existence of a high level of safety culture. There should be a clear statement of quality and nuclear safety policy confirming managements' commitment to quality and nuclear safety. A clear written policy on drug and alcohol use also should be available to all employees, contractors and visitors and implemented.

The Quality Policy Statement should deal with:

- individual responsibility for quality of performance
- accountability for results achieved
- the quality assurance programme as a task to assist management in promoting and assessing quality in operation
- worker responsibility for reporting conditions adverse to quality
- periodic assessments and reviews to evaluate the effectiveness of the quality systems implementation.

The Nuclear Safety Policy should:

- declare a commitment to excellent performance in all activities important to the safety of the nuclear power plants
- emphasise that nuclear plant safety has the utmost priority
- state that nuclear plant safety overrides if necessary the demands of production or project schedules
- be provided to all members of the staff in the organization for their guidance
- be clearly understood by all staff members
- be declared to the public as one of the objectives of the corporate organization.

Executive functions should support the safe and efficient operation of the plant and the development of performance indicators to allow a concise overview of plant performance. Annual goals and objectives should be formulated for all areas of plant operations and support, including emergency preparedness, and should be communicated to site personnel possibly using performance indicators for measurable goals. Specified levels of delegated authority related to assigned responsibilities and the promotion of strong lateral and vertical communications to encourage overall team work are required.

The executive functional responsibilities for the formulation of programmes, supply of human resources for direct plant operations, accident management and the fostering of good lateral and vertical communications between line and staff organizations in the area of operations and maintenance should be clearly identified. In addition the responsibilities of staff and line organizations need to be clear.

When services are provided from outside the operating organization, responsibilities shall be allocated within the organization for specifying, controlling and monitoring those services, to ensure effective co-ordination with the activities of the plant organization without erosion of the responsibilities of site management. The extent to which the services and facilities are provided on and off the site and from within or outside the operating organization will vary, but the following areas must be adequately covered:

- Training
- Radiation Protection
- Chemistry
- Emergency Support Services
- Operational Services and Technical Support Services

The operating organization should monitor the plants' operating and support functions to evaluate performance against stipulated objectives for the safe operation of the plant, to reveal deviations, deficiencies and equipment failures and to provide feedback for timely corrective actions. The oversight function of a high level multidisciplined safety review committee or adequate professional organization provide a good feedback mechanism to foster a commitment to a strong safety culture. The adequacy of the activities in the following areas is significant:

Assessments of subordinate activities by line managers:

- Personnel performance evaluation programme
- Off-hour plant tours
- Personnel performance monitoring
- Achievement of goals and objectives
- Communication of safety policy from the Corporate to the Plant level.

Quality assurance:

- On-site quality assurance and quality control programmes
- Equipment and material procurement quality assurance.

Independent review:

- Changes to operating procedures or plant modifications important to safety should be assessed by independent review and/or analysis by Safety committees
- A Senior Corporate level Manager should be responsible for Nuclear Safety Policy

## 4.0 PLANT ORGANIZATION AND MANAGEMENT

The documented plant organization should indicate the staffing arrangement within the categories of direct line operating personnel and supporting personnel. The extent to which the support functions are self-sufficient or dependent upon services from outside the station organization should be demonstrated by functional organizational charts including manpower resource allocation together with a specification of the duties and responsibilities of key personnel.

There should be strong lines of authority established to deal with matters bearing on nuclear plant safety with clear reporting relationships and simple interfaces. Sufficient experienced staff should be available in order that duties relevant to nuclear plant safety can be carried out without undue haste or pressure. Attitudes towards nuclear safety should be one of the selection criteria when hiring or promoting managers. Performance appraisals should include a section on attitudes towards safety.

The plant objectives should be defined within the operating organizations' policies and objectives, and plant management programmes implemented as the means by which the plants' objectives are achieved. A management programme should consist of a systematic application of planning schedules, procedures, reviews and audits supported by appropriate resources. Each programme should define the extent to which off-site resources are used to supplement plant services and facilities.

Annual goals and objectives including performance indicators should be written to provide plant personnel with specific goals to strive for. Results of these goals should be trended, analysed and subsequently used to provide corrective action.

A policy statement on nuclear safety issued by the plant manager should be provided as guidance to all plant staff. This policy should declare a commitment to excellent performance in all activities important to the safety of the plant. The policy should state that plant safety has the utmost priority, overriding if necessary the demands of production and project schedules.

Administrative procedures in the form of standing instructions or rules, generally applicable to all personnel on site, should ensure safe and effective methods of working.

The training of personnel at the plant is an important contribution to excellence. Special training needs exist for each functional organization and management must ensure that the responsibility for such training is well understood by the function management and that appropriate resources and facilities are available to the training organization to meet the various training needs. The quality of the training programmes should be assessed by plant management.

A clear understanding of the division of responsibilities and authority should exist between all units of the plant organization, and between such units and other parts of the operating organization and relevant outside organizations providing services. The different organizations and plant personnel must clearly understand their authority, responsibilities and accountabilities, and check that staffing and resources are sufficient to accomplish the tasks assigned. The number of personnel reporting directly to one supervisor should not be so large as to effect the supervisors' ability to perform his duties. Clear lines of authority must be established to deal with matters of nuclear safety. Responsibilities for nuclear safety should be clearly defined.

The effectiveness and promulgation of goals and objectives throughout the plant organization are important. Objectives should be established for each management unit and

reviewed as appropriate. Consistency of the objectives of the operating organization, the plant, the departments and the units should be evident. Adequate communication of these objectives to personnel, as well as management review to assess performance indicator progress towards achievement of the objectives, should also be evident.

Goals and objectives approved by senior management should be established to cover the following activities:

- Training and retraining
- Operations
- Maintenance
- Surveillance
- Technical/engineering support
- Radiation protection
- Chemistry
- Emergency preparedness
- Quality assurance and quality control
- Fuel management
- Waste management
- Commissioning
- Project management
- Civil engineering and construction
- Mechanical equipment installation
- Electrical and I&C equipment installation.

- The overall planning and scheduling function, however achieved, should ensure the effective integration of those activities that involve all plant departments in complex operation and maintenance activities. This co-ordination of activities becomes particularly important during major plant outages or refuelling operations. Significant areas include the planning of system and equipment clearances and radiological clearances for work authorisation; the management of nuclear safety during outages; resource allocation for multiple department activities; documentation control between departments; post maintenance or post modification testing before restoration to service; and assessment of progress and reports to management.
- Operating history and departmental interfaces should be reviewed and evaluated by referring to management reports. Included in this evaluation should be performance indicators related to plant operating availability, maintenance work requests, outstanding deficiencies, reactor trips, safety system actuations and performance, radiation exposure data, industrial safety performance and training programme attendance. In depth nuclear industry and in-house operating experience feedback analysis should be completed and programmes and procedures changed as appropriate to reflect the lessons learned. Safety performance indicators should be trended and the results reviewed by department managers. There should be a full time safety review group which reports to the plant manager.
- The meeting of goals and objectives should be routinely monitored by plant management. Managers and supervisors should be held accountable for the achievement of assigned objectives. Department managers should conduct routine

meetings at which progress reports on meeting goals and objectives are reviewed. Safety performance indicators, operating experience feedback, budget and financial matters, and personnel issues should also be subjects under review at these routine meetings.

A nuclear power plant safety policy should be established and communicated to all plant personnel. A safety policy should exist and should contain the essential elements as outlined in INSAG-4 `Safety Culture'. Plant staff should be familiar with the policy. Periodic meetings should be conducted at which the plant manager and other managers convey and reinforce the safety policy. A mechanism should exist which enables plant staff to report safety concerns to plant management. Managers should encourage good safety performance and provide appropriate recognition. Department managers, on a periodic basis, should inspect the conduct of work in the plant and in particular, work on safety related systems. Managers should demonstrate their commitment to safety by being involved in plant work activities.

Administrative procedures, rules or instructions should be provided to achieve uniformity of performance in areas covering more than one department.

- The degree of conformity throughout the plant should be consistent;
- Identification of plant equipment and components should be consistent;
- The stations' filing and records retention system, and the development, authorisation, control and review of station documentation should be evident;
- Registers should be maintained of nominated persons to perform specified functions under the site license;
- An up to date index of departmental procedures, instructions and drawings should be available. In addition to operating procedures, such programmes as industrial safety, computer software control, office hours and shift rotation, emergency plan administration, fire fighting, first aid and medical treatment, physical protection and site security, procurement, material control and storage, accident reporting and investigation, public relations and interfaces with other authorities, and general employee training should be addressed by procedures.
- A system for tracking commitments and corrective actions should be established. Corrective actions should be tracked to completion.
- Administrative procedures should be provided which clearly define the responsibilities and authority for each department regarding the various training programmes, such as operations, maintenance and radiation protection.

## 5.0 EFFECTIVE SUPERVISION

Management and supervisory personnel must monitor station activities, assess the results and identify needed improvements. By leadership and example, they must affirm a high regard for nuclear safety and reliability and promote high standards of performance. This can only be achieved by managers and supervisors being effectively and frequently present in the plant to reinforce desirable behaviour, coach plant personnel and correct behaviour where necessary. A common OSART finding is the lack of effective supervisory and management presence in the field.

## 6.0 QUALITY ASSURANCE PROGRAMME

The quality assurance programme should provide the means to evaluate that site activities important to nuclear safety are operationally monitored and to obtain assurance that they remain within the design assumptions and Operational Limits and Conditions. Verification of effective implementation of the quality assurance programme should be performed by designated individuals or groups from within or outside the operating organization, who are knowledgeable and experienced in nuclear power plant operation and quality assurance. This area is not discussed further since it is covered in more detail in other lectures.

## 7.0 REGULATORY AND OTHER STATUTORY REQUIREMENTS

The operational safety of the plant is subject to surveillance by the regulatory body. The operating organization should give every assistance to carry out its functions. Good liaison is essential to foster mutual understanding and respect in achieving the common objective of safe operation. In addition statutory requirements of other government agencies may have to be observed.

The responsibilities of the regulatory body and the precise responsibilities within the operating organization in respect of government legislation need to be understood and complied with. The operating organization usually stipulates that the plant manager is legally responsible for observing the conditions of the operating licence and the requirements of the regulatory body. Further services may be provided within the operating organization to support the site management, including independent inspection services. However, these should in no way diminish the primary responsibility of the plant manager for the safe operation of the plant.

Effective arrangements and appropriate documentation must exist to ensure that the conditions of the operating licence and any amendments are adhered to. Periodic updating of safety analysis reports and analysis of inspection and incident reports should be evident. Information should be passed to site personnel outlining the authority of regulatory body inspectors. All plant personnel should be aware of their responsibility for dealing with reportable incidents. Effective communication channels should exist throughout the operating organization so that compliance with regulatory requirements is assured and prompt reporting is executed where necessary.

The relationship between the regulator and plant management should be one of mutual respect with a frank, open and yet formal relationship. The regulator and plant management should hold regular discussions on plant operating experience and problems. The extent to which the regulatory agency relies on the internal safety processes of the plant or of the utility should be clear.

The extent to which other statutory requirements overlap regulatory requirements will depend on governmental policies and organization. Clarification is desirable with respect to the requirements and responsibilities of such additional items as:

- Conventional codes, standards and industrial practices such as statutory periodic inspections, pressure testing and storage of hazardous materials
- Conditions of work in industrial establishments, such as age limitations, employment of women, working hours and safety
- Limitations in the industrial use of certain materials, such as asbestos, toxic materials, hazardous chemicals and flammable liquids

- Special transportation requirements for hazardous materials
- Special radiological requirements, such as radioactive materials in transit
- Environmental protection measures
- Emergency preparedness interface with government, state and local authorities.

A regulatory organization should exist which has sufficient knowledge experience and capability to carry out the regulatory inspection and audit programme.

## 8.0 INDUSTRIAL SAFETY PROGRAMME

The operating organization should have a general policy on industrial safety, which includes the measures taken to ensure the industrial health and safety of personnel on the site is satisfactory. This subject is discussed in more detail in lecture 10.2

## 9.0 DOCUMENT AND RECORDS MANAGEMENT

Documentation comprises recorded information which describes, defines, specifies, reports or certifies designated activities, requirements, procedures or results. The administrative control of documentation to the required standards of quality assurance should be achieved by the application of general administrative procedures augmented as necessary by detailed departmental instructions and procedures. Lecture 9.3 discusses this in more detail.

## 10.0 SITE ACCESS CONTROL

The security group must as a major objective provide nuclear security for the protection of the public through prevention or deterrence of intrusion, theft, surface attack and internal or external sabotage of safety related systems and nuclear materials.

The security group should have plans and procedures in place to provide industrial security of the owner controlled property in the event of labour problems or civil disturbances through vehicle entrance and exit control, vehicle parking and traffic control and access control.

Hardware and software should be maintained as problem free as practical such that protective barriers are continuous and control and monitoring is not dependent on compensatory measures.

Access and background screening control should be such that unauthorised access is not possible.

A fitness for duty programme should be in place and instructions should be detailed enough that security personnel can easily understand them during off hour times when a fitness for duty situation may arise.

## 11.0 OSART EXPERIENCE

Isolation in the international nuclear power community is disappearing. Even in countries with a new or developing nuclear power programme, operators and safety authorities are making contact with foreign peers or counterparts.. However it was noted that some plants do not make full use of operating experience from other plants

Some countries are facing a difficult economic situation, and where the government is the owner, they are unable to provide NPPs with adequate financial resources for all of the

required design upgrading programmes. Consequently, less significant improvements are postponed or deleted, and maintenance is more corrective than preventive. The increasing necessity of nuclear power competitiveness — in Eastern as well as in Western countries — challenges organizations where safety culture is still insufficiently rooted in staff and management. In some instances nuclear safety is not clearly indicated by management as the highest priority and not all managers are convinced that the quest for excellence in operational safety leads also to competitiveness.

Organization in the former Soviet designed plants is complex. Several specialized departments (or 'workshops') are responsible for surveillance, maintenance programmes, engineering, planning, etc, for a specific plant area or type of equipment. Operational shifts are constituted of personnel from these different workshops. This results in a complex co-ordination of plant operations by the main control room staff. Simpler organizations are being studied by some of these plants. It was noticed that all plants seem to have clear written procedures to define roles, responsibilities and relationships.

Management based on goals and objectives, with performance indicators to measure the fulfilment of these objectives, is progressing and it is practised today in varying degrees in the majority of plants. In several operating organizations, goals and objectives are an integral part of the plant's business plan — some plants even prepare a strategic plan for three to five years — with action plans to improve their weaknesses. These plans may be adapted for each department through management contracts with department managers. Generally, as you progress down the plant management chain there is less commitment to effective management based on goals and objectives. Sometimes the business plan remains at the management level, with goals and objectives being insufficiently communicated to, and shared with, the staff to ensure their adherence to them. In countries with a tradition of centralized management and weak delegation, the practice of management by goals and objectives is not so well developed. When they do exist, some goals and objectives are not measurable, and even if there are some indicators — often WANO performance indicators — they are not really used as tools for management.

Communication and human factors remain areas with a large potential for improvement. Communication about strategy, objectives, policy and daily activities, is often insufficient because managers spend too little time in the field, with workers and employees, to explain their expectations and monitor the achievement of them. The value of such a practice is however now recognized by everybody and it is in progress, but its effectiveness has to be improved. When managers are observed in the field they are often not effectively reinforcing desired behaviour.

In some plants, although a punitive approach to discipline is recognized as harmful, there is still a limited acceptance of human error. Besides the human aspect of this problem, this attitude is especially harmful in inhibiting openness, transparency, event reporting and experience feedback. Fortunately this management behaviour has been observed changing for the good.

Several other plants have improved the management of human resources. This includes an annual personnel performance appraisal system, linked with training and in some instances with the promotion system of the company. Although human resources are considered as the most valuable asset of an enterprise, experience feedback in this area is still developing and there is opportunity for improvement.

Training for management personnel is not as well developed as for operators. It is often infrequent and focused on technical issues rather than management techniques.