

UPSAT Guidelines

1996 Edition

*Reference document for
IAEA Uranium Production Safety Assessment Teams
(UPSATs)*



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FOREWORD

The IAEA Uranium Production Safety Assessment Team (UPSAT) programme provides advice and assistance to Member States to enhance the safety and environmental performance of uranium production facilities during construction, commissioning and operation. The UPSAT programme, initiated in 1995, is not restricted to any particular group of Member States, whether developing or industrialized, but is available to all countries with uranium mines and/or mills under construction, commissioning or in operation.

Sound design and construction are prerequisites for the safe and environmentally responsible operation of uranium mines and mills. However, the safety of the facility depends ultimately on sound policies, procedures and practices; on the capability and reliability of the construction, commissioning and operating personnel; on comprehensive instructions; and on adequate resources. A positive attitude and conscientiousness on the part of the management and staff in discharging their responsibilities is important to safety.

UPSAT missions consider these aspects in assessing a facility's construction and operational practices in comparison with those used successfully in other countries, and when exchanging ideas, at the working level, for enhancing safety.

The IAEA Safety Series publications, including particularly those dealing with the mining and milling of radioactive materials, the Basic Safety Standards for Radiation Protection, and the expertise of the UPSAT members themselves form the bases of the review. The UPSAT Guidelines provide overall guidance for the experts to ensure the consistency and comprehensiveness of the safety assessment. Additional guidance and reference material to complement the expertise of the UPSAT members may be prepared by the IAEA, should the need be demonstrated.

UPSAT reviews are performance oriented in that they accept different approaches to construction, commissioning, operational safety and environmental protection, that represent good practices and may contribute to ensuring a good safety and environmental record on the part of the operating organization. Recommendations are made on items of direct relevance to safety and environmental protection, whereas suggestions made might enhance plant safety and environmental protection only indirectly but would certainly improve performance. Commendable good practices identified at sites are communicated to other sites, where relevant and with due regard to commercial sensitivities, in order to effect improvements.

EDITORIAL NOTE

In preparing this publication for press, staff of the IAEA have made up the pages from the original manuscript(s). The views expressed do not necessarily reflect those of the governments of the nominating Member States or of the nominating organizations.

Throughout the text names of Member States are retained as they were when the text was compiled.

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1. INTRODUCTION

1.1. PURPOSE

These guidelines have been prepared to provide a basic structure and common reference both across the various areas covered by an UPSAT mission and across all the missions in the programme. As such, they are addressed, principally, to the team members of UPSAT missions but they will also provide guidance to a host uranium production facility preparing to receive a mission. In particular the selection of IAEA publications relating to the safety of uranium production (given at the end of the report) is valuable reading for personnel at the host facility.

An UPSAT review of a uranium production facility is based on documents describing the site and its structures, systems and components; the organization, training and qualification of site personnel; written procedures; interviews and discussions with site personnel; observations of operating practices; and the review of records and reports. The review focusses on performance in various areas important to safety and environmental performance, the managerial aspects of policy implementation, the control of activities, verification and correction, as well as document control. An UPSAT review may take place at a uranium production project during commissioning, operation and decommissioning.

UPSAT Guidelines have been developed in the following areas and are presented in Sections 3.1 to 3.9:

- 3.1. Management, organization and administration
- 3.2. Training and qualification
- 3.3. Operations
- 3.4. Maintenance
- 3.5. Safety, fire protection, emergency planning and preparedness
- 3.6. Radiation protection
- 3.7. Environmental monitoring programme
- 3.8. Construction management
- 3.9. Commissioning and decommissioning.

Since an UPSAT may be carried out at any time during the lifetime of a uranium production site, the areas to be reviewed will depend on the status of the project. Normally Sections 3.1–3.7 will be reviewed at an operational facility. During the pre-operational and decommissioning phases the review will also include Sections 3.8 and 3.9, in addition to Sections 3.1–3.7.

The guidelines are intended to help each expert to formulate his review in the light of his own experience. They are not all-inclusive and should not limit the expert's investigations, but are better considered as illustrating the adequate requirements for his review.

It is recognized that uranium production is a competitive business in many countries. The primary purpose of an UPSAT mission is to ensure the safe and environmentally responsible operation of a uranium production site, but information may also be exchanged within the UPSAT guidelines, which may enhance the efficient operation of the site. Since some of this information may be of a proprietary or commercially sensitive nature, it can only be exchanged with the full agreement of both the host facility and the facility supplying the relevant expert. Where such an agreement cannot be reached, this type of information will not be part of the UPSAT report. At the discretion of the participating facilities, confidentiality agreements may be required of the UPSAT experts.

1.2. OBJECTIVES OF UPSAT MISSIONS

The UPSAT is intended to be a peer review conducted by a team of international experts with direct experience applicable in the technical areas of evaluation. Judgements of performance are made based on the combined expertise of the international team. The review is therefore not a regulatory inspection nor

audit against set codes and standards. Instead, it is a technical exchange of experiences and practices at the working level aimed at strengthening the programmes, procedures and practices being followed.

The key objectives of the mission are:

- to provide the requesting Member State or organization with an objective assessment of the status of operational safety and practices at the site in the context of generally accepted international practices of operational safety and performance;
- to provide recommendations and suggestions for improvement in areas where performance falls short of generally accepted practice; and
- to provide key staff of the site with an opportunity to discuss their practices with experts who have experience of other practices in the same field.

1.3. METHODOLOGY FOR UPSAT MISSIONS

1.3.1. Preparation

On receipt of a request for an UPSAT mission, an IAEA co-ordinator will be assigned to carry out the following:

- Establishment of liaison contacts at the site and regulatory authority.
- Arrangement of a preparatory meeting with the site management and other organizations involved.
- Recruitment of external experts for the team.

At the same time, the site management in the host country should nominate a contact person with whom the liaison officer may correspond.

The preparatory meeting, usually attended by the team leader and co-ordinator, is held at the site (approximately six months prior to the mission) to allow site management, counterparts and other organizations involved to participate. The meeting covers:

- The main features of the UPSAT programme
- Management's preparation for the review
- Preparation of the advance information package
- Logistic support required
- Financial arrangements.

Following the meeting, the IAEA will recruit the team members and the site management should designate one counterpart for each area of review, who will be the contact person for the corresponding team member during the review.

1.3.2. Team composition

The team is composed of a team leader, an IAEA staff member, and up to six other experts drawn primarily from other uranium production facilities. No one from the host country is included in the team.

1.3.3. The review

The UPSAT team uses four steps to acquire the information needed to develop their recommendations as set out in the experts 'Technical Notes' (Section 1.3.5). These are:

- review of written material
- interviews with personnel
- direct observation of performance, status and activities both at site and at off-site facilities
- discussion of evaluations/tentative conclusions with experts.

Experts are expected to cover each topic to the extent necessary to be able to make an informed judgement of the item. Weaknesses identified should be addressed to the degree required to document the concerns in the experts' Technical Notes with sufficient facts necessary to make the concern understandable and accurate. Formulation of recommendations and suggestions should be based on the identified weaknesses.

Documents

Documents of general interest to the whole team are listed in Section 1.5, while those specific to a given area that are to be reviewed only by the expert responsible are set out in the appropriate section of the specific guidelines.

Interviews

Interviews with personnel can then be used to:

- Provide additional information not covered by the documentation
- Answer questions, and perhaps satisfy concerns arising out of the documentation review
- Form a judgement of their understanding of the arrangements and their own duties and responsibilities
- Establish whether the individuals are satisfied with the formal arrangements
- Form a judgement of their competence, professionalism and commitment to safety.

The interviews are also used to provide the opportunity for all the important information to be exchanged between experts and counterparts, and therefore should be held at the working level between peers. These interviews should be a 'give and take' discussion and not an interrogation of the counterparts by the experts. Properly conducted, these interviews are possibly the most important part of the UPSAT mission.

Direct observation

Direct observation of work activities under way is an important aspect of the review process. A substantial part of the review period is spent at the site reviewing procedures and practices in use. Workers may be interviewed to gain an impression of their technical knowledge, skills, attitudes and morale. The observation of work should include safety practices, use of procedures, drawings and instructions, quality control measures in use, supervision of activities and management control of work. From these observations, the reviewer will form a view of:

- The way the arrangements are put into effect at the work location
- The technical knowledge and skills of the work force
- The attitude and morale of the work-force
- Supervision of work by management
- The extent of commitment to safety objectives.

Based upon the interviews and observation the reviewer can then if necessary modify his preliminary view, which was based only on the formal arrangements, to form a judgement of performance. It may be that more than one iteration through document review, interview and observation is necessary in order to gain sufficient facts to form a judgement.

1.3.4. Evaluation criteria

UPSAT members are selected to ensure that a variety of national approaches to operational safety and environmental are represented. Each expert invariably has, in addition to his particular area of expertise, knowledge of some other national approaches and some other relevant areas. Coupling this knowledge with the IAEA Basic Safety Standards and the Safety Standards specific to the mining and milling of radioactive ores allows the best international standards to be identified.

In the evening of each working day of the review, the team leader calls a meeting of one to two hours duration, where each expert summarizes his concerns developed during the day, including perceived strengths and weaknesses. This creates an opportunity for other team members to contribute their views, further strengthening the experience base of the evaluation. It is important that each expert comes to the meeting prepared to make a succinct statement of his findings, in order to allow the other review areas to be discussed at the same meeting.

The UPSAT review thus compares observed site performance with successful and cost-effective safety and environmental practices found at other uranium production facilities worldwide. This comparison may result in a recommendation, suggestion, good practice or good performance in accordance with the following definitions:

Recommendation

A recommendation is advice on how improvements in operational safety or environmental performance can be made in that activity or programme that has been evaluated. It is based on proven, good international practices and addresses the root causes rather than the symptoms of the identified concern. It very often illustrates a proven method of striving for excellence which reaches beyond the minimum and which is designed to result in tangible improvements. Absence of recommendations can be interpreted as performance corresponding with proven international practices.

Suggestion

A suggestion is either an additional proposal in conjunction with a recommendation or may stand on its own following a discussion of the pertinent background. It may indirectly contribute to improvements in operational safety or environmental performance but is primarily intended to make a good performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to current work. In general, it is designed to stimulate management and supporting staff to continue to consider ways and means for enhancing performance.

Good practice

A good practice is an indication of an outstanding performance, programme, activity or equipment markedly superior to that observed elsewhere, not just the fulfillment of current requirements or expectations. It should be superior enough to be brought to the attention of other production sites of the requesting Member States as a model of the general drive for excellence.

Good performance

A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to good operational safety or environmental performance, that works well at the facility. It might not be necessary to recommend its adoption by other sites, because of financial considerations, differences in design and other reasons.

1.3.5. Reporting

Technical Notes

During the course of the review, after each evening meeting, each team member writes detailed Technical Notes on his observations and conclusions, including any recommendations, suggestions, good practices or good performances. These form the basis of oral presentations at the exit meeting. One or more copies of the Technical Notes are given to the site manager prior to the exit meeting.

The Technical Notes are the 'field notes' of the individual experts and are considered by the IAEA to be restricted documents. As such they are not to be released to be public or derestricted by the site. A copy of the Technical Notes should not be provided to the regulatory authority by the site if the notes will in turn be made public. The site, however, is encouraged to let the regulatory authority read the Technical Notes at the site.

UPSAT report

On completion of the review, the team leader will prepare the UPSAT report, based on the Technical Notes. This is an official IAEA document which summarizes the team's main observations and conclusions including, all recommendations and good practices. Before the text is finalized, the facility and the regulatory authority concerned are given the opportunity to offer comments. This report is submitted through official channels to the Member State which requested the UPSAT. The IAEA restricts distribution to itself, members of the review team, and the site.

1.3.6. Schedule

Immediately preceding the review, team members are required to attend a briefing of about four hours duration led by the team leader. This provides an opportunity for them to meet and resolve any questions not covered in these guidelines.

The team members also meet for one to two hours in the evening of each working day to discuss their findings, following which they write up their Technical Notes.

The weekend in the review period is left free allowing 10 working days which are scheduled as follows:

- Day 1: Entry & Introduction
 Site entry formalities, introduction to security, radiation protection and safety requirements.
 General site tour. Meet counterparts and agree to review schedule.
- Day 2–6: Review. Each expert schedules his own review in advance and agrees it with his counterpart on day 1. The Saturday of the review is frequently held open as a team work day so that the experts can catch up on completing their Technical Notes.
- Day 7: Reserve for open items.
- Day 8: Technical Notes feedback to plant counterparts.
- Day 9: Technical Notes finalization. Preparation for exit meeting.
- Day 10: Exit meeting.

1.4. IMPORTANT SAFETY AND ENVIRONMENTAL ISSUES FOR UPSAT MISSIONS

An important aspect to be reviewed by the experts in all areas during the conduct of an UPSAT mission is the safety culture present at a site. The concept of safety culture was developed by the International Safety Advisory Group (INSAG) and is explained in the IAEA publication No. 75-INSAG-4 'Safety Culture' (see list of IAEA publications related to uranium production safety at the end of the report). Safety culture is defined as that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance. The concept applies equally well to uranium mining and milling operations.

In the appendix to INSAG-4 there is a list of questions for use by the reviewers in forming judgements as to the effectiveness of safety culture in an organization or in individuals. Some questions are only applicable to some review areas and some to all review areas. The questions are intended to be used by the reviewers so as to provoke thought rather than to be prescriptive. They are not intended to be asked directly of the site counterparts by the reviewers, since in this case they may only invite obvious yes/no responses. The reviewers should question their counterparts and site personnel about programmes and procedures and observe how people perform work in order to develop their opinions about safety culture. The reviewers should then ask themselves these questions in order to determine if the particular safety culture aspects are apparent in the specific area being reviewed.

The Team Leader will then summarize the conclusions relating to safety culture in the overview or the introduction to the Technical Notes.

The following list of questions related to safety culture was adapted from the appendix to INSAG-4:

Regulator interface (applicable to Section 3.5)

- What is the nature of the relationship with licensee?
- Is there mutual respect between the regulatory staff and the facility?
- Is the relationship frank, open and yet adequately formal?
- Is there regular joint discussion of the licensees' experience and problems?
- To what extent does the regulator rely on the facility internal safety process?
- What is the nature and extent of the regulator's presence at the facility?

Corporate policy (applicable to Section 3.1)

- Has a corporate safety and environmental policy statement been issued?
- Are corporate managers and their staff familiar with this policy?
- Does the corporate board have expertise in uranium production safety?
- Is there an active safety and environmental review committee?
- Is there a senior manager with safety and environmental issues as prime responsibilities?

Highlighting safety and environmental issues

- Has the site manager issued a policy statement on safety and environmental issues?
- Are the managers and personnel familiar with the safety and environmental policy?
- Does the site manager hold safety and environmental meetings with personnel?
- Is there a process for personnel to report safety and environmental concerns to management?
- Is there a system of recognition that includes factors relating to safety and environmental performance?

Definition of responsibility

- Has the assignment of safety and environmental responsibilities been clearly announced?
- Are documents that identify safety and environmental responsibilities up to date and reviewed?

Selection of managers

- Do the managers recognize attitudes to safety and environment when selecting/promoting staff?
- Do annual appraisals include a section on attitude to safety and environment?
- Can cases be identified, in which safety and environmental attitude was significant for promotion?

Review of safety and environmental performance

- Does management receive regular reviews of the site safety and environmental performance?
- Are the results of safety and environmental reviews acted on in a timely way?
- Are managers aware of how the safety and environmental performance of their facility compares with others?
- Do staff routinely read and understand reports on operating experience?
- Is there a system of safety and environmental performance indicators and reasons?
- Are managers aware of the trends of safety and environmental performance indicators and reasons?
- What arrangements exist for reporting safety-related and environmental events at the site?
- Is there a full time safety and environmental review group which reports directly to the site manager?
- What are the trends for deficiencies, temporary modifications, procedure revisions?

Training (mainly applicable to Section 3.2)

- Does all critical training/retraining culminate in final assessment?
- What resources are allocated to training?
- Is the quality of training programmes assessed at corporate and plant level?
- Is there a periodic review of the applicability, correctness and results of training?
- How frequently do production requirements interfere with training?
- Do personnel understand the significance of operating limits and responsibility?
- Are personnel trained in the special importance of following procedures?
- Does retraining take into account difficulties experienced?
- Do maintenance sessions make use of mock-ups and video recordings?
- Do training programmes address safety culture?

Local practices

- Has the site manager instituted safety-related and environmental initiatives beyond corporate requirements?
- Are records on maintenance and equipment performance retrievable, complete, up to date?
- What is the general state of the facility, tidiness, leaks, logbooks, records?
- How is the work by supporting organizations and contractors, supervised, reviewed, signed off?

Field supervision by management (mainly applicable to Sections 3.3 and 3.4)

- What is the working style of the supervisors on shift?
- Do managers often make first hand inspections of safety-related and environmental work?

Workload (mainly applicable to Sections 3.3 and 3.4)

- Is there a clear policy of limits to overtime?

Attitudes of managers

- Are conflicts between safety and environment and costs/operations discussed?
- Are the production schedules examined by an internal safety review process?
- When safety and environment interfere with production, do safety and environment come first?

- Do managers remind personnel that haste and shortcuts are inappropriate?
- Do managers explain their commitment to safety culture to their personnel?
- Do managers disseminate to personnel the lessons learned in-house and at other sites?
- Is there a system for bringing safety and environmental concerns to managers?
- What is the attitude of managers and personnel to audits or safety and environmental reviews?
- Do management regularly review personnel performance and safety and environmental attitude?
- What is the management attitude to safety and environmental infringements and violations of Technical Specifications?
- What systems exist to apprise managers of safety and environmental accomplishment and shortcomings?
- Do managers participate in personnel training courses where safety and environmental policy is explained?
- Does the plant manager from time to time inspect the conduct of safety-related and environmental work?
- Do managers give attention to the physical working environment of their personnel?

Attitudes of individuals

- Are personnel aware of the management's commitment to safety culture?
- Can personnel state ways in which errors might prejudice safety and environment performance?
- Can personnel clearly enumerate their own responsibilities?
- Can Operations, Maintenance or Technical Support list any recent violations of operating limits and conditions (OLCs)?
- Are procedures followed when quicker methods are available?
- How attentive are personnel to the completeness and accuracy of records?
- What steps would personnel take if they observed actions that reduce safety margins?
- What would personnel do if a mistake were found in a procedure?
- Do personnel use the mechanism for reporting safety and environmental shortcomings and improvements?
- Do control room personnel show a watchful and alert attitude at all times?
- Do personnel make maximum use of training opportunities?
- Do personnel communicate their experience to other individuals and groups?
- What is the personnel attitude to safety reviews and audits in their area?

1.5. REFERENCE MATERIAL

The basis for the review of the performance of the site and personnel consists of reviewing documents; programmes and procedures; facility operation records; and internal and external reports. The following list includes typical documents for each of these groups. Contents and designation of these documents may vary owing to national practices.

Organizational and policy documents

- Construction or operating licence and conditions
- Organization, authorities and responsibilities for:
 - facility headquarters
 - the project team
 - the construction site organization
 - operating staff
- Vendor listing and contract responsibilities
- Procurement practices, policies and procedures
- Personnel training and qualification policies and procedures
- Work planning and scheduling procedures
- Construction schedule and status
- Startup schedule and status

- Preventive maintenance programme and status
- Safety and environmental policy
- Quality assurance policy.

Plant status documents

- System description
- Flow sheet
- Diagrams.

Programmes and procedures

- Operating licence and conditions
- Emergency plans
- Technical procedures
 - operations
 - maintenance
 - surveillance tests
 - in-service inspections and tests
 - radiation protection
 - emergency preparedness
 - quality assurance
 - operational experience feedback
 - modifications
- Administrative procedures
 - plant organization, authorities and responsibilities
 - work planning and scheduling
 - personnel training and qualification
 - procurement.

Plant construction/commissioning/operating records

- Records on plant construction
- Operating history
- Plant logs and records
- Temporary and permanent modifications
- Work requests and permits
- Equipment histories
- Surveillance test results
- Calibration records
- Radiological data
- Chemical/metallurgical data.

Internal and external reports

- Facility reports (daily, weekly, monthly, quarterly, annual, etc.)
- Safety and environmental committee reports
- Industrial safety reports
- Radiation protection reports
- Effluent reports
- Unusual event reports
- Emergency exercise reports
- QA audit reports
- Regulatory inspection reports
- UPSAT reports
- External evaluations reports.

2. PRACTICAL HINTS FOR REVIEWERS

The process used to obtain information on items during the review of operational safety and environmental practices in a uranium production site should not be limited to questions. Activities should be witnessed and documents should be checked in such a way that the focus is on essential aspects of site performance.

At the same time, the interviews or questions should lead to obtaining meaningful responses and documents from the counterparts. For example, a simple question such as 'do you have an effective organization?' will be properly answered only with the word 'yes'. The reviewer should ask more tactical questions to obtain a more useful response. For example, 'please show and describe the organization chart', and 'what is your function and interface with other sections in the organization chart?' Asking people to describe their understanding will also show whether their understanding is consistent with the documented information that is produced.

Similarly, as far as possible important activities and operations should be witnessed to allow the reviewer to judge safety and environmental performance. Such activities and facilities might include, for example, special maintenance work, functional and surveillance testing, instrument calibration, shift turnover and emergency drills.

2.1. OBSERVATIONS

A fundamental part of the UPSAT methodology is the observation of ongoing site activities. The performance of several individuals is likely to be representative of all personnel within a discipline or group. The results of management's effort to implement site policy and procedures, and the effectiveness of training, are exemplified by these individuals. Therefore, it is inappropriate to treat these observations as a reflection on an individual. Instead, the observations should be treated as symptoms of management attitude, and the persons involved should remain anonymous.

Each UPSAT focusses on those aspects of the facility organization that are important in achieving quality or high standards in the end product. Accordingly, the UPSAT generally concentrates on those activities that the site has identified as sufficiently important to require the establishment of some system, such as a written document, to control the activity. This system is first evaluated for its adequacy, i.e. the degree to which it incorporates appropriate details and controls to ensure that the desired result is achieved. As a second part of the review process, the team determines whether or not this system has been implemented, i.e. is the system 'in place' and actually being utilized by the personnel? The final and most important part of the review process is the determination of the quality of the results being achieved by the site. A significant portion of each review, therefore, is devoted to observing site personnel performing their day-to-day work. By perfecting observation skills, the expert is able to see conditions and situations that generally are symptomatic. Attention to detail is paramount. The expert must have a broad outlook of his surroundings and the ongoing activities. Information obtained through observation becomes an important foundation for the overall review results.

Numerous activities at a site contain the necessary elements that make an observation worthwhile. In selecting an activity and planning for the observation segment of the review, there are several questions that can be considered to help in deciding the most beneficial course of action. Some basic questions with discussion are as follows:

- Is the system/work important to safety and environment? Observations need not involve safety- or environment-related work; however, if the work is safety- or environment-related or important to safety or environment, the results of the observations will carry considerably more impact. That is, work important to safety and environment should be controlled in a manner that promotes excellence. If deficiencies in this type of work are noted, they may be significant in themselves.

- Is the work of sufficient complexity that a written procedure has been developed? For many of the activities that are observed, a procedure has been developed by the site to ensure that specific steps are accomplished in a manner such that the end product meets a minimum quality standard.
- Does the work involve several departments or disciplines? Although single-discipline observations can be productive, those that require the cooperative effort of several elements of the site organization often provide a more significant input to the team's effort to evaluate the status of the site.

In selecting an activity to observe, the expert is looking for performance of an individual that is representative of the organization's ability to train its personnel and implement its policies and procedures. With the appropriate selection of activities, the results of the observations will provide an overall reflection of the site's performance.

2.2. CONDUCTING OBSERVATIONS

2.2.1. Preparation

As with all other phases of a review, preparation is the key element. The two most important parts of the preparation phase are the determination of what and when. The what to observe can be determined by establishing liaison with the site to ascertain what activities will be going on during the period of the review. This will enable the expert to plan for specific activities and to conduct the necessary research and study. Other observations will be on an 's occurring' basis. The 'when to observe' question is answered best by 'the earlier the better'. By conducting results-oriented observations in the first few days of an UPSAT, the expert gains considerable insight into weaknesses within the organization. This then enables him to properly direct his activities during the remainder of the UPSAT.

2.2.2. Initiating the observation

Most observations should be planned in advance and arrangements made as to when and where the expert(s) will meet with the individual(s) who will be the subject of the observation. Most observations begin at the beginning of the shift or, for particular work assignments, at the beginning of the work.

Experienced UPSAT members will plan their schedules such that a primary and an alternate objective are always scheduled. The reviewer merely shifts attention to the alternate objective while awaiting resumption of the primary objective. Reviewers must place due emphasis on the management of their time to avoid wasting it.

2.3.3. Observing

Establishing good rapport with the individuals under observation is important. They should understand that the purpose of the observation is not to criticize them personally, but to look for both good practices and flaws in site training procedures, policies, and practices and their implementation. Except in the case of immediate hazard to site equipment or personnel safety, reviewers should not interfere with site operations. Questions are a necessary part of an observation, but should be asked at times when they do not adversely affect the performance of the individual being questioned.

The expert should be looking, in a broad manner, at many items during the observation process. Subsequent to observing the work activity, the reviewer organizes his notes and commences analysis of his observations. This process generally results in the need for follow-up action in order to resolve unanswered questions. This follow-up may require a return to the physical area of the site to confirm or gather further information.

2.3. ACTIVITIES TO OBSERVE

The type of activities that generally provide a good indication of overall performance includes: organizational meeting, training sessions, routine operations, maintenance, monitoring, and radiation safety inspections.

2.4. OBSERVATION TECHNIQUES

Take detailed notes. Sometimes apparently irrelevant material becomes meaningful when analysing and summarizing an evolution.

Log times when taking notes. These can be used to correlate site responses and personnel actions noted by other reviewers in other areas of the site.

Include procedure numbers and other reference information for follow-up.

Include questions and items to follow up in the notes. Information could be lost if memory is trusted for recall later.

Include preparatory activities in the observation if possible.

Do not assume — ask questions. Even if operator •A” told you the answer, ask operator •B”.

Constantly ask yourself, ‘Why is the person being observed doing that? Is it the correct thing to do?’ Note details.

Do not just observe the activity, observe the individuals and the surroundings. Look under, over, and around. Think beyond the operation.

- Where did that instrument come from?
- Why does the operator keep changing settings?
- How many management personnel have I seen?

Follow up after the operation is completed. Track paper, review the job with supervisors, and question the people who performed the task.

For operations of a longer duration, check periodically.

2.5. OBSERVATION AND EXAMINATION OF ROOT CAUSE EVALUATIONS

Examination of root cause evaluations can provide useful insight into the strength of the safety culture at the site under review. This applies to all department, including the radiation protection organization.

- Determine through record review and direct questioning, what unusual events have occurred recently.
- After developing a list of unusual events, select one or two that seem to be the most important. Verify that investigations and root cause analyses were done. Examine the investigations and root cause analyses.
- Examine the investigation and analysis report.
- Examine the recommended corrective actions to prevent recurrence.
- Finally, taking the report, cause determinations, recommended corrective actions and management follow-up as a whole. Is there a commitment to excellence and has this commitment been transmitted to and been accepted by those under its control?

3. SPECIFIC GUIDELINES

3.1. MANAGEMENT, ORGANIZATION AND ADMINISTRATION

The safe and efficient operation of a uranium production facility requires the establishment of general policy by the corporate organization; the setting of site management objectives and goals; assessing the achievement of these goals and implementing corrective actions where goals are not met. The provision of appropriate financial, technical, material and human resources is required to achieve these goals. The reviewer should determine the effectiveness of safety culture in the corporate organization and at the site.

3.1.1. Organization and management

Expectations

A documented organizational structure should be established with clearly defined functional responsibilities. Adequate services and facilities should be made available to the site manager for the safe and efficient operation of the facility. In examining the structure of the organization and its relationship with the site management, consideration should be given to management functions in the following areas:

- Policy making functions involving setting management objectives, defining safety and quality policy, deciding on the allocation of finances, providing material and human resources, approving the contents of management programmes.
- Supporting functions relating to the provision of technical and administrative services and facilities required to perform the operating functions with regard to both the on-site and off-site organizations.

There should be strong lines of authority established to deal with matters bearing on site safety with clear reporting relationships and simple interfaces. Performance appraisals for managers should include a section on attitudes towards safety.

The site objectives shall be defined within the operating organization's policies and objectives, and management programmes implemented as the means by which the sites objectives are achieved.

Annual goals and objectives including performance indicators should be written to provide site management with specific goals.

A policy statement on safety issued by the site manager should be provided to all personnel.

Preparatory work

Documents to be reviewed in advance (when available):

- Organizational chart including functional responsibilities
- Goals and objectives
- Corporate safety policy.

Documents to be made available for review at the site:

- Management job descriptions
- Descriptions of interface control between the on-site and off-site organization
- Safety policy documents of the corporate and site organization.

Investigations

A review of the plant organization should be conducted. Confirm that there are clear lines of authority established to deal with matters of safety; responsibilities for safety should be clearly defined.

Check that the performance appraisal process includes an assessment of attitudes towards safety.

Investigate the effectiveness and promulgation of management goals and objectives throughout the plant organization.

Review policy making functions. This includes a review of the site organization's documents detailing the structure, responsibilities and staffing arrangements together with appropriate interviews to determine the precise authority and responsibilities of the site manager.

Policy making functions should be reviewed in relation to setting management objectives, deciding resource allocations, approving management programmes, communication and ensuring that safety issues receive appropriate attention. There should be a clear management statement and commitment to quality and safety. A written policy on drug and alcohol use should be available to all employees, contractors and visitors.

The Safety and Quality Policy should:

- declare a commitment to excellent performance
- be clearly understood by all personnel
- define individual responsibility for quality accountability
- define the quality assurance programme
- define worker responsibilities with regard to quality
- incorporate periodic assessments and reviews.

Review executive functions relative to the support of safe and efficient operation of the plant and the development of performance indicators to allow a concise overview of site performance.

The extent to which the services and facilities are provided will vary, but investigation is needed to ensure that the following are adequately covered:

- Training
- Radiation protection
- Environmental monitoring
- Emergency support services
- Operational services and technical support services.

Investigate and establish the corporate review and support functions if any at the site, the following areas should be investigated:

- Management performance monitoring and evaluation programme
- Achievement of corporate goals and objectives
- Communication of safety policy from the corporate to the site level
- A senior corporate level manager should be responsible for safety policy
- Provision of adequate resources with regard to safety.

3.1.2. Document and records management

Expectations

Documentation comprises all types of recorded information: records management is a system or method of control, which includes document control and should be used for all types of documents.

Preparatory work

Documents to be reviewed in advance:

- None.

Documents to be made available for review at the site:

- All general administrative instructions and procedures related to document control and records management.
- Index of departmental procedures relevant to documentation.

Investigations

Review the administrative control of documentation. Production and control of all instructions and procedures should be generally standardized to ensure that:

- Each procedure or instruction is sufficiently detailed that a qualified individual could perform the required function without direct supervision.
- Procedures or instructions are reviewed, verified and approved at the appropriate level in the organization before issue.
- The frequency of subsequent reviews are specified and measures implemented to ensure compliance.
- Designation of instructions or procedures provides an identification number, revision number or date, and indicates the approval status.
- Temporary procedures and instructions are issued in accordance with appropriate controls that limit their area of application and their period of validity.
- Periodic audits are conducted.

3.2. TRAINING AND QUALIFICATION

Adequate training is essential for safe operation. The degree and extent of training required for a particular individual will vary, depending on previous qualification and experience, and the duties and responsibilities assigned. It is the responsibility of management to ensure that all personnel and contractors receive appropriate training. Qualifications are maintained by participation in continuing training programmes.

Expectations

Management is responsible for the qualification of personnel and should support the training organization with necessary resources. The training organization is responsible for assisting the site manager in establishing, verifying and maintaining the competence of site employees. Managers and supervisors should be responsible for defining the training needs and ensuring that the training provided

reflects operating experiences. Managers and supervisors should ensure that production requirements do not interfere with the conduct of training programmes.

Performance based programmes for initial and continuing training should be developed and implemented for all personnel. The content of each programme should be based on a systematic approach to training such as job and task analysis, ensuring the necessary knowledge and skills are incorporated. The programme should be constructed to allow for updating when changes in the tasks, systems or procedures are made.

Qualifications of each individual should be assessed against established training objectives and performance criteria during and after the training, before assignment to a new job and periodically thereafter. Individual training records should be maintained.

Training instructors should be technically competent in their assigned areas of responsibility and have credibility with the trainees and other station personnel.

Preparatory work

Documents to be reviewed in advance (when available):

- Training goals and objectives
- Organization chart showing training staff.

Documents to be made available for review at the site:

- Job description and training records
- Training material.

Investigations

Review the structure and tasks of the training organization. Evaluate the adequacy of:

- Training administration and programme planning,
- Development of training courses,
- Production of training material, and maintenance of training facilities and equipment.

Review the responsibilities and authorities assigned to training staff. Review the policy and role of management in allocating resources for training.

Assess the training services provided by external organizations.

Determine if goals and objectives are used to monitor and improve training and the effectiveness of training programmes is periodically reviewed.

Evaluate the training and qualification of the instructors, checking in particular for:

- Methods employed to:
 - maintain and improve the technical knowledge and the instructional skills of the instructors;
 - keep instructors up-to-date with the routines and practices in the work environment
 - evaluate instructor performance
- Industrial safety: electrical safety, rigging and lifting, work in confined spaces, chemical hazards, use of personnel protection equipment, first aid
- Radiation protection
- Environment protection
- Fire protection, including fire prevention

- Adherence to procedures
- Quality assurance and quality control
- Site security
- Emergency plans and procedures
- Introduction to site organization and administration.

3.3. OPERATIONS

Operations comprise the mining, milling, effluent treatment and waste management activities. The direct operating groups control the facility operations and have a direct impact on the safety and environmental performance of the site. The detailed structure of the groups varies according to the policy of the operating organization, the types of operations at the site — underground mining, open pit mining, milling, in situ leach operation, re-processing of tailings — and the use of contractors. Each operating group or department is usually managed by a person termed here as the Operating Department Manager, and each shift is managed by a person here referred to as a Shift Supervisor. During other than normal office hours, each operating department is under the control of a Shift Supervisor, one of whom will likely have overall control of the site. Thus, Shift Supervisors are an important part of the management. The typical management at many sites consists of the Site Manager, the Operating Department Managers and the Shift Supervisors, in descending order.

The operating departments are supported by staff, usually under the control of the Site Manager, which include Maintenance, Safety and Radiation Protection, and Environmental Protection.

3.3.1. Organization and functions

Expectations

The organization, functions and activities of the management, supervisory, and operating personnel should ensure that the facility is operated safely and effectively under normal conditions and during anticipated accident and failure conditions.

The responsibilities and authorities of management and supervisory personnel should be clearly defined.

Management programmes should identify goals and objectives to be met at each stage of the operation through the systematic application of planning schedules, procedures, reviews and audits.

Preparatory work

Documents to be reviewed in advance (when available):

- General description of operations
- Organization chart including functional responsibilities and contractors, where used.

Documents to be made available for review at the site:

- Job descriptions for all operating functions including contractors
- Procedures governing the co-ordination of the Operating Departments with each other and with other groups
- Operating Departments procedures and administrative controls
- Organizational structure, objectives and responsibilities during normal and accident conditions.

Investigations

Through interviews and review of documents confirm that:

- The organizational structure of the operation, including contractors, is clearly defined.
- The responsibilities and authorities of company and contractor personnel during normal operations and accidents are clearly defined.
- A quality policy statement and quality assurance programme to promote and assess quality in operations has been documented and implemented.
- Supervisory personnel are involved to the extent necessary in the authorization and performance of:
 - Monitoring programmes
 - Quality assurance inspections and testing
 - Maintenance activities
 - Changes to operating instructions
 - Temporary and permanent facility modifications.
- Administrative controls and effective planning to keep exposure of operations personnel as low as reasonably achievable.
- Operational reports and records for management, other groups and regulatory authorities are in existence.
- Provisions for prompt support of supervisors exist in case of problems in the areas of maintenance, radiation protection, industrial hazards, normal operations, etc.
- The selection, training and qualification of operations personnel are adequate.
- Resources are sufficient to ensure the performance of defined responsibilities.

Check that site management has established and maintained adequate channels of communication between the different operating and support groups.

Check that the site management has established goals and objectives for the different operating groups and that the necessary policies and programmes are established to implement operating requirements.

Check that procedures have been established for the co-ordination of the activities of the operating personnel with those of other groups of on-site and off-site organizations, as appropriate e.g. emergencies and accident situations.

Check to see if managers and shift supervisors spend some of their time walking the site, observing personnel carrying out their activities. Performance appraisals of operating personnel should be used to enhance individual performance, prevent complacency, and improve production efficiency and operating safety.

Review the programme for long term surveillance of the plant with respect to the performance and trends of the main operating parameters. The results should be reported routinely to the operations group.

Review the mechanism by which employees can bring environmental and safety concerns to the attention of the management and the effectiveness of management response.

Check that responsibilities and lines of authority for emergency response are clearly understood.

Review the policies and practices for ensuring that operations personnel are fit for work. Specifically, there should be a clear policy against drug and alcohol abuse.

3.3.2. Design, equipment and conduct of operations

Expectations

The facilities and equipment used by the operating staff should be well maintained and adequate to support safe and reliable operation under all operating conditions.

Preparatory work

Documents to be reviewed in advance:

- General descriptions of mining, milling and waste management, including site maps and plans.
- Some jurisdictions require an operating manual for critical facilities to be filed with the regulatory agency. Where this exists, it should be reviewed.
- Any Codes of Practice governing operating procedure, in particular for radiation protection.

Documents to be made available for review at the site:

- Site licence

M i n i n g

- Geology, hydrogeology, ore type and grade, rock mechanics, seismic events
- Underground and open pit mine engineering design
- Mining methods, mine type and depth of deposit
- Blasting methods and materials
- Roof support and rock bolting
- Treatment of voids and backfilling
- Ventilation and dust control plans and methods
- Mine planning
- Ore transport and handling methods and equipment
- Underground temperature control
- Drilling methods, machinery and equipment
- Mine water management
- Methods of grade control
- Hoisting and winching methods and equipment

M i l l i n g

- Ore handling, crushing and milling methods and equipment
- Extraction process flow diagrams and piping and instrumentation drawings
- Materials handling
- Process control
- Effluent and emission controls, e.g. dust collection, control, spill limitation
- Water conservation and management systems
- Bulk chemicals and consumables
- Product packing, handling and storage

W a s t e m a n a g e m e n t

- Design of tailings retention systems and waste rock dumps
- Tailings treatment and handling
- Long term stabilization, rehabilitation and remediation plans
- Dust control methods and controls over tailings erosion
- Acid-generation and heavy-metal leaching potential
- Water control, retention and treatment systems

Investigations

Through review of documents and plans, interviews with engineering and operating personnel, site inspection and direct observations, assess the adequacy of the facility design and working methods with

regard to • best available practice” in terms of safety, limitation of emissions, environmental conditions in the workplace and efficiency of the operation.

The aim of the investigation should be to identify areas in which the design and working practices can be improved to result in enhanced efficiency of operation and safety.

Ensure that personnel, in particular underground miners, are familiar with the Codes of Practice for radiation protection and are complying with them.

Determine whether violations of operating limits and conditions are reported.

Arrangements and procedures should be in place which address the actions necessary following an accident at the site. These include underground mine rescue teams and emergency response teams for surface accidents.

The investigation should pay particular attention to reviewing and assessing design and working methods in the following areas:

Mining

- Hoist inspection, maintenance, qualifications of operator and operation
- Scaling and ground control
- Open pit design and slope stability
- Emergency procedures, including second exit, refuge stations and self-rescue units as required
- Ventilation system and operation, with special attention to the use of auxiliary ventilation
- Explosives storage, handling and accountability
- Handling of misfires
- Material and equipment procurement, management, and critical spares
- Ore handling and transport
- In situ leach well-field balance
- In situ leach well-field reclamation plan and implementation
- Mobile equipment maintenance, pre-start inspections and operation
- Water management, including separation of clean and contaminated water, water treatment, and consideration of potential radon source
- Training
- Personal protective equipment use and maintenance
- Work-place monitoring for radiation and industrial hygiene, including sampling plan, instrument calibration, use and records
- Shafts, drifts and raises inspection, maintenance and use
- Fuel transport, storage and distribution
- Track maintenance
- Electrical distribution, system maintenance, isolation
- Communications system coverage, maintenance, effectiveness and backup system
- Housekeeping
- Operating history
- Fire protection

Milling

- Ore storage and handling, stockpile liners and water management
- Material and equipment procurement, management, and critical spares
- Facility equipment condition, accessibility, maintenance and use
- Electrical and communication systems
- Process instrumentation and control room layout and operation

- Effluent treatment and control systems, including consideration of water recycle to minimize fresh water demand and treatment chemical usage
- Emergency procedures
- Work-place safety including lighting, ventilation and radiation safety measures
- Airborne emissions monitoring
- Operating history and monitoring trends
- Housekeeping
- Qualification of operators
- Mobile equipment maintenance, inspections and operation
- Chemical storage and use
- Work-place monitoring
- Training
- Pipe and vessel labelling
- Emergency shutdowns
- Equipment lock-out procedures
- Personal protective equipment
- Fire protection.

W a s t e m a n a g e m e n t

- Water management
- Waste rock characterization and management
- Tailings disposal system design, operation and monitoring
- Leachate protection
- Waste control and segregation
- Emergency procedures
- Reclamation and conceptual decommissioning plans
- Distribution systems such as liquid and slurry pipelines
- Waste minimization
- Waste inventory records
- Geotechnical stability of dams, impoundments, etc.
- Monitoring
- Effluent treatment.

3.4. MAINTENANCE

Proper maintenance of equipment is essential for the safe, reliable and efficient performance of a uranium production facility.

A high level of maintenance should be encouraged by management through defined standards, such as performance indicators and success criteria.

The selection and training of maintenance personnel should be well established so that a high quality of maintenance standards and activities can be achieved. Sufficient resources should be provided and the planning and progress reporting should be such that workload backlog is kept to a minimum.

Maintenance facilities and equipment should be sufficient to perform maintenance activities effectively. All maintenance activities from the planning stage to execution should be carried out in such a manner that the radiation exposure of both site personnel and the general public is kept as low as reasonably achievable (ALARA).

3.4.1. Organization and functions

Expectations

The organization and administration of the maintenance department should ensure the efficient and effective implementation and control of maintenance activities.

Goals and objectives of the maintenance department should be defined and endorsed by management. Performance indicators should be established and reported in annual and quarterly reports. Effective and high quality maintenance programmes should be prepared and implemented. The maintenance programmes should provide monitoring of safety related systems and components at the level required to ensure that the systems will continue to function satisfactorily throughout life of the facility. They should address preventive, predictive and corrective maintenance.

The organization and staffing of the maintenance department, as well as the staff responsibilities in maintenance, should be described in writing and be understood by all affected personnel. When external contractors are used, they must work to the same administrative controls and standards as site personnel.

Preparatory work

Documents to be reviewed in advance (when available):

- Site organization chart including functional responsibilities
- Maintenance department organization chart, including interfaces with other organization units in the maintenance activity planning and performance
- Maintenance department policies and procedures manual
- Maintenance department programme descriptions
- Quality assurance documents and inspection programmes relating to maintenance
- The goals and objectives of the maintenance department.

Documents to be made available for review at the site:

- Maintenance personnel function descriptions
- Maintenance department performance indicators
- Summary reports of the maintenance department.

Investigations

Check that the maintenance organization is clearly defined, and that staffing and resources are sufficient to accomplish assigned tasks. Responsibilities and authority management of all personnel, should be clearly defined in writing and understood. Likewise, interfaces with supporting groups should be clearly defined and understood.

Check that the site management has established goals, objectives, and performance indicators for the maintenance organization, and that policies and programmes are established to implement site requirements.

Check the process of evaluation and revision of maintenance policy documents in response to local maintenance activity.

Confirm that personnel are safety conscious in the conduct of their work, and that personnel are actively encouraged to develop methods to improve safety, reliability, quality and productivity.

3.4.2. Maintenance facilities and equipment

Expectations

Working facilities should provide sufficient space and equipment to perform maintenance activities effectively. Maintenance facilities and equipment should be in good repair.

Preparatory work

Documents to be reviewed in advance (when available):

- General site layout showing the locations of all maintenance facilities
- List of main equipment

Documents to be made available for review at the site:

- List of corrective maintenance work reports for past six months
- List of maintenance and inspection procedures
- List of outstanding maintenance requests

Investigations

Confirm that the size and arrangement of maintenance facilities promotes the safe and effective completion of work. Check that facilities are provided for work on contaminated equipment if necessary.

Check that proper tools, equipment and consumable supplies are available to support work requirements. Special tools should be identified and stored to permit retrieval when needed. Unserviceable tools and equipment should be removed from use. Contaminated tools should be segregated.

Confirm that measuring and test equipment are calibrated and controlled for accuracy. Test equipment that is out-of-tolerance should be removed from service.

3.4.3. Maintenance programmes

Expectations

The maintenance programmes should include comprehensive programmes for preventive, predictive and corrective maintenance. These programmes should be reviewed and updated in defined periods by maintenance personnel.

Preventive, predictive and corrective maintenance should contribute to a safe and reliable performance of installations and machinery.

Preventive maintenance (PM) entails preplanned routine testing, inspection, servicing and overhaul of structures, systems and components. Its purpose is the early detection and correction of equipment degradation to ensure the continuing capability of the facility to perform its intended functions. These preplanned activities should be specified in a preventive maintenance schedule.

Predictive maintenance techniques should be used to monitor the conditions of installed equipment and systems to optimize the preventive maintenance programme.

The procedures for corrective maintenance should be developed separately, or as a part of maintenance administrative procedures.

Preparatory work

A corrective maintenance file should be kept for future reference. Assessment of root cause analysis of component failure should be carried out. Other equipment that may be susceptible to similar failures should be identified.

Documents to be reviewed in advance (when available):

- PM programme and planning description
- List of predictive maintenance techniques used
- Flow diagram for the corrective maintenance work control procedure (may be a part of a general work control procedure).

Documents to be made available for review at the site:

- Procedures for PM planning and scheduling
- PM schedule for the review period
- List of items included in the preventive maintenance schedule
- Preventive maintenance procedures
- Procedures to implement the monitoring techniques and to review the results
- Procedures to implement feedback from predictive maintenance techniques results to the maintenance programme
- Administrative procedures relevant to the corrective maintenance
- List of corrective maintenance work
- Example of the corrective maintenance report
- Example of root cause analyses of component failures
- Example of corrective maintenance history file.

Investigations

Confirm that all systems and components important to safety are included in the preventive maintenance schedule including a check of predictive and corrective (PM) activities which are scheduled and performed at various established intervals. Check that waived maintenance activities are authorized by management.

3.4.4. Procedures, records and histories

Expectations

Maintenance procedures and other work related documents should provide appropriate directions for work and should be used to ensure that maintenance is performed safely and efficiently.

Detailed maintenance instructions issued to personnel should be compiled in accordance with quality assurance requirements and should point out the impact of the work on safety.

Maintenance history should be used to support maintenance activities, upgrade maintenance programmes, optimize equipment performance and improve equipment reliability. Appropriate arrangements should be made for orderly collection of records and production of reports on maintenance activities. Maintenance history records should be easily retrievable and available for use. The use of computerized maintenance history handling should be discussed.

Preparatory work

Documents to be reviewed in advance (when available):

- Administrative procedure for the preparation and issuance of maintenance procedures and work instructions
- Safety classification of systems or components
- Scope of work
- Post maintenance testing required
- Traceability of all issued work authorizations for work on safety related components and systems.

Documents to be made available for review at the site:

- Selected safety related corrective maintenance procedures
- Selected preventive maintenance procedures
- Work instructions
- Selected maintenance history files
- Quality assurance procedures.

Investigations

Check that procedures and instructions are clear, concise, properly controlled, and contain adequate information for users to understand and perform maintenance effectively, in a safe and practical manner.

Ensure maintenance history files are in place and periodically reviewed to identify trends.

3.4.5. Performance of maintenance activities

Expectations

Maintenance should be implemented in a safe and efficient manner to support site operation.

A work control system should be in use to ensure that maintenance is properly completed and documented.

Preparatory work

Documents to be reviewed in advance (when available):

- Work authorization procedures
- Flow diagram for general work control procedure.

Documents to be made available for review at the site:

- Outstanding and completed maintenance requests.

Investigations

Check that maintenance is performed by qualified personnel and in accordance with approved procedures. Observe whether good industrial safety and radiological protection practices are followed.

Check that managers and supervisors routinely observe maintenance activities and ensure adherence to site policies and procedures.

Check that contractors and other non-facility personnel conducting site maintenance operate under the same control procedures and to the same standards as site maintenance personnel.

Review the whole work control system to determine whether the control of work is in accordance with procedures.

Check that work planning and a job priority system is in place.

3.5. SAFETY, FIRE PROTECTION EMERGENCY PLANNING AND PREPAREDNESS

All mining and milling operations are intrinsically hazardous activities, therefore operations carried out in an unsafe manner may result in negative impacts on human resources, equipment, the facilities production capability and efficiency.

The safe and efficient operation of a uranium mining and milling facility requires the establishment of a general safety policy by mine management which should be in accordance with good international practice, national regulations and laws. Management objectives with regard to the safety policy needs to be defined in writing and communicated effectively to the workforce.

3.5.1. Health and safety programme

Expectations

Management should have drawn up a general policy on safety that includes the measures to be taken to ensure that the health and safety of site personnel are in accordance with national laws, standards and regulations, and should also reflect good practices adopted internationally. All elements of the safety policies should appear in safety manuals while details should be included in written procedures.

The health and safety programme should clearly define the responsibilities of managers, supervisors and workers to provide them with adequate authority to fulfil their responsibilities. Management should ensure that the safety programme is applicable to on-site contractors.

The health and safety programme should be understood and adhered to by all site personnel with each individual aware of their responsibilities with respect to the safety provisions.

Management should implement safety committee(s) to provide an overview of working conditions. The committee should include workers, supervisors and management. The committee's work should assist with identifying unsafe work practices.

Consideration should be given to a programme of risk management and the creation of a safety culture which allows for the rewarding of personnel who actively contribute to maintaining and improving the safety culture.

Regular safety meetings should be held in the workplace at which personnel receive feedback on safety issues or are given the opportunity to discuss their concerns.

Safety policy and objectives should be reviewed on an ongoing basis to ensure that goals are being met, deficiencies identified and corrective actions implemented with performance indicators identified, recorded, reviewed, and communicated on a regular basis.

Safety procedures and instructions may be used in the following activities:

- Electrical supplies
- Portable electric tools
- Welding, cutting and grinding tools

- Use, storage, disposal and transport of hazardous and toxic substances
- Lifting, handling, hoisting and winching equipment
- Confined spaces
- Ladders and scaffolding
- Openings and excavations
- Excavations, formwork and shoring of concrete structures
- Inspections prior to commencing work
- Explosive or flammable atmospheres
- The storage, handling and use of explosives
- Tailings operations
- Ore handling, backfill operations, pumping and flood control
- Ore transport systems
- Ventilation surveys
- Monitoring of the working atmosphere for hazardous and toxic materials
- Methods to mitigate heat stress in deep underground mines
- Site first aid procedures
- Site fire plan.

Preparatory work

Documents to be reviewed in advance:

- Organizational chart, including functional responsibilities of the safety officer, if applicable.

Documents to be made available for review at the site:

- Industrial safety policy, manual and mission statement
- Safety codes, procedures and instructions
- Safety reports and audits
- Procedures and instructions for safety measures for contractors
- Accident statistics
- Safety committee meeting minutes
- Ventilation plans and survey records.

Investigations

Determine by review that there are policies, programmes, procedures and responsibilities assigned to ensure safety in the work place for personnel and contractors.

Check that the safety programme contains the requirement to review at specified intervals the following:

- The safety programme and procedures
- Surveillance, testing and inspection programme for safety hardware.

3.5.2. Fire protection programme

Expectations

The fire protection programme should take into account the appropriate requirements and incorporate procedures for fire fighting, testing and maintenance of fire protection systems. A fire fighting plan that takes into consideration the numbers of personnel, area fire ratings, types of possible the availability of fire suppressions systems and methods to mitigate the effects of a fire should be available.

Fire fighting plans should be available for specific operations and hazards.

The fire protection system should be an initial design consideration with diverse means to protect against fires and fire related explosions. The design consideration should include a thorough review of the use of potentially flammable materials and measures to eliminate their use or inhibit their flammability.

Diverse monitoring and protection systems should exist with both automatic and manual initiation capabilities and fail safe supervision and alarms. Fire suppression systems should be matched through engineering evaluation dependent on needs.

The fire protection programme should also assess the fire fighting capability required on the site in relation to the ready availability of any off-site back up from local fire brigades.

The fire protection programme should also take into account the necessary training of fire brigade members, fire brigade backup support, required realistic drills and a defined chain of command for on the scene emergency conditions.

Procedures should exist to prohibit or impose tight administrative controls over the use of combustible materials, the temporary disabling of fire barriers or fire suppression and detection systems. General training relative to fire hazards and secondary effects of fires and fire zone protection should be provided to personnel in working areas.

Preparatory work

Documents to be reviewed in advance:

- Organization chart with functional areas related to fire protection
- The fire protection programme.

Documents to be made available for review at the facility:

- Fire protection programme and procedures
- Facility fire hazards analysis
- Training and fire drill records
- Statistics and reports on fires at the facility for the last 5 years
- Fire protection system plan.

Investigations

Investigations and assessments should concentrate in particular in the following:

- Areas where combustible gases and explosives may be present or where large amounts of flammable materials may be used or stored.

Comprehensively inspect work areas to evaluate the following:

- Housekeeping practices with regard to the build up of potentially flammable materials
- Controls over the use of flammable materials
- The presence of signs indicating escape routes
- The current status of existing fire detection and fire fighting hardware
- The use of appropriate equipment in explosive atmospheres
- The adequacy of the designed fire protection system
- Work practices in potentially explosive and flammable atmospheres
- Proper identification and labelling of flammable and explosive materials
- The presence of visual cues and instructions in the workplace regarding the presence of explosive and inflammable materials or atmospheres
- Access controls to those work areas where explosive and flammable atmospheres may exist

- Fire fighting hardware provided in each area is compatible with the types of fires that may occur
- Test status of existing fire fighting hardware.

Review the fire protection training programme to ensure it adequately meets the need of the facility. Areas that should be evaluated are:

- Special equipment training
- Facilities for realistic training
- Training department feedback from operations and other users
- Trainee records
- Review of lesson plans for adequacy
- On-site/off-site common drills.

Where the facility fire fighting capability is supplemented by assistance from local civil fire fighting organizations determine if the outside organization is properly trained and equipped to provide meaningful support to the facility in the case of serious fires both on surface and underground.

3.5.3. Emergency planning and preparedness

Expectations

Emergency preparedness is related to the capability of coping with accident situations, mitigating their consequences, protecting the health and safety of site personnel and the general public and protecting the environment. It is the task of the operator and the public authority to place and establish the necessary organizational structures and assign responsibilities for emergency arrangements. The effective conduct of emergency response requires the preparation of plans outlining all activities which may be required to be implemented in the event of an emergency. Emergency implementing procedures provide a method for rapid and practical implementation of the plans.

Planning, implementation and control of emergency preparedness activities should be put under the responsibility of an organization which should ensure that the emergency arrangement are properly integrated with the relevant off-site emergency services and that the state of preparedness is properly maintained, regularly tested and updated, as a result of information feedback from training, drills, exercises and industry experience.

Provisions should be made for adequate on-site and off-site response facilities and appropriate equipment and resources that can be brought into operation without delay in the event of an emergency, with proper coverage of fire fighting, first aid and rescue requirements.

The equipment should be stored and maintained in an appropriate manner, be readily accessible and available during emergency situations.

A comprehensive, documented training should be provided for developing and maintaining the necessary knowledge and skills required by all persons having duties under the emergency plan, to enable them to respond correctly and efficiently in the event of an emergency. The programme should include periodic, comprehensive and integrated on-site and off-site exercises aimed at assessing the co-ordinated response of all emergency response organizations.

Preparatory work

Documents to be reviewed in advance (when available):

- Emergency plan(s).

Documents to be made available for review at the site:

- Emergency equipment inventories
- Equipment operating manuals and maintenance records
- Emergency training procedures, schedules, lesson plans and records
- Report of drill exercises.

Investigation

Determine whether the emergency plan identifies the appropriate public authorities responsible for emergency actions.

Determine that the responsibilities and authority for emergency preparedness are clearly defined and understood.

Review the on-site emergency plans and associated procedures, and determine whether it adequately covers the following aspects:

- Development, maintenance and revision of identified emergency plan scenarios.
- Resolution of emergency planning deficiencies.
- Notification and activation of the emergency response organization, including normal and alternate means of communication.
- Documentation of the evolution of the emergency situation and actions taken.
- Provision of information to outside organizations and the public.
- Procedures are reviewed, updated and distributed in a controlled manner.
- In particular pre-arranged plans and agreements should provide for transportation and medical treatment of injured personnel in pre-identified and adequately equipped facilities; first aid facilities and supplies should be identified and their availability and use covered by the procedures; fire fighting, with identified equipment and pre-arranged plans and agreements for external support should be adequately covered.
- Segregation and duplication of critical information including site layouts, schematics, equipment and safety system drawings.

Determine, by appropriate sampling of routine examination/maintenance records and/or demonstration, the status of operability of this equipment and these resources.

Determine whether a documented training programme is implemented and review it for effectiveness for initial training of all personnel assigned to various functional areas of emergency activity. Review whether safety culture is incorporated in the training. Review the effectiveness of the emergency training programme at various organizations having a role in the emergency response.

Determine whether a programme exists for conducting periodic exercises involving on-site and off-site organizations to test the emergency planning and preparedness.

3.6. RADIATION PROTECTION

The radiation protection programme should ensure that the radiation exposure of workers and members of the public is kept as low as reasonably achievable and in accordance with international recommendations, national regulations and laws. The programme should establish the administrative, operational, and technical measures to achieve this goal. It should clearly define the responsibilities of the managers, workers and the radiation protection group, and provide adequate authority to enforce them.

3.6.1. Organization and functions

Expectations

The operating organization is responsible for establishing and implementing a well structured radiation protection programme and should have an independent radiation protection group which has the authority to enforce radiation protection regulations, standards, procedures and safe working practices.

The radiation protection programme should be documented with policies and procedures and should be based upon appropriate radiation protection regulations. The programme should incorporate, where feasible, the radiation protection standards recommended by the ICRP, including the ALARA principle, and, in the absence of established standards, the policies and procedures should also reflect good practices adopted by other countries.

The radiation protection programme should include provisions for setting radiation protection policies, criteria and administrative limits, etc., for normal and abnormal circumstances. In addition, there should be arrangements for quality assurance activities, provisions for monitoring programme effectiveness using appropriate goals and performance indicators.

Preparatory work

Documents to be reviewed in advance (when available):

- Organizational chart including functional responsibilities and individuals in each position
- Job descriptions.

Documents to be made available for review at the site:

- Radiation protection procedures
- Personnel training and qualification records
- Investigation and routine reports.

Investigations

Review the overall role and scope of the radiation protection programme and determine management's commitment to good radiation protection and safe work practices. This includes written policy statements regarding the ALARA principle. Determine whether all personnel have a responsibility for radiation protection and safe work practices, and whether management and the radiation protection group have taken adequate measures to motivate workers to comply with radiation protection requirements.

Review the radiation protection organization and how radiation protection functions are delegated. Evaluate and confirm the adequacy of staffing, training, including experience and qualification requirements for each position. Determine how personnel are kept updated in the field of radiation protection. Confirm that the radiation protection group has sufficient professional personnel or has adequate access to other personnel to support its activities.

Determine the specific responsibilities of the radiation protection group. Identify the types of interactions of the radiation protection group with the rest of the site. Identify the main tasks performed and services provided by the radiation protection group. Determine if the radiation protection group reacts in a timely manner to requests made by other groups and whether the radiation protection group plays an active part in the development and delivery of radiation protection training for all personnel, development of site specific policies and procedures, in reviewing operating manuals, maintenance procedures, etc., where occupational radiological hazards may be present.

Evaluate the independence and authority of the radiation protection group. Determine if the radiation protection group has the authority to stop work if radiation protection practices are judged to be unsafe, and if there have been incidents or circumstances where this has actually occurred. Determine if the radiation protection manager participates in policy discussions and has direct access to the site manager. Check whether there is a process for employees to report safety concerns. Determine if the guidance and work of the radiation protection group is considered and if their recommendations are implemented by management.

Review the approach used to control radiation exposures arising from the operation of the site. Determine how radiation protection policies, criteria, procedures, administrative limits, goals, etc., are set. Identify which parameters or performance indicators are used to evaluate the effectiveness of the radiation protection programme (e.g. collective dose of individual work groups, total collective dose, frequency and severity of unplanned exposures, etc.). Determine which work groups are associated with large dose exposures. Evaluate how problems are identified, assessed and reviewed for trends and how deficiencies are corrected. Determine if radiological events are subjected to incidental investigation and evaluate how lessons learned from past occurrences are incorporated, when appropriate, into revised site policies, procedures and practices.

Determine if the performance indicators and significant radiological events are reported to site management. Determine if personnel are routinely informed and updated on goals, performance indicators, significant radiological events and lessons learned from these events.

Determine how the radiation protection group ensures that appropriate quality assurance activities are performed with respect to document control, equipment calibration, record management, etc., pertaining to radiation protection activities. Evaluate how the radiation protection group monitors and evaluates its performance and effectiveness and if it is subjected to internal and external audits. Through interviews determine the attitude of personnel to external audits and reviews. Confirm whether managers are aware of their performance in comparison to other sites.

3.6.2. Radiation work control

Expectations

Sources of external and internal radiation to individual and collective exposures should be kept as low as reasonably achievable (ALARA). The primary responsibility for optimizing personnel radiation exposure is normally assigned to the radiation protection group. In addition, all levels of management and personnel should have an individual responsibility for safe work practices and for keeping the exposures as low as reasonably achievable.

Preparatory work

Documents to be reviewed in advance (when available):

- Site radiation protection regulations.

Documents to be made available for review at the site:

- Procedures for external dose monitoring
- Classification of areas (controlled, supervised)
- Classification of personnel according to exposures
- Radiation work permits
- Radiation survey records.

Investigations

Since worker knowledge is vital to external and internal exposure control, review the information provided to radiation workers. Determine that general employee and radiation worker training is provided and review any special handbooks or other material provided to the workers for use at the work place. Question workers and observe their activities to evaluate their awareness of policies and procedures.

Evaluate administrative controls that may include the radiation work permit (RWP) programme and its implementation. Determine if RWPs are prepared and issued by individuals who have been properly trained. Determine whether the content of the radiation work permit provides all information necessary for worker protection.

Evaluate if appropriate controls exist for the movement of equipment from controlled areas to other areas.

Determine that the radiation survey programme adequately characterizes radiological conditions (including internal exposure hazards) in an accurate and timely manner. Observe an actual survey and determine if the programme of routine surveys is sufficiently comprehensive to provide required information on radiation conditions around the site. This programme should include provisions for trending radiation levels. Review the programme for producing, maintaining, retrieving and using radiation survey records to assure that effective use can be made of this information.

Determine what special provisions are made for unusual hazards.

Review how internal exposures are controlled, good housekeeping practices, and how the site minimizes the spread of contamination.

Review general hygiene procedures such as showering at the end of the shift and appropriate wash and eating areas.

3.6.3. Internal radiation exposure

Expectations

Internal radiation exposure should be kept to a level as low as reasonably achievable (ALARA). Work in areas of potential high internal exposure requires consideration of appropriate protective clothing, respiratory protective equipment and contamination control measures.

Preparatory work

Documents to be reviewed in advance (when available):

- Site radiation protection regulations.

Documents to be made available for review at the site:

- Procedures for removal of equipment from the controlled and supervised areas
- Procedures for the use of protective clothing and respirators
- Procedures for the maintenance of respirators
- Procedures for monitoring airborne activity and surface contamination
- Procedures for cleaning and decontamination of areas and equipment
- Procedures for monitoring personnel, dust monitoring, bioassay

Investigations

Review the site procedures for the control of personnel contamination. Determine that eating, drinking, smoking and chewing items in radiologically controlled areas is prohibited. Evaluate worker understanding for contamination control measures and the importance of compliance.

Determine if proper use of protective equipment is emphasized through practical training.

When engineering controls cannot be employed, ensure respiratory protection devices are available. Determine if the respiratory protection programme includes formal training, fitting, and procedures regarding selection, issue, cleaning and repair of respiratory protection devices. Determine that the protection factor provided by each respirator is considered.

Determine if a programme of air sampling and airborne exposure tracking over time is employed. Determine if such a programme includes timely air sampling and evaluation which is coordinated with the worker's presence in the area.

3.6.4. Personnel dosimetry

Expectations

Exposure monitoring of individuals and management of dose records should meet the requirements established by the appropriate standards.

The availability of various personal monitoring devices, including thermoluminescent dosimeters (TLD), radon daughter monitors and air samplers, should be assessed.

Preparatory work

Documents to be reviewed in advance (when available):

- Site radiological procedures.

Documents to be made available for review at the site:

- Radiological protection regulations and procedures
- Radiation protection reports.

Investigations

Determine if personnel are adequately monitored in the various areas of the site. Review the way dosimetry devices and equipment are calibrated, used, and how dosimetry measurements are assigned to the exposed individuals. Determine how routine individual external exposure and air monitoring are performed.

Evaluate the methods and models used to convert the exposure to dose. Check that they are consistent with the appropriate standards. Confirm that dosimetry operations are performed with the results interpreted by qualified persons. Confirm that appropriate methods are employed to ensure that doses resulting from exposures to internal alpha irradiation (dust and radon daughters) and gamma and beta (if applicable) radiation are accurately recorded.

Identify the quantity and types of dosimetry devices and review applicable procedures for recovery, processing and record documentation. Review the procedures and methods used to obtain a formal dose assessment in the event of loss of a dosimeter and in the event of unusual dosimeter readings.

Review the provisions for monitoring contractors and the requirements for recording doses.

Review procedures for assigning effective dose equivalent resulting from exposures to airborne contaminations and examine the site's bioassay programme.

Review the methods governing the assignment of effective doses, especially from unusual events. Determine how suspect or anomalous results are handled. Confirm that incidental investigations are undertaken and that a system of reporting to management is in place. Check that lessons learned are incorporated into the programme and communicated to all employees.

Review personnel dosimetry results over time and verify that trends are reported and used as a basis for action. Review the latest report. Determine how previous employee exposures are obtained and how reports of contractor exposures received at the facility are made available for future use.

3.6.5. Radiation protection instrumentation, equipment and facilities

Expectations

Management should provide adequate instrumentation, facilities and equipment necessary for the radiation protection programme. The equipment and devices used to obtain radiological measurements and doses should be calibrated, maintained and used so that results can be accurately determined.

Preparatory work

Documents to be reviewed in advance:

- List of types and numbers radiological instruments.

Documents to be made available for review at the site:

- Calibration and maintenance programme.

Investigations

Review the condition of radiation survey instruments used for measuring alpha, beta and gamma radiation. Review the location of fixed instruments for monitoring personnel contamination, and observe radiological monitoring of areas and processes. Determine that the number of survey instruments is adequate. Review the devices used for air sampling, and assess the awareness of the radiation protection personnel regarding the purpose of the radiation monitoring programme.

Review calibration and quality control procedures. Determine whether there is an established schedule for routine calibration of all instruments. Review the calibration and test records for the instruments and check whether the instruments are marked with the latest date for calibration.

Review the types and amounts of protective clothing and respiratory protective equipment. Check the rules specified for using such equipment. If protective clothing and respirators are cleaned at the site, check the cleaning facilities.

Confirm that adequate facilities are provided for laundry and storage of protective clothing and that change and shower rooms are available.

3.6.6. Radioactive waste storage and discharges

Expectations

Waste generated during operations and maintenance should be identified and managed. Liquid and gaseous effluents from the site should be effectively monitored and controlled. Solid waste disposal and effluent releases should be documented and an environmental surveillance programme be in place.

Preparatory work

Documents to be reviewed in advance (when available):

- Effluent releases
- Storage, transport and disposal of solid radioactive waste.

Documents to be made available for review at the site:

- Procedures for the monitoring and control of gaseous and liquid waste and for the handling of solid waste
- Schematics of the waste management programme
- Waste inventory
- Descriptions of installed monitoring systems.

Investigations

Review the waste management programme and observe its implementation. Check the procedures for collection and storage of radioactive waste and the programme for waste volume reduction. Determine compliance with applicable procedures.

Review the quantity of radioactive material released to the environment on an annual basis. Determine that releases meet appropriate standards, but are also as low as reasonably achievable. Determine how the annual ALARA goals are set for effluent releases.

Review the procedures for monitoring, trending and controlling effluent releases, including administrative procedures. Review effluent release permits, documentation and reports. Review the installed monitoring system including environmental monitoring requirements.

Review the environmental surveillance programme, considering the arrangements for sampling, the environmental media sampled and the radionuclides monitored. Review the analytical procedures used to analyse environmental samples.

3.6.7. Radiation protection support during emergencies

Expectations

The programme for radiation protection support during emergencies should be integrated into the site's emergency procedures and serve the purpose of minimizing both worker exposure and the exposure of the general public. Procedures should be in place to provide technical and operational support. Periodic training and practice exercises should be undertaken to ensure an effective response in the event of an emergency.

Preparatory work

Documents to be reviewed in advance (when available):

- A general description of the site's emergency plan.

Documents to be made available for review at the site:

- Emergency procedures which apply to the radiation protection organization
- Inventory of radiation protection equipment reserved for emergency use.

Investigations

Review the radiation protection emergency procedures. Confirm that they clearly detail radiation protection responsibilities.

Review the training provided and all necessary equipment is available including process for assessing impact to the environment and public.

Determine the frequency of emergency drills and the extent to which radiation protection personnel are involved. Confirm that all radiation protection personnel can be expected to be proficient in the event of an actual emergency. Review the critiques of past emergency drills and confirm that identified problems have been corrected.

3.7. ENVIRONMENTAL MONITORING PROGRAMME

Expectations

The site should have an environmental monitoring programme which generates sufficient data to adequately assess the impacts of all facilities on the local environment and to meet appropriate standards. The programme should cover air, surface and ground water, and other significant components of the local environment, as identified in the environmental impact assessment of the site. The analytical capability of the programme should be adequate to demonstrate compliance with the requirements and to give assurance that the impacts are acceptable.

Preparatory work

Documents to be reviewed in advance:

- Environmental monitoring department staffing, reporting structure and position in the site organization chart
- Environmental monitoring and models used in its development plan
- Licence requirements
- Environmental monitoring reports.

Documents to be made available at the site:

- Sampling procedures
- Radiation and chemical laboratory procedures
- Maintenance and calibration of instruments
- Quality assurance plan for the radiation and environmental laboratories
- Reports of field inspections
- Inspection reports.

Investigations

The independence of the environmental monitoring department from operations should be confirmed. The organization and staffing of the department should be examined to ensure adequacy to carry out the required programme satisfactorily. Environmental personnel should be interviewed to assess environmental awareness, commitment to the programme, and reporting of unusual observations which may not be a defined part of the programme.

Environmental personnel should be accompanied in the field, observing actual sampling technique and comparing with the defined programme. Field notes should be examined for completeness.

Instrument calibration records and the laboratory quality assurance programme should be checked.

Results of the environmental programme should be compared with the acceptable limits.

Specific areas to be reviewed for radioactivity, heavy metals and other specified chemical contaminants are:

- Surface and groundwater monitoring
- Sediment sampling
- Biological sampling
- Soil and terrestrial plant sampling
- Atmospheric sampling
- Metallurgical sampling
- Public dose assessment and impacts arising from other pollutants.

3.8. CONSTRUCTION MANAGEMENT

Construction projects are improved if the management effectively administers policies and programmes that ensure adequate control over all aspects of the project. The future operators should be asked to help in the design and construction phases of the project to enhance the operability, maintainability and reliability of the installations.

When design has been completed, a preliminary safety analysis should be performed to ensure that all requirements will be met, and that the installations will be safe for operation. Additional check-points are established as required during development and construction so that satisfactory final design, installation and verification of the adequacy of safety related equipment can be reviewed.

Expectations

A documented organizational structure should be established with clearly defined functional responsibilities. This structure should be clearly established in the areas of:

- Project organization: primarily the team assigned to the construction, startup and commissioning of the installations;
- Main contractors.

The corporate organization at the site, as part of the project organization, should set management objectives and provides appropriate financial, technical, material, manpower and oversight resources.

Maintaining effective project management demands a continuous knowledge and awareness of appropriate data on the progress of design and construction and of significant problems. Hence good communication and efficient links are necessary.

The interface between design engineering and construction engineering should be clearly identified. Documents issued under the design engineers' responsibility should be sufficiently detailed to provide input for the construction engineering work.

Preparatory work

Documents to be reviewed in advance:

- Organizational charts and descriptions of functional responsibilities
- List of contracts and subcontracts with descriptions of their scope.

Documents to be made available for review at the site:

- Progress reports
- Procedures governing design changes.

Investigation

Review the corporate and the project's organizational structures if they clearly define and establish effective relationships among departments involved in the construction project.

Check if the communications between project management structures and contractor management are effective.

Determine if the project management has the operational responsibility for the quality, scheduling and cost of the project, covering the following areas:

- project control (planning, scheduling, cost control),
- engineering control,
- procurement control,
- construction control,
- quality assurance.

Confirm if the project manager, the construction manager or the quality assurance manager have the authority to stop or delay construction activities for quality reasons, for better co-ordination with other activities or for industrial safety reasons.

Determine if the procedures are complete and easy to understand and if they include prescriptions for the control of the work to be performed.

Check if the personnel are fully aware of all procedures applicable to the work they are performing.

Check if the operating organization of the operator participates in the pre-turnover activities and in the control of completion of systems and equipment in order to take responsibilities after the turnover for system testing.

Confirm that the structure of the contractor's project organization is clearly defined.

Determine if communications between contractor management and subcontractors are effective. Confirm that the main contractor directs and controls the subcontractors to meet the project objectives.

3.9. COMMISSIONING AND DECOMMISSIONING

3.9.1. Commissioning

Commissioning of a mine is unlike commissioning of a processing plant, in that a mine cannot be completely constructed before commissioning commences. Thus, commissioning tends to be a phased process in which distinct portions of the mine are developed and brought into service. For an underground mine, development will start with sinking of a shaft or development of a decline or adit. Ventilation and water management systems cannot be installed in final form while the development of the mine is under way, because the physical conditions change daily. Hence, temporary measures must be in place to provide sufficient ventilation to the work place and to manage mine water during these early stages. Plans must be developed based on the knowledge of the mining conditions gathered during exploration drilling programmes.

During early mine development, monitoring programmes are vital. These comprise engineering monitoring of ground conditions and hydrogeology, as well as radiation and industrial hygiene monitoring. Monitoring programmes must be very flexible at the beginning and are developed into routine sampling schedules as statistical data are accumulated.

In an underground mine, after the shaft has been sunk, the permanent hoist, electrical and pumping systems are installed. The ventilation system will continue to develop as underground development proceeds. In most cases, horizontal development must proceed to the point where a second shaft or ventilation raise can be constructed before the final ventilation circuit can be installed.

An open pit mine frequently requires de-watering to control slope stability. The de-watering system will continue to develop as the mine is deepened. Again, monitoring is important, for both groundwater levels and ground stability. In addition, the quality of groundwater must also be monitored, because this will dictate the need for treatment of water before discharge to the environment.

In an in situ leaching mine, the hydrogeologic characteristics must be carefully examined and monitored. Once determined, the system is continually monitored to assure well-field balance and control, and to ultimately prescribe the appropriate groundwater restoration.

The mill can be commissioned by a more conventional process, since much, if not all, of the construction can be completed before commissioning proceeds. Before commissioning commences, full maintenance support and a full inventory of spare parts must be available. Service systems such as electrical, air, water and instrumentation, should be commissioned first. Again, it is vital to have the monitoring systems in place before start of commissioning. Systems important to safety and environmental protection should be commissioned before the process itself. Hence, ventilation systems and emission control systems, such as scrubbers and dust collectors should be commissioned first. Commissioning of the chemical process should start with filling vessels and testing all piping systems with water. After integrity has been demonstrated with water, slurry can be entered to the system. The crushing and grinding circuits could be commissioned with waste rock, rather than ore, but this choice depends upon what other work may be in progress in the area at the start of commissioning. If construction work is still being completed by contractors who are not radiation workers, it may be desirable to commence commissioning with non-radioactive material.

Expectations

The commissioning of an operation is intended to take the operation from the construction phase to full production without undue risk to the health and safety of the personnel involved, with satisfactory control of emissions from the operation, and with acceptable environmental impacts.

Preparatory work

Documents to be reviewed in advance:

- Company policies with respect to health, safety and environmental protection
- Commissioning plan
- Description of commissioning organization, including permanent site personnel, contractors, and special assistance.

Documents to be made available for review at the site:

- Monitoring programmes
- Contingency plans
- Description of emission control and water treatment systems
- Description of monitoring programmes.

Investigations

The commissioning plan should be examined for compliance with the appropriate standards, taking into consideration site conditions. The detailed plan should be reviewed against the resources available at the site to ensure that it is realistic and applicable to site conditions. Specific aspects of the plan to be considered are:

- Inspection of buildings and equipment *versus* construction drawings
- Calibration of all instrumentation
- Testing all alarms
- Operability and effectiveness of monitoring systems
 - process
 - work place
 - environmental
- Safety systems
- Environmental protection systems
- Staffing
 - normal operating staff
 - additional technical staff (commissioning engineers)
 - additional maintenance staff (on shift)
- Training manuals
 - supervisors
 - operators
 - all duties and responsibilities clearly defined
- Operating check sheets
- Equipment manufacturers' instructions available
- First startup procedures allow for one-time requirements such as curing of fire brick
- Normal and rapid shutdown procedures in place
- Emergency response team trained
- Check pump and fan rotations
- Testing of all vessels and piping with water before using hazardous chemicals
- Procedures for documenting all changes
- Established communications between shifts
- Data collection and comparison with design and predictions.

3.9.2. Decommissioning

Consideration of decommissioning falls into two distinct categories. Most jurisdictions now require that a mining and milling facility have a conceptual decommissioning plan available before startup. This

is frequently a requirement of the environmental impact assessment which is part of the decision-making process on whether or not the project should proceed. During the early stages of production, this conceptual plan is sufficient. The important things to consider in the review are the effectiveness of the plan and assurance that the site is being operated in a fashion which complements, rather than runs counter to, the plan.

During operations, some pieces of equipment and some parts of the site are likely to be removed from service, long before the entire operation reaches the end of its useful life. It is generally advisable to decommission these items as they go out of service. This reduces the problems at the end of project life and also allows monitoring of the decommissioned parts of the site while resources are still readily available for any corrective action which may be required.

As the site nears the end of its useful life, the conceptual plan should be developed into a detailed decommissioning plan, which describes how each part of the operation will be taken out of service, removed, and the site restored to a safe and environmentally acceptable condition. It must be recognized that any decommissioning plan will not remove all vestiges of human activity from the site. The objective should not be to recreate a pristine environment, but rather to leave the site in such a condition that it does not present hazards to casual visitors to the site and that it does not represent a source of continuing environmental impact.

Expectations

The conceptual decommissioning plan should briefly describe the expected condition of the site at the end of production, state the objectives of the plan, and briefly describe the steps to be taken to take the site out of service, remove chemical reagents, equipment and buildings, close mine openings, and stabilize the site.

The detailed plan should describe the steps needed to accomplish all of the objectives, indicating the resources required in terms of personnel and equipment. Predictions of emissions from the site after decommissioning are required and environmental pathways modelling to assess the impacts of the decommissioned site are generally required. Most jurisdictions require a site monitoring programme after completion of decommissioning to demonstrate that the site is performing as predicted. This programme must be carried on for some years before the site may be abandoned.

Preparatory work

Documents to be reviewed in advance:

- Company decommissioning policy
- Conceptual decommissioning plan.

Documents to be made available for review at the site:

- Detailed decommissioning plan
- Regulatory and site-specific requirements for decommissioning.

Investigations

The decommissioning plan should be examined for compliance with the appropriate standards, taking into consideration local conditions. The detailed plan should be reviewed against the resources available at the site to ensure that it is realistic and applicable to site specific conditions. Specific aspects of the plan to be considered are:

- Potential future uses of the site, buildings and equipment
- Removal or neutralization of all chemical reagents

- Decontamination and salvage of usable equipment
- Control of materials leaving the site for both contamination and monetary value
- Demolition of structures
- Consideration of back-fill requirements
- Permanent sealing of mine openings
- Stabilization of tailings
- Stabilization of waste rock, including consideration of acid generation and heavy metal leaching potential
- Site grading and re-vegetation
- Elimination of contaminated seepage and run-off
- Emergency response capability
- Source term predictions and environmental pathways modelling
- Application of the ALARA principle in the development of the plan
- Decommissioning and post-decommissioning monitoring programmes
- Abandonment.

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