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1982 Evaluation

Quad Cities Nuclear Power Station

Commonwealth Edison Company

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INPO

EVALUATION

of

QUAD CITIES NUCLEAR POWER STATION

Commonwealth Edison Company

SUMMARY

INTRODUCTION

The Institute of Nuclear Power Operations (INPO) conducted an evaluation of Commonwealth Edison Company's (CECO) Quad Cities Nuclear Power Station during the weeks of May 23 and May 30, 1982. The station is located on the Mississippi River, approximately 20 miles northeast of Moline, Illinois. Unit 1 began commercial operation in February 1973, and Unit 2 began commercial operation in March 1973.

PURPOSE AND SCOPE

INPO conducted an evaluation of site activities to make an overall determination of plant safety, to evaluate management systems and controls, and to identify areas needing improvement. Information was assembled from discussions, interviews, observations, and reviews of documentation.

The INPO evaluation team examined station organization and administration, operations, maintenance, technical support, training and qualification, radiological protection, and chemistry. The team also observed the actual performance of selected evolutions and surveillance testing. Corporate activities were not included in the scope of the evaluation, except as an incidental part of the station evaluation. As a basis for the evaluation, INPO used performance objectives and criteria relevant to each of the areas examined; these were applied and evaluated in light of the experience of team members, INPO's observations, and good practices within the industry.

INPO's goal is to assist member utilities in achieving the highest standards of excellence in nuclear plant operation. The recommendations in each area are based on best practices, rather than minimum acceptable standards or requirements. Accordingly, areas where improvements are recommended are not necessarily indicative of unsatisfactory performance.

DETERMINATION

Within the scope of this evaluation, the team determined that the plant is being operated in a safe manner by qualified personnel.

The following beneficial practices and accomplishments were noted:

Plant personnel display a positive attitude and good morale.

The station has an impressive availability and capacity factor record.

Material condition of the plant is impressive.

The training and qualification program for station nuclear engineers is excellent.

Improvements were recommended in a number of areas. The following are considered to be among the most important:

Continued management attention is needed to improve operator professionalism and attentiveness.

Control of the "out of service" tagout system needs to be upgraded.

Shift turnover practices need to be improved.

Training and qualification of equipment attendants should be upgraded.

Increased attention to radiological protection is needed, particularly in areas such as contamination control, Special Work Permits, and adherence to good radiological protection practices by workers.

In each of the areas evaluated, INPO has established PERFORMANCE OBJECTIVES and supporting criteria. All PERFORMANCE OBJECTIVES reviewed during the course of this evaluation are listed in APPENDIX II.

Findings and recommendations are listed under the PERFORMANCE OBJECTIVES to which they pertain. Particularly noteworthy conditions that contribute to meeting PERFORMANCE OBJECTIVES are identified as Good Practices. Other findings describe conditions that detract from meeting the PERFORMANCE OBJECTIVES. It would not be productive to list as Good Practices those things that are commonly done properly in the industry since this would be of no benefit to CECO or to INPO's other member utilities. As a result, most of the findings highlight conditions that need improvement.

The recommendations following each finding are intended to assist the utility in ongoing efforts to improve all aspects of its nuclear programs. In addressing these findings and recommendations, the utility should, in addition to correcting or improving specific conditions, pursue underlying causes and issues.

As a part of the second and succeeding evaluations of each station, the evaluation team will follow up on responses to findings in previous reports. Findings with response actions scheduled for future completion have been carried forward in APPENDIX I to this report. In areas where additional improvements were needed, a new finding that stands on its own merit has been written. Thus, this report stands alone, and reference to previous evaluation reports should not be necessary.

The findings listed herein were presented to CECO management at an exit meeting on June 3, 1982. Findings, recommendations, and responses were reviewed with CECO management on August 19, 1982. Responses are considered satisfactory.

To follow the timely completion of the improvements included in the responses, INPO requests a written status by March 31, 1983. Additionally, a final update will be requested six weeks prior to the next evaluation.

The evaluation staff appreciates the cooperation received from all levels of Commonwealth Edison Company.

COMMONWEALTH EDISON COMPANY

Response Summary

Commonwealth Edison Company is pleased that INPO has found Quad-Cities to be operated safely by qualified personnel. We recognize the beneficial practices and accomplishments noted by the evaluation team. The station has committed many man-hours over the past year to improve the material condition of the plant, and it is our intent to maintain the housekeeping of the plant at a high level of cleanliness. We further recognize those areas cited by the evaluation team in which improvements are needed. As described in the following pages, Quad-Cities Station's responses have been written to address the findings and recommendations presented by the INPO evaluation team. We are committed to the corrective actions stated, and to their completion in a timely manner. We appreciate the professional performance and cooperation exhibited by the evaluation team during the conduct of the evaluation.

ORGANIZATION AND ADMINISTRATION

MANAGEMENT ASSESSMENT AND QUALITY PROGRAMS

PERFORMANCE OBJECTIVE: Management should assess station activities to ensure and enhance quality performance of all aspects of nuclear plant operation.

Finding (OA.3-1)

The following Good Practice was noted: The Quality Control group is extensively involved in non-safety-related work, such as turbine/generator overhauls and balance-of-plant weld repairs. Important balance-of-plant equipment has been designated "reliability related," and graduated quality controls are applied for selected major maintenance tasks on this equipment.

OPERATIONS

CONDUCT OF OPERATIONS

PERFORMANCE OBJECTIVE: **Operational activities should be conducted in a manner that achieves safe and reliable plant operation.**

Finding (OP.2-1) **Operators need to be more attentive to plant parameters and conditions.** Instances were observed in which operators were not closely monitoring the control boards.

Recommendation Emphasize the need for attentiveness and vigilance to all control room operators. Increase management observation and review of control room activities.

Response There are existing procedures and standing orders that address various shift operations and requirements. This information will be incorporated into a single procedure entitled "Conduct of Shift Operations" and will be included in the administrative procedures manual, QAP. This procedure will expand upon shift turnover requirements and will address operator demeanor when assigned to a control room operator position. During the time that this procedure is being formulated, shift turnover and control room attentiveness will be discussed with each control room operator. After the procedure becomes effective, it will be reviewed with each control room operator. This new procedure will be completed by February 28, 1983 and reviewed with each control room operator by April 1, 1983. Increased management observation and review of control room activites has been implemented.

PLANT STATUS CONTROLS

PERFORMANCE OBJECTIVE: **Operational personnel should be cognizant of the status of plant systems and equipment under their control, and should ensure that systems and equipment are controlled in a manner that supports safe and reliable operation.**

Finding (OP.3-1) **An independent verification of component position is not performed for safety-related systems and equipment following routine maintenance or testing.**

Recommendation Revise existing procedures to require an independent verification of safety-related components that have been repositioned during maintenance or testing. This verification should be performed as soon as practical after the required maintenance or testing is completed.

Response The revision to the out-of-service procedure (Ref. OP 3-4) will include a requirement to independently verify safety-related components that were repositioned during maintenance and are not verifiable from the control room by observation or surveillance testing. This program will be implemented concurrently with the out-of-service procedure rewrite, which will commence following the Unit 1 refuel outage this fall and be completed by April 1, 1983.

Finding (OP.3-2) **The current shift turnover practices do not ensure a complete and comprehensive transfer of information.** A number of shift turnovers were observed that did not fully convey ongoing shift activities and plant status.

Recommendation Review and expand the existing turnover requirements to include additional guidance to the operators. The additional guidance should include a review by supervisors and control room personnel of such items as active out-of-service tagouts and the status of lifted leads, jumpers, and defeated alarms. INPO Good Practice OP-201, "Shift Relief and Turnover," could be of assistance in this effort.

Response The response to Finding OP.2-1 will include the above noted items.

Finding (OP.3-3) **The size of Caution tags and the method of attaching them to control boards and panels causes labels, indicating lights, and control switches to be obscured on occasion.**

Recommendation Correct current conditions where tags obscure labels, indicating lights, and control switches. The use of smaller tags should be considered. INPO Good Practice OP-203, "Procedures For The Protection of Employees Working On Electrical and Mechanical Components," could be of assistance in this effort.

Response The size of the caution card has been reduced so as not to obscure panel labels, lights, and switches. These cards are on order and their use will be implemented when received.

Finding (OP.3-4)

Out-of-service tagout system improvements are needed to enhance and ensure the control and assessment of plant status. Tags were placed without proper approval on occasion. In several instances, the same master out-of-service number was assigned to unrelated jobs.

Recommendation

Expand the out-of-service system to include the following elements:

a. an index of master out-of-service tagouts

b. a tagging sheet that specifies the particular valves, breakers, or components to be tagged. This sheet should identify the proper sequence of positioning components when required, identify the component position, and provide for operator sign-off at the time the tag is posted or removed.

c. tags that include the master out-of-service number, component identification, and component positions.

INPO Good Practice OP-203, "Procedures For The Protection of Employees Working On Electrical and Mechanical Components," could be of assistance in this effort.

Response

The entire out-of-service procedure is being reviewed. This review process will begin following the Unit 1 refuel outage and will address the concerns and recommendations of this finding. Full implementation of a revised program is expected by April 1, 1983.

Finding (OP.3-5)

A periodic review of the physical status of current out-of-service tagouts is needed. Although a quarterly audit of the Master Out-Of-Service Log is conducted, a physical check to verify that tags are still legible and properly attached is not being conducted.

Recommendation

Expand the periodic review of the status of master out-of-service cards and slave cards to include the following performance checks:

a. applicability or need for outstanding out-of-service tagouts

b. proper condition, placement, and installation of each tag

c. proper position of tagged equipment

INPO Good Practice OP-203, "Procedures For The Protection of Employees Working On Electrical and Mechanical Components," could be of assistance in this effort.

Response Included with the quarterly audit of the master out-of-service log will be a physical check of a portion of the active out-of-service cards. This physical verification will include a review of the applicability of the out-of-service tagouts, the proper condition and installation of each tag, and a check of the equipment to ensure that it is in the proper position. This program will be addressed in the review of the out-of-service card procedure (see OP.3-4) and be implemented concurrently, with completion expected by April 1, 1983.

Finding (OP.3-6) **Out-of-tolerance and defective instruments are not labeled or otherwise identified.**

Recommendation Implement a system to ensure timely identification of out-of-tolerance and defective instruments utilizing controlled work request stickers, tags, or other similar methods.

Response A method will be devised and implemented to identify defective and out-of-tolerance instruments in the main control room. Plans to implement this program are now in progress and completion is expected by March 1, 1983.

OPERATIONS FACILITIES AND EQUIPMENT

PERFORMANCE OBJECTIVE: **Operational facilities and equipment should effectively support plant operation.**

Finding (OP.6-1) **The plant paging system cannot be heard or understood in some areas of the plant.**

Recommendation Evaluate the paging system with emphasis on improving plantwide audibility. Adjust installed speakers or add speakers as appropriate in areas identified by the evaluation of the paging system.

Response An investigation will be initiated to identify areas of the plant that are inadequately covered by the page. Improvements will be made in those areas where needed. This investigation will begin by January 31, 1983, and the necessary improvements initiated by April 1, 1983.

Finding (OP.6-2)

Plant equipment identification needs upgrading. Few components or systems are presently labeled. Numerous unidentified valves were noted in the plant.

Recommendation

Complete the existing labeling program for equipment, systems, and valves.

Response

A program will be initiated by September 30, 1982 to upgrade component labeling. This will include a review of all valve tagging. Identification of component labeling will continue through 1983 when Unit 2 will be shut down for refueling. Final review of component labeling is expected to be completed by July 1, 1984.

MAINTENANCE

WORK CONTROL SYSTEM

PERFORMANCE OBJECTIVE: **The control of work should ensure that identified maintenance actions are properly completed in a safe, timely, and efficient manner.**

Finding (MA.3-1)

Improvement is needed in the identification of plant deficiencies. A number of deficiencies were identifed that were not reflected in the work control system.

Recommendation

Emphasize the need to identify and report material deficiencies on a routine basis with all plant personnel. Direct management efforts toward more aggressive identification of deficiencies by means of periodic, detailed plant inspections.

Response

Starting with the department head meetings, the need for identifying and reporting plant deficiencies will be discussed. This will carry over into the individual department meetings. The department heads' position descriptions will be changed to incorporate the responsibilities for in-plant inspection as to identifying material conditions. This program will be implemented by November 1, 1982.

MAINTENANCE PROCEDURES AND DOCUMENTATION

PERFORMANCE OBJECTIVE: **Maintenance procedures should provide appropriate directions for work and should be used to ensure that maintenance is performed safely and efficiently.**

Finding (MA.6-1)

Improved guidance on the use of procedures is needed. Procedures are not always used during maintenance of safety-related systems. In some cases, procedures have not been developed for instruments used to monitor safety-related systems.

Recommendation

Provide additional guidance for the use of procedures covering, for example, when procedures are to be used as general guidance, when they are to be followed step-by-step, when sign offs are required, and when procedures must be at the job site. Evaluate the need for additional maintenance procedures, and develop appropriate procedures based on this evaluation.

Response

The administrative procedure that provides guidance for using maintenance procedures will be revised to reflect the above recommendation. Each department within the maintenance area

will evaluate the need for additional procedures. The procedure changes and review will be completed by November 1, 1982.

MAINTENANCE FACILITIES AND EQUIPMENT

PERFORMANCE OBJECTIVE: Facilities and equipment should effectively support the performance of maintenance activities.

Finding (MA.8-1)

Spare parts support of maintenance needs to be improved. Parts are frequently difficult to identify and retrieve.

Recommendation

Conduct additional training for stockroom personnel in the use of parts indexing systems. Inventory records should be periodically reviewed to verify that locations and stock levels are accurate.

Response

The station will undertake additional training for storeroom personnel in the use of the parts indexing system. Efforts are underway to better the cycle-count (inventory control). A review of the location accuracy during each cycle-count will be included. The station has increased its management staff in the Stores Department as an aid to accomplish this task. This program will be initiated at the conclusion of the Unit 1 refueling outage. Completion of the training is expected by April 1, 1983.

Finding (MA.8-2)

Order and cleanliness need to be improved in plant maintenance shops. Material from inactive jobs was not properly stored or protected. Personal articles were routinely stored on workbenches and shop equipment. Trash and industrial debris were noted in shop areas.

Recommendation

Increase supervisory attention to general housekeeping in the shop areas. Consider assigning specific responsibilities for housekeeping of each area.

Response

Position descriptions will be revised to reflect responsibility in the area of shop housekeeping and cleanliness. This project will be completed by November 1, 1982.

TECHNICAL SUPPORT

OPERATING EXPERIENCE REVIEW PROGRAM

PERFORMANCE OBJECTIVE: Industrywide and in-house operating experiences should be evaluated and appropriate actions undertaken to improve plant safety and reliability.

SOER STATUS

The status of Significant Operating Experience Report recommendations is as follows:

Number of Recommendations	Action Taken
29	Satisfactory
40	Not applicable
38	Pending
0	Further review needed

The following recommendations are pending action:

SOER Number	Recommendation Number
80-6	1, 3, 4, 5, 6, 7, 8, 10
81-7	1, 2
81-10	1
81-13	1, 2, 3, 4, 9, 12, 13
81-15	1a, 1b, 1c, 2a, 2b, 2c, 3
82-1	1, 2, 3, 4
82-2	1, 2, 3, 4, 5, 6, 7
82-3	1, 2

An update on the status of each recommendation listed in the "pending action" category shown above is requested in the six-month follow-on response to this report. In addition, the status of each immediate action (red tab) SOER recommendation received subsequent to this evaluation should be included in the six-month follow-on response. A tabular summary, similar to that above, is requested.

Finding (TS.3-1)

The following Good Practice was noted: Rigorous investigations are conducted for in-house events. Particular emphasis is placed on evaluation of events involving personnel error under a structured, positive, and non-punitive program that rewards good performance and results in meaningful corrective actions.

PLANT MODIFICATIONS

PERFORMANCE OBJECTIVE: Plant modification programs should ensure proper review, control, implementation, and completion of plant design changes in a safe and timely manner.

Finding (TS.4-1)

Lead shielding is installed on some piping systems without a review of its effect on system stresses.

Recommendation

Perform an engineering evaluation of lead shielding currently in place to ensure that design load specifications are not exceeded. Establish controls to prevent the future placement of lead shielding on plant piping systems and equipment without adequate engineering review.

Response

A program is being established to identify plant piping and equipment that currently have lead blankets or sheeting added for the purpose of shielding. These areas will be evaluated to ensure the equipment can withstand the added static and dynamic loading. Corrective measures will be taken if the analysis so indicates. To assist the station technical staff engineers in their evaluations, an Action Item Record (AIR 4-82-16) has been written to the station nuclear engineering department to provide proper guidance and formal criteria.

To prevent further installation of unauthorized lead usage, a memo has been sent to all station departments involved informing them of the new policy requiring evaluation prior to installation of shielding. It is intended to fully implement this program by March 1, 1983.

Finding (TS.4-2)

Drawings provided for control room personnel do not always reflect as-built status. Control room drawings are not marked to indicate modifications or the existence of drawing change requests.

Recommendation

Annotate control room drawings in the same manner as satellite station aperture cards to inform users that modifications or drawing change requests are in progress and that up-to-date system status is available in document control.

Response

Presently, there are P&IDs in the control room for each unit, which are updated as each new revision is received by the Central File Office. To ensure better control of these as-built drawings when a drawing change request is submitted, the control room print will be stamped accordingly. This will indicate that this print does not reflect the actual as-built condition, and the Central File will need to be consulted. This program will be in effect by October 1, 1982.

TRAINING AND QUALIFICATION

TRAINING ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: The training organization and administrative systems should ensure effective control and implementation of training activities.

Finding (TQ.1-1)

Reference materials and instructor lesson plans used in conjunction with operator initial and continuing training need to be reviewed and updated to reflect current plant conditions. Administrative policies have not been established for the periodic updating of reference materials.

Recommendation

Implement procedures to periodically review and update reference material and instructor lesson plans used for operator training.

Response

Although the manuals used for operation training have not been updated since their initial writing, the sections used as reference material in conjunction with operator training are correct. Lesson plans will be reviewed for accuracy prior to use for instructional purposes. It is intended to complete the initial review of the lesson plans by October 1, 1982.

Finding (TQ.1-2)

The on-the-job training (OJT) programs for licensed operators, non-licensed operators, and maintenance personnel need improvement. Specific examples include the following:

a. The OJT program for licensed operators does not adequately define the training tasks to be accomplished during the three months on shift and does not evaluate trainee progress.

b. Equipment attendants are assigned to shift duties prior to completion of the OJT checklist.

c. Training objectives and criteria for maintenance OJT are not clearly defined.

Recommendation

Develop a structured OJT program for maintenance personnel and revise the OJT program for operators to include the following:

a. tasks to be performed, observed, simulated, or discussed

b. identification of individuals or classifications of individuals qualified and responsible for conducting OJT

c. skill and knowledge performance standards

d. identification of individuals or classifications of individuals qualified and responsible to conduct final checkouts

e. assurance that the individual has demonstrated competency in specified tasks prior to job assignment

Response

A list of tasks to be performed, observed, or discussed during the on-the-job training (OJT) phase of the licensed operator qualification program was prepared following the July 1981 Quad Cities evaluation. The intent was to utilize these lists in the next licensed operator training class; no scheduled class has yet reached the OJT portion of the program. These lists will be reviewed and revised as necessary to include all tasks and objectives to be accomplished during the OJT portion of the program. Periodic evaluations of progress during the OJT program also will be made. The above revisions will be completed by January 1, 1983 and implemented in subsequent programs.

The qualification checklist for the OJT program for equipment attendants (EA) will be completed prior to an individual's assignment on shift. In addition, the OJT portion of the EA training will be lengthened. This will be implemented with the next EA training class.

The basis for a structured OJT program for maintenance personnel and the final version of the OJT program for operations personnel are the job and task analyses currently in progress at the corporate level. A schedule for implementation of these programs will be developed by November 1982. The new program for mechanical maintenance personnel will be implemented by April 1983. A target date for implementing the remaining programs is December 1983.

NON-LICENSED OPERATOR TRAINING AND QUALIFICATION

PERFORMANCE OBJECTIVE: The non-licensed operator training and qualification program should develop and improve the knowledge and skills necessary to perform assigned job functions.

Finding (TQ.2-1)

Examinations to ensure that equipment attendants understand the content of the retraining program are not conducted. In addition, criteria for successful completion of retraining have not been established.

Recommendation Establish criteria for the successful completion of retraining. Examine equipment attendants at the completion of retraining to ensure that training objectives have been met.

Response Various methods of ensuring that training objectives have been met at the completion of equipment attendant retraining will be reviewed. Finalization of the method is anticipated by December 31, 1982.

RADIOLOGICAL PROTECTION

RADIOLOGICAL PROTECTION ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: The organization and administrative systems should ensure effective control and implementation of the radiological protection program.

Finding (RP.1-1)

Station personnel do not always adhere to radiological protection procedures or requirements. Examples include improper donning, wearing, and removal of protective clothing; improper handling of contaminated material; exiting contaminated areas at locations other than step-off pads; inadequate control of respirators; and evidence of smoking in radiologically controlled areas.

Recommendation

Station managers and supervisors, including those in maintenance, and operations, as well as radiological protection, should more aggressively enforce adherence to radiological protection procedures and requirements and ensure that personnel understand their responsibilities in this area.

Response

The station has initiated the implementation of revised Radiation Control Standards. All station personnel will be trained in the new standards as part of the annual retraining program. Through the retraining program, as well as through routine department and station meetings, adherence to and enforcement of radiation protection procedures will be emphasized. This retraining program will be completed by October 1, 1982.

Finding (RP.1-2)

The Special Work Permit (SWP) and proposed Radiological Work Permit (RWP) systems do not ensure that workers entering radiation and contamination areas are informed of the radiological conditions or of the necessary protective measures required.

a. SWPs are not always required in areas where workers could receive significant doses of radiation.

b. SWPs are not required for work in contaminated areas.

c. SWPs provide workers with radiation and contamination levels that frequently do not reflect the conditions that the worker will actually encounter.

Recommendation

Expand and upgrade the SWP system (or proposed RWP system) to provide additional information and better protection for the worker.

Response The station has recently implemented a new Radiological Work Permit (RWP). Effective application of this RWP will provide accurate information specifying actual radiological conditions in the work area. Additionally, the station is committed to increasing the Radiological Protection staff to include a radiation protection foreman on all shifts. These actions along with strengthened supervisory and management attention should ensure effective control and implementation of our Radiological Protection Program.

EXTERNAL RADIATION EXPOSURE

PERFORMANCE OBJECTIVE: **External radiation exposure controls should minimize personnel radiation exposure.**

Finding (RP.4-1) **Specific problems were noted in the portable radiation survey instrument calibration program as follows:**

a. Calibration procedures require only single point adjustment, which does not permit linearity checks.

b. Records of calibration are not available for all instruments in use, in particular, some high range instruments.

c. High range instruments are only calibrated on the lower end of the scale due to insufficient source strength. It is recognized that a new calibrator has been ordered that does have sufficient source strength.

d. Follow-up actions are not required to be taken in the event as-found data on instrument calibration is significantly out of tolerance.

Recommendation Modify the existing calibration program to address the areas discussed above. ANSI-N323 could be used for guidance.

Response The station is currently implementing an electronic data processing-based calibration records system. This system should provide calibration records for all portable radiation survey instruments and provide information pertaining to the disposition of all units found to be out of tolerance. This information will be trended and reviewed to determine if instrument calibration frequency is correct and to ascertain the suitability of instruments for use in the station. With the receipt of the new calibrator, the station will be able to calibrate high range survey instruments to 3000 R/hr. ANSI-N323 will be used for guidance in establishing the new calibration program. This new calibration program will be completed by January 1, 1983.

Finding (RP.4-2)

Deficiencies exist in meth[illegible] to control personnel exposure. The following examples were noted:

a. Job-specific surveys are not always performed prior to allowing personnel to work in high radiation areas.

b. Radiation areas and hot spots are sometimes not posted correctly.

Recommendation

Ensure that job-specific surveys are performed prior to permitting work to be accomplished within radiation areas. Upgrade the existing radiation area and hot spot postings to provide workers with more meaningful information.

Response

The station intends to provide job-specific surveys prior to commencement of work within radiation areas. These job-specific surveys are required by the revised RWP Program. The increased staff of radiation chemistry technicians, in addition to the shift coverage to be provided by additional radiation protection foremen, should make completion of such surveillance achievable. The station will continue its efforts to upgrade posting of radiation areas and hot spots. The necessity of proper posting of areas will be stressed with all responsible personnel. These new programs will be implemented by June 1, 1983.

INTERNAL RADIATION EXPOSURE

PERFORMANCE OBJECTIVE: **Internal radiation exposure controls should minimize internal exposures.**

Finding (RP.5-1)

Positive low level whole-body counts (below established limits) are not investigated to ascertain and correct the causes. A review of recent whole-body count records indicate a number of workers with positive counts.

Recommendation

Investigate and take action to eliminate the causes of apparent low level internal contamination of personnel. Include in this investigation the possibility of external contamination as opposed to actual internal deposition.

Response

As part of the station review of bioassay data, a program will be established to evaluate the validity of all positive Co-60 results. The intent of the investigation will be to identify those cases where bonafide internal disposition has occurred. The frequency of external contamination interference should be reduced through the enforcement of showering requirements prior to bioassay and through the use of paper suits for individuals undergoing analysis.

The corrective measures taken to minimize external contamination will be implemented by September 1, 1982. The program to validate positive results will be implemented by January 1, 1983.

PERSONNEL DOSIMETRY

PERFORMANCE OBJECTIVE: The personnel dosimetry program should ensure that radiation exposures are accurately determined and recorded.

Finding (RP.8-1)

Guidance for determining when extremity dosimetry is to be used; or for evaluating when multiple, whole-body dosimetry may be required, is not provided. Location of these dosimeters is now left to the judgment of technicians who prepare SWPs.

Recommendation

Develop criteria that provide guidance for the use of extremity and multiple whole-body dosimetry. These criteria should be based on measured or anticipated dose rates and should be included in appropriate procedures.

Response

The station is currently developing a procedure to provide guidance on the use of dosimetry. Requirements for extremity dosimeters, precautions concerning dosimeter limitations, and radiological work conditions necessitating multiple whole-body dosimeters will be addressed. Training of all responsible radiation protection personnel will be initiated upon completion of the procedure. This program will be completed by January 1, 1983.

RADIOACTIVE CONTAMINATION CONTROL

PERFORMANCE OBJECTIVE: Radioactive contamination controls should minimize the contamination of areas, equipment, and personnel.

Finding (RP.9-1)

Current plant contamination control practices have the potential for permitting the spread of low level contamination outside the radiologically controlled area. The following examples were noted:

a. During 1981, a large number of personnel were found contaminated upon exiting the controlled area.

b. Whole-body monitoring for radioactive contamination is not performed at the exits of some contaminated areas or

at the exits of controlled areas. Portal monitors are being used as the primary means of personnel monitoring. These monitors do not have the sensitivity required to detect station contamination limits.

c. Plant surveys periodically find contaminated items outside of controlled areas.

Recommendation

a. Document all skin and clothing contamination incidents to monitor trends, identify the underlying causes for problem areas, and implement corrective action to reduce these contaminations. Plant management should be kept informed of trends and of the effectiveness of corrective action.

b. Establish requirements for performing whole-body monitoring when exiting contaminated areas and for monitoring hands and feet when exiting the radiologically controlled area. Ensure all workers are aware of the personnel monitoring requirements and enforce compliance with these requirements.

c. Ensure that all items removed from the controlled areas are properly surveyed for contamination to minimize the potential spread of contamination to clean areas of the station.

Response

The station has stressed detailed documentation of all personnel and clothing contamination incidents. The station continues to maintain this practice and to compile and trend the data, as it did at the end of 1981. Copies of personnel and clothing contamination surveys will be provided to applicable work group supervisory personnel for corrective action. The station will develop whole-body monitoring requirements. Additional contamination monitoring equipment is being purchased, and frisking stations are being constructed with the goal of providing personnel contamination monitoring areas. Personnel contamination monitors will be stationed at the exit from controlled areas to augment the portal monitors. Instructions to workers concerning contamination monitoring requirements will be posted in the plant. All workers will be informed through routine safety meetings of any revisions to the contamination control program.

The station will emphasize to all employees the necessity of having all items properly surveyed prior to removal from controlled area, to reduce the potential for material being released without survey.

Instructions to personnel regarding the contamination control program will be implemented by October 31, 1982. Programmatic changes involving the installation of shielded frisking stations and the procurement of additional monitoring equipment will be implemented by March 31, 1983.

CHEMISTRY

CHEMISTRY CONTROL

PERFORMANCE OBJECTIVE: **Chemistry controls should ensure optimum chemistry conditions during all phases of plant operation.**

Finding (CY.3-1)

Cleaning agents and solvents are not always controlled in a manner that prevents their use for unauthorized purposes or their inadvertent disposal into radioactive waste systems. A number of unauthorized cleaning agents were observed in the reactor buildings.

Recommendation

Determine the acceptability and approved use of these chemicals and specify proper methods of disposal. Industrial chemicals should be controlled to ensure they are used only as intended. Personnel should be instructed in the use and control of approved chemicals and the reasons why such a program is necessary.

Response

A program will be developed to ensure stringent controls over the use of cleaning agents and solvents in the station. A list of unauthorized cleaners and solvents will be compiled, distributed, and routinely updated. The station will emphasize with all work group supervisors their responsibility to ensure that unauthorized materials are removed from the station, and new cleaners and solvents are forwarded to chemistry for analysis and authorization prior to use. The Stores and Chemistry groups will work together to maintain control of cleaning agents. The training department will review cleaning agent control with personnel in initial general employee training. This program will be implemented by June 1, 1983.

Finding (CY.3-2)

Increased efforts are needed to determine the source of high iron concentrations in condensate pump discharge samples. Samples are not taken or analyzed in a timely manner to monitor for further degradation of system chemistry or assist in determining the source.

Recommendation

Increase the frequency of sampling and analyses to identify the source of iron, and monitor levels until the problem is corrected.

Response

The station began sampling condensate pump discharge for iron because of reduced condensate demineralizer run times. From samples taken since the INPO evaluation, it has been determined that soluble and insoluble iron concentrations for both units are within the normal range. Earlier samples are not considered representative because the sample lines were not purged properly.

The station is continuing to investigate the reduced demineralizer run time problem. Equipment problems and the presence of possible water contaminants are being investigated to improve demineralizer performance.

Finding (CY.3-3)

The corrosion inhibitor (nitrite) concentration in the reactor building closed cooling water (RBCCW) systems is frequently out of specification.

Recommendation

Determine and correct the cause of decreasing nitrite concentration in the RBCCW systems. Increased sampling and chemical additions should be considered until the problem is resolved. Analyses should be performed after chemical addition to ensure system chemistry is within required specifications.

Response

The station Technical Staff Department is continuing its efforts to eliminate the source of decreasing nitrite concentration in the RBCCW system. The routine sampling of RBCCW has been accelerated from once per week to twice per week. Chemical addition to RBCCW is initiated should sample results indicate that nitrite concentrations are below specified limits. The system will be sampled and analyzed following chemical addition to ensure that the chemistry is maintained within specifications.

LABORATORY ACTIVITIES

PERFORMANCE OBJECTIVE: **Laboratory and counting room activities should ensure accurate measuring and reporting of chemistry parameters.**

Finding (CY.4-1)

The chemistry spiked sample program does not include routine samples such as chlorides, iron, or silica. In addition, not all technicians are required to perform analyses of spiked samples prior to assuming chemistry duties.

Recommendation Periodically require technicians to analyze spiked samples for analyses that they might be expected to perform.

Response The chemistry spiked sample program will be expanded to provide unknown samples of chloride, silica, pH, and conductivity. These efforts will be coordinated through the Commonwealth Edison Company Technical Services Nuclear Department. This program will be implemented by January 1, 1983.

Finding (CY.4-2) **Additional emphasis on chemistry procedural controls is needed.** Examples of observed problems include the following:

a. A technician did not adhere to the procedure for a conductivity determination. This caused the result to be in error.

b. A draft (unapproved) procedure was used to operate the atomic absorption unit.

c. A written procedure for sampling reactor water has not been developed.

Recommendation Establish detailed guidance on the use of procedures, and emphasize proper adherence to procedures with all technicians. Managers and supervisors should periodically monitor for proper use of procedures. Procedures should be prepared for all significant activities, such as reactor water sampling.

Response Adherence to procedures will be stressed to both union and management personnel in the Radiation/Chemistry Department. Procedure QAP 1000-4 has been written to provide guidance on the use of Radiation/Chemistry Department procedures. Procedures have been written for sampling reactor water in both normal and accident conditions. The training on these new procedures will be completed by May 1, 1983.

APPENDIX I

Summary of Outstanding Response Action from Previous Evaluation (1981)

PLANT OPERATIONS PROCEDURES

Finding (OP.4-1) **Uncontrolled notes, graphs, portions of procedures, labels, and drawings of a temporary nature that are used as operator aids are attached to control panels at various plant locations.**

Recommendation Implement administrative controls for all written instructions or aids used by operations personnel. The use of posted instructions should be minimized.

Response A program has been initiated to reduce or eliminate where possible the graphs, labels, and drawings that are in place and used as additional operator aids. Labels that appear to be temporary will be reviewed and will be made permanent where the label provides useful information that would be difficult to convey in any other manner. These actions will be completed by December 1, 1981.

Status The review of notes, graphs, labels, and other aids is currently in progress. System modifications and procedure changes are being implemented to reduce reliance on notes and labels. The revised date for completion of this item is September 1982.

MAINTENANCE ORGANIZATION AND ADMINISTRATION

Finding (MA.1-1) **Procedures governing the Preventive Maintenance Program have not been provided.** The result is periodic maintenance which may not be well controlled, reviewed, or evaluated for completeness and accuracy. Better assurance that all important plant equipment is undergoing adequate routine maintenance on a periodic basis is needed.

Recommendation Develop and implement a more comprehensive program for preventive maintenance.

Response The station has been provided a "Preventive Maintenance Administrative Guideline" from the Commonwealth Edison Company corporate office. The station is pursuing the development of a more formal preventive maintenance program based upon this guideline.

Status A program outline for the Preventive Maintenance Program has been developed. The formal program is organized into two separate stages. Phase I covers maintenance history files, surveillance, vibration analysis, trend analysis, lubrication, and spare parts inventory. Phase II covers computer-based capabilities to implement Phase I. Full implementation of the Preventive Maintenance Program is expected by July 1983.

MAINTENANCE HISTORY

Finding (MA.5-2)

Maintenance history does not, in all cases, contain sufficient detail to fully describe the circumstances, conditions, and significance of the maintenance activity, or to allow for meaningful evaluation of equipment performance and identification of persistent or recurring maintenance problems. Additionally, the cause of failure (or other need for repair) is usually not indicated. The maintenance history program is not governed by an approved administrative procedure.

Recommendation Provide a maintenance history that better facilitates analysis of equipment performance. Formalize the current program, including documentation of the methods in use.

Response This area will be addressed in the station's Preventive Maintenance Program. See response to Finding MA.1-1.

Status This item is part of the Preventive Maintenance Program discussed in finding MA.1-1. Full implementation of the Preventive Maintenance Program is expected by July 1983.

PLANT EFFICIENCY AND RELIABILITY

Finding (TS.2-1)

The thermal efficiency and reliability of the plant has not been optimized.

Recommendation Remote monitoring and/or calculation of such items as feedwater heater terminal difference, turbine shaft seal leakoffs, turbine extraction line pressure drops, turbine stage pressure drops, and valve leakage to low pressure portions of systems should be routinely evaluated to determine the effect of each on unit efficiency and reliability. Evaluation results could be used for ALARA and predictive/preventive maintenance considerations. An engineering analysis should be made to determine those items that are cost effective or worthy of being done for other reasons. This engineering analysis should be the basis for determining additional items that should be part of a program to optimize plant thermal efficiency and reliability.

Response An engineering analysis will be performed by the station to determine what additional process parameters are cost effective to augment the existing thermal efficiency monitoring program. These parameters will be fed to the station's new process computer, when installed, because the existing process computer does not have sufficient spare inputs. The new process computers are scheduled for installation by September 1982. The engineering analysis will be completed by that time.

Status The technical staff has implemented the use of the Performance Evaluation of Power System Efficiencies (PEPSE) computer program to better monitor cycle efficiency and to analyze problems in the thermal cycle. A maximum capacity test was recently performed on Unit 1 to determine the cause for unaccounted deratings. The results of this test are currently being evaluated. Further, an engineering evaluation is in progress at the station to determine the cost benefit of adding certain process parameters to the new computers that are to be installed later. This evaluation should be complete by December 1982.

NON-LICENSED OPERATOR TRAINING

Finding (TQ.4-2) **Retraining is not being conducted for all equipment attendants.** Retraining sessions are regularly scheduled, but several equipment attendants have not attended. Alternate or make-up training sessions have not been conducted. Refresher training in plant systems and additional job-related technical training are missed as a result of this practice.

Recommendation Equipment attendant participation in the retraining program should be closely monitored. Job assignments which interfere with retraining should be minimized, and essential information missed by equipment attendants should be covered by other means.

Response Participation by equipment attendants in the retraining program will be closely monitored. It is CECO's intent to approach 100 percent coverage of personnel in the Equipment Attendant Group in the retraining program. Makeup training will be utilized as necessary to meet this intent.

Status The participation of equipment attendants in the retraining program has been emphasized and reinforced. This participation has been limited during refueling outages; however, job assignments that cause interference with retraining are being minimized. Further, the Training Department is developing a tracking system for this retraining so that participation by certain individuals in selected class modules is monitored and documented. The training schedule and tracking mechanism will be formalized by December 1982.

RADIOLOGICAL PROTECTION TRAINING

Finding (RC.2-2) **The radiation and chemistry technician training program needs improvement in the following areas:**

a. Oral examinations are not used for initial qualifications of radiological protection and chemistry technicians.

b. Radiological protection and chemistry technicians do not receive plant systems training. It is understood that the plant training department plans to offer systems training to these personnel by August 1981.

Recommendation Include oral examinations in the technician training and qualification program to explore areas of weakness demonstrated on written tests. Oral examinations may also be used to determine the technician's ability to use his knowledge in unusual or complex situations.

Provide plant system training for technicians to aid them in applying radiological protection requirements to work on or around these systems.

Response Oral examinations designed to assess areas of weakness demonstrated on written examinations will be incorporated in future Rad-Chem Technician training. Plant system training will be provided to all future Rad-Chem Technician classes. This training will be delivered to the current Rad-Chem Technician staff as part of an expanded 1982 technician retraining program. This item will be implemented by March 1, 1982.

Status Oral examinations have been incorporated into initial rad-chem technician training class. Plant systems training has also been made a part of the curriculum. The present rad-chem technician staff has been given plant systems training, and it is intended to continue this training on a regular schedule.

EXTERNAL RADIATION EXPOSURE

Finding (RC.4-1) **Planning to reduce personnel radiation exposure appeared insufficient.** It is recognized that a number of exposure reduction efforts have been undertaken during some major plant modifications. However, more effort is needed for normal operations and routine outage work. The plant's ALARA committee has had a few meetings, and, until the last few weeks prior to the evaluation, the ALARA coordinator had spent only a small fraction of his time on ALARA work. Although the station does have an administrative goal of 5 rem per year for individuals, this goal frequently has not been achieved.

Recommendation Expand the ALARA program to include preplanning for specific jobs, following exposure trends, and initiating corrective action if exposure trends or accumulation are excessive. Stricter adherence to the individual annual exposure goal of 5 rem is recommended. Goals are recommended for specific jobs when significant exposures are anticipated. Overall annual goals are recommended.

Response Commonwealth Edison is pursuing implementation of its ALARA Program. The preplanning of specific work, in addition to the review of, and response to, exposure trends is part of CECO's program. The use of task-based goals is viewed by CECO to be an effective tool in reducing radiation exposure. Additionally, CECO is planning a new radwaste system and is evaluating decontamination of the primary system. Once these efforts are complete, INPO's recommendation of a 5 rem annual individual exposure goal will be achievable. This item is an ongoing CECO program and will be implemented at Quad Cities in accordance with the goals of CECO's corporate office.

Status The CECO corporate office has issued an ALARA manual that sets forth the Company's ALARA program. A corporate ALARA coordinator is to be named to direct the efforts of the Station ALARA Coordinators. Quad-Cities has begun its implementation of this program and has the goal of full compliance by the end of 1982.

Finding (RC.4-3) **The plant's use of film badge measurements for legal exposure records complicates control of personnel exposures during outages because of the delay involved in obtaining results.** During outages when personnel receive exposures approaching limits, a more timely method for accurately determining exposures is needed. The plant is using pocket dosimeters to obtain a second check against film badges. Records show this information is inconsistent and cannot be relied upon for adequate control during the period necessary for badge processing.

Recommendation Replace the film badge system with a thermoluminescent dosimetry system to provide a more timely method of determining exposures.

Response Commonwealth Edison Company is evaluating the replacement of the film badge system with a thermoluminescent dosimetry system in response to recommendations by the NRC and by American Nuclear Insurers, as well as by INPO.

Status The evaluation of the replacement of the film badge system with a thermoluminescent dosimetry system should be complete by January 1983.

SOLID RADIOACTIVE WASTE

Finding (RC.7-1) **The amount of solid radioactive waste generated needs to be reduced.**

Recommendation Establish methods to segregate radioactive from nonradioactive material in controlled areas and to minimize the amount of material taken into contaminated control areas. Emphasize waste reduction methods in training programs.

Response Commonwealth Edison concurs with the INPO recommendation. The Quad Cities Station volume reduction program will be revised to include segregation of waste material in controlled areas, minimizing material brought into controlled areas, and investigations of solid waste sources. Maximum employment of reuseable containers and materials will be emphasized. The Nuclear General Employee Training program will be updated to include volume reduction techniques employed by Quad Cities. The station anticipates having these changes in effective operation by April 1, 1982.

Status The volume reduction program is being expanded to include good practices involving segregation of waste, minimizing material brought into the plant, investigation of waste sources, and employment of reuseable containers. A revised date for completing implementation of the program is October 1982.

RADIOACTIVE CONTAMINATION CONTROL

Finding (RC.9-2) **The number of areas in the plant requiring protective clothing needs to be reduced.** Several areas require respiratory equipment because of high levels of loose surface contamination. Areas such as the reactor building equipment rooms, turbine building pump vaults, and radioactive waste processing facilities require respirators for entry. The requirement for respiratory equipment increases the difficulty of performing operational duties in these areas.

Recommendation Establish a program to eliminate or minimize the source of radioactive contamination in these areas and decontaminate the areas to levels where respiratory requirements are minimized.

Response The Rad-Chem Department will compile a quarterly summary of the status of plant radioactive contamination. This item will be tracked by the Rad-Chem/Technical Support surveillance program schedule. Process changes, engineering controls, and decontamination efforts will be reviewed in the report, with subsequent actions based upon past progress. Copies of the report will be supplied to the Station Superintendent and Assistant Superintendents for review, comment, and action. Procedures will be revised to provide action levels recommending decontamination, based upon contamination levels, radiation exposure rates, and occupancy. These actions will be implemented by April 1, 1982.

Status A quarterly plant contamination status report is presently being developed, as are procedures to provide decontamination action levels. The first report will be issued and the necessary procedures will now be implemented by September 1982.

APPENDIX II

Performance Objectives Reviewed

ORGANIZATION AND ADMINISTRATION

OA.1 Station Organization and Administration

Station organization and administrative systems should ensure effective implementation and control of station activities.

OA.2 Mission, Goals, and Objectives

Station mission, goals, and objectives should be established and progress monitored through a formal program.

OA.3 Management Assessment and Quality Programs

Management should assess station activities to ensure and enhance quality performance of all aspects of nuclear plant operation.

OA.4 Personnel Planning and Qualification

Personnel programs should ensure that station positions are filled by individuals with proper job qualifications.

OA.5 Industrial Safety

Station industrial safety programs should achieve a high degree of personnel safety.

OA.6 Document Control

Document control systems should provide correct, readily accessible information to support station requirements.

OPERATIONS

OP.1 Operations Organization and Administration

The operations organization and administrative systems should ensure effective control and implementation of department activities.

OP.2 Conduct of Operations

Operational activities should be conducted in a manner that achieves safe and reliable plant operation.

OP.3 Plant Status Controls

Operational personnel should be cognizant of the status of plant systems and equipment under their control, and should ensure that systems and equipment are controlled in a manner that supports safe and reliable operation.

OP.4 Operations Knowledge and Performance

Operator knowledge and performance should support safe and reliable plant operation.

OP.5 Operations Procedures and Documentation

Operational procedures and documents should provide appropriate direction and should be effectively used to support safe operation of the plant.

OP.6 Operations Facilities and Equipment

Operational facilities and equipment should effectively support plant operation.

MAINTENANCE

MA.1 Maintenance Organization and Administration

The maintenance organization and administrative systems should ensure effective control and implementation of department activities.

MA.2 Plant Material Condition

The material condition of the plant should be maintained to support safe and reliable plant operation.

MA.3 Work Control System

The control of work should ensure that identified maintenance actions are properly completed in a safe, timely, and efficient manner.

MA.4 Conduct of Maintenance

Maintenance should be conducted in a manner that ensures efficient and effective plant operation.

MA.5 Preventive Maintenance

The preventive maintenance programs should contribute to optimum performance and reliability of plant equipment.

MA.6 Maintenance Procedures and Documentation

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

MA.7 Maintenance History

The maintenance history should be used to support maintenance activities and optimize equipment performance.

MA.8 Maintenance Facilities and Equipment

Facilities and equipment should effectively support the performance of maintenance activities.

TECHNICAL SUPPORT

TS.1 Technical Support Organization and Administration

The technical support organization and administrative systems should ensure effective control and implementation of department activities.

TS.2 Surveillance Testing Program

Surveillance inspection and testing activities should provide assurance that equipment important to safe and reliable plant operation will perform within required limits.

TS.3 Operations Experience Review Program

Industrywide and in-house operating experiences should be evaluated and appropriate actions undertaken to improve plant safety and reliability.

TS.4 Plant Modifications

Plant modification programs should ensure proper review, control, implementation, and completion of plant design changes in a safe and timely manner.

TS.5 Reactor Engineering

On-site reactor engineering activities should ensure optimum nuclear reactor operation without compromising design or safety limits.

TS.6 Plant Efficiency and Reliability Monitoring

Performance monitoring activities should optimize plant thermal performance and reliability.

TS.7 Technical Support Procedures and Documentation

Technical support procedures and documents should provide appropriate direction and should be effectively used to support safe operation of the plant.

TRAINING AND QUALIFICATION

TQ.1 Training Organization and Administration

The training organization and administrative systems should ensure effective control and implementation of training activities.

TQ.2 Non-Licensed Operator Training and Qualification

The non-licensed operator training and qualification program should develop and improve the knowledge and skills necessary to perform assigned job functions.

TQ.3 Licensed Operator Training and Qualification

The licensed operator training and qualification program should develop and improve the knowledge and skills necessary to perform assigned job functions.

TQ.4 Shift Technical Advisor Training and Qualification

The shift technical advisor training program should develop and improve the knowledge and skills to perform assigned job functions.

TQ.5 Maintenance Personnel Training and Qualification

The maintenance personnel training and qualification program should develop and improve the knowledge and skills necessary to perform assigned job functions.

TQ.6 Technical Training for Managers and Engineers

The technical training program for engineers and managers should broaden overall knowledge of plant processes and equipment as a supplement to position-specific education and training.

TQ.7 General Employee Training

The general employee training program should develop a broad understanding of employee responsibilities and safe work practices.

TQ.8 Training Facilities and Equipment

The training facilities, equipment, and materials should effectively support training activities.

RADIOLOGICAL PROTECTION

RP.1 Radiological Protection Organization and Administration

The organization and administrative systems should ensure effective control and implementation of the radiological protection program.

RP.2 Radiological Protection Personnel Qualification

The radiological protection qualification program should ensure that radiological protection personnel have the knowledge and practical abilities necessary to effectively implement radiological protection practices.

RP.3 General Employee Training In Radiological Protection

General employee training should ensure that plant personnel, contractors, and visitors have the knowledge and practical abilities necessary to effectively implement radiological protection practices associated with their work.

RP.4 External Radiation Exposure

External radiation exposure controls should minimize personnel radiation exposure.

RP.5 Internal Radiation Exposure

Internal radiation exposure controls should minimize internal exposures.

RP.6 Radioactive Effluents

Radioactive effluent controls should minimize radioactive materials released to the environment.

RP.7 Solid Radioactive Waste

Solid radioactive waste controls should minimize the volume of radioactive waste and ensure safe transportation of radioactive material.

RP.8 Personnel Dosimetry

The personnel dosimetry program should ensure that radiation exposures are accurately determined and recorded.

RP.9 Radioactive Contamination Control

Radioactive contamination controls should minimize the contamination of areas, equipment, and personnel.

CHEMISTRY

CY.1 Chemistry Organization and Administration

The organization and administrative systems should ensure effective implementation and control of the chemistry program.

CY.2 Chemistry Personnel Qualification

The chemistry qualification program should ensure that chemistry personnel have the knowledge and practical abilities necessary to implement chemistry practices effectively.

CY.3 Chemistry Control

Chemistry controls should ensure optimum chemistry conditions during all phases of plant operation.

CY.4 Laboratory Activities

Laboratory and counting room activities should ensure accurate measuring and reporting of chemistry parameters.

CY.5 Chemical and Laboratory Safety

Work practices associated with chemistry activities should ensure the safety of personnel.