U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-254/86018(DRSS); 50-265/86018(DRSS)

Docket Nos. 50-254; 50-265 Licenses No. DPR-29; DPR-30

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, IL 60690

Facility Name: Quad Cities Nuclear Power Station,
Units 1 and 2

Inspection At: Quad Cities Site, Cordova, Illinois

Inspection Conducted: October 27-30, 1986
Telephone discussion, November 12, 1986

Inspectors: R. B. Holtzman — Date: 11/28/86

M. J. Oestmann — Date: 12/1/86

Approved By: M. C. Schumacher, Chief
Radiological Effluents and
Chemistry Section — Date: 12/1/86

Inspection Summary

Inspection on October 27-30, 1986 (Reports No. 50-254/86018(DRSS); No. 50-265/86018(DRSS))
Areas Inspected: Routine unannounced inspection of plant chemistry and radiochemistry, including management controls and organization, chemistry staffing, water chemistry control program, facilities and equipment, quality assurance/quality control of analytical measurements, and chemical processes and practices of controlling chemical impurities.
Results: No violations or deviations were identified in eight of the nine areas inspected. One apparent violation was identified in the area of laboratory operation for failure to use during May to October 1986, a properly standardized hydrochloric acid solution in the analysis of sodium pentaborate from the standby liquid control system, as required by Technical Specification 6.2.A.1.

DETAILS

1. Persons Contacted

[1]R. L. Bax, Station Manager, Quad Cities Nuclear Power Plant (QCNP)
[2]R. Robey, Superintendent, Services, QCNP
[1]G. Spedl, Assistant Superintendent Technical Services, QCNP
[1,2]J. Sirovy, Radiation - Chemistry Supervisor, QCNP
[1]C. Norten, Quality Assurance Engineer, QCNP
[1]J. W. Wethington, Quality Assurance Engineer, QCNP
[1]M. Kooi, Regulatory Assurance Engineer, QCNP
R. Weibenga, Chemist, QCNP
R. Legon, Chemist, QCNP
J. Woolridge, Chemist, QCNP
R. Knight, Chemist, QCNP
R. Moore, Engineering Assistant, QCNP
S. Willoughby, Quality Assurance Inspector, QCNP
E. Cole, Training Instructor, QCNP
V. Neels, Training Instructor, QCNP
J. Bonucci, Chemical Engineer, Technical Services, CECo
R. Hebeler, Laboratory Foreman, QCNP
J. Dauber, Rad-Chem Technician, RCT, QCNP
J. Rosenow, Radiation Protection Foreman, QCNP
[1]A. Morrongiello, NRC Resident Inspector

The inspector also contacted other chemistry and health physics personnel during this inspection.

[1]Present at the exit meeting on October 30, 1986.
[2]Present at telephone discussion of November 12, 1986.

2. Licensee Action on Previous Inspection Findings

a. (Open) Open Item (50-254/85006-02; 50-265/85006-02): Training of licensee personnel in water chemistry control. A training program in water chemistry control for BWRs is being developed by the licensee's Production Training Center which will be presented in January 1987 as a pilot program to the Dresden plant managerial and technical staff in accordance with the corporate policy in this subject (NSD Directive NSDD-S17, dated August 26, 1986). The training program will be presented later in 1987 to the Quad Cities management personnel. The Quad Cities training department did present a one hour seminar on this subject to the Radiation Chemistry Technician (RCTs) in September 1985. Lesson plans on this subject reviewed by the inspector appeared adequate. This item remains open pending completion of this training for Quad Cities plant management and technical staff.

b. (Open) Open Item (50-254/85006-04; 50-265/85006-04): Full implementation of the licensee's water chemistry control program.

The licensee established an internal working group on BWR water chemistry control program in 1985 to identify specific plant modifications needed and to assign responsibilities for water chemistry improvement modifications in order to carry out NSD Directive NSDD-S17. Tests of plant modifications have been performed and another plan has been developed to implement each modification. Included in the list are improvements in chemistry sampling systems and in-line instruments (see Sections 2 and 5) and modification to the make-up waste demineralization and storage tank waste purification systems. These items of improvements and changes will be made in 1987. This item will remain open pending completion of these modifications.

c. (Closed) Open Item (50-254/85006-05; 50-265/85006-05): Counting room control charts should include daily results to observe trends on counter reliability. The licensee has implemented new control charts on which are plotted the daily results of the check sources and background counts for all the counters, alpha-beta, Ge and Ge(Li) gamma detectors, and the liquid scintillation counter (LSC). These appear to be generally satisfactory.

d. (Open) Open Item (50-254/85006-06; 50-265/85006-06): Licensee plans to upgrade the process instrumentation to meet the chemistry analysis requirements and to perform comparisons between laboratory and plant instrumentation. The inspectors discussed with licensee representatives their plans to improve the chemistry sampling system and plant in-line process monitors to continuously monitor chemical parameters in different plant components and systems. Conductivity monitors at the Reactor Water Recirculation Sample, RWCU Filter Demineralizer Inlet and Outlet and Fuel Pool Filter Demineralizer Inlet and Outlet will be replaced in the Reactor Building Sample Panel in 1987. Replacements of conductivity monitors to be made in 1987 in the Turbine Building Sample Panel include the Condensate Pump Discharge, Condensate Demineralizer Effluent and the Effluent Header and the Final Feedwater. In addition, a dissolved oxygen monitor will be installed on the Final Feedwater. These changes should aid in fully implementing the licensee's BWR water chemistry control program. This item will remain open pending completion of these changes and additions.

3. Management Controls, Qualifications and Training

The inspectors reviewed management controls and staffing of the Chemistry Group in the Radiation - Chemistry Department. Five chemists, a chemistry engineering associate and a laboratory foreman report to the Lead Chemist, who, in turn, reports to the Radiation - Chemistry Supervisor. The Lead Chemist received a B.S. Degree in Chemical Engineering in 1976; his qualifications meet the requirements of ANSI/ANS 3.1-1978. Each chemist has a Bachelor of Science Degree in Chemistry and is assigned specific responsibilities. Laboratory assignments of the RCTs are made by the laboratory foreman. The staffing appears adequate to perform the necessary chemistry functions for the plant.

The foreman supervises the six to eight of a total of 32 RCTs working in the chemistry laboratory at any one time. The foreman helps in training of the RCTs in the operation of laboratory instruments and provides QC samples to the RCTs to test their laboratory proficiency.

The training program for the RCTs was reviewed. It includes formal lectures, OJT experience and supervisory observation in accordance with QCP 1400-6 "On The Job Training for Radiation Chemistry Technicians," approved July 30, 1982. Six newly hired RCTs have completed their 14-week radiation - chemistry training at the Braidwood Production Training Center. All RCTs have also undergone a two-week annual retraining program involving discussions on chemistry control and laboratory practices. Each RCT has also completed the OJT Qualification Course. The inspectors' review of selected qualification cards indicated no problems. About twenty RCTs are ANSI-qualified. The remainder will be after additional experience is obtained. The possibility of having shifts with no ANSI-qualified RCTs on duty appears not to be a problem, since an ANSI-qualified Rad-Chem Foreman is always on duty. No problems were noted in the review of the training and retraining programs for the RCTs.

No violations or deviations were identified.

4. Water Chemistry Control Programs

The inspectors reviewed Revision 1 to the licensee's BWR Water Chemistry Control Program outlined in NSD Directive NSDD-S17 dated August 25, 1986, and noted several changes to the version (Revision 0) discussed in a previous inspection.[1] They included addition of sulfate as a key chemical parameter with limiting concentrations during different plant operating modes, which is consistent with the BWR Owners Group Guidelines, and clarification of action level definitions. A Variance Request Report requirement has also been added. Some of the administrative limits are more restrictive than in Revision 0, such as the achievable value for dissolved oxygen down to 10 ppb rather than 20 ppb for reactor feedwater/condensate at power operation. The licensee has set March 1, 1987 as the date when each BWR station is required to incorporate these requirements into the station's procedures. This item will be reviewed in a future inspection. (Open Items No. 50-254/86018-01; No. 50-265/86018-01.)

In 1985, the licensee prepared new procedures and revised several old procedures to reflect the corporate directive NSDD-S17 (Revision 0), including the following:

QAP 300-22	Water Chemistry Control
QAP 300-T10	Reactor Coolant Conductivity Action Levels
QAP 300-T11	Reactor Coolant Chloride and pH Action Levels
QAP 300-T12	Reactor Coolant Silica and Oxygen Action Levels
QAP 300-T13	Feedwater Chemistry Action Levels
QAP 300-T14	Condensate Conductivity Action Levels
QAP 300 T15	Control Rod Drive and RWCU Chemistry Action Levels
QCP 100-3	BWR Water Chemistry Control

[1]Inspection Reports No. 50-254/85006; and No. 50-265/85006.

QCP 200-3 Reactor Water Conductivity and Chloride

The inspector's review of these procedures and the associated log forms revealed no problems.

The inspectors discussed the implementation of this corporate directive NSDD-S17 with the Radiation Chemistry Department Supervisor and the Production Department Superintendent. The inspectors confirmed that there was close cooperation between the two groups. Management appears knowledgeable in the significance of the directive and willing to devote extensive efforts to implement it.

The inspector reviewed trend plots over time since 1984 showing levels of the key chemical parameters relative to administrative limits and action levels. There have been fewer instances in 1986 when the parameter exceeded the administrative limits. Whenever limits were exceeded appropriate action levels were imposed in a timely manner. The licensee appears to be able to maintain better control over water chemistry than in earlier years.

No violations or deviations were identified.

5. Water Sampling and Process Monitoring

The inspectors observed the sample panels in the Reactor Building and Turbine Building Sample Hoods during a tour of the plant and during RCT sample collection from each panel. The inspectors noted that there was good agreement (within ±5%) between the grab sample conductivity and the RWCU Outlet and Inlet Monitor readings. However, the correlation between the reactor coolant conductivity of the grab sample and the in-line monitor conductivity was difficult to determine because the range of the in-line monitor was much greater (0-10 μmho/cm) than the actual conductivities of less than 0.6 μmho/cm. The use of the high range monitor is related to T/S 3.6.C.4 which allows the conductivity to reach up to 10 μmho/cm. A licensee representative reported that the conductivity measurements of the grab sample are considered more reliable than the in-line measurements. These monitors will all be upgraded in 1987 (see Section 2d).

No violations or deviations were identified.

6. Implementation of the Chemistry and Radiochemistry Programs

The inspectors reviewed aspects of the chemistry and radiochemistry programs, including physical facilities, laboratory operations and QA/QC practices in the laboratory.

The laboratory space and facilities were adequate, in both the cold and hot laboratories. The facilities were clean and well-maintained and the housekeeping was good. The hoods were checked daily to assure that adequate ventilation was available for the chemistry operations and the air flow rate through them was determined quantitatively every quarter.

The Dionex Ion Chromatograph (IC) system, located in a fume hood, was somewhat crowded. A licensee representative stated that they were planning to remodel the laboratory, within a year or so, and to remove the hood to allow more room for the IC. The laboratory also had an automated total organic carbon analyzer (TOC), and a Hitachi UV Spectrophotometer for silica analyses. The ion chromatograph was the primary analytical method for chloride, fluoride, sulfate, nitrites and nitrates in reactor water, while specific ion electrodes were used as backup analytical methods for chloride and fluoride. A Perkin-Elmer Model 5000 Atomic Absorption Spectrophotometer is used for the analyses of trace metals in reactor coolant.

The counting room had good quality counting equipment, three shielded Ge(Li) and one High Purity Ge detector controlled by two Ortec multichannel analyzers and their associated computers. They also had two Tennelec and one Canberra low-level alpha-beta multi-sample proportional counters. All the counting equipment was operational and well-maintained.

The inspectors observed several RCTs collecting and analyzing various samples. The RCTs appeared to be generally knowledgeable about the procedures and laboratory practices and skilled in operating the sample panels. One senior RCT, who had not been in the laboratory for many months, had difficulties in some of the operations, particularly in the IC and TOC analyses. He asked appropriate questions of the Laboratory Foreman and other RCTs about operations of the instruments to help compensate for some of the deficiencies.

The inspectors reviewed implementation of Procedure No. QCP 600-9, "Determination of Sodium Pentaborate," Revision 9, approved May 28, 1986, which is used in the determination of the boron concentrations in the standby liquid control tank. The inspectors noted that the sodium hydroxide titrant was required to be standardized against a 0.1000 N hydrochloric acid standard.

Contrary to this requirement, during the period May to October 1986, the licensee failed to use a certified HCl standard to standardize the sodium hydroxide solution used in this analysis. This is a violation of Technical Specification 6.2.A.1 which requires adherence to written procedures covering systems and components involving nuclear safety of the facility. (Violations No. 50-254/86018-02; No. 50-265/86018-02 - Severity Level IV).

The inspectors had additional concerns about the quality of this procedure for the analysis of boron; it did not require the analysis of replicate samples, and the titrant was neither standardized against the material being analyzed (boron), nor checked against a boron check sample. The licensee is developing a performance procedure and agreed to consider the requirement of duplicate sample measurements. Changes in this procedure will be examined in a subsequent inspection (Open Items No. 50-254/86018-03; No. 50-265/86018-03).

One apparent violation was identified.

7. Implementation of the QA/QC Program in the Chemistry and Radiochemistry Laboratory

The inspectors reviewed the Chemistry/Radiochemistry QA/QC program as described in the procedures and as otherwise implemented in the laboratory. Over the last year or so, the licensee has been developing a non-radiological program to include testing of the RCTs for analytical proficiency, QC performance charts for instrumentation, and a corporate interlaboratory comparison program. A similar program is being developed and used for radiological QA; the use of QC charts to control counter performance and an interlaboratory crosscheck program were instituted. The only QA/QC procedures implemented at present are:

QCP 1400-11 Verification of analytical performance, Revision 2, approved May 28, 1986 and
QCP 1400-12 Quality control program for chemistry instrumentation, Revision 5, approved May 28, 1986.

The inspectors reviewed the RCT performance testing program. Unknown samples for checking the RCTs have been incorporated into the regular analysis program by assigning these samples on the daily laboratory assignment sheets given to the RCTs ("QCNPS Laboratory Assignment Schedule"). These sheets, filled out by the Laboratory Foreman daily, list the analyses to be performed. The RCT then does the assigned performance test samples in his regular schedule. At present, they use mainly vendor-supplied samples from Environmental Research Associates (ERA) relating to waste water to include pH, conductivity, total alkalinity, sulfate, chloride, total organics and trace metals for AA analyses. For the sulfate and chloride analyses, the samples are diluted to bring the test concentrations into the ranges required to be maintained by various procedures. The licensee is presently incorporating a boron performance sample into the high-level boron analysis for the standby liquid control tank.

The performance tests results for the RCTs were collected, reviewed for acceptability (within ±10% of the known values as defined by the vendor), and tabulated by a chemist. These data were then summarized and statistics calculated. Some of the analyses with unacceptable values were repeated, but mainly, at present, the data are collected for the estimation of interlaboratory variability. The results from May 1985 through June 1986 showed variabilities (relative standard deviations) of the results for pH and conductivity to be low ($\leq$ 3%), for sulfate and high-level chloride (3.3 ppm) to be moderate ($<$ 10%), and for low-level chloride (33 ppb) and boron (550 ppb) to be high ($>$ 15%). The results of 29 trace metal analyses (Fe, Cu, Cr, and Ni) by 8 RCTs by atomic absorption, were mostly good, except that 7 of 8 Cr values were substantially greater than the 10% vendor-recommended acceptance limits. This problem appears to be caused by matrix interferences with the Cr analyses, and does not necessarily reflect on the RCTs proficiencies. The chemist is attempting to resolve the problem. Analyses with high variabilities will be reviewed during a subsequent inspection (Open Items No. 50-254/86018-04; No. 50-265/86018-04).

The inspectors reviewed the logsheets and control charts for the instrument performance checks: conductivity of water from the laboratory demineralizer, millivolt readings of the specific ion electrodes in 20 ppb chloride solutions, silica standards on the Hitachi UV Spectrophotometer, and three buffer solutions on the pH meters. These charts appeared to be suitable for control of the procedures and to demonstrate problems that might arise during their operation.

The licensee participates in the corporate interlaboratory comparison program for non-radiological analyses of chloride, fluoride, sulfate, iron, copper, nickel, chromium, and silica in a simulated BWR reactor coolant matrix. The licensee's results for the June 1986 comparison for fluoride and silica were within a few percent of the known values, but those for chloride and sulfate differed by more than 20% from the known (the trace metal results were not submitted). The variabilities of these results were similar to those of the other BWR plants in the program. In the cover letter transmitting the results, the Technical Support Center notified the participants that discussions would be held to determine the causes of the problems with the chloride and sulfate analyses.

The inspectors reviewed the control logbooks and charts for the counting room instruments. Charts were maintained for the alpha and beta performance sources and backgrounds for the Canberra and Tennelec alpha-beta counters. Control limits were set at 95 and 105% of the respective source means. Background limits were set at about three times the maximum value normally expected. Similar charts were maintained for the Ge and Ge(Li) gamma spectrometers using the 356-keV Ba-133 and 1332-keV Co-60 lines. These systems were further controlled by the AAIS system which automatically removes the detector from service when, after a second count, the source values differ from the mean by more than two sigma (counting statistics). The charts for these counters are plotted through the AAIS and updated weekly. The chemist noted that the control will probably be changed to two sigma values, with mean values calculated from the previous monthly or bimonthly data. He noted that the 5% limits presently used are, in most cases equivalent to the three-sigma control limits used by most laboratories.

The usefulness of these controls was demonstrated with the alpha-beta counters in which contaminated planchets were found. Further the inspector noted on the control charts that, while the beta counters appeared to operate statistically most of the time, approximately every other week, a source would give an acceptable, but high value. The chemist and a manufacturer's representative were unaware of the cause; the chemist agreed to check it further, and especially to check for contaminated planchets when this occurs again. This will be followed in a future inspection. (Open Items No. 50-254/86018-05; No. 50-265/86018-05)

The licensee also participated in quarterly radiological crosscheck programs with a vendor, Analytics, Inc., and with the EPA. With the vendor using NRC criteria, the gamma samples in a Marinelli beaker and 47-mm filter (11 nuclides) and H-3 were in good agreement. However, for Sr-89, Sr-90 and

Fe-55 analyses done by the licensee's contractor laboratories, there were substantial number of disagreements (seven of thirteen analyses) with the Analytics, EPA and NRC laboratories. The Lead Chemist had submitted a memo to the Radiochemistry Services Group of the corporate Technical Center asking for a resolution of the problem.

The inspectors discussed with licensee representatives the desirability of extending the assignment of the RCTs to the Chemistry Group beyond the usual eight-to-ten day period. Because of the rotation of the RCTs between Chemistry and Health Physics Groups, the RCTs do not return to the Chemistry Group for a period of eight to ten weeks. This absence from the laboratory results in a loss of laboratory proficiency. The problem is further exacerbated by the fact that some of the RCTs may trade their laboratory time for other duties, and thus spend even less time in chemistry. Licensee representatives agreed with this assessment, but because of labor arrangements could not promise any changes would be forthcoming in the near future. The management is aware of these concerns and is attempting to address them by an improved testing program and modification of the rotation schedule.

This QA/QC program is still under development, but it appears to be progressing acceptably. Data are collected regularly and maintained by the staff. The program is being modified and expanded to include more analyses, e.g., high-level boron, and to assure that each RCT is tested at least annually on analyses required by T/S. This program may be modified to conform to the Corporate QA/QC program being drafted and scheduled for initial implementation early in 1987.

No violations or deviations were identified.

8. Confirmatory Measurements

The licensee collected a liquid radwaste sample which was split with NRC Reference Laboratory, Radiological and Environmental Sciences Laboratory in Idaho Falls, Idaho (RESL). Each laboratory will analyze for gross betas, H-3, Fe-55, Sr-89 and Sr-90 and report the results to Region III. (Open Item 50-254/86018-06; 50-265/86018-06)

9. Plant Systems Affecting Plant Water Chemistry

The inspectors discussed the makeup water treatment system (MUD) with licensee representatives and the changes to the system to improve water quality. The inspectors observed the various components used in treating the well water before it is used for makeup to the plant. The water is processed through a filter and a demineralizer system consisting of cation, anion, and mixed bed demineralizers. By improving system operation, the licensee lowered the conductivity and silica levels to 0.2 μmho/cm and 20 ppb, respectively. The proposed major changes to the MUD will include replacement of the existing operating panel and installation of new in-line conductivity monitors. These changes are to be completed in 1987.

The licensee identified a main condenser tube leak in July 1986 and imposed appropriate action levels in a timely manner. The leaking tubes were plugged before plant operation was resumed.

The inspectors observed the condensate demineralizer system composed of seven Powdex filter/demineralizer units. Only three units were operational during the current inspection since Unit 2 was in an outage. Review of log sheets of analytical results on samples taken from the condensate pump discharge, from each of the condensate demineralizers and of reactor feedwater indicate that the condensate demineralizer system was capable of maintaining feedwater of the required purity.

The inspectors also reviewed the status of the RWCU system to maintain reactor coolant water quality. Continuous sampling stations are located in the influent header and in each effluent line from the demineralizer. Results of samples taken from the effluent during 1986 to date showed that the licensee was able to maintain good reactor coolant quality. Conductivity, chloride, fluoride, and pH were maintained below the administrative guidelines of directive NSDD-S17. At no time were T/S 3.6.C limits on conductivity and chloride exceeded.

It appears that the licensee is able to operate the various cleanup systems in an adequate manner to obtain the desired water quality during plant operations.

No violations or deviations were identified.

10. Decontamination Process

The inspectors observed the London Nuclear Decontamination System set up to remove oxide films in the reactor coolant system. The chemical decontamination processes (CAN-DECON and LOMI) are being used to remove the radioactive oxide films on the recirculation pipes in order to be able to perform in-service inspection of several weld overlays made during a previous outage. The intent is to reduce potential man-rem dose before the inspection is performed.

A licensee representative reported that over 90 curies of radioactive oxides had been removed from the reactor vessel of Unit 2.

The weld overlaps were designed to overlap pipe cracks identified in an earlier outage. The cracks could have been caused by intergranular stress corrosion cracking (IGSCC) resulting from poor water quality used in previous years. The licensee is aware of the importance of maintaining good water quality to avoid IGSCC.

No violations or deviations were identified.

11. Licensee Internal Audits

One onsite and one offsite QA audit and four surveillances on chemistry and radiochemistry control were performed by the licensee's QA Department in 1985 and 1986. The audits had adequate checklists and were comprehensive. Each finding and observation were closed out in a timely

manner. The findings were concerned with calibration of laboratory instruments and their traceability to NBS, records retention, reagent labeling, certification of standard solutions and use of Class A glassware. No findings were identified in the four surveillances reviewed.

No violations or deviations were identified.

12. Open Items

Open Items are matters which have been discussed with the licensee, which will be reviewed further by the inspectors, and which involve some action on the part of the NRC or licensee or both. Open Items disclosed during the inspection are discussed in Sections 4 and 6-8.

13. Exit Meeting

The inspectors reviewed the scope and findings of the inspection with licensee representatives denoted in Section 1 at the conclusion of the inspection on October 30, 1986. The licensee acknowledged the significance of the water chemistry control program to long-term plant reliability and the need to fully implement the corporate directive to improve and monitor desired water quality of plant systems. The licensee acknowledged the inspectors' concerns about the impact of the rotation schedule of the RCTs on their laboratory proficiency and noted that this is an ongoing corporate concern. The licensee was apprised of the possibility that the improper standardization of hydrochloric acid would be a violation. This was confirmed by telephone discussion on November 12, 1986.

In reference to the inspector comments the licensee also agreed to the following actions:

a. Analyze a split liquid radwaste sample for gross beta, H-3, Sr-89, Sr-90 and Fe-55 and to report the results to Region III.

b. To use a standard reference material, such as potassium acid phthalate, to standardize the NaOH solutions in the sodium pentaborate analysis when standardized HCl is not available.

During the inspection, the inspectors discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspectors during the inspection. Licensee representatives did not identify such documents or procedures as proprietary.