U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-454/85022(DRSS); 50-455/85020(DRSS)

Docket Nos. 50-454; 50-455 Licenses No. NPF-37; CPPR-131

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

Facility Name: Byron Nuclear Power Station, Units 1 and 2

Inspection At: Byron Site; Byron, Illinois

Inspection Conducted: May 6, 7, and 10; June 5-7, 10-14 and 27, July 8-9, and 22, 1985

Inspectors: D. E. Miller for — 8/7/85 Date

R. A. Paul for — 8/7/85 Date

N. A. Nicholson for — 8/7/85 Date

P. C. Lovendale — 8/8/85 Date

Approved By: L. R. Greger, Chief
Facilities Radiation Protection Section — 8/7/85 Date

Inspection Summary

Inspection on May 6, 7, and 10; June 5-7, 10-14, and 27; July 8-9, and 22, 1985 (Reports No. 50-454/85022(DRSS); 50-455/85020(DRSS))

Areas Inspected: Nonroutine, announced inspection of the radiation protection program including: circumstances surrounding personal exposures greater than station limits; a personal contamination incident; the radiation protection program associated with startup activities; ALARA program; exposure controls; training and qualifications; organization and management controls; two unplanned volume control tank releases; an unplanned boric acid evaporator release; Unit 2 condensate sump overflow; and licensee action on previous findings. The inspection involved 182 inspector-hours onsite by five NRC inspectors.

Results: Several violations were identified (failure to follow radiation protection procedures - Sections 5, 6, 7, and 13; inadequate instructions to workers - Section 5; inadequate high radiation area controls - Section 5; inadequate evaluation of radiological conditions - Section 6; lack of adequate procedures - Sections 5 and 14). Enforcement conferences were held June 27, 1985 and July 22, 1985 to address the inspection findings.

DETAILS

1. Persons Contacted

W. D. Britton, Quality Insurance Inspector
W. Burkamper, Quality Assurance Supervisor
R. A. Chrzanowski, Security Administrator
T. P. Joyce, Operating Engineer
J. Langan, Licensing
W. McNeill, General Instructor
R. E. Querio, Station Superintendent
F. Rescek, Technical Health Physics Supervisor, CECo
D. St. Clair, Technical Staff Supervisor
M. Snow, Compliance Department
J. R. Van Laere, Radiation-Chemistry Supervisor
G. Wagner, Power Operations Manager, CECo
R. C. Ward, Assistant Superintendent Administration and Support Services
K. T. Weaver, Station Health Physicist

J. A. Hinds, Senior Resident Inspector, NRC

The above personnel attended the June 14, 1985 exit meeting.

The inspectors also contacted members of the operations, rad/chem, technical, mechanical, training, security, and engineering staffs during this inspection.

2. General

This inspection, which began at 10:30 a.m. May 6, 1985, included reviews of the circumstances surrounding a personnel entry into the incore motor drive area resulting in exposures exceeding station limits, personnel entry into containment and subsequent exposures greater than administrative limits, and a contamination incident resulting from maintenance work on a CVCS valve. Also reviewed were neutron surveys conducted at specified power levels; two unplanned VCT releases; circumstances regarding an unplanned boric acid evaporator release and overflow into the Unit 2 condensate pump area; routine operations of the ALARA, exposure control, contamination control, and training programs; and rad/chem staff qualifications and stability. Direct surveys of the plant taken during tours were in general agreement with licensee data.

3. Licensee Action on Previous Findings

(Open) Open Item (454/85014-020): Review neutron survey data. The licensee continues to conduct and review neutron surveys. This is discussed more completely in Section 8.a.

4. Organization and Management Controls

The inspector reviewed the licensee's organization and management controls for the radiation protection and radwaste programs including

changes in the organizational structure and staffing, and effectiveness of procedures and other management techniques used to implement these programs.

Twenty-seven qualified radiation-chemistry technicians (RCTs), are available for shift work; RCTs perform both chemistry and health physics functions. Seven RCTs in training are expected to be qualified by July, 1985. RCTs report to one chemistry foreman and six health physics foremen who in turn report to a lead foreman. The professional staff includes health physics and chemistry support, in addition to ALARA, GSEP, and TLD coordinators. Management and professional staff report to the Station Health Physicist who in turn reports to the Radiation-Chemistry Supervisor. The Radiation-Chemistry Supervisor is the station's radiation protection manager as defined by Regulatory Guide 1.8. The Radiation-Chemistry Supervisor reports to the Assistant Superintendent for Administration and Support Services in accordance with TS 6.2.1.

Staff stability was reviewed. This department has experienced a fairly low turnover rate during the past two years; two RCTs left the organization and three were promoted. A total of 42 RCT positions are allotted for Unit 1 operations and Unit 2 startup testing. Until those positions can be filled, the licensee plans to rely on contracted technicians, who are expected to be onsite within the next month. A significant amount of overtime has been necessary to complete assigned radiation protection coverage and technical specification surveillances and samples; the RCT staff has been working 12 hour shifts, five days a week since January 1985. Relief is anticipated with the newly qualified RCTs and contracted technicians.

No apparent violations were identified.

5. Personal Exposures Greater Than Administrative Limits

On May 1, 1985, the licensee notified the resident inspectors that two station electrical maintenance (EM) workers exceeded their administrative dose limits (100 mrem/day) while working in a high radiation area (HRA) earlier that day. The following scenario was developed based on regional inspectors' interviews with the following involved personnel: shift engineer (SE), technical staff engineer, health physics (HP) foreman, EM foreman, two RCTs, and two EMs.

At approximately 11:00 p.m., the "A" incore detector became stuck behind the seal table shield wall during Unit 1 flux map startup testing conducted on the backshift of April 30-May 1, 1985. (Refer to Attachment 1 for a diagram of the incore detector drive train.) The reactor was at 48% power. A faulty electrical relay in the "A" incore drive motor on the 411' level of containment was thought to be the problem. The SE initiated a work request for two EMs to locally reset the relay. Relatively low radiation levels were expected in the vicinity of the incore drives since the incore detectors, other than the stuck incore, were in their shielded storage positions and the stuck incore was behind a shield wall. However, before the work commenced, the technical staff developed a temporary procedure to remotely free the detector, and the work request for containment entry was cancelled.

The temporary procedure failed to release the "A" detector, and at approximately 2:30 a.m., the SE telephoned the HP foreman to reinstate a work request for the local incore drive repair. The SE expressed an urgency to complete this repair. The HP foreman outlined Radiation Work Permit (RWP) options, including a Type II RWP for emergency entry which did not require a prejob survey but which specified continual RCT surveillance. This type of RWP was selected and used for the first time in the plant's brief operating history. During the attempt to remotely free the stuck detector using the improvised temporary procedure, the other five moveable detectors were withdrawn from their previously shielded positions to the 5-path positions at the incore drive motor area, near the relay which was suspected to have malfunctioned. The technical staff and control room personnel involved in the flux mapping procedure were aware of the new detector positions and the associated potential radiological hazard, but did not convey this information to the SE or HP foreman. Although the radiation environment was discussed earlier in preparation for the canceled work, no comparable discussion occurred between the SE and the HP foreman for this work. The HP foreman was not aware of the change in the detector positions nor the corresponding high radiation fields. His actions were based on previous survey data of the drive area (approximately 5 mR/hr) when the detectors were in a shielded position. The SE was also unaware of the changed incore detector positions and the resultant radiological hazard in the vicinity of the incore drive motors.

The SE notified the EM department to prepare for the job. The HP foreman began to complete RWP 50147 (emergency) for this entry. He authorized the EMs doses to 100 mrem/day on the RWP in accordance with BRP 1140, Radiation Work Permit. The RCTs assigned to this job signed in on standing radiation/chemistry prejob survey RWP 50106 instead of RWP 50147 (emergency). The HP foreman instructed the RCTs to conduct a jobsite survey at the incore motor drive area, in addition to a routine containment survey and sample collection. He told the RCTs to telephone the jobsite dose rates to him for RWP 50147 completion, even though dose rate information is not needed to initiate an emergency RWP by licensee procedures. When questioned, the HP foreman stated he confused the RWP for emergency entry requirements with those of a prejob survey. Specific instructions regarding the required continual RCT surveillance of the EMs were not discussed with the RCTs, who were unaware that the EM's entry was to be made under a Type II RWP for emergency entries. The prejob instructions were inconsistent with RWP 50147 requirements.

The RCTs departed from the health physics office. The HP foreman then briefed the EM foreman and EMs. The HP foreman issued audible, integrating, alarming dosimeters (digidoses) to the EMs and stated the alarm setpoint was 90 mrem. He did not inform the EMs that the digidoses' increasing chirp rate corresponded to increasing radiation levels, nor did he specifically instruct the EMs to leave the area if the digidoses alarmed. Because the digidoses had been used for only a short time at the Byron Station, their use was not addressed during NGET training according to a station instructor. One of the EMs, however, had previously used digidose instruments at another CECo facility. The EMs briefly reviewed RWP 50147; the HP foreman indicated this was an emergency entry RWP with RCT

coverage, but did not specifically state that continuous RCT surveillance was required. Jobsite radiation dose rates, based on previous surveys, (5 mR/hr) were briefly discussed. Neither dose rates nor stay times were recorded on RWP 50147 at that time. The EM foreman stated he was told these dose rates were low, approximately 5 mR/hr; he stated he was not aware of the detectors' withdrawn positions.

The two RCTs entered containment at approximately 3:09 a.m. In accordance with the HP foreman's instructions, routine airborne samples and direct surveys enroute to the jobsite were taken. Dose rates increased to 200 mR/hr as the RCTs descended the stairs to the 411' incore drive area; a significant increased digidose chirp rate was noted. Dose rates at the bottom of the stairs a few feet from the drive units were 5 R/hr; general area readings in the vicinity of the incore drive units were approximately 5-7 R/hr. The RCTs exited the area after an estimated 30-second stay time. The survey results were not called back to the HP foreman because of poor phone capability, the high noise level, and wearing of full-face respirators. The RCTs collected another sample and exited containment via an alternate route to avoid the high fields at the incore drive area.

At approximately 3:24 a.m., the EM's entered containment and proceeded directly to the incore drive motor area. Although they did not find the RCTs at the jobsite as anticipated, they proceeded with the job because the previous survey results discussed with them indicated low dose rates; they assumed these levels did not warrant RCT coverage. They apparently were not alerted to the elevated dose rates because they wore earplugs in addition to full-facepiece respirators and could not hear the increasing digidose chirp rate. The EMs removed the incore drive motor cover and reset the relay. They remained in the area "briefly" to finish the job after hearing their digidoses alarm. It could not be determined at what time the EMs first heard the alarms. They were in the area of the incore drives for approximately 3 minutes; the alarms should have sounded after approximately 1 minute in the area. When the RCTs exited containment the security guard and the EM foreman at the personnel hatch informed the RCTs that the EMs had entered containment earlier and were still inside. The RCT with the lowest dose immediately returned to containment to retrieve the EMs, whom he met a few feet from the hatch; both EMs' digidoses were alarming. They all exited containment.

The EMs' pencil dosimeters (0-200 mrem) were offscale. Initial digidose readouts for the two EMs were 299 and 279 mrem. Whole body film badge results, received at 4:00 p.m. that day, indicated doses of 340 and 280 mrem, respectively. The film badges should be reflective of the actual whole body dose based on their location (chest) and the radiation surveys of the work location. Extremity doses should not have been significantly higher than the whole body doses since the EMs were not working in close proximity to an individual incore detector. The dose rates could have been higher, however, had the incore detectors been exposed at a higher flux rate or for a longer time period, or if the work had been conducted sooner after retraction of the incore detectors from the core. Work area dose rates could have been approximately an order of magnitude higher under less favorable circumstances.

Several problems apparently led to this unplanned exposure.

- The SE, HP foreman, RCTs, and EMs were unaware of the withdrawn position, of the incore detectors, and the associated high radiation fields while planning this entry. This resulted from (1) inadequate communications between the technical and control room staff involved in the flux mapping procedure, who were aware of the potential radiological hazard, and the SE, who stated he was unaware of the incore detector locations and the radiological hazards, and (2) inadequate followup by the SE and HP foreman to verify the incore detectors' positions. Also the HP foreman and RCTs did not recognize the inherent radiological hazards associated with the incore detectors. A review of the radiation-chemistry training program indicated that no formal training addressing reactor systems and associated radiological conditions had been provided to radiation protection personnel.

- The incore detectors, other than the stuck detector, should have been returned to their shielded storage positions prior to a containment entry. They were not, partially due to the communication and evaluation problems noted above, but also because of the lack of adequate precautions in the procedure used for flux mapping. Flux map testing was conducted in accordance with BOP-IC-03, Incore Moveable Detectors - Partial Core Flux Mapping, just before the detector became stuck. This procedure did not include a restriction prohibiting containment entry while the incore detectors were withdrawn as did a comparable procedure, BOP-IC-01: Incore Moveable Detectors - Flux Mapping Procedure. It is standard practice to prohibit containment entry with the incore detectors in unshielded locations.

- Use of the RWP system and worker instructions by the HP foreman were not adequate. As noted above, the HP foreman did not possess adequate knowledge of the potential radiological hazards associated with the proposed work. However, appropriate implementation of radiological controls still could have minimized worker exposures. The Type II RWP for emergency entry was used to meet an "urgent" situation, as perceived by the SE. This RWP use was initially justified by licensee personnel to prevent a reactor trip, one of the conditions specified by BRP 1140-1, Radiation Work Permit, that permits an emergency entry; however, a reactor trip was apparently not an immediate threat as indicated by maintained steady power levels throughout the shift. The lack of familiarity with the emergency RWP provisions and its first implementation at Byron led to considerable confusion. This was reflected by the HP foreman's inconsistent directions to the EMs and RCTs, the RCTs' use of a standard RWP for prejob surveys and the EMs' use of an emergency RWP requiring continual RCT surveillance, the unfamiliarity of all involved personnel with procedures surrounding use of the emergency RWP, and the inadequate instructions given to the EMs concerning digidose use and RCT surveillance.

- The EMs did not terminate their work and exit containment immediately upon recognition that their digidose monitors were alarming.

- No area monitor was located at the incore drive area; therefore local radiological conditions could not be predicted before entry. An area monitor was located in the 401' level seal table room, which is shielded from the incore drive area by approximately 36 inches of concrete. This monitor readout reflected the stuck incore detector but not the other five incore detectors at their five-path position near the jobsite. Although it was determined that the rad/chem personnel involved in this event were unaware of the monitor's location, this weakness did not affect the licensee's involvement in this incident since the monitor readout was not evaluated by the rad/chem personnel before this entry.

The following apparent violations were identified based on this incident.

- 10 CFR 50, Appendix B, Criterion V states activities affecting quality will be prescribed by documented instructions, procedures, or drawings appropriate to the circumstances. The operating procedure in use did not restrict containment entry by personnel when the incore detectors were unshielded. (Violation 454/85022-01)

- 10 CFR 19.12 requires instructions in radiological conditions and precautions be given to individuals entering the restricted area commensurate with potential radiological health conditions. The two EM workers were not adequately instructed regarding: (1) continual RCT attendance; (2) digidose use; and (3) current jobsite radiation levels. (Violatior 454/85022-02)

- TS 6.12.2. states an approved RWP will specify dose rates and stay times for individuals entering radiation fields greater than 1,000 mR/hr; in lieu of stay times, but not of dose rates, continuous RCT surveillance may be used. RWP 50147 for the May 1, 1985 incore detector repair job did not specify stay times or dose rates, nor was continual RCT surveillance provided for two EM workers who entered fields above 1,000 mR/hr. (Violation 454/85022-03)

- BRP 1140-1, Radiation Work Permit, Section E.1 states emergency entries are to be made with an RCT in continual attendance at the jobsite. Section C.3 of this procedure states workers signing an RWP must comply with its requirements. Continual RCT attendance at the jobsite was not maintained for two EM workers who made emergency entries into containment. Further, these workers, who signed RWP 50147 for this entry, exceeded the 100 mrem/day limit specified by this RWP. (Violation 454/85022-04)

- BRP 1000-A1, Work In Controlled Areas - Personnel Conduct, states a worker should leave the controlled area as quickly as possible when the dose equivalent equals the exposure authorized for the job. The EM workers remained in the controlled area after exceeding their authorized exposure limits. (Violation 454/85022-05)

Several apparent violations were identified.

6. Personal Contamination Incident

On July 1, 1985, a mechanical maintenance crew consisting of a foreman, an "A" mechanic, and a "B" mechanic, removed contaminated insulation from a leaking CVCS valve without using protective clothing and without prior notification of the Rad/Chem Department. As a result, the "B" mechanic's hands and clothing were contaminated, and the "A" mechanic's shoes were contaminated. Based on discussions with the involved personnel, including the mechanical maintenance foreman, the "B" mechanic, the "A" mechanic, and radiation protection personnel, the following scenario was developed.

The mechanical maintenance foreman was assigned to evaluate needed repairs for a leaking CVCS relief valve located about 20 feet above the floor of the 364-foot elevation piping penetration area. At about 2:00 p.m. the foreman entered the area under a general entry radiation work permit (RWP 5-0004) and climbed into the overhead to observe the leaking valve. He determined that the insulation around the valve had to be removed before he could determine the exact source of the leak. At about 2:30 p.m., the foreman returned to the area with the two mechanics. All three workers climbed into the overhead and removed the insulation from the leaking valve and the surrounding piping. The "B" mechanic removed the majority of the insulation with some assistance from the foreman. The "A" mechanic held open a plastic bag for the waste material. After completing the insulation removal, all three workers exited the area and proceeded to the 401-foot elevation where they used a personal contamination monitor (frisker) to survey themselves. When the "B" mechanic moved his hand within about four inches of the probe, the alarm sounded. All three workers then proceeded up the stairs to the 426-foot elevation where they entered the decon room, and at the direction of the foreman, washed their hands. An RCT passing by the decon room observed the workers washing their hands and, after summoning assistance, took charge of the decontamination. All but very small amounts of contamination were removed from the "B" mechanic's hands. No further traces of the contamination could be detected by July 3, 1985. Shoe contamination on the "A" mechanic was also removed. All three workers received whole body counts. No internal radioactivity was detected. The exact magnitude of the skin contamination is not known since the Rad/Chem Department was not given the opportunity to perform an initial survey of the mechanic's hands. Based on a contamination survey of the insulation material removed, the licensee estimated the skin contamination to have been about 125,000 dpm per 100 square centimeters.

Before the initial entry into the 364-foot piping penetration area to inspect the leaking valve, the foreman claims to have contacted the rad/chem office by phone and then in person on his way into the plant. According to the foreman, on both occasions he asked the rad/chem representative, "any problem in the 364-foot piping penetration area?", to which the rad/chem representative replied, "no". However, none of the eight rad/chem personnel on shift at that time could recall any contact with the foreman. Even if he had contacted rad/chem, the information exchanged was not adequate to assess the radiological hazards associated

with the foreman's task of climbing into the overhead (unsurveyed area) to inspect the leaking valve. The foreman could not identify any of the rad/chem representatives that he stated he had contacted either by name or by physical description. During the interview with the inspectors, the foreman stated that he was in possession of the work request, which clearly indicated that the valve was leaking radioactive liquid and was causing the surrounding area to become contaminated, that he was aware that the chemical and volume control system (CVCS) contained radioactive liquid, and that the door leading to the 364-foot piping penetration area was posted with a sign which read, "Contact Rad/Chem Before Entry." Based on this, it appears that the foreman should have been aware that information regarding protective clothing requirements, area dose rates, and special radiological precautions should have been requested from the rad/chem office before he entered to inspect the leaking valve under the general entry RWP.

Technical Specification 6.11 states that radiation protection procedures shall be approved, maintained and adhered to. Procedure BRP 1000-A1, Radiological Control Standards, states that the job supervisor shall contact the Rad/Chem Department for protective clothing requirements, dose rates, and special radiological precautions before entering a controlled area. 10 CFR 20.201(b) requires an evaluation or survey be conducted of the radiological conditions to determine the extent of the radiation hazards that may be present. The foreman's failure to obtain adequate information from the Rad/Chem Department regarding the radiological conditions in the vicinity of the leaking CVCS relief valve before entering the area is a violation of this procedural requirement and 10 CFR 20.201(b). (Violation 454/85022-06)

After arranging for the two mechanics to assist him, all three proceeded to the 364-foot piping penetration area. They did not contact the rad/chem office regarding their intent to remove the insulation from the leaking CVCS relief valve, but the "B" mechanic reportedly asked the foreman while enroute to the work area if they should stop and confer with a rad/chem representative regarding their task. The foreman reportedly answered "no", and did not indicate that he had already contacted rad/chem. Upon arrival at the 364-foot piping penetration area. the mechanics observed that the door to the area was posted with a sign stating "Contact Rad/Chem Before Entry," and that the leaking valve was dripping liquid into a funnel normally used for containment of radioactive liquids. A hose connected to the funnel was directing the liquid to a floor drain and was held in place by a sticker which read "Radioactive Material." The "B" mechanic reportedly again asked the foreman if they should contact the rad/chem office or wear protective clothing to remove the insulation. The foreman reportedly answered "no" and stated that "it wasn't that bad", an apparent reference to the amount of contamination present. As the job of removing the insulation progressed, the foreman reportedly stated that "maybe we should have worn gloves, but it's too late now." At no time did the foreman stop the job, even though he apparently knew they were handling radioactively contaminated material without the proper protective clothing.

Technical Specification 6.11 states that radiation protection procedures shall be approved, maintained and adhered to. Procedure BRP 1000-A1,

Radiological Control Standards, states rules to minimize the spread of contamination as follows: (1) observe radiological precautions on all signs and labels; (2) assume surfaces are contaminated unless otherwise indicated; (3) utilize work practices to minimize contamination spread; and (4) consult the Rad/Chem Department before uncovering contaminated equipment or disassembling potentially contaminated material. In addition, this procedure states the job supervisor shall contact the Rad/Chem Department for protective clothing requirements, dose rates, and special radiological precautions before entering a controlled area. 10 CFR 20.201(b) requires an evaluation or survey be conducted of the radiological conditions to determine the extent of the radiation hazards that may be present. The foreman's failure to observe posted radiological precautions, observe good work practices, and consult with the Rad/Chem Department concerning evaluation of the radiological hazards present is a violation of these procedural requirements and 10 CFR 20.201(b). (Violation 454/85022-06)

After removing the insulation from around the leaking valve, all three workers proceeded to the 401-foot elevation of the auxiliary building where they surveyed themselves for contamination. The "B" mechanic stated he thought he was contaminated, even before he began the survey, because he was sure the insulation was contaminated. When he moved his hand within about four inches of the probe, the alarm sounded. All three, at the direction of the foreman, proceeded to the decontamination room located on the 426-foot elevation. Both mechanics and the foreman stated that they knew of the posting at the personal contamination monitoring station which requires immediate notification of the rad/chem office if they find they are contaminated. However, the foreman directed the two mechanics to proceed to the decontamination room even though the "B" mechanic questioned whether rad/chem should be notified. Upon entering the decon room, all three workers began washing their hands without a rad/chem representative in attendance. As a result, the Rad/Chem Department was unable to determine the extent of contamination initially present on the mechanic's hand and had to estimate skin dose (which was minimal based on surveys of the material handled). Although the foreman stated that he left the two mechanics in the decon room and went to the rad/chem office to summon assistance, and that an RCT returned with him to the decon room, the mechanics stated that the foreman remained in the decon room with them from the time they first entered until after a passing RCT noticed their activities and assumed the decontamination responsibilities. None of the rad/chem personnel on shift recalled any contact with the foreman, nor could the foreman identify the RCT he stated he contacted by name or by physical description.

Technical Specification 6.11 states that radiation protection procedures shall be approved, maintained and adhered to. Procedure BRP 1000-A1, Radiological Control Standards, requires that workers observe radiological precautions on all signs and labels. Procedure BRP 1470-1, Personal Decontamination, states deconning methods should only be conducted under the direction of trained individuals, usually rad/chem personnel. Failure to adhere to the reporting requirements posted at the personal monitoring station concerning rad/chem notification, and performing the decon procedure without a rad/chem representative in attendance is a violation of these procedural requirements. (Violation 454/85022-07)

The licensee initiated followup and investigative actions after this event. A dose assessment for the "B" mechanic's skin showed less than 5 mrem, well within the 10 CFR 20 limit of 7.5 rem per quarter. The three mechanical maintenance personnel were whole body counted July 1, 1985; the "B" mechanic had a followup count July 2, 1985. No internal depositions were identified.

The Station Superintendent met with the maintenance and rad/chem departments on July 3, emphasizing radiation workers' responsibilities. On July 4, 1985, the decontamination room door was reportedly posted with a notice to contact rad/chem before initiating personal decontamination.

A Radiation Occurrence Report (85026) briefly describing this event was written immediately after the Rad/Chem Department was notified at approximately 2:30 p.m. July 1, 1985. The Station Health Physicist conducted a group interview with involved personnel the following morning to obtain an account of the event. Individual interviews of the mechanics were hampered because of their vacation schedules. All three mechanical maintenance personnel had been interviewed by July 9, 1985, eight days after the incident. The station's account did not differ significantly from the inspectors'. CECo corporate health physicists conducted a two hour onsite review July 3, primarily interviewing the mechanical maintenance foreman and Station Health Physicist.

Several apparent violations were identified.

7. April 17, 1985 Containment Entry

A review of licensee Radiation Occurrence Reports (RORs) identified another case of exceeding administrative dose limits during a containment entry when the reactor was at 20% power. This occurred April 17, 1985, when a shift foreman (SF) and an equipment attendant (EA), accompanied by an RCT, entered containment to locate an RCS leak. Dose limits for the entry were approved to 200 mrem under a Type II RWP with continual RCT attendance for dose monitoring. The three wore full sets of protective clothing and respirators; digidoses with alarm setpoints of 150 mrem were issued. This crew entered containment and initially inspected low dose areas outside the missile barrier, accumulating a total dose of < 5 mrem for each individual. At the shift foreman's direction, the three crossed inside the missile barrier, into a significantly higher dose area, to inspect the "D" reactor coolant pump (RCP). The RCT and SF ascended a ladder to inspect a piping area (general fields 2-3 R/hr) near the RCP; the EA remained at the base of the ladder acting as a safety attendant. Doses at the ladder base were approximately 60 mrem. Following a brief tour of the piping area with the RCT, the SF proceeded approximately ten feet toward the pressurizer to inspect a valve without the RCT. He returned to the RCT and the three exited containment; the RCT's and SF's digidoses were alarming. While the RCT remained at containment access removing his protective clothing, the SF and EA reentered containment to retrieve the SF's flashlight which had been mistakenly left behind. The SF was concerned that the last flashlight might violate TS 4.52.c, which prohibits loose debris inside containment during plant operation. At this point, licensee reports indicate the SF's dose was approximately 180 mrem, the EA's approximately 120 mrem, and the RCT's approximately 250 mrem.

The SF and EA, aware they were approaching their limits, initially remained outside the missile barrier; however, they did not find the flashlight and decided further search inside the missile barrier was necessary. Since the EA had a lower accumulated dose, he initiated a search of the piping area the SF and RCT had toured earlier. The EA reportedly exited the piping area when he noted his digidose readout was approaching the 200 mrem limit. Meanwhile, the SF, concerned that the EA had not returned, entered the piping area to search for the EA. The SF exited the area and met the EA at the missile barrier. Both exited containment without having found the flashlight. Final doses were 260 mrem (SF), 295 mrem (EA), and 254 mrem (RCT). These doses indicate the three remained in the controlled area after exceeding their authorized dose limits, an apparent violation of BRP 1000-A1 which states a worker should leave the controlled area as quickly as possible when reaching his authorized exposure. (Violation 454/85022-05)

The involved personnel failed to follow RWP directions. Although they were aware of their dose limits and took cursory measures to remain within these limits, they did not heed the specific requirements of the RWP. These actions, and resulting consequences, were in violation of BRP 1140, Radiation Work Permit, which states the requirements of the RWP must be complied with. Contrary to this, doses for the three individuals exceeded the 200 mrem limit authorized on the RWP. In addition, the RCT did not remain in continual attendance with the SF and EA as specified by the RWP. Lack of continuous RCT surveillance for workers entering radiation fields greater than 1000 mR/hr is a violation of TS 6.12.2. (Violation 454/85022-08)

Management followup on this event was not initiated until May 14, 1985, apparently because the ROR describing the event had been misplaced before management review. Further investigations were delayed because of time conflicts with the May 1, 1985 incore area entry (Section 5). Comprehensive management review was initiated July 13, 1985.

Violations were identified as noted.

8. Radiation Protection - Startup

a. Startup Surveys

Neutron surveys at 75% power levels were reviewed. Neutron levels throughout containment and at the personnel hatch remain higher than anticipated presumably because of a nozzle shield cover design.[1] This situation and applicable dose reduction resolutions were addressed in an April 30, 1985 memo to the station superintendent from the ALARA coordinator. A permanent design modification, anticipated to reduce neutron streaming, has been approved. This modification has been rescheduled for the November outage after equipment unavailability and time constraints precluded installation during the July shutdown. If a significant reduction in observed

1 IE Report No. 50-454/85014; 50-455/85009

neutron levels result from this modification, it would be implemented at Byron Unit 2 and Braidwood Units 1 and 2. Interim dose reduction measures at Byron Unit 1 include installation of water shields outside the hatch and proposed poly shielding to be hung inside the hatch.

A contractor study was recently completed of general neutron dose rates, fields and energies at various power levels. The final report has not yet been published.

b. Facilities

Facility and equipment differences between the two units were evaluated to determine an impact on radiological practices and/or procedures. The Radiation-Chemistry Supervisor did not identify any significant differences.

No apparent violations were noted.

9. Training and Qualifications

The inspector reviewed the training and qualifications aspects of the licensee's radiation protection, radwaste, and transportation programs, including: changes in responsibilities, policies, goals, programs, and methods; qualifications of newly hired or promoted radiation protection personnel; and provision of appropriate radiation protection, radwaste, and transportation training for station personnel. Also reviewed were management techniques used to implement these programs and experience concerning self-identification and correction of program implementation weaknesses.

To meet ANSI N18.1-1971 criteria referenced by TS 6.3.1, twenty-seven RCTs have completed the training/certification program described below. Those with less than two years' experience work under appropriate rad/chem supervision. These RCTs are certified for backshift coverage. All chemistry and health physics foremen meet ANSI N18.1-1971 qualifications for non-licensed supervisors. The Radiation Chemistry Supervisor (the designated Radiation Protection Manager) and the Station Health Physicist meet Regulatory Guide 1.8 RPM qualifications in accordance with TS 6.3.1.

These 27 certified RCTs have completed a training/qualifications program of twelve weeks coursework, four weeks laboratory/work exercises, four weeks of OJT, and completion of certification guides in accordance with BRP 1920, RCT Certification Guides. Tests scores, and certification sheets were reviewed; no problems were noted.

The inspector noted that over half of the RCT certification sheets for shipment surveys (BRP 1930, T8) had not been completed; waivers had been issued in accordance with applicable procedures. The Station Health Physicist is establishing a schedule to complete these waivers. According to the Rad/Chem Supervisor, currently these surveys are completed under a foreman's supervision.

Coursework was reviewed. No specific, formal training on radiological hazards associated with plant systems was given to RCTs or HP foremen. This was perceived as a programmatic weakness, contributing to the May 1, 1985 incore drive area entry (Section 5). This was discussed at the exit.

The majority of RCTs do not have extensive operational nuclear plant experience; their backgrounds are comprised primarily of preoperational and startup experience. Approximately 18 RCTs worked at Quad Cities Nuclear Station during an outage to gain operational experience.[2] Other RCTs completed the above training program with brief tours of other CECo facilities.

No apparent violations were identified.

10. Maintaining Occupational Exposures ALARA

The inspector reviewed the licensee's program for maintaining occupational exposures ALARA, including: changes in ALARA policy and procedures; worker awareness and involvement in the ALARA program; establishment of goals and objectives, and effectiveness in meeting them. Also reviewed were management techniques used to implement the program and experience concerning self-identification and correction of program implementation weaknesses.

A formal ALARA program is being developed in accordance with BAP 700, ALARA, under the direction of the ALARA coordinator, a former SRO at Braidwood with equipment attendant and health physics experience at the Byron station. Exposure goals for each department for 1985 have been established. The station ALARA committee, represented by the three departmental superintendents, meets quarterly; minutes reviewed indicated dose reduction considerations were addressed at the last two meetings.

A job history file is being assembled to facilitate future job planning which will track individual job data by RWP, component/equipment number, job, and workers' names. Radiological information stored and retrieved includes airborne and contamination levels, workers' doses, contact doses, stay times, and man-rem estimates. This job file will be expanded when the station gains computer access to the corporate ALARA program around September 1, 1985.

Currently, the ALARA coordinator relies on job histories maintained by the Zion station for planning activities. ALARA reviews of selected RWPs in accordance with BAP 700-2, ALARA Reviews, were reviewed by the inspector. A checklist of dose reduction measures is followed; no problems were noted. Dose estimates were comparable to actual job doses. A prejob briefing was held for the ALARA reviews. Rad/chem representatives attend the morning meeting as a job planning and awareness measure.

Photographs of equipment have been posted outside higher dose rooms throughout the auxiliary building to reduce workers' stay times in these areas. A complete set is kept by the rad/chem department.

2 IE Report No. 50-454/83008; 50-455/83006

To promote worker awareness of ALARA, an ALARA suggestion box has been established with awards given to notable dose saving measures. Posters promoting ALARA are planned.

The contamination control program was reviewed. Currently, the ALARA coordinator has defined 4400 square feet of the auxiliary building as contaminated (> 1000 dpm/100 cm^2) or less than 1% of the total area. The plant goal is to maintain the contaminated portion of the auxiliary building at less than 5%. All of containment is posted as a contaminated area. Daily surveys are reviewed; contaminated areas are targeted for cleanup by four designated deconners. Decontaminated areas are tracked; their location and source of contamination noted.

No apparent violations were identified.

11. Exposure Controls

a. External Controls

The inspector reviewed the licensee's external exposure control and personal dosimetry programs, including: changes in facilities, equipment, personnel, and procedures; adequacy of the dosimetry program to meet routine and emergency needs; planning and preparation for maintenance and refueling tasks including ALARA considerations; required records, reports, and notifications; effectiveness of management techniques used to implement these programs; and experience concerning self-identification and correction of program implementation weaknesses.

The licensee conducts the external exposure control program in accordance with BRP 1210-1, Personnel Monitoring for External Exposures. Film badges are clipped to security badges and issued to each individual to provide positive controls over badge distribution. The inspector reviewed exposure results for the second quarter 1985; no exposures exceeding NRC limits were identified. Five individuals exceeded administrative limits as described in Sections 5 and 7. HPs review daily updates to identify individuals approaching their limit and contact the appropriate work supervisor and access control personnel when limits are approached. These updates will be maintained at access control.

Neutron dosimetry is issued to individuals entering containment and working around the personnel hatch where elevated neutron readings have been identified. Timekeeping is also used for neutron dose assessment; the higher of the two exposures is recorded as the official dose.

According to a health physicist, exposures for lost and/or missing badges are assessed in accordance with BRP 1200-T5, Radiation Investigation Sheet. New badges are assigned for the remainder of the two week badge period. This process was followed by rad/chem personnel when an inspector's badge was inadvertently lost; no problems were noted.

b. Internal Controls

The inspector reviewed the licensee's internal exposure control and assessment programs including: facilities; equipment; personnel; procedures affecting internal exposure control; and assessment of individual intakes.

A standup whole body counter is used to determine internal deposition. No depositions approaching the licensee's investigation level (>2% MPBB) have been identified, nor has the 40-MPC hour evaluation threshold been approached. The licensee has developed a conversion from internal activity deposited to MPC-hours, to verify compliance with 10 CFR 20.103. However, this conversion has not been established in the program, either by procedure or in the computer software used for whole body counting. Licensee representatives agreed to formally incorporate this conversion in the program (Open Item 50-454/85022-09; 50-455/85020-01)

No apparent violations were identified.

12. Licensee Event Report (LER) Followup

The inspector reviewed LER 85045 which identified a reactor coolant sample collected and analyzed on April 10, 1985, in excess of the six-hour period allotted after a reactor trip by Technical Specifications (TS) 3/4.4.8, Table 4.4-4. The surveillance form, BAP 1400-T5, initiating the sample request was completed about 90 minutes after the trip; however, this sample was not collected immediately because of increased sampling activity associated with the boric acid evaporator rupture disk event discussed in Section 16. The sample was collected and analyzed seven hours and 45 minutes after the trip. No problems were identified with the analytical results.

Surveillance sheets for TS required samples are now placed in color coded folders readily identified as a priority sample. The HP foremen have been instructed in TS required samples and appropriate followup. A status board in the access control office lists TS required nonroutine samples. Routine sample collection is assigned from a daily printout by the chemistry supervisor. Since this system was initiated, fifteen samples required by this technical specification were collected and analyzed within this specified time frame. The licensee's corrective actions were appropriate and timely.

No violations were identified by the inspectors.

13. Allegation (RIII-85-A-0100)

The inspector reviewed an allegation submitted by a contractor that individuals had exited the security building through an alarming portal monitor on April 22, 1985 around 6:20 p.m., a common quitting time. The alleger stated he had contacted licensee representatives regarding this matter, but that he subsequently noted various occasions during high

traffic flow periods when no security officer was posted at the portals to monitor personnel egress.

The station security plan does not require this designated post (post 8) to be staffed; however, posted personnel can most effectively respond to portal alarms, since the officer on the opposite side of the turnstiles is preoccupied collecting badges and security personnel within the adjacent glass enclosed office may not be capable of responding timely. Instructions concerning security guards' specific actions to portal monitor alarms are outlined in distributed post orders and addressed during basic guard training. Discussions with security personnel indicated they were aware of these actions.

The inspector observed portal monitor surveillance on June 6, 1985, at the times specified by the alleger. At 4:20 p.m., guards were posted at the portals; no alarms were actuated. At 5:26 p.m., a guard was not posted to observe correct portal monitor exit procedures; the inspector observed a portal monitor alarm actuation, but no attempt was made by security personnel to either intercept the individual (to require another attempt to pass through the portal monitor) or to restore the monitor before other personnel exited. A guard from the glass enclosed office reset the alarm after several workers exited through the portal. This is an apparent violation of BRP 1460-3, Operation of the IRT Portal Monitors, Section E.3, which states security (personnel) will stop any personnel who alarm the portals from leaving the plant and notify the Radiation/Chemistry Department for further action (Violation 454/85022-10; 455/85020-02).

This allegation was substantiated. One apparent violation was identified.

14. Unit 2 Condensate Pit Overflow

On May 24, 1985, diluted reactor coolant (RCS) water was inadvertently transferred to the Unit 2 condensate pit sump and the construction runoff pond via an unproceduralized valve lineup (Radiation Occurrence Report 85017). This lineup was initiated to transfer recycle holdup tank (HUT) water to the chemical drain tank (CDT). This is an alternate flowpath; the HUT inventory is normally treated by the boric acid evaporators which were out of service at the time. Operating engineers, in an effort to reduce the HUT inventory, transferred this water to the CDT to near capacity using P&ID lineups. A permanent procedure did not address this lineup nor was a temporary change initiated. This is an apparent violation of 10 CFR 50, Appendix B, Criterion V which states activities affecting quality will be prescribed by documented instructions, procedures, or drawings appropriate to the circumstances (Violation 454/85022-11; 455/85020-02).

Three valves (OAB 8630, OAB 8591, and OAB 0003) to the CDT remained open following the transfer; they were not restored to their normal closed M-65 configuration. Following the transfer, Unit 1 operators initiated a dilution of RCS boron concentrations with letdown from the Volume Control Tank (VCT) to the HUTs. The above referenced valve lineup created an alternate flowpath by gravity flow to the CDT. The CDT reached capacity and overflowed. Overflow was directed through the CDT filtered vent

system, equipped with loop seal drains to remove water accumulations; the coolant was then collected by the Unit 2 auxiliary building equipment drain sump, which overflowed into the floor drain system, and ultimately to the condensate sump which flows to the construction runoff pond (CRO). An estimated 6,000 gallons of water contaminated sections of the turbine building and Unit 2 auxiliary building. No personal contaminations were reported during this occurrence. Survey results reviewed indicated no measurable activity was detected from the CRO outlet. Extensive decontamination efforts of approximately 600 square feet of plant area, including temporary office space, were initiated. The floor area was deconned by water washings and acid etchings to 200 dpm/100 cm^2 fixed contamination; sealers were applied to the floor and surrounding walls. Drains were flushed, but fixed contamination remains. The inspector took direct reading surveys of the sump. No levels significantly above background were identified. The sump remains posted and barricaded.

Condensate sump samples indicated a total isotopic concentration significantly less than one MPC fraction (unrestricted). No measurable activity was identified in samples taken of the flume and CRO outlet following the overflow. The CRO inlet sample indicated a total activity less than one MPC fraction (unrestricted). Followup sampling was conducted during the inspection. No isotopic migration was identified. No regulatory or technical specifications limits were exceeded.

On May 26, 1985, the licensee initiated a temporary procedure and a 10 CFR 50.59 review to address this lineup. The licensee is completing further actions in response to this occurrence. This will be reviewed in a future inspection.

One apparent violation was identified.

15. VCT Releases

Two unrelated volume control tank (VCT) releases occurred, one on May 28, 1985 and the other June 4, 1985. In both cases, no technical specifications limits were approached or exceeded. Noble gases and associated short lived daughter products were involved. The auxiliary building ventilation system was out of service at the time of the releases, thereby impeding the dilution and clearance of the area. A license condition required the auxiliary building ventilation system to be fully operational by July 1, 1985. Until that date, system testing was being conducted. Neither release was reportable by regulatory requirements.

On May 28, 1985, Unit 1 operators were routinely venting the VCT; a diaphragm valve in the release path developed a leak around 9:50 a.m. and by approximately 10:00 a.m. the VCT was secured. Elevated background levels were noted on an area monitor approximately 60-70 feet from the VCT cubicle. Rad/chem staff cleared the area immediately adjacent to the VCT cubicle and valve area. Samples of the VCT vicinity were collected over a four-hour period. Initial maximum values indicated the 40 MPC-hour value was not exceeded; however, access to the auxiliary building was restricted for approximately four hours as a precautionary measure. The clothes of seven people were contaminated with noble gas daughter isotopes; they were detained by rad/chem personnel until this short lived activity decayed. A

maximum of 0.477 Ci of noble gas products were released, less than 0.1% of the technical specifications limits. A slight increase of activity was noted on the vent stack monitor; no alarms were actuated.

At approximately 1:05 p.m. on June 4, 1985, a release from the VCT occurred via a pressure regulating valve on a sample line. This line had been opened for a routine sample collection. This is a separate line from that involved during the May 28, 1985 release; no generic deficiency between the two releases or associated valves was identified. Elevated readings were noted on laundry room friskers, approximately 100 feet from the VCT valve gallery. At 1:10 p.m., rad/chem personnel ordered a precautionary evacuation of the 426' elevation and began efforts to initiate the auxiliary building exhaust system. The valve was isolated at 1:45 p.m., and by 2:30 p.m., the entire auxiliary building was evacuated. Four maintenance workers were in the VCT valve gallery aisle at the time, repairing the valve attributed to the May 28, 1985 release. They finished this job and exited this area at 1:10 p.m. Whole body counts indicated no uptakes occurred; 10 MPC hours were assigned to these individuals and three RCTs who sampled the area. Whole body exposures were approximately 10 mrem by pencil dosimeter for the maintenance workers and RCTs. The clothing of five workers near the valve gallery, in addition to the four maintenance workers and RCTs, were contaminated with noble gas daughter isotopes. The twelve were detained and their clothing aerated until this short lived activity decayed. Evacuating personnel were surveyed by RCTs before release. At 2:50 p.m. the ventilation system was activated, clearing the auxiliary building; reentry was authorized at 3:45 p.m. A total of 0.684 Ci were released, approximately 0.1% of technical specifications limits.

Both valves were repaired and testing completed by June 5, 1985. No problems were noted.

No apparent violations were identified.

16. Boric Acid Evaporator Release

On April 10, 1985, a release occurred during testing of the OA boric acid evaporator (BAE) vent lines. A temporary alteration (M85-0-093) was installed to bypass a suspected leaking check valve (OAB037); an open manual valve on the bypass line maintained the normal vent path from the OA BAE to the gaseous waste vent header. This temporary alteration was completed in accordance with BAP 300-T5, Temporary Alteration, and was reviewed by the licensee per 10 CFR 50.59. The testing required the BAE to be in a recycle mode, venting to the gaseous waste header. Concurrently, the Unit 1 operator vented the VCT to the gaseous header for approximately two minutes, unaware of the BAE venting. A pressure spike resulted in the header, overpressurizing the bypass line and BAE, causing the BAE rupture disk to fail. Approximately 80 gallons of BAE inventory flashed to steam, partially condensed to liquid, and followed the inplace flowpath to the OB evaporator room. Since the auxiliary building ventilation system was not operational at the time, steam was vented through the discharge piping to the auxiliary building floor drain. Condensing steam appeared at a 346' level drain near the elevator. Process area monitors alarmed, indicating a potential airborne problem,

primarily noble gases and decay products. The auxiliary building was evacuated and secured; contaminated areas at the OB BAE room were barricaded. Five individuals were contaminated. They were decontaminated by routine washings to normal background levels; no internal deposition was identified by whole body counts. The supply fans were restored approximately one hour after the event. No detectable contamination was measured at the affected area approximately 4.5 hours after the leak. Access to the auxiliary building was restored around 4:00 p.m. when samples and air monitors indicted normal levels had been established for approximately one hour. No radiological technical specifications limits were approached or exceeded. This matter will be reviewed further to determine the adequacy of the licensee's alteration review and communication with operations personnel. (Open Item 454/85022-12)

No apparent violations were identified; one open item was established for future review.

17. Enforcement Conferences

An enforcement conference was held June 27, 1985, to discuss the entry into the incore detector motor drive area, Region III staff's concerns about the problems contributing to the entry, and the associated violations. Enforcement options under consideration were addressed. The meeting, held at the Region III office, was attended by Mr. J. G. Keppler, Regional Administrator, NRC Region III, Mr. C. Reed, Vice President, Nuclear Operations, Commonwealth Edison Company, and members of their respective staffs.

Region III personnel indicated their concern that performance by the involved licensee control room operators, technical staff, shift engineer, HP foreman, and electrical maintenance personnel ranged from only marginally acceptable to largely unacceptable in this event. The extent of personnel performance weaknesses and the licensee's weak initial management response to this event were emphasized. The need for improved attention to radiation protection practices by all workers, including supervisors, was stressed.

Licensee representatives acknowledged that they were concerned with the problems which led to this entry and stated their intent to strengthen the Byron radiation protection program. Specific corrective actions were discussed including specialized systems training for radiation/chemistry personnel, administrative measures to verify incore detectors' positions before entry, procedural revisions for RWP use, and installation of a locked gate at the incore drive area. These actions will be reviewed during future inspections. In response to the NRC's concern that investigation and followup actions were delayed, licensee representatives acknowledged that corporate and station management did not initially recognize the appropriate significance of this occurrence. Licensee upper management representatives emphasized that followup investigations and corrective actions of future radiological occurrences would be more timely and thorough at both station and corporate levels.

An enforcement conference was held July 22, 1985 in the Regional Office to discuss the July 1, 1985 contamination occurrence and the April 17, 1985

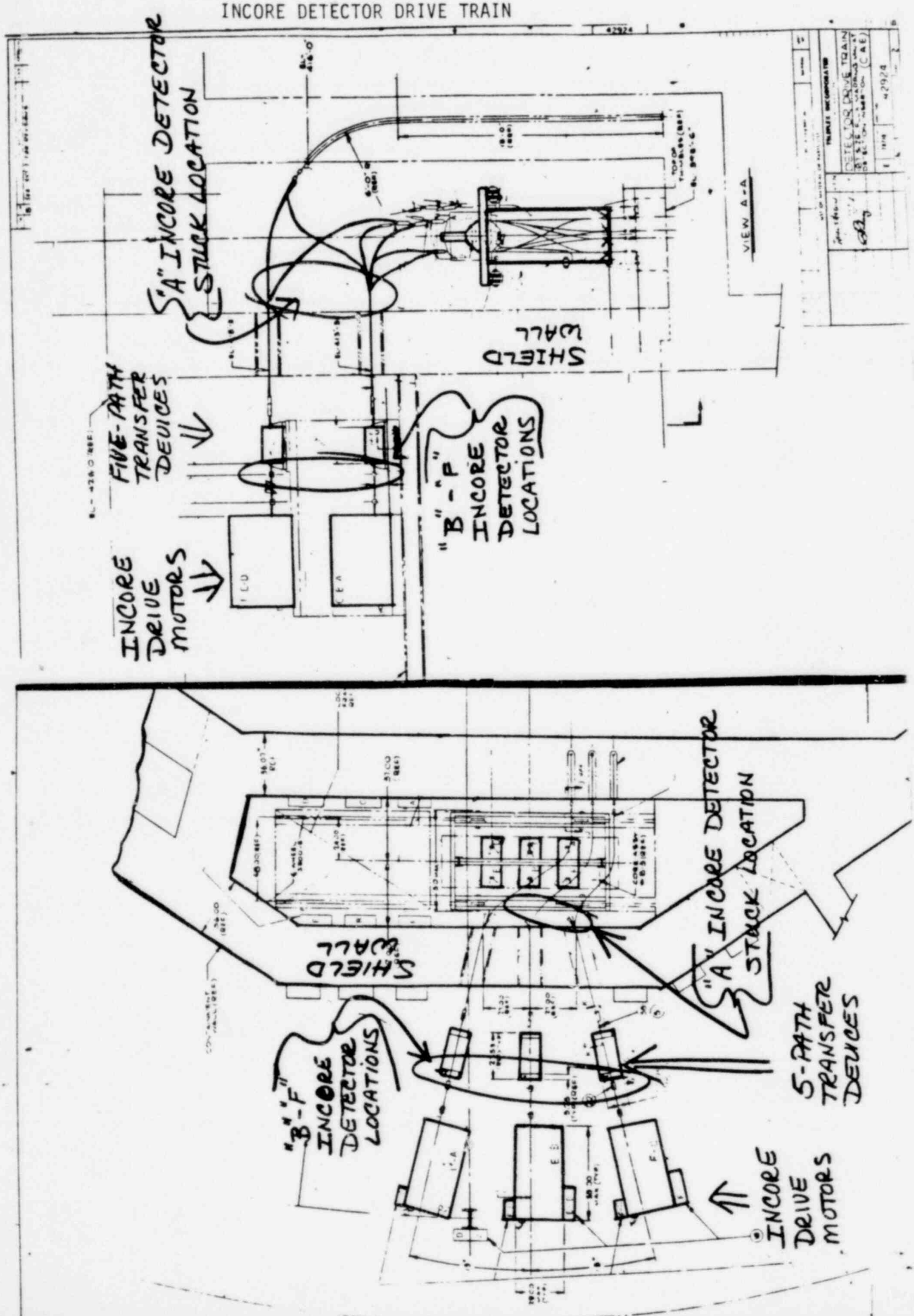
containment entry. Enforcement options were discussed. The meeting was attended by Mr. J. G. Keppler, Mr. C. Reed, and members of their respective staffs. Licensee representatives described the circumstances that led to these events based on their followup investigations and interviews. Corrective actions for these events were addressed, including departmental staff meetings to emphasize procedural adherence and worker responsibility, and disciplinary actions. The licensee concluded the mechanical maintenance foreman's actions were not willful but were reflective of unsatisfactory supervisory performance in the July 1 event. The foreman was removed from his supervisory position, according to licensee personnel, in addition to other disciplinary action.
Region III's evaluation of this incident did not totally concur with the licensee's conclusions, particularly concerning the licensee's conclusion that training was a significant contributor to the event; the inspectors' interviews with personnel indicated they were knowledgeable of the correct radiation protection practices and procedures. Licensee investigations identified several root causes of these events, including staff motivational problems and inadequate senior management commitment to the radiation protection program. The station superintendent reiterated his increased support of this program and stated that he has recently held meetings with various departments to promote radiation safety.

Region III personnel indicated that the three events (April 17, May 1, and July 1) were of particular significance because of the failings of supervisory personnel to follow established radiation protection procedures and practices. These supervisory personnel not only were responsible to varying degrees for the radiation safety of other personnel, but also in their supervisory roles they are influential in shaping the behavior of other personnel. Additionally, the frequency and extent of these supervisory failings, and management's failure initially to take timely actions to understand and correct them, imply significant management weaknesses in the support of their radiation protection program.

The inspector discussed the likely informational content of the inspection report, with regard to documents or processes reviewed, with licensee representatives on June 14, 1985. The licensee did not identify any such documents or processes as proprietary.

Attachment

INCORE DETECTOR DRIVE TRAIN



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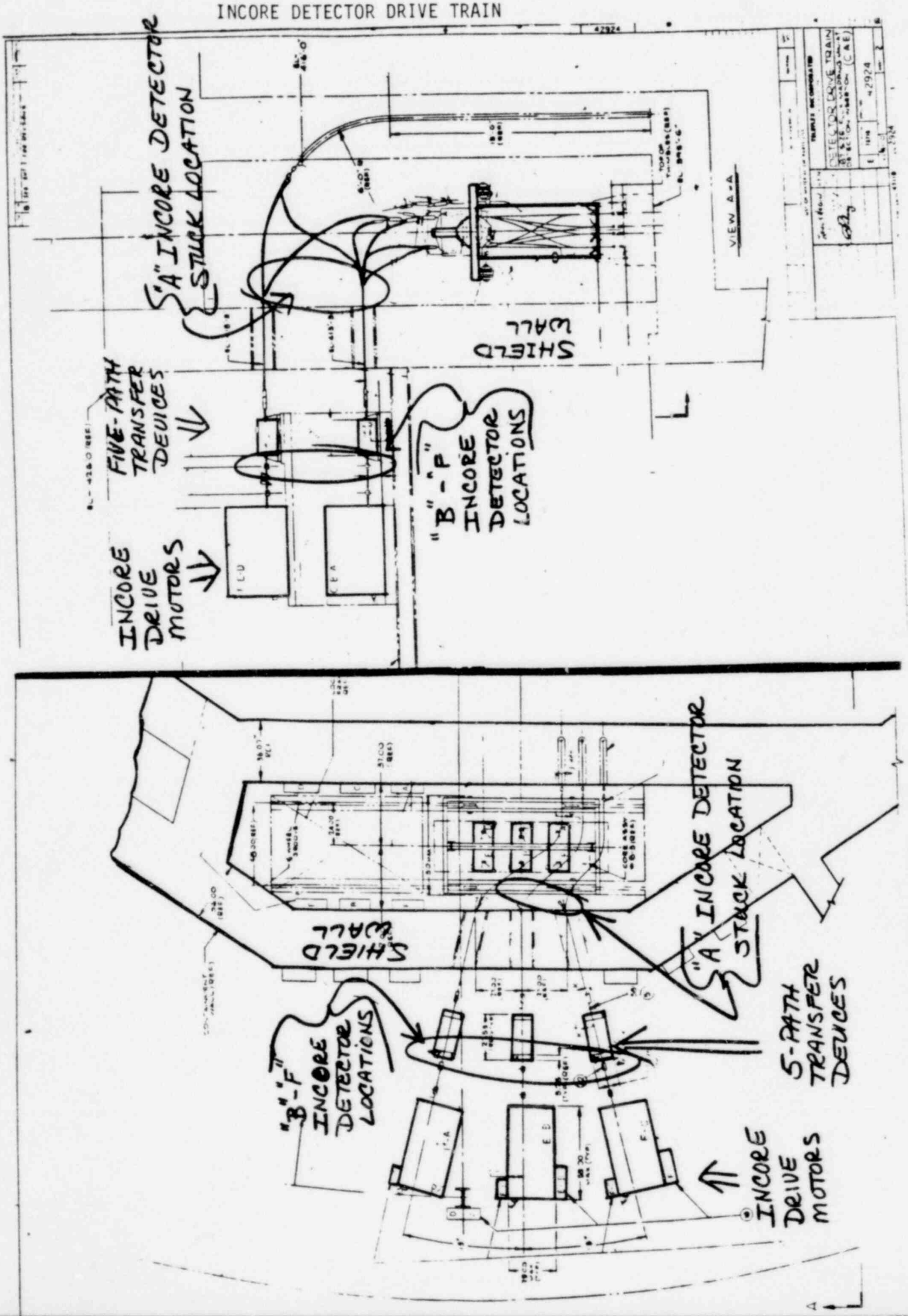

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