U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-331/90005(DRSS)

Docket No. 50-331 License No. DPR-49

Licensee: Iowa Electric Light and Power Company
IE Towers
P.O. Box 351
Cedar Rapids, IA 52406

Facility Name: Duane Arnold Energy Center

Inspection At: Palo, Iowa

Inspection Conducted: February 27 through March 9, 1990

Inspector: William Snell for 3/27/90
C. F. Gill Date

Approved By: William Snell 3/27/90
William Snell, Chief Date
Radiological Controls and
Emergency Preparedness Section

Inspection Summary

Inspection on February 27 through March 9, 1990 (Report No. 50-331/90005(DRSS))
Areas Inspected: Special, announced inspection to review the circumstances surrounding an unplanned radiation exposure event.
Results: The review of the unplanned radiation exposure event indicated that a regulatory overexposure (pursuant to 10 CFR 20.101) did not occur; however, a substantial potential may have existed for such an overexposure (Subsection 3.g). Apparent violations of regulatory requirements were identified (Subsection 3.l). The appropriate enforcement action for these apparent violations will be determined and communicated to the licensee by separate correspondence.

ATTACHMENT A

Exposure Results from 11/11/89
IRM CABLE REPAIR AND REPLACEMENT

(WBD from Dosimetry unless otherwise noted,
Extremity Doses are from Finger Rings)

(All doses in REM)

I&C Technicians(ICTs)	WBD	Extremity
No. 1 (B IRM)	00.260	RH - 00.950 LH - 00.655
No. 2 (B IRM)	00.250	RH - 02.335 LH - 03.730
No. 3 (F IRM)	00.180	RH - 01.380 LH - 00.245
No. 4 (F IRM)*	00.390 (Skin Dose = 00.390)	RH - 02.350 LH - 02.760

*TLD Results

HP Technicians (HPTs)	WBD	Extremity
No. 1	00.245	N/A
No. 2	00.235	N/A

Laborers (HP Helpers)	WBD	Extremity
No. 1	00.085	N/A
No. 2	00.315 (Dosimeter)	N/A
Total 11/1/89 - 11/13/89	00.310 (TLD)	
No. 3	00.125	N/A

The administrative overexposure occurred when the dosimetry of Laborer No. 2 was noted to be reading 315 mr vs. the worker's current weekly limit of 300 mr. ICT No. 2 directly handled the "B" IRM cable and ICT No. 4 directly handled the "F" IRM cable.

DETAILS

1. Persons Contacted

J. Axline, Technical Support
V. Crew, Technical Support
*H. Giorgio, Radiation Protection Supervisor
R. Hannan, Plant Superintendent
R. Hite, ALARA Coordinator
J. Hogan, Radiation Protection
B. Johnson, Licensing
R. Lieb, Dosimetry Supervisor
*J. Probst, Technical Support
K. Putnam, Technical Support Supervisor
S. Swailes, Training Superintendent
D. Thornton, Health Physics Supervisor
K. Young, Assistant Plant Superintendent - RP/SEC

M. Parker, NRC Senior Resident Inspector

The above individuals attended the onsite exit meeting on March 2, 1990.

*Denotes those contacted by telephone during the period March 5-9, 1990.

The inspector also contacted other licensee and contractor employees.

2. Licensee Action on Previous Inspection Findings

(Closed) Open Item (331/89028-03): Review the licensee's investigation findings regarding an unplanned radiation exposure event which occurred on November 11, 1989. This review has been completed (see Section 3).

3. Followup of an Unplanned Radiation Exposure Event (IP 93702)

On November 11, 1989, at approximately 1700 hours, an unplanned radiation exposure occurred to a health physics (HP) helper while working in the drywell. This exposure resulted in a dose of approximately 305 mrem incurred during an estimated two to five minute period, as measured by self-reading dosimetry (SRD). While the HP helpers radiation dose due to this event exceeded the licensee's weekly administrative limit of 300 mrem (weekly total was 350 mrem by SRD, total for November 1-13, 1989 was 310 mrem by TLD), the HP helper's total quarterly exposure of 520 mrem was well within the regulatory limit of 3000 mrem/quarter (pursuant to 10 CFR 20.101).

Because there was a potential for significant radiation exposures from this event, two Radiation Specialists from NRC Region III were dispatched to the site to perform the initial event followup inspection on November 14, 1989. The inspection findings were presented in Subsection 3.b of Inspection Report No. 50-331/89028(DRP). The inspectors determined that while a regulatory overexposure did not occur, the licensee was conducting

a formal investigation of this event to determine the nature of any programmatic breakdown which may have existed. The inspectors indicated that the results of the licensee's investigation would be reviewed further during a future inspection (Open Item No. 331/89028-03, see Section 2 above). Shortly before the current followup inspection, the licensee indicated to the inspector that the licensee's investigation and initiation of corrective actions were completed and ready for review. The inspection findings regarding the inspector's review of the circumstances surrounding this event and the review of the licensee's subsequent corrective actions are presented below. The review consisted of interviews with appropriate licensee representatives and documentation analyses, including investigation reports, supporting documentation, and narrative summaries of the event prepared by cognizant individuals (with the aid of the licensee's investigation team).

a. Pre-job Meeting and Briefing

On Saturday, November 11, 1989, an approximate two-hour (0730 to 0930) ALARA pre-job meeting for B and F intermediate range monitor (IRM) extractions from the reactor vessel was conducted in the I&C Instrument Shop. Both IRMs had exhibited operational problems since reactor startup on October 23, 1989 (B- and F-IRMs were found stuck in the core at 1648 hours on October 23, 1989 and at 1746 hours on October 24, 1989, respectively). Shutdown, in part to repair/replace the B- and F-IRMs, commenced at 2000 hours on November 8, 1989. The reactor was manually scrammed per procedure at low power at 0506 hours on November 9, 1989. The as-found locations for the B- and F-IRMs were approximately 30 and 93 inches into the active core (from the bottom), respectively. The purpose of the pre-job meeting was to discuss plans for the safe removal of the irradiated IRM detectors into a fabricated lead shielded container (pig) for subsequent transfer to the fuel cask storage pool.

Attendees at the pre-job meeting included representatives from HP, HP helpers, ALARA, Instrument Shop, Maintenance Engineering, and I&C. According to the inspector interviews with licensee representatives and documentation review, discussion at the pre-job meeting centered on the tasks to be performed, the adequacy of the lead pig design, and the dose rates expected from the IRM detectors. The ALARA checklist (incorporated into the RWP) included extremity dosimetry and whole-body administrative limit dose extensions to 1000 mrem/week for the I&C technicians (ICTs), HP hold points for shielded IRM detector handling at 10 R/hr at 18 inches, and contingency plans for shielding the IRM detectors. According to the ALARA checklist, the expected unshielded, contact dose rate was listed as 120 R/hr for the B-IRM detector.

Personnel interviewed and documentation reviewed indicated that attendees at the pre-job meeting left the meeting with the understanding that the only radiological hazard associated with the job would be the irradiated IRM detectors due to the activation products Cs-137 and Co-60. There was apparently no discussion of a

potentially significant radiation hazard from the irradiated IRM cables. A pre-job briefing and job observation memorandum, dated November 13, 1989, does state that the pre-job meeting addressed a 1983 IRM removal in which the estimated contact IRM detector dose rate was 15,000 R/hr based on a one-meter dose rate of 640 R/hr. Inspector interviews with licensee representatives did not identify any licensee action to use the 1983 data to verify/validate the dose rate estimated for the 1989 B-IRM irradiated detector. (On March 20, 1990, the licensee informed the inspector that the 1983 IRM removal data discussed with workers during the pre-job briefing was erroneous, see Subsection 3.i below).

At approximately 1030 hours on November 11, 1989, the workers were briefed prior to commencing work to remove the B-IRM. According to inspector interviews with licensee representatives and documentation review, the workers were briefed on the details of the plan (and the contingency plan) for safe removal of the B-IRM detector, including HP hold points. Specific verbal instructions were given to ensure that dose rates to any worker would be no more than 10 R/hr. The briefing did not identify the B-IRM cable as a potential radiological hazard. The ICTs wore two sets of protective clothing (PC); respirators; 200 mR, 500 mR, 1R, and wrist SRDs; alarming dosimetry; and finger ring dosimetry. The HP technician (HPT) working under the reactor vessel wore two sets of PC; a respirator; 200 mR, 500 mR, and 1R SRDs; and alarming dosimetry. The HPT on the 757-ft. level of the drywell wore two sets of PC; 200 mR, 500 mR, and 1R SRDs; and alarming dosimetry. The HP helpers (on the 757-ft. level of the drywell) wore one set of PC and 200 mR, 500 mR, and 1R SRDs. In addition, all workers wore TLDs. The briefing included a discussion of each worker's role and responsibilities.

b. The First Drywell Entry

At approximately 1100 hours on November 11, 1989, work commenced on the removal of the B-IRM cable and detector. As an ICT manually extracted the IRM cable from the reactor vessel through the lead pig, the undervessel HPT surveyed the cable near the extraction location. The survey radiation instrument reportedly showed background dose rates until the B-IRM detector was six to eight feet away from the instrument, at which time the dose rate began to rise significantly (recollected to be greater than 100 R/hr). The HPT believed the increased dose rate was due solely to the proximity of the IRM detector. Licensee representatives stated that because of the rapid extraction of the cable, a detailed survey was not made.

The lead shielded one-gallon container (pig) had a "J-tube" in it such that a technician could pull the cable through and position the IRM detector in the center of the can thereby preventing "steaming" out the tube openings. However, there appears to have been a problem positioning the detector within the pig, and the IRM detector apparently lodged near the exit opening of the J-tube, which resulted in a contact dose rate of 450 R/hr. The IRM cable was cut approximately six to eight feet away from the pig, coiled,

and laid on the 757-ft. level of the drywell near the A Recirculation Pump Riser and the ladder to the undervessel area. The final six to eight feet of the cable were later cut off as well, leaving only a small portion of cable extending from the end of the pig. According to licensee representatives, the open ends of the pig were taped closed and the dose rates to the HP helpers who carried the pig were measured to be less than 10 R/hr. Following a review of the situation by the acting ALARA Coordinator, the pig was transported from the drywell up to the refueling floor and all personnel left the drywell at approximately 1200 hours. Shortly before leaving the drywell, an ICT coiled the last six to eight feet of the cable (not known at the time to be highly radioactive) and laid it with the rest of the cable on the 757-ft. level of the drywell.

c. Activities After Exiting the Drywell After The First Entry

After conducting whole-body frisks after leaving the drywell, it was noted by several individuals that their badges and dosimetry were contaminated, and facial contamination was identified on two ICTs who had worn respirators while working under the reactor vessel. The results of airborne sampling during the work showed that some airborne contamination was present. The acting ALARA coordinator stated to the licensee's investigation team that he looked at the airborne results for indications of the presence of Na-24, being aware that this could occur on cabling (based on prior discussions with the radiological engineers), and did not identify this nuclide. However, according to the RP Supervisor, the sample analysis software did not include Na-24 in its library, and an analysis of unknown spectral peaks showed the presence of airborne Na-24. There were also some contamination problems on the floor, apparently due to activation products deposited from the B-IRM cable. Nasal smears were taken from all individuals involved in the previous work activity because of the identified airborne contamination problem. All three individuals who had not worn respirators showed positive nasal smears. These workers were subsequently decontaminated and whole body counts indicated that no detectable internal contamination was received.

At approximately 1400 hours, a meeting was held to prepare a differently designed shielded pig for the F-IRM removal to take advantage of the lessons learned (high dose rate on pig) from the removal of the B-IRM. The newly designed and fabricated pig was a straight-through device (rather than a J-tube design), which utilized threaded shielded plugs to locate the IRM detector in the center of the pig, to reduce dose rates to ICTs extracting the IRM and to HP helpers who would carry the pig from the drywell. The pig was to be located in the control rod drive (CRD) window on the 757-ft. level of the drywell to minimize handling and transfer time for the pig.

At approximately 1500 hours, a pre-job meeting was conducted with a new IRM ICT crew, HP helpers, HPTs, and ALARA. Plans discussed included having the HP helpers bag the B-IRM cable and remove the bagged cable from the immediate work area before beginning extraction

of F-IRM. Discussions held with ICTs and HPTs stressed the need to adequately locate the F-IRM within the re-designed pig to avoid the high dose rate associated with the improper placements of the B-IRM in the original J-tube pig. Due to the demonstrated airborne contamination problem, all workers wore respirators and two sets of PC. The same types of dosimetry worn for the first entry were also worn for the second entry of the drywell. The HP helper who exceeded the licensee's weekly administrative dose limit (who had not been in the drywell during the morning's activities) stated to the licensee's investigation team that he recalled asking if he would need an alarming dosimeter and being told by an HPT that one would not be necessary because of the low dose rates expected. Despite knowledge that the shielded B-IRM detector had exhibited a dose rate significantly in excess of that estimated in the ALARA checklist and that cable activation products resulted in an airborne contamination problem during the first drywell entry, the licensee did not conduct a pre-entry radiation survey of the drywell to identify the presence of the source of this unexpected radioactivity.

d. The Second Drywell Entry

The work crew re-entered the drywell about 1630 hours to remove the F-IRM. Either immediately prior to, or just after entering the drywell airlock (individuals' recollections differ), the HP helper was instructed by the 757-ft. level HPT to bag the B-IRM cable. The HP helper proceeded into the drywell, bagged the cable, moved the bagged cable out of the immediate work area, and then remained nearby (six inches to five feet from the bagged cable, recollections differ) to assist the ICTs located under the reactor vessel, if needed. The 757-ft. level HPT had not entered the work area yet because of difficulty establishing headset communications, including freeing his snagged headset cord. Thus, the HP helper had handled the cable, placed it in a bag, and remained in the vicinity of the bagged cable without realizing that the cable was a significant radiological hazard and without the cable being surveyed.

When the 757-ft. level HPT arrived at the work area, he noted that the HP helper had already bagged the cable. The HPT proceeded to open the bag and take a smear from the cable (without first conducting a survey of the bag and its contents), possibly with the HP helper's assistance (recollections differ). The HPT then noted that the HP helper was standing near the A Recirculation Pump Riser (a known high radiation source); therefore, he asked the HP helper to move to a low dose rate area at the outer wall of the drywell. A short time later, the HPT realized that a bag was not available for the smear sample. He proceeded to the airlock, accompanied by the HP helper. The licensee estimates that the HP helper was in the near vicinity of the bagged cable for two to five minutes.

Shortly after the 757-ft. level HPT and the HP helper entered the drywell airlock, the undervessel HPT returned to the 757-ft. level via the ladder near the bagged cable. He was carrying a radiation survey meter which had been in use below the vessel.

Although he was not conducting a formal survey, he noted that the radiation background at the 757-ft. level was significantly higher than expected. After determining that the A Recirculation Pump Riser was not reading abnormally high, he searched for the unknown source which was resulting in an elevation in the radiation background. As he approached the bagged cable, the survey meter went off the highest scale at 50 R/hr. Upon returning with a survey meter with a higher scale, he measured approximately 125 R/hr on contact with the surface of the bag.

After the undervessel HPT noted the unexpected high dose rate due to the bagged cable, he realized that this unknown (and previously unsurveyed) highly radioactive source had been recently handled and bagged by the HP helper. The HPT proceeded in the direction of the airlock to discuss the matter with the helper. On the way to the airlock, he met the 757-ft. level HPT who was returning to the work area. Upon notification that the cable was a significant, previously unidentified radiological hazard, the 757-ft. level HPT moved the bag further away from the immediate work area. The HPTs proceeded to the airlock to read the HP helper's SRDs. The helper's 500 and 200 mR SRDs and TLD were attached to the outside of his left thigh inside his PC. (The dosimetry positioning was arranged because of the manner that he was expected to transport the F-IRM detector in its shielded pig.) The helper's 1R SRD was on the outside of his PC, in the center of his body, about waist level. The 200 mR SRD was offscale, the 500 mR SRD read 315 mR, and the 1R SRD read 450 mR. Because the HP helper's weekly administrative dose limit was 300 mR, the helper was excluded from further drywell entries.

e. Activities After Exiting the Drywell After the Second Entry

At approximately 1700 hours, subsequent to the discovery of the B-IRM cable high dose rates, work was halted and all workers returned to the drywell step-off-pad (SOP) area while dose extensions and alarming dosimeters were obtained for the HP helpers and a replacement HP helper was dressed out in required PC and dosimetry. Despite the unexpected high dose rates associated with the B-IRM cable found during the previous entry, the licensee apparently did not re-evaluate the radiological hazards present before re-entry to extract the F-IRM, even though the F-IRM was known to have been stuck further in the core than the B-IRM and was thus likely to have even higher dose rates. According to licensee representatives, no pre-entry consideration was given to allowing the F-IRM cable additional time to decay, nor was serious consideration given to establishing an HP hold point to further evaluate the situation before re-entry. It does not appear that the licensee's corrective actions after discovering the high dose rates associated with the B-IRM cable were adequately conservative.

f. The Third Drywell Entry

At approximately 1730 hours, the work crew re-entered the drywell to extract the F-IRM from the reactor vessel. The survey of the F-IRM

cable as it was extracted from the reactor vessel was again inadequate to identify that the cable was a significant radioactive source. Without a radiation survey of the cable being performed, the I&C technician was allowed to extract the cable by hand, cut the cable into segments, and toss the segments onto a plastic bag spread over the grating on the 757-ft. level of the drywell. After workers had secured the F-IRM detector in a shielded container, an HPT measured a contact cable dose rate of 1000 R/hr. It appears that if the F-IRM had been extracted before the B-IRM, the HP helper would have received a significantly higher dose.

g. Radiological Considerations

The doses received by workers in this event are summarized in Attachment A to this report, based on licensee determinations. The inspector's review of these dose determinations did not result in any significant differences. The highest dose was 390 mrems by an I&C technician who handled the F-IRM cable. The HP helper who handled the B-IRM cable received 310 mrems. The maximum extremity dose was under 4 rems. These doses are all well within regulatory limits.

However, the fact the regulatory limits were not exceeded may have been fortuitous. Any of the following factors could potentially have increased the worker's exposure significantly:

- The IRMs could have been extracted earlier if the licensee had come to a decision sooner on the need to extract and replace the IRMs. The half life of Na-24 (the activation product responsible for the cable's high dose rate) is 15 hours. Extraction 15 or 30 hours earlier would thus have increased the dose rate by a factor of two or four, respectively.

- If the worker had not been instructed to move by HP personnel for unrelated ALARA considerations, his time close to the unknown radiation source may have been longer.

- If the F-IRM had been removed first, the worker's exposure to the IRM cable would have presumably been greater. The F-IRM cable measured 1000 R/hr on contact, compared to the B-IRM cable contact dose rate of 125 R/hr.

h. Immediate Causes of the Unplanned Radiation Exposure

- The survey of the cable as the B-IRM was extracted from the reactor vessel failed to identify the cable as a significant radiation source. (The HPT believed that the sudden increase in survey instrument readings for the last few feet of cable was due to the approaching detector).

- No survey was performed on the cable following removal of the cable from the B-IRM detector. (The cable was manually pulled from the reactor vessel, cut from the IRM detector, coiled, and carried from under the reactor vessel to the 75-ft. level of the drywell by an I&C technician without any member of the work group being aware that the cable represented a significant radiological hazard).

- No re-entry survey of the drywell was performed before the workers began the task of extracting the F-IRM. (All workers had left the drywell after the shielded B-IRM detector had been removed from the drywell, in part, because the shielded detector had a much higher dose rate than expected.)

- The B-IRM cable was not surveyed prior to the HP helper placing the cable within a bag, prior to an HPT opening the bag and taking a smear from the cable, or prior to the HP helper remaining in the near vicinity of the bagged cable.

- Work planning and briefings in preparation of each drywell entry did not identify the potential for a highly radioactive cable.

- The individual who received the administrative overexposure was not wearing alarming dosimetry.

i. Root Causes

- Failure to properly disseminate pertinent information on the potential high dose rates from IRM cables recently located within the reactor core during power operation. The radiation level calculations and graphs were seen but not thoroughly reviewed or understood by the ALARA Coordinator.

  (1) Calculated radiation levels, and knowledge of events at similar plants, were not effectively transmitted from Radiological Engineering to the ALARA Coordinator and Maintenance personnel.

  (2) Inadequate review of NRC Information Notice (IN) 88-63, High Radiation Hazards from Irradiated Incore Detectors and Cables. (The formal review performed and approved by Technical Support did not recognize the applicability to in-core cabling, other than the TIP. Therefore, the corrective actions taken were ineffective with regard to IRM cabling. The IN was also reviewed by the Training Department who decided that placing the IN on the HP required reading list was an adequate response to the IN. Although the HP and ALARA personnel associated with the IRM extraction had read the IN, none of them were aware that IRM cabling could be a significant radiological hazard.)

- Bypassing of Precautions within the applicable IRM repair and replacement procedure without full knowledge of corrective compensatory actions or agreement on the necessary compensatory actions. (The Precautions stated that if an IRM was known to have been stuck in the core during power production, it should be removed from the core area and allowed to decay for at least six weeks prior to removal from the reactor vessel. Both the B- and F-IRMs were known to be stuck in the core during power production).

- Poor communication among individuals and departments regarding the schedule and mechanisms for replacement of the IRMs.

  (1) In late October and early November 1989, the plant experienced B- and F-IRM problems. The HP group was requested to evaluate the radiological hazards expected as part of a contingency plan for a brief outage to correct the IRM problems. Radiological engineers calculated the expected IRM detector and cable dose rates due to Co-60 and Cs-137 as a function of the time the IRMs had been stuck within the core during power operation. The existence of Na-24 in the IRM cables was also identified but a dose rate was not quantified. The radiological engineers presented their information at an October 30, 1989 inter-departmental contingency planning meeting. However, because of mislabeled graphs and poor communications, the other attendees left the meeting with the misunderstanding that the IRM detectors would have high dose rates but that the IRM cables would not be a significant radiological hazard.

  (2) Upon review of the October 30, 1989 meeting notes, the radiological engineers realized that while the dose rate from the IRM detectors had been considered, no mention was made of the significance of waiting until the Na-24 in the cable's insulation had adequately decayed before IRM removal from the reactor vessel. These matters were subsequently discussed with the ALARA Coordinator during early November. However, the ALARA Coordinator apparently did not fully understand the dose rate calculations or the desirability for a five-day waiting period for Na-24 decay or that the IRM cables would be significant radiological hazards.

  (3) About a week before the administrative overexposure, an HPT who was involved in a 1983 IRM extraction at DAEC incorrectly communicated details concerning this event to the acting ALARA Coordinator who, in turn, passed the verbal misinformation to the workers during the pre-job meeting on the morning of November 11, 1989 (see Subsection 3.a) because he did not verify the information by reviewing the 1983 job history file. If he would have reviewed that file, he would have noted that while the dose rate from the 1983 IRM detector was 8 R/hr at one meter (500 R/hr at six inches), the contact dose rate on the cable was 200 R/hr. Thus, the licensee missed another opportunity to identify the IRM cable as a significant radiological hazard.

(4) Beginning on November 9, 1989, the outage schedule listed IRM removal and replacement as an outage activity, but the ALARA and HP personnel did not fully recognize the likelihood of the need for rapid IRM replacement until late on November 10, 1989. Also, meetings on IRM replacement held over the previous two weeks had not focused on the actions needed to fully compensate for the radiological conditions of IRM extraction.

(5) The decision to remove and replace at least one IRM was confirmed late on November 10, 1989. The IRM removal preplanning meeting began at approximately 0800 hours the following morning, with the work to be performed that day to accommodate the planned startup on November 12, 1989. The short period of time allotted for pre-job planning and briefing of workers does not appear to have allowed enough time for detailed task assessments or for the workers to be cognizant that the IRM cables could be a significant radiological hazard.

- The normal practice of surveying an item prior to being bagged was not followed. (There was no procedural guidance specifying such surveys.)

j. Corrective Actions Based on the Licensee's Investigation Findings

In response to the administrative over-exposure, the licensee assembled a three person team to evaluate the event, determine root causes, and recommend corrective actions. The team, which was independent of the site Radiation Protection staff, included a contractor with significant radiological protection experience, a former Health Physics Technician, and an individual trained in INPO's Human Performance Evaluations System (HPES). The root cause of the event was determined by the team to be "primarily poor communication of, and evaluation of, available information on expected radiological conditions for the job being performed." Recommended corrective actions are as follows:

- For future work on the reactor vessel, or the components within, ALARA pre-job reviews will be required for procedures to be performed by Maintenance and Operations personnel.

- All calculations regarding expected dose rates, and/or other limitations regarding job planning, will be formally transmitted to the Radiation Protection Supervisor, ALARA Coordinator, and the appropriate Maintenance and Operations personnel.

- Circumstances surrounding this event will be covered in HP initial training, HP and Maintenance continuing training, and Technical Staff/Technical Manager training.

- A review of the methodology needed for proper analysis of operating experience events will be conducted in Technical Staff/Technical Manager training.

- Requiring alarming dosimeters without exception for all activities in high radiation areas will be considered.

- The Iowa Electric internal response to IN 88-63 will be revised.

- Obtaining a special GE undervessel cable extraction tool, which can significantly reduce doses, will be considered.

k. Additional Corrective Actions

After completion of the investigation team report regarding the November 11, 1989 administrative overexposure event, the licensee arranged for the contractor member of the investigation team to review the HP/ALARA program in detail, based on the identified root causes for the event, in order to develop further corrective actions to enhance the program. Some of those recommended corrective actions are delineated below:

- Provide instructions to HP staff in continuing training regarding basics of bagging, tagging, and surveys.

- Require the HP Supervisor to approve changes to special RWPs.

- Require all documentation to be completed, including line-outs, N/A, or NR, as appropriate.

- Explicitly identify the possibility of highly radioactive cables in the training program.

- Provide verbal summaries of Significant Event Reports, NRC Information Notices, etc. in the HP hot sheet briefings.

- Provide ALARA with copies of training films.

- Training for Maintenance and HP should address the need for ALARA planning pursuant to the work schedule or to reschedule the work to accommodate ALARA planning.

- Revise maintenance procedures to deal with the possibility of a highly radioactive cable.

- Maintenance should prepare temporary instructions where necessary to satisfy procedural requirements.

- The ALARA review form should have separate areas to record clarifications, restrictions, and ALARA actions.

- ALARA should review maintenance procedures for key jobs.

- Consider revising HP Instruction No. 6.2 to require recording the disposition of unknown peaks on WBCs via peer review, supervisory review, or radiological engineering.

- Revise RWP procedures to include documentation of TLD relocation.

1. Apparent Regulatory Violations

(1) 10 CFR 20.201(b) requires that each licensee make or cause to be made such surveys as (1) may be necessary for the licensee to comply with the regulations in this part, and (2) are reasonable under the circumstances to evaluate the extent of radiation hazards that may be present. 10 CFR 20.201(a) defines a survey as an evaluation of the radiation hazards incident to the production, use, release, disposal or presence of radioactive materials or other sources of radiation under a specific set of conditions.

Contrary to the above, on November 11, 1989, surveys necessary and reasonable to ensure compliance with the occupational dose limits of 10 CFR 20.101, were not made prior to workers handling and remaining in the near vicinity of highly radioactive intermediate range monitor (IRM) cables immediately following IRM extraction from the core. Specifically, the radiation hazards present had not been properly evaluated in that the Na-24 activation product in the IRM cable insulation had not been recognized and quantified adequately during preplanning, and radiation surveys were inadequate to identify that the B-IRM cable was highly radioactive (125 R/hr) and inadequate to quantify the dose rate of the F-IRM cable (1000 R/hr) until after workers had handled and remained in the near vicinity of the cables. (Apparent Violation No. 331/90005-01).

(2) Technical Specification 6.8.1 requires that written procedures, including applicable instructions, be prepared, approved, implemented, and maintained. Administrative Control Procedure No. 1407.1, Control and Accounting of Special Nuclear Material, Step 6.3.1 requires that removal/installation of source range monitors and intermediate range monitors be performed per the SRM/IRM Repair Procedure.

Contrary to the above, on November 11, 1989, workers removed, less than two days after reactor shutdown, IRMs known to be stuck in the core during normal power production by improperly attempting to implement Maintenance Department Repair Procedure No. MECFUN-G080-003, General Electric IRM/SRM Detectors, which

was applicable only for IRM/SRM removal after the activation products had decayed for a significant period of time. Workers did not implement procedural Precaution (7) which states that IRMs known to have been stuck in the core during normal power production should be removed from the core area and allowed to decay for at least six weeks prior to removal from the reactor vessel. The workers also failed to implement the health physics Caution that states that if the dose rate exceeds 20 R/hr on contact with the drive tube, terminate the removal, secure the detector and leave the area, in that the drive tube was not surveyed during removal. The drive tube would have measured greater than 20 R/hr because the contact dose rate for the B-IRM detector was at least 450 R/hr and F-IRM cable was at least 1000 R/hr. Also, the licensee did not prepare and approve a procedure, with applicable instructions, which was relevant to removal, soon after reactor shutdown, of IRMs which were known to have been stuck in the core during normal power production. (Apparent Violation No. 331/90005-02)

Two apparent violations were identified.

4. Exit Meeting

The inspector met with licensee representatives (denoted in Section 1) at the conclusion of the onsite inspection on March 2, 1990, and by telephone through March 9, 1990. The inspector summarized the scope and findings of the inspection, including the apparent violations (Subsection 3.1). The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any such documents/processes as proprietary.