U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No.:	50-341
License No.:	NPF-43
Report No.:	50-341/98016(DRS)
Licensee:	Detroit Edison Company
Facility:	Enrico Fermi, Unit 2
Location:	6400 N. Dixie Hwy. Newport, MI 48166
Dates:	September 14-18, 1998
Inspectors:	N. Shah, Radiation Specialist M. Mitchell, Radiation Specialist
Approved by:	Gary L. Shear, Chief, Plant Support Branch 2 Division of Reactor Safety

EXECUTIVE SUMMARY

Enrico Fermi, Unit 2
NRC Inspection Report 50-341/98016

This announced inspection included the as-low-as-is-reasonably-achievable (ALARA) planning and controls for the sixth refueling outage (RFO6); internal exposure monitoring; radiological surveys and postings; radiation worker performance; and the control of high, locked high and very high radiation areas. Ongoing work such as the recirculation motor removal/replacement, drywell insulation removal/replacement, the torus desludging/recoating and strainer replacement and fuel movement were also observed. No previously identified NRC items were reviewed during this inspection and no violations were identified.

- RFO6 activities were well planned and utilized effective ALARA controls. Accrued dose was consistent with completed work including emergent activities. Shielding and scaffolding support work was well conducted. Workers exhibited good work practices and Radiation Protection (RP) management and technicians' work oversight was effective (Section R1.1).

- The inspectors concluded that the licensee maintained an effective internal exposure control program. Whole Body Counting systems were appropriately used and well maintained. In-vitro bioassays were conducted as required for the torus diving work. The licensee's actions following the discovery of iodine in the main steam reheaters were considered appropriate (Section R1.2).

- Radiological postings and controls were well maintained and associated surveys were well performed. During walkdowns, the inspectors observed good work practices and observed no significant, radiological impediments to routine work. However, one worker was observed performing an improper whole body frisk, and some problems were identified with radiological access control between the Reactor and Turbine Buildings and with workers frisking after leaving the torus and drywell work areas (Section R2.1).

- Access to high, locked high and very high radiation areas was well controlled and associated keys were properly issued and accounted for by RP staff. One problem with housekeeping and scaffold material condition was identified inside the waste clarifier room, a posted Locked High Radiation Area (Section R2.2).

- ALARA Planning and controls for the recirculation pump work (Section R4.1), drywell insulation removal and replacement (Section R4.2), torus desludging/recoating and strainer replacement (Section R4.3), and refueling floor activities (Section R4.4) were considered good.

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- ALARA Planning and controls for the recirculation pump work (Section R4.1), drywell insulation removal and replacement (Section R4.2), torus desludging/recoating and strainer replacement (Section R4.3), and refueling floor activities (Section R4.4) were considered good.

Report Details

IV. Plant Support

R1 Status of Radiation Protection and Chemistry (RP&C) Controls

R1.1 ALARA Planning and Controls for the Sixth Refueling Outage (RFO6)

a. Inspection Scope (IP 83750)

The inspectors reviewed the ALARA planning and controls for RFO6. This inspection included a walkdown of the Reactor and Turbine Buildings, observations of work activities, interviews with workers, and a review of documents.

b. Observations and Findings

The RFO6 dose goal was 114 rem and as of September 17, 1998, about 63 rem was accrued with about 50% of the planned work completed. Significant activities and the current dose/work status through the above date were: recirculation pump motor replacement, 14.3 rem (40% complete); drywell insulation removal/ replacement, 9 rem (50% complete); and torus desludging/recoating and strainer replacement, 1.5 rem (50% complete). Each of these jobs was assigned an ALARA project manager, responsible for planning, control and coordination between RP and other work groups. These activities are discussed in more detail in Section R4 of this report.

Emergent work from the failure of some valves during Local Leak Rate Testing (LLRT), two additional main steam isolation valves (inboard/outboard) that also failed testing, and scope growth from the recirculation pump motor work, contributed an additional 2 rem to date. Outage individual total effective dose equivalent (TEDE) totals were less than 1 rem and the number of contamination events (23) was low. Only one outage worker had declared pregnancy and she was being controlled in accordance with 10 CFR Part 20 requirements.

Based on discussions with ALARA planners, workers and RP Technicians (RPTs), the inspectors concluded that work activities had been appropriately planned. During the 3rd Quarter 1998 ALARA committee meeting, the RP group discussed the significant outage activities and the associated controls. Several meeting attendees interviewed by the inspectors stated that a quorum was present and the RP presentation received a critical review. Radiation work permits (RWPs) reviewed by the inspectors made use of industry and station historical data, were consistent with the associated ALARA plan, and listed contingency planning stop points. During pre-job planning, work planners either used digitized pictures or directly observed worksite locations. For drywell work, the licensee developed integrated planning maps showing the location of significant activities and corresponding shielding/scaffolding. These maps were considered very effective by workers.

As in past outages, TEDE-ALARA reviews did not support the use of respirators for radiological controls. These analyses were selectively validated by the inspectors. For industrial safety concerns, some respirators were worn during turbine disassembly/ reassembly.

Outage support activities such as shielding and scaffolding installation/removal were also reviewed by the inspectors. As of September 17, about 18 rem was accrued with 50% of the planned work completed. Workers felt that management supported scaffolding/shielding work, but identified some problems with scope growth owing to the above LLRT valve failures. Additionally, a Corrective Actions Resolution Document (CARD No. 98-17667) described some planning/coordination problems with Inservice Inspection (ISI) scaffolding support. However, overall performance was considered good. Shielding and scaffolding locations were identified based on previous RFO use or as indicated by the work planners. Predefined engineering evaluations were also obtained prior to installation. Digitized pictures from the fifth refueling outage (RFO5) were used to familiarize inexperienced personnel with the work site and a mock-up of recirculation piping was used for shielding installation training. In RFO5, about 20 rem dose savings was attained from temporary shielding; a similar savings was expected for RFO6.

Overall, ALARA controls and RPT coverage were considered good. During walkdowns, the inspectors observed RP management in the field and effective control of work activities by RPTs. Air samples (including lapels) were appropriately collected and tracked, evaluated for alpha contamination during analyses, and identified no significant airborne hazards. Workers were observed utilizing low dose areas which had been posted by RPTs and using good work practices. Access to the upper drywell elevations (i.e., above 627') were properly controlled (Section R4.4) to prevent potentially significant exposures during fuel movement. Remote cameras and teledosimetry were also observed in use during drywell activities. Prejob briefings and planning meetings attended by the inspectors, were attended by appropriate personnel, adequately discussed radiological concerns (including RWPs and ALARA plans), and considered interferences from other, ongoing work.

c. Conclusions

RFO6 activities were well planned and utilized effective ALARA controls. Accrued dose was consistent with completed work including emergent activities. Shielding and scaffolding support work was well conducted. Workers exhibited good work practices and RP management and technicians' work oversight was effective.

R1.2 Internal Exposure Control

a. Inspection Scope (IP 83750)

The inspectors reviewed the use of in vivo counting systems and in vitro bioassay methods, observed whole body counting (WBC) operations, and reviewed procedures

and operational data for WBC and bioassay. The inspectors also reviewed the licensee's actions following the detection of iodine in the main steam reheaters (MSRs).

b. Observations and Findings

Station procedures required that in vivo bioassay be performed during worker in-/out processing and after a suspected intake. All persons authorized onsite were included in the bioassay program. Under special circumstances, the RP Superintendent can exempt workers from bioassay. However, no exemptions had been granted through the outage to date. The inspectors observed routine WBC activities and noted that staff were knowledgeable of procedures and used them to perform data collection. No deviations from procedural expectations were observed during the inspection.

The licensee maintained three WBCs; two stand-up and one chair system. Each was calibrated after initial installation or major equipment changes (such as detector replacement); these calibrations were then verified annually. The inspectors reviewed a recalibration of the chair system after detector replacement (January 30, 1997) and calibration verifications from the last two years. The chair calibration was performed using a methodology consistent with industry and NRC guidance and all verifications were conducted as stated in station procedures.

The licensee planned to replace the software used in the WBC systems in January 1999, as it was no longer supported by the vendor and was not year 2000 compatible.

In vitro bioassay was performed after a suspected/known uptake involving alpha or beta emitting isotopes. Entrance and exit bioassays were also performed for torus and fuel pool diving work. The inspectors verified that divers involved in the torus work (section R4.3) had submitted entrance bioassays. However, the analytical results were not available during the inspection. Additionally, a bioassay sample was required if torus, tritium water levels reached a prescribed limit. These limits had not been exceeded as of this inspection. No other in-vitro analyses had occurred since RFO5.

During opening of the MSRs, RP staff identified a release of entrained iodine (I^{131}). Given the good fuel history and the lack of significant operating events, iodine was not expected in the steam systems. The inspectors and licensee RP staff independently determined that the resultant exposure was < 10 mrem committed effective dose equivalent (CEDE). The source of the iodine had not been determined as of the conclusion of this inspection, but was being evaluated by the licensee.

c. Conclusions

The inspectors concluded that the licensee maintained an effective internal exposure control program. Whole Body Counting systems were appropriately used and well maintained. In-vitro bioassays were conducted as required for the torus diving work. The licensee's actions following the discovery of iodine in the MSRs were considered appropriate.

R2 Status of RP&C Facilities and Equipment

R2.1 Radiological Surveys, Conditions, Practices, Labeling, and Postings

a. Inspection Scope (IP 83750)

The inspectors conducted several walkdowns of the Radiological Restricted Area (RRA) including the Reactor, Turbine, Radwaste and Auxiliary Buildings and the Onsite Storage facility (OSSF). During these walkdowns, the inspector reviewed plant radiological posting and labeling, control of contamination areas, radworker performance, radiation surveys, plant housekeeping, and materiel condition.

b. Observations and Findings

The radiological surveys, postings, and labeling effectively informed plant workers of radiological conditions and presented information in accordance with station procedure. Independent radiation surveys conducted by the inspector throughout the facility verified that area postings and container labels were appropriate. Several plant staff were interviewed to verify that station requirements regarding surveys and postings were well understood. Plant housekeeping and material condition was controlled consistent with ongoing work.

Contamination control practices were effective and housekeeping was considered good. Catch basins were well secured, contaminated materials were appropriately bagged and/or labeled, and contaminated area boundaries were well maintained. Several minor examples of contaminated hoses improperly routed to drains were observed in the Radwaste Building, which were promptly corrected by RP personnel. Workers were observed using proper work controls inside contaminated areas and appropriately surveying material prior to leaving the RRA. However, an inspector observed one worker performing an improper whole body frisk. The inspector reported the incident to RP supervision who subsequently counseled the worker's work group.

During walkdowns, the inspectors observed no significant radiological impediment to workers, but did note a potential problem with radiological access control between the Reactor and Turbine Buildings (both posted RRAs). During the outage, the licensee required that all personnel leaving the Reactor Building via the Drywell Entrance/Egress Building, perform a whole body frisk prior to entering the Turbine Building. This requirement was an RP outage expectation and not stated in procedures. The inspectors observed that during high occupancy periods (such as work break times), some workers entered the Turbine Building breezeway before doing the expected survey. Additionally, some workers interviewed by the inspectors were not aware of the expectation.

In addition, the inspectors identified that workers at the torus and drywell control points were not informed (via local postings or attending RPTs) of the closest whole body frisker (WBF) to their location. Because both areas were considered contaminated, workers were required to frisk after leaving. The inspectors observed some workers

proceeding to the nearest WBF and others proceeding to the main RRA control point WBFs. The inspectors noted that this practice could result in a potential contamination spread throughout the facility. RP management agreed with both observations and planned to evaluate the use of additional postings and/or controls.

The inspectors reviewed current 1998 radiation survey data and noted that these surveys were comprehensive, conducted at the appropriate locations, and at the required frequencies. In particular, the inspectors observed current survey data being posted at the drywell, torus diving and refueling floor control points, and being used by workers in the field.

c. Conclusions

Radiological postings and controls were well maintained and associated surveys were well performed. During walkdowns, the inspectors observed good work practices and observed no significant, radiological impediments to routine work. However, one worker was observed performing an improper whole body frisk and some problems were identified with radiological access control between the Reactor and Turbine Buildings, and with workers frisking after leaving the torus and drywell work areas.

R2.2 Condition of High, Locked High and Very High Radiation Areas

a. Inspection Scope (IP 83750)

The inspectors observed the licensee controls over high (HRA), locked high (LHRA) and very high radiation areas (VHRA) and the condition of several infrequently entered LHRAs in the Radwaste and Reactor Buildings. This inspection consisted of a review of procedures, a plant walkdown, and interviews with workers.

b. Observations and Findings

Accompanied by an RP Supervisor, an inspector observed the condition of the following infrequently entered LHRAs: the centrifuge tank room, the centrifuge feed tank recirculation pump room, the waste clarifier/spent resin tank room, the condensate phase separator tank room and the reactor water cleanup phase separator tank rooms. Radiological housekeeping and equipment material condition were considered good with the exception of the waste clarifier tank room. This room contained debris which partially blocked access to the floor sump. Scaffolding located in the room was noted to be in an unsafe condition (i.e., missing bracing, etc) and did not have a station approval tag. The licensee documented this finding in a CARD (no. 98-17771) and planned additional follow-up actions.

The inspectors noted that all observed areas were locked and properly posted and that only two locations, the traversing incore probe (TIP) storage area and the drywell were controlled as VHRAs. However, the drywell is only a VHRA during normal operation and was considered an LHRA during the outage. LHRA keys were appropriately stored, controlled and inventoried by RP staff. Each LHRA was controlled by a specific lock

(i.e., no common keys) and each key was tagged with the location and other, supplemental information, such as whether RP supervision permission was required for entry or if the area was not routinely surveyed.

The inspectors observed workers using effective controls in HRAs/LHRAs and verified, through interviews, that workers understood them. Entry procedures were reviewed for clarity and consistency with NRC regulations and industry practice; no problems were identified.

c. Conclusions

Access to HRAs, LHRAs, and VHRAs was well controlled and associated keys were properly issued and accounted for by RP staff. One problem with housekeeping and scaffold material condition was identified inside the waste clarifier room, a posted LHRA.

R4 Staff Knowledge and Performance in RP&C

R4.1 Recirculation Pump Motor Work (IP 83750)

The inspectors observed the ALARA controls and planning for the recirculation pump motor work. This job was a first-time station evolution and industry history was used during prejob planning. However, the lack of station experience has resulted in emergent work from interferences, etc that were unforeseen during preoutage planning, and which was expected to increase the total job dose beyond the 17 rem estimated (see Section R1.1). Work controls included using dedicated work crews and having each crew train on a mockup of the recirculation pump motor and seal assembly prior to the outage. Digital photos and films from previous RFOs were also used to familiarize inexperienced workers with the work site. All replacement internals were fit-tested in low dose areas prior to actual installation. Remote cameras and dedicated RPT coverage were used to monitor workers and lower exposure from supervisory walkdowns. The inspectors observed effective radworker practices such as use of low dose areas and noted RPTs in continual attendance and controlling personnel access. Additionally, air samples and high efficiency particulate air (HEPA) filtration units were used to monitor and minimize potential airborne levels. A review of the RP logbook entries and associated survey records, did not identify any significant radiological problems.

R4.2 Drywell Insulation Removal/Replacement (IP 83750)

The inspectors observed the ALARA planning and controls for the drywell insulation removal/replacement work. As recorded in RP logbook entries and stated by workers, the work was going smoothly. Significantly lower than expected drywell dose rates and good worker performance, will probably result in this work being completed for well below the 28 rem goal. In particular, the workers' performance was somewhat surprising as most had relatively little nuclear experience. Based on industry and plant history, RPTs were present during initial breaching of insulation and lapel air samplers were worn by the workers. However, in lieu of respiratory protection, faceshields were

worn. Although HEPA filtration and vacuum systems were available, lower than anticipated surface and airborne contamination levels did not require their use. The inspectors noted no significant problems while observing this work activity.

R4.3 Torus Desludging/Recoating and Strainer Replacement (IP 83750)

The inspectors observed the ALARA controls and planning for the torus desludging/recoating and strainer replacement work. Because the job required extensive diving and the divers were inexperienced with nuclear work, a local pool was used as a training mockup. Additionally, a computer model of the torus and the strainers was used to assist in the prejob planning. This model identified a potential problem with the size of one of the replacement strainers which required that a modification be made prior to job start. Had this problem been identified during work, it could have increased the job scope and associated exposure. The inspectors observed good diving controls including the use of teledosimetry, remote communications and underwater cameras. Areas having high underwater dose rates were indicated by tags hanging on the torus railing. RPTs were in continuous attendance, were aware of industry events involving diving operations and of the diver's proximity to the high dose rate areas. Additionally, whenever divers entered or exited the water proper controls were used to minimize the potential spread of hot particles. To maintain good water clarity, a portable, backwashable filtering system was used. Previously, a disposable filtration system would have been used. The new system was expected to save about 1 rem from the total exposure.

R4.4 Refueling Floor Activities (IP 83750)

The inspectors observed the ALARA controls and planning for refueling floor activities. Specifically observed were portions of undervessel Inservice Inspection (ISI) and fuel movement work. Total dose through September 17, 1998, was about 1 rem with 50% of the overall scope done. Area dose rates (1-5 mrem/hr) and contamination levels ($\leq$ 1000 disintegrations per minute /100 cm^2) were low, and were posted daily on an RP status board. Area radiation monitors, continuous air monitors and portable air samplers were well located, operable and a review of monitor and sample trending data identified no radiological concerns. Access to the refuel floor was well controlled and RPTs were continuously in attendance. The RPT logbook was maintained as required and a selective review of entrees since the start of RFO6 identified no significant problems with work control or coordination. Through interviews, the inspectors verified that refuel floor workers were kept appraised of plant activities and that drywell personnel were informed when fuel movement was occurring.

X1 Exit Meeting Summary

The inspectors presented these results to licensee management and staff during an exit meeting on September 18, 1998. The licensee representatives stated that none of the materials examined during the inspection were considered proprietary.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

L. Craine, General Superintendent, RP/Environmental Control
L. Crissman, General Superintendent - Radwaste
R. Gaston, Licensing/Compliance Supervisor
R. Gilmore, Supervisor--Radiological Health
P. Gipson, Senior Vice President
T. Haberland, Work Control Superintendent
D. Harmon, RP Supervisor/Operations (ALARA)
K. Harsley, Licensing Compliance
E. Kokosky, Superintendent and Radiation Protection Manager
G. MacAdam, General Supervisor, Radiation Protection Operations
W. O'Conner, Nuclear Assessment, Assistant Vice-President
J. Oetken, Radiological Engineer
N. Peterson, Director, Nuclear Licensing
D. Williams, Assistant Radiation Protection Manager

NRC

G. Harris, Senior Resident Inspector, Fermi 2

INSPECTION PROCEDURES USED

IP 83750, "Occupational Radiation Exposure"

ITEMS OPENED, CLOSED, AND DISCUSSED

THERE WERE NO ITEMS OPENED, CLOSED OR DISCUSSED IN THIS REPORT

LIST OF ACRONYMS USED

ALARA	As-Low-As-is-Reasonably-Achievable
CARD	Condition Assessment Resolution Document
CEDE	Committed Effective Dose Equivalent
HRA	High Radiation Area
HEPA	High Efficiency Particulate Air
ISI	Inservice Inspection
LHRA	Locked High Radiation Area
LLRT	Local Leak Rate Testing
MSR	Main Steam Reheaters
VHRA	Very High Radiation Area
OSSF	Onsite Storage Facility
RFO	Refueling Outage
RP	Radiation Protection
RP&C	Radiation Protection & Chemistry
RPT	Radiation Protection Technician
RRA	Radiologically Restricted Area
RWP	Radiation Work Permit
TEDE	Total Effective Dose Equivalent
WBC	Whole Body Counting
WBF	Whole Body Frisker

PARTIAL LIST OF DOCUMENTS REVIEWED

Station Procedure Nos:

MOP13 (rev. 5)	Conduct of Refueling and Core Alterations
MRP06 (rev. 1)	Accessing and Control of High Radiation, Locked High Radiation and Very High Radiation Areas
MRP-11 (rev 2)	Nuclear Medicine Patients
MRP-03 (rev 3)	Personnel Radiation Monitoring Devices
65000.211 (rev 7)	Operating Procedure Bioassay Sample Collection and Processing
65000.246 (rev 4)	Startup, Shutdown and Quality Control of Atlan-Scan Whole Body Counter
65000.247 (rev 4)	Performing a Whole Body Count using Atlan-Scan Whole Body Counter
65000.248 (rev 5)	Efficiency Calibration and Activity Verification of Atlan-Scan Whole Body Counter
65000.249 (rev 5)	Startup, Shutdown and Quality Control of Standup Whole Body Counter
65000.250 (rev 5)	Performing a Whole Body Count using Standup Whole Body Counter
65000.251 (rev 5)	Efficiency Calibration and Activity Verification of Standup Whole Body Counter
65000.252 (rev 2)	Startup, Shutdown and Quality Control of Chair Whole Body Counter
65000.253 (rev 5)	Performing a Whole Body Count using Chair Whole Body Counter
65000.254 (rev 4)	Efficiency Calibration and Activity Verification of Chair Whole Body Counter
65000.257 (rev 2)	Calculation of Internal Dose
65000.704 (rev 9)	Issuance of Respiratory Protection Equipment
63.300.200 (rev. 11)	ALARA Reviews

CARD Nos:

98-1771 (9/17/98)	Potentially Unsafe Saffolding and Poor Housekeeping Inside the Waste Clarifier Tank Room
98-17667 (9/13/98)	ISI Scaffolding Concerns

RWP Nos (includes associated ALARA plans).

98-1080 (rev.1)	Remove and Replace the A & B Recirc Pump Impellers
98-1079 (rev. 1)	Remove and Replace Reactor Recirc Pump Motors , Including Seal Replacement
98-1081 (rev. 0)	Inspect A & B Recirc Pump Casings to Include RP Coverage
98-1083 (rev. 1)	Disassemble/Clean/Reassemble the 'B' Recirc Motor in the Turbine Building and All Other Associated Work
98-1120 (rev. 0)	Torus Diving-Change Out Six Suction Strainers, Desludging, Underwater Coating Inspections/Repair & Replace/Inspect Diving Equipment
98-1123 (rev. 0)	Set-Up, Use and Mobilization of Backflushable System for Torus Desludging to Include the Transfer of All Radioactive Containers To/From Radwaste

98-1061 (rev. 1) Perform Insulation Removal, Repair, and Replacement In Support of Drywell Work.

Miscellaneous:

September 17, 1998, memorandum to D. Williams, Radiation Protection Shift Manager, regarding RFO6 Dose Status and Emergent Work

September 3, 1998, memorandum to E. Kokosky, Superintendent Radiation Protection and Chemistry, regarding pre-outage informal training for craft insulators.

Engineering Design Package No. 29637 (rev. A) titled "Replace Min-K Insulation With NUKON Insulation"

3Rd Quarter ALARA Committee Meeting Minutes

RFO5 Post Outage Lessons Learned Report