

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-440/89016(DRSS)

Docket No. 50-440

License No. NPF-58

Licensee: Cleveland Electric Illuminating Company
Post Office Box 5000
Cleveland, OH 44101

Facility Name: Perry Nuclear Power Plant, Unit 1

Inspection At: Perry Site, Perry, Ohio

Inspection Conducted: May 2 through June 2, 1989

Inspectors: M. A. Kunowski *M. A. Kunowski*

June 5, 1989
Date

Reviewed By: M. Schumacher, Chief
Radiological Controls
and Chemistry Section
M. Schumacher

June 5, 1989
Date
6/5/89
Date

Approved By: L. Robert Greger, Chief
Reactor Programs Branch
L. Robert Greger

6/5/89
Date

Inspection Summary

Inspection on May 2 through June 2, 1989 (Report No. 50-440/89016(DRSS))

Areas Inspected: Special, announced inspection to review allegations of a possible overexposure.

Results: The inspectors' review of this event indicated that an overexposure probably did not occur; however, a potential for one appears to have existed. The radiation field intensity was not known at the time of entry. Also, the worker exited the area without completing his work assignment because he noted an unexpected SRD reading. The inspectors identified several radiological control weaknesses attendant to the event, including inadequate surveys in support of an RWP and a lack of aggressiveness and curiosity by the radiation protection technicians covering the drywell during the incident. Four allegations related to the incident were unsubstantiated; two allegations were substantiated (Sections 2 and 3). Four apparent violations of regulatory requirements were identified, including (1) inadequate surveys, (2) failure to document a survey, (3) failure to follow radiological control procedures for installation of shielding and for initiating a radiological occurrence report, and (4) failure to use appropriate dosimetry in a high radiation area. (Sections 2 and 3).

DETAILS

1. Persons Contacted

*R. R. Bowers, Corporate Health Physicist
*W. E. Coleman, Manager, Operations Quality Section
+G. R. Dunn, Lead Engineer, Licensing and Compliance Section, Perry Plant Technical Department (PPTD)
*M. W. Gmyrek, Manager, Perry Plant Operations Department
++H. L. Hegrat, Operations Engineer, Licensing and Compliance Section
J. V. Ivery, Superintendent, R. J. Frazier
*S. F. Kensicki, Director, PPTD
*R. A. Newkirk, Manager, Licensing and Compliance Section
R. W. Parsons, Superintendent, R. J. Frazier
C. Reiter, Health Physics Supervisor, PPTD
T. E. Shega, System Engineer, PPTD
*L. L. VanDerHorst, Plant Health Physicist, PPTD
+*F. C. Whittaker, Lead Health Physics Supervisor, PPTD
*S. J. Wojton, Manager, Radiation Protection Section, PPTD

The inspectors also contacted other licensee employees, including technicians, workmen, and supervisors.

*G. F. O'Dwyer, NRC Resident Inspector

*Denotes those present at the exit meeting on May 10, 1989.

+Denotes those present at the exit telephone meeting on June 5, 1989.

2. Allegation Followup

(Closed) Allegation (AMS No. RIII-89-A-0054)

a. Allegation Concern No. 1: A worker may have been overexposed during a job.

An allegation concerning a possible overexposure was received in the Region III office on April 10, 1989; subsequent telephone conversations with the aleger were held on April 27, May 11, and May 31, 1989. The aleger stated that on March 24, 1989, a worker may have been overexposed when he was allowed to work in an unexpectedly high radiation field near a hotspot that was later determined to be 12 R/hr on contact. Several concerns were expressed by the aleger, namely, that the worker was blamed for the exposure, that the RPM may have been covering up the exposure, that the Radiation Work Permit (RWP) for the job was not properly written, that the hotspot in the pipe should have been shielded, and that the worker had not been issued proper dosimetry for the job.

These allegations were reviewed by Region III inspectors during a special onsite inspection on May 2-3, and May 8-10, 1989 and in subsequent telephone discussions with licensee representatives

through June 2, 1989. The inspection consisted of record and procedure review, job site observations, and interviews of workers and licensee technical and management personnel.

Discussion: On March 24, 1989, at 6:45 p.m., the worker, who is a pipefitter, and his foreman entered the drywell on RWP 890335 to provide support for inservice inspection (ISI) work. Attached to the RWP were several survey maps for various locations in the drywell, including the general areas in which the men had to go. The men stated they notified the radiation protection technicians (RPTs) at the drywell access control desk before entry, as required by the RWP, and were told of the radiological conditions in the areas in which they had to work, as shown on the survey maps.

The individuals then entered the drywell and first went to the reactor water cleanup (RWCU) system on the 583' elevation. After approximately 30 minutes, the men left this area and went to the 630' elevation to scope another job, removal of pipe supports (snubbers and pipe clamps) on the low pressure coolant injection (LPCI) line. The supports are located about 2' upstream of a LPCI line check valve in an approximately 3.5' x 5' x 6' pit, adjacent to, but below, the 630' elevation walkway. This pit is normally not accessible from the walkway, being enclosed by jet shielding; however, some of the jet shielding had been removed on March 22, 1989, allowing access to it.

Within the pit, the foreman recorded some preliminary data and explained to the worker what had to be done for the job. The men left the area after approximately 15 minutes (at about 8:00 p.m.) and returned to the drywell exit. As they left the drywell, they told the RPTs that they had received approximately 30 mrem, an unexpected amount, on their SRDs during their short time at the LPCI job site. The RPTs attributed this exposure to the time the workers spent at the RWCU job, where the general area dose rates ranged from 100-150 mrem/hour, and not the LPCI job, where general area dose rates supposedly ranged from 5-18 mrem/hour, according to the posted survey, dated May 16, 1989, taken before the jet shielding was removed. No records were found which showed that a survey of the pit area was conducted after removal of the jet shielding on March 22 and the initial pit entry by the workers on March 24.

The RPT who was named in the allegation stated that after the men left he surveyed the pit and identified a 2.5 R/hour (contact) hotspot on the LPCI pipe about 3' downstream of the snubbers, and also measured general area dose rates of 80-100 mR/hour. These general area levels were about a factor of ten higher than those measured during the survey of March 16, 1989, which was being used to allow entry under the RWP. However, the March 16, 1989, survey was done with the jet shielding in place and, therefore, did not properly characterize the radiological conditions in the pit. The licensee's use of an inappropriate survey to govern RWP entry is an apparent violation of 10 CFR 20.201(b), which requires the licensee

to make surveys that are necessary and reasonable to evaluate the extent of radiation hazards that may be present (No. 440/89016-01a).

In addition, the inspectors determined that the survey identifying the 2.5 R/hour hotspot was not documented, an apparent violation of the 10 CFR 20.401(b), which requires the licensee to maintain records of surveys required by 10 CFR 20.201(b) (No. 440/89016-02).

At 11:45 p.m., the foreman and the worker returned to the drywell, with a second worker. The RPT stated he informed them of the survey results including the hotspot. (However, the worker and the foreman stated to the inspectors that they were not informed of any hotspot. The foreman stated that he and the RPT went to the work area, where the RPT explained that he had surveyed the area earlier in the day and that dose rates along the bottom of the pipe were 80 mR/hour and indicated that general area dose rates were lower. The worker stated that the survey results that were relayed to him were general area dose rates were 30-40 mR/hour.)

The worker stated he began the job, assisted by the second worker, who did not enter the pit, but stayed on the 630' walkway to get tools as needed. Meanwhile, the foreman, with the agreement of the RPT, obtained lead shielding and gave it to the workers, who "hung" it on the pipe near the snubbers. However, it appears that the lead shielding was not placed around the pipe elbow, the spot identified by the RPT as the hot spot, but on a horizontal section of the pipe near the snubbers.

They continued working until the first worker read his low-range SRD, and observed what he thought was movement of the SRD hairline. (Both workers stated to the inspectors that the worker read the SRD because of his apprehension about the radiation hazards in the area and not because of such instructions by the RPT.) The workers immediately left the area and went to the drywell exit where they informed the named RPT of the behavior of the SRD. The worker estimated that he had been in the pit for 35 to 40 minutes before he left.

The RWP record shows 210 mR total dose based on the worker's low-range SRD; the RPT stated that the worker's high-range SRD read 50 mR. The RPT also stated that he told the worker that the discrepancy may be due to a faulty low-range SRD. (It was later ascribed by health physics management to differences in location of the two dosimeters with respect to the hotspot.)

The RPT stated that sometime later he resurveyed the pit with a different meter and found that the intensity of the hotspot had increased to 3.5 R/hour and the general area dose rates had increased to 300-400 mR/hour. The technician then returned to the drywell exit and informed the workers of the survey results. (The workers claim that when the technician returned, he apologized to

them saying, in effect, that the meter he used for the previous survey must have been defective, and that there was a hotspot in the elbow of the pipe and general area dose rates were 300-400 mR/hour. The workers then left the drywell, at about 12:30 a.m., on March 25, 1989.

Another foreman (the general foreman) stated to the inspectors that after hearing of the hotspot, he borrowed a Bicron Model Tech 50 G-M survey meter from the RPTs at the drywell control desk and surveyed the elbow. He stated that he measured 5 R/hour on contact with the elbow (5 R/hour is the highest value obtainable with this model survey meter.)

According to the technician, after he informed the workers of the survey results he informed his supervisor of the apparent change in the radiological conditions in the pit. Subsequently, no further entries were allowed, pending an ALARA review. The RPT documented his survey approximately 30 minutes later, at 1:00 a.m. There is no record of the survey by the general foreman.

During his next shift (on Saturday night, March 25th), the RPT stated that he again surveyed the work area in the pit and determined that the hotspot was now reading 12 R/hour and the general area dose rate was 1 R/hour. For this survey, the RPT climbed down into the pit, whereas, for the two previous surveys, he did not enter the pit, but just reached in with his meter from the walkway. An inspection of the work area by an NRC inspector indicated that because of the narrow, partially obstructed opening to the area, and the position of the 12" LPCI pipe in the pit, an adequate survey of the work area could not have been made from the walkway with the type of survey meter used by the technician. Performing the two surveys of the pit from the walkway is another instance of an apparent violation of 10 CFR 20.201(b), which requires the licensee to make surveys that are reasonable to evaluate the extent of radiation hazards that may be present (No. 440/89016-01b).

On his next shift, (Saturday-Sunday, March 25-26), the worker discussed the incident with an HP supervisor who took the worker's TLD for processing, and began an investigation to determine if an overexposure had occurred. Later, the worker discussed the incident with the HP supervisor responsible for external dosimetry on nightshift. This supervisor apparently tried to allay some of the worker's concerns, and provided, at the worker's request, a preliminary dose estimate that ranged from 210 mrem to 7000 mrem. The 210 mrem value was the worker's recorded dose for the job according to the low-range SRD and the 7000 mrem value was a worst-case estimate assuming the worker was in contact with a 3.5 R/hour hotspot for the entire 2 hours he spent in the drywell. The supervisor then refined the estimate by assuming 20% of the time was spent in transit to and from the work area, and explained to the worker that even this simple assumption would change the upper estimate from 7 rem to 4.76 rem. (The supervisor stated in a memo

dated March 26, 1989, that he later realized that he miscalculated the value, noting that 80% of 7 rem is 5.6 rem, not 4.76 rem.) After discussing this estimate and general information on the effects of radiation, the supervisor and the worker then discussed other details of the job.

During the remainder of the week, the plant HP staff made a more formal evaluation of the potential doses to the worker and the foreman. The evaluation used personal dosimetry results, a detailed survey of the work area, and times and distances obtained from a reenactment of the job in the dose reconstruction. The reenactment was performed in the pit using an HP supervisor of similar height as a surrogate for the worker. The reconstruction for the worker assumed:

- (1) The head 12 inches from the hotspot for 26.5 minutes in a field of 500 mR/hr;
- (2) The head 9 inches from the hotspot for 26.5 minutes in a field of 1000 mR/hr; and
- (3) The head 3 inches from the hotspot for two minutes in a field of 3500 mR/hr.

(According to licensee representatives, distances referenced for the dose rates were measured from the pipe to the center of the detector which is located approximately 1 1/2 inches from the base of the survey meter.)

The resulting dose estimate to the head of the worker was 780 mrem for his two entries into the pit. A similar but more detailed scenario was used to estimate 346 millirems for the foreman's entries (17 minutes) into the pit. The corporate health physicist made independent dose estimates based on the worker's dosimeter readings and allowing for attenuation through the body but using the same dose rate-time scenario. He obtained 750 and 860 mrem for the worker's high and low range dosimeters, respectively, which are not significantly different from the 780 mrem estimated by the station staff.

The reconstruction was necessitated by the absence of dosimetry on the portion of the total body (the head or top of the back) nearest the hotspot. The reconstruction for the foreman appears better because it was based on his detailed written description of his actions and assumes a short period in contact with the pipe. The reconstruction for the worker assumed no contact time despite the worker's assertion that he leaned against the pipe (although not necessarily the hot spot). An NRC inspector who entered the pit noted that it was neither difficult nor awkward to place his head on the LPCI pipe. The worker told NRC representatives that he was not sure of time or positions with reference to the hotspot.

While the licensee's dose estimate of 780 mrem for the worker may be a reasonably good estimate of his actual dose, there is an uncertainty associated with this estimate due to the worker's stated lack of specific recollection of his body movements in the pit. However, because the worker did not recall having his head in contact with the pipe for a significant length of time, it does not appear that even under conservatively assumed conditions, he could have received a dose in excess of regulatory limits.

Finding: This allegation could not be substantiated. It appears, based on the results of this inspection, that no overexposure occurred although the worker's dose may have been underestimated by assuming that no time was spent in direct contact with the hotspot. However, a potential for an overexposure did exist and an overexposure may have occurred if the worker had not left the work area when he did and/or if the hotspot radiation levels had been higher. Two apparent violations of NRC requirements were identified.

- b. Allegation Concern No. 2: The RPM told the worker that the exposure was the worker's fault.

Discussion: The RPM denied making a statement of this nature to the worker. The RPM stated to the inspectors that while discussing the incident with the worker and hearing comments from the worker concerning how many times he questioned the RPTs about the dose rates in the area that he (the RPM) did tell the worker that if he was not satisfied with the answers he was getting from the techs that he should have pursued the matter at a higher level, as allowed and encouraged by station policy.

Findings: The RPM made a statement that could be interpreted as ascribing fault to the worker; however, the RPM denied that was the intention. The allegation was not substantiated. No violations of NRC requirements were identified.

- c. Allegation Concern No. 3: The alleger stated that he was concerned that the RPM may be covering up the alleged overexposure because the RPM would not allow the worker to see or copy any of the records pertaining to the incident, and because of the RPM's statement that he (the RPM) "never had anyone burned out at Perry" and that he would evaluate the dose and "it will probably be under 1000 mR." This concern was reinforced by the fact that another HP supervisor had earlier given him an exposure estimate of 4.78 rem (The licensee's memo of March 26, 1989 refers to this estimate as 4.76 rem. See Allegation Concern No. 1.)

Discussion: The RPM stated to the inspectors that the worker requested to review or receive copies of some records but that he declined because the evaluation was not yet complete. The RPM stated that the worker was told that copies could be requested after completion of the evaluation. On May 2, 1989, the RPM told the

inspectors that the evaluation had been completed but no request from the worker had been received. He further stated that he had no reason to deny the worker's request and, in fact, had responded to a similar request from the foreman for his records. He added that such detailed records are not normally given to workers.

The RPM told the inspectors that he did not remember making the statement that he "never had anyone burned out at Perry," but stated that he did tell the worker that it was not Perry's policy to "burn out" workers; but rather it was Perry's policy to minimize dose to the individual and to groups of workers, and to equally distribute dose as much as possible. He also stated that his forecast of under 1000 mR was based on his knowledge of the tentative results of the evaluation then in progress, which was much more plausible than the crude 4.76 rem estimate made before detailed measurements were taken in the pit.

Findings: The inspectors could not substantiate the allegation that the RPM was concealing information from the worker regarding the worker's exposure. The RPM acknowledged that records of the incomplete evaluation were not given to the worker but stated that the worker was told he could request a copy of the evaluation when completed. No violations of NRC requirements were identified.

- d. Allegation Concern No. 4: The Radiation Work Permit (RWP) for the job on which the alleged overexposure occurred was not properly written.

Discussion: The algeber stated that he was told by the ALARA Coordinator (name unknown) that the HP department "screwed up the RWP." The inspectors interviewed the members of the ALARA staff, including the dayshift and nightshift ALARA Coordinators, and several ALARA Specialists. The nightshift ALARA Coordinator remembered being questioned by an individual unknown to him about the incident but stated that he did not remember making such a statement about the RWP to the individual, and probably would not have made such a statement. RWP No. 890335, written March 1, 1989, covered in-service inspection and support work which included snubber removal in the pit. The RWP covered such work, throughout the drywell. It specified that HP be notified before the start of work so that area conditions may be established and also required either HP coverage or a dose rate meter to enter a high radiation area (HRA). The entire drywell was posted as an HRA with control over entry exercised at the HP desk at its entrance where the RWP sign-in sheets are kept. In this case, area conditions were established not from a survey at the time of entry on March 24, but from the record of a survey made on March 16, as noted in the discussion under Allegation Concern No. 1, this survey was inadequate because it did not accurately depict conditions in the pit at the time of entry.

Finding: The RWP, although very generally written, was adequate to prevent this occurrence had it been followed; therefore the

allegation was unsubstantiated. However, overall radiological control was vitiated due to inadequate surveys to establish radiological conditions, as described under Allegation Concern No. 1.

- e. Allegation Concern No. 5: A pipe with a hotspot should have been shielded during the work in the area.

Discussion: Station practice is to shield or flush hotspots before allowing work to proceed and if not practical, then to use other means to limit worker exposure such as restricting staytime or using alarming dosimeters. The opportunity to use such controls before work in the pit began on March 24 was missed due to the inadequate survey previously discussed. Also, the controls were not imposed before worker reentry following discovery of the 2.5 R/hr hotspot. Shielding was hung by the workers after reentry, at about 11:45 p.m. However, it was not hung in accordance with Perry Administrative Procedure PAP-0122, "Selection and Use of Temporary Shielding," which requires completion of a request form PPNP No. 6623 and an estimate by the ALARA Coordinator of the person-rem that would be incurred if the shielding were not installed. Failure to follow this procedure is an apparent violation of Technical Specification 6.11.1 which requires adherence to procedures for personnel radiation protection (Violation 440/89016-3a).

Finding: This allegation is substantiated. Although licensee procedures were vague on this point, good ALARA practice would have dictated shielding the hotspot before work began in the pit; that it was not hung then is an apparent result of the inadequate survey. When it was hung, it was done so improperly. One apparent violation was identified.

- f. Allegation Concern No. 6: Dosimetry should have been placed on the worker's head while working near the hotspot.

Discussion: Based on discussions with the worker and the foreman, a reenactment of the job, and survey information, it is apparent that a steep dose gradient existed in the work area, and that the highest dose during the job would have been to the head and upper back, not the chest where the dosimetry was placed. The dosimeters near the chest would have been subject to shielding from the worker's body, whereas a dosimeter on the head or upper back would not. Therefore, the dose recorded by the dosimeter near or on the chest would be inaccurate. So too would the dose determined by back-calculation from the dosimeter because of uncertainties in position of the chest with respect to the source and because of the varying shielding effect as the worker moved around in the work area. 10 CFR 20.202(a)(3) requires each licensee to supply appropriate personnel monitoring equipment to each individual who enters a high radiation area. In apparent violation of this requirement, the licensee did not supply appropriate personnel

monitoring equipment to the two workers who entered the pit, a high radiation area, in that dosimetry was not placed on the part of the whole body subject to the highest dose (No. 440/89016-04).

Findings: The allegation was substantiated. One apparent violation of NRC requirements was identified.

3. Licensee Performance

This event revealed weaknesses in the licensee's radiological controls; most notable was the failure to adequately survey to determine radiological conditions attendant upon entry to the work area. This was significant because the controlling RWP was generally written, leaving radiological details to be determined by site-specific surveys. An adequate survey taken at entry should have resulted in identification of elevated radiation levels, an ALARA review, better worker instructions, and issuance of proper dosimetry such that the incident would have been avoided. An inadequate survey tends to undermine the RWP system of controls.

A related and perhaps more fundamental weakness was the apparent lack of curiosity by the radiation protection group covering the drywell work on March 24-25, 1989, when the exiting workers first expressed concern about their SPD readings and again after the 2.5 R/hour hotspot was identified. Opportunities to avoid an incident were again lost due to lack of aggressive response by the radiation protection group.

Lack of aggressiveness also appeared to be a weakness in the licensee's followup investigation of the event. Problems identified by the inspectors included the following.

- The licensee did not begin an investigation of this event until the worker sought out an HP supervisor on the worker's next shift (Saturday-Sunday, March 25-26) with complaints concerning the event. The foreman was not interviewed until two days after the incident (on Monday, March 27, 1989), when he also sought out an HP supervisor.
- The licensee's investigation was too narrowly focused and did not include other relevant documents such as the work order covering the worker and his foreman and the HP drywell logbook until their relevance was pointed out by the inspectors. Both of these records indicated that other workers involved in snubber related work had entered the same general area; however, subsequent licensee review of these entries indicated they were not in close proximity to the hotspot.
- The licensee had in place two procedures for conducting and documenting a thorough review which had not been invoked at the time of the inspection. Perry Administrative Procedure, PAP-0124, "Radiological Occurrence Reporting," should have been implemented by initiation of a Radiological Occurrence Report (ROR) shortly

after the event. This procedure (Section 5.1) defines a radiological occurrence as "an event which results in or could result in a violation of the intent of Perry radiological procedures, practices, or policies; or personnel radiation exposures in excess of administrative guides and 10 CFR 20 limits." The procedure also states (Section 3.4) "Individuals are responsible for reporting radiological occurrences in a timely manner." Contrary to this requirement, and thus in apparent violation of Technical Specification 6.11.1, no ROR was initiated for this incident although it violated the intent of Perry radiological procedures, practices, and policies on ALARA and external exposure control (No. 440/89016-03b).

An example of an apparent violation of NRC requirements was identified.

4. Exit Interview

An exit interview was conducted with licensee representatives (Section 1) on May 10, 1989, to discuss the tentative findings and possible enforcement options. The inspector stated that although the event may not have resulted in an overexposure, a significant potential did exist for one. The inspector also identified several apparent violations including inadequate evaluation, failure to document a survey, unauthorized shielding placement, and failure to initiate an ROR. The licensee stated that a condition report (which has a higher threshold than an ROR) was being initiated. The licensee did not identify any material reviewed by the inspectors as proprietary.

A telephone conversation was held with the licensee representatives (denoted in Section 1) on June 5, 1989, to discuss the inspection findings including apparent violations. The following matters were specifically addressed:

- a. NRC determination that an overexposure apparently did not occur, but that there may have been a substantial potential for one.
- b. Other specific allegation findings.
- c. Apparent violations for inadequate surveys (Section 2.a), for failure to document a survey (Section 2.a), for installation of temporary shielding and for failure to initiate a radiological occurrence report both contrary to procedure (Sections 2.e and 3), and failure to use appropriate dosimetry in a high radiation area (Section 2.f).
- d. Weaknesses in radiological controls related to the incident and in the licensee's followup.
- e. Confirmed the receipt of the list of topics to be specifically addressed at the Enforcement Conference, and the time, date, and location of the Enforcement Conference.