U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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Report No.:	030-31373/96002(DNMS)
Licensee:	Conam Inspection
Facilities:	1. Conam Inspection Corporate Office 2. Conam Inspection Gary Field Office
Location:	1. 1245 W. Norwood, Itasca, IL 60143 2. 2090 East 15th Avenue, Gary, IN
Dates:	March 28 through April 11, 1996 (On site at the Gary Field Office) November 12, 1996 (Exit Meeting by Telephone)
Inspectors:	T. F. Young, Radiation Specialist G. W. West, Radiation Specialist
Approved By:	M. P. Phillips, Chief Nuclear Materials Inspection Branch 2

EXECUTIVE SUMMARY

CONAM INSPECTION
NRC INSPECTION REPORT NO. 030-31373/96002(DNMS)

This was a routine, unannounced safety inspection to evaluate the licensee's oversight of radiation safety controls for its facilities, equipment, personnel, and procedures for the conduct of radiographic operations at the Gary field office. The NRC inspectors determined that the licensee's oversight of its facilities and equipment were generally adequate. However, in reviewing the February 1996 personnel radiation dosimetry report, the inspectors identified an event that occurred on February 27, 1996, involving a high exposure to one of the licensee's radiographers. Subsequent investigation into this event identified the following apparent violations:

1. Failure to properly secure the source assembly in the exposure device after each exposure as required by 10 CFR 34.22(a) and License Condition 26.

2. Failure to complete a survey of the entire circumference of the exposure device after each exposure as required by 10 CFR 34.43(b).

3. Failure to control radiation exposure of a worker to less than 5 rems (0.05 Sv), total effective dose equivalent (TEDE) as required by 10 CFR 20.1201(a).

4. Failure to immediately report to NRC an event that may have caused or threatens to cause an individual to receive a radiation dose of 25 rems (0.25 Sv), TEDE, or more as required by 10 CFR 20.2202(a).

5. Failure to conduct an adequate evaluation of personnel exposures to radiation in order to demonstrate compliance with 10 CFR 20.1201(c) as required by 10 CFR 20.1501(a)(2).

The root cause of the event appeared to be human error, with contributing factors including: (1) time constraints placed on the radiographer at the job site, (2) failure of the radiographer to follow the licensee's Operating and Emergency Procedure Manual (O&E) to properly secure the source assembly in the exposure device after each exposure, (3) weaknesses in the licensee's internal audit program, and (4) weaknesses in the written exam and field exam that were included in the licensee's training program for radiographic testing (RT) personnel.

As corrective actions following the event, the radiographer was restricted from further involvement with the licensee's radiation sources for the remainder of 1996; and the RSO issued a memo to all Radiation Safety administrative personnel about the event and the proper procedure to survey and secure exposure devices after each exposure and requested them to instruct all RT personnel about the event and the procedures to prevent recurrence.

An additional apparent violation was also identified during the inspection unrelated to the event for failure to provide a film badge to an individual who calibrated survey meters as required by License Condition 26.

Two areas of concern were also identified regarding weaknesses in the licensee's programs for internal audits and training of RT personnel in the proper procedure to secure the source assembly in the exposure device after each exposure when multiple exposures are completed from a single RT set up.

INSPECTION DETAILS

1. Program Summary and Inspection History

1.1. Inspection Scope

The inspectors reviewed the current license and licensee commitments contained in letters and applications and the licensee's corrective actions for violations identified during the previous two years.

1.2. Observations and Findings

On February 2, 1995, Amendment No. 6 of License No. 12-16559-01 was issued. The license authorized possession and use at temporary job sites for various sealed sources and devices, for conduct of: radiographic testing (RT), moisture/density measurements, X-ray fluorescence testing, and survey instrument calibration. There were no special license conditions or exemptions from NRC requirements noted in the license.

During the period of November 17, 1994, through February 26, 1996, the NRC completed seven routine, unannounced inspections at the licensee's permanent field offices located in Reading and Sharon Hills, PA; Natick, Auburn, and Springfield, MA; and Columbus, OH. These inspections included one temporary job site in Lima, OH. No violations were identified during these inspections.

The last inspection of the Gary field office was completed on September 10-24, 1993. One violation was identified for failure to carry emergency instructions while transporting licensed material.

2. Licensee Organization and Management Controls

2.1. Inspection Scope

The inspectors reviewed the licensee's current chain of command for control of licensed material and compared the names and qualifications of the incumbents with the names and qualifications of those individuals described in the licensee's commitments.

2.2. Observations and Findings

The licensee's corporate officers who were responsible for the radiation safety program continued to include Boyd Creech, President; Michael Creech, Senior Vice President; and Robert Slack, Radiation Safety Officer (RSO). The management at the Gary field office, included Randy Sweet, General Manager (GM); and Steve Fay, Radiation Safety Supervisor (RSS). These individuals were recently appointed in March 1996 to replace Bill Hiestand and Keith Tucker, respectively, who were no longer employed by the licensee. Also, there were changes for administrative personnel responsible for the Radiation Safety Program at the other field offices.

Although the names and titles of personnel differed from the names and titles submitted with the licensee's application dated March 29, 1993, which is referenced in License Condition 26, the current individuals met the qualifications for administrative personnel described in Section 5.1 of the licensee's Radiation Safety Administrative Procedures Manual (RSAM). According to the RSO, these individuals were qualified radiographers with at least three years of RT experience and had successfully completed the licensee's 125 question written exam. Also, the RSO had revised RSAM Section 1 so that when changes in administrative personnel assignments occurred, the appendices would be updated. The inspectors conferred with Region III license reviewers who indicated this was an acceptable practice. No problem was identified by the inspectors.

The GM and RSS were in the process of completing an audit of the entire radiation safety program at the Gary field office. There were 12 RT personnel assigned to this field office. RT equipment assigned to this field office included 11 exposure devices containing iridium-192 sealed sources, one exposure device containing a cobalt-60 sealed source, and one survey instrument calibrator containing a cesium-137 sealed source. As of March 24, 1996, RT equipment was located at temporary job sites in Region III and in Region I.

2.3. Conclusions

No apparent violations of NRC requirements were identified. Although the updated list of the licensee's radiation safety personnel was different from that originally submitted to NRC, the individuals were apparently qualified radiographers. The licensee is permitted to make administrative personnel changes providing the individuals meet the licensed qualification requirements, as was the case here.

3. Review of February 27, 1996, Event

3.1. Background

3.1.1. Inspection Scope

On March 28, 1996, during a routine unannounced inspection of the licensee's radiographic operations at the Gary field office, the inspectors reviewed the February 1996 personnel radiation dosimetry report that indicated a whole body radiation dose value of 4750 millirems (47.5 mSv) to one individual. The inspectors investigated the details of the radiation dose.

The inspectors interviewed individuals at the Gary field office, including: the radiographer, GM, and RSS.

3.1.2. Observations and Findings

The radiographer described the event to the inspectors during three separate interviews as follows.

On February 27, 1996, the radiographer and a second radiographer were completing radiographic testing of welds for a company located in Indianapolis, IN. These individuals were working the 10 hour evening shift. The radiographer was completing the exposures of the welds and running film to and from the dark room that was located on a licensee vehicle parked outside the building. The second radiographer was working in the dark room loading and unloading film cassettes and developing and interpreting the films. The radiographer was using an Amersham Model 660B exposure device containing 94 curies of iridium-192 in a sealed source assembly.

At about 6:30 p.m., the radiographer was completing RT of welds on two inch pipe in a vacuum pump room on the second floor of the building. After about 15 exposures of several welds, the radiographer retracted the source in the usual manner at the end of an exposure. The drive cable control unit was located outside the vacuum pump room, about 20 feet from the exposure device. The radiographer opened the door and entered the vacuum pump room with a survey instrument and loaded film cassette. The radiographer approached the rear of the exposure device that was mounted on the top platform of a six foot step ladder. The guide tube and collimator were attached to a weld in the ceiling area about three feet above and three feet to the right of the exposure device. The radiographer used the survey instrument to check the radiation levels at the rear and sides of the exposure device and the collimator and guide tube. The radiographer observed no excessive radiation levels and noted the typical reference level, 20 millirems per hour (0.2 mSv per hour), at the right side of the exposure device. The radiographer did not survey the front (exit port) of the exposure device.

10 CFR 34.43(b) requires, in part, the licensee to ensure that a survey with a calibrated and operable radiation survey instrument is made after each radiographic exposure to determine that the sealed source has been returned to its shielded position. The survey must include the entire circumference of the radiographic exposure device and any source guide tube. Failure of the radiographer to complete a radiation survey of the entire circumference of the exposure device after the radiographic exposure was an apparent violation 10 CFR 34.43(b).

The radiographer indicated that he was careless and did not survey the entire circumference of the exposure device after the exposure as required.

The radiographer then set the survey instrument aside and climbed the ladder to the second step from the top to exchange the film cassette for the second exposure of the weld. As the radiographer was facing the exposure device, he reached upward and to the right and removed the collimator and guide tube and unstrapped the first cassette and laid it near the survey instrument on an equipment cart below the ladder.

The radiographer was wearing his dosimetry equipment in a pouch that was worn in front of his waist near the midline of the body. The Direct Reading Dosimeter (DRD), Alarming Ratemeter (AR), and film badge were randomly positioned within the waist pouch along with the radiographer's other personal items. In this position, the dosimetry equipment was closer to the exposure device than the whole body. The radiographer estimated that he was in this position for about one minute.

When the radiographer was ready to strap the second film cassette onto the weld, he reversed his position on the ladder so that he was no longer facing the exposure device and the left side of his upper leg was closest to the exposure device. In this position, the dosimetry equipment was displaced so that it was further from the exposure device than the upper left leg and the film badge was shielded from the exposure device by the radiographer's body. The radiographer estimated that he was in this position for about three minutes while he strapped the second film cassette to the weld and repositioned the collimator for the second exposure of the weld. As the radiographer climbed down the ladder, he picked up the first cassette and survey instrument and reached for the rear of the exposure device to reset the automatic locking mechanism for the second exposure. The radiographer discovered that the automatic locking mechanism was not in the correct position to secure the source in the exposure device.

10 CFR 34.22(a) requires, in part, that, during radiographic operations, the sealed source assembly be secured in the shielded position each time the source is returned to that position. In addition, License Condition 26 requires the radiographer to follow the procedures contained in the licensee's Operating and Emergency Procedures Manual (O&E) that was included in the licensee's application dated March 29, 1993. O&E Item 10.3.3(c)15 requires that for the Amersham Model 660B exposure device, the radiographer turn the selector ring from operate to lock and secure with the projector lock.

On February 27, 1996, the radiographer did not realize that the automatic locking mechanism was not engaged, did not rotate the selector ring from operate to lock, and did not secure the projector lock. These steps to properly secure the source in the exposure device should have been completed after the radiographer surveyed the exposure device and before the radiographer replaced the film cassette on the weld and repositioned the collimator for the second exposure. If the radiographer had completed any of these three redundant steps to properly secure the source assembly in the exposure device, the radiographer would have discovered the unsecured source before continuing to replace the film on the weld. The radiographer indicated

that he was aware of the O&E requirement, but it was not his practice to rotate the selector ring from operate to lock or to secure the projector lock after each exposure. It was the radiographer's routine practice to rely solely on the automatic locking mechanism. Failure of the licensee's radiographer to secure the source in the exposure device is an apparent violation of 10 CFR 34.22(a) and License Condition 26.

Upon realizing that the source was not secured, the radiographer returned to the drive cable control that was positioned just outside the vacuum pump room. The radiographer rotated the control crank about 1/3 to 1/2 turn to fully retract the source assembly into the exposure device so that the automatic locking mechanism was engaged. He applied pressure on the crank in the forward direction and felt resistance that indicated the automatic locking mechanism had engaged. The radiographer checked his DRD and noted that it read "off scale" i.e. > 200 millirems (2 mSv).

The radiographer stated that he checked the AR and noted that it was in the "on" position, and that he checked the alarm test and the AR produced a sustained audible alarm signal. The radiographer, RSO, and inspectors found the alarm signal to be functional and properly respond in tests performed on the AR subsequent to the event. The AR threshold was calibrated in December 1995 to alarm at 500 millirems per hour (5 mSv per hour). The event produced a film badge result of 4600 millirems (46 mSv) in 4 minutes, e.g. 70000 millirems per hour (700 mSv per hour) e.g. 140 times the alarm threshold of the AR. The radiographer insisted that the AR was "on" when he removed it from the waist pouch, however, he did not hear an alarm signal during the event.

The radiographer re-entered the vacuum pump room with the survey instrument and completed a thorough radiation survey of the exposure device and surrounding area, properly secured the source assembly in the exposure device, and removed the key from the projector lock. He went to the dark room and notified the second radiographer about the event. He telephoned the Gary RSS, who instructed him to stop RT until further notice from the RSO. Later the Gary RSS instructed the radiographer to cease all RT operations and report to the Gary field office on the next day, February 28, 1996, so that the RSS and the RSO could review the event. No one from the Gary field office went to the site of the event to observe the scene of the event. Although photographs were taken of the camera location and the ladder in relation to the room, no photographs were taken with the radiographer in either of the two positions referred to above when the event occurred.

3.1.3. Conclusions

Two apparent violations of NRC requirements were identified for failure to properly secure the source assembly in the exposure device after each exposure and for failure to complete a radiation survey of the entire circumference of the exposure device after each exposure. There was no plausible explanation for the failure of the AR to alert the radiographer.

3.2 Results of Licensee Investigation

3.2.1. Inspection Scope

The inspectors evaluated the RSO Incident Report dated February 28, 1996, and the RSO memo dated February 29, 1996, that was sent to all Radiation Safety administrative personnel describing the event and instructing all RT personnel about the procedures to properly secure the source assembly in the exposure device after each exposure. The inspectors interviewed the RSO and the radiographer about these items and about the condition of the RT equipment that was involved in the event.

3.2.2. Observations and Findings

On February 28, 1996 the RSO and radiographer met to discuss the event and determine the radiographer's radiation dose. The RSO tested the radiographer's dosimetry equipment and found the DRD and AR to be operable and reliable. The RSO interviewed the radiographer without props and concluded that the radiographer was not more than waist high on the ladder and was facing the exposure device for the entire period that he was replacing the film on the weld, the dosimetry equipment was worn in a waist pouch at the front of the radiographer, and therefore he concluded that the film badge was closer to the exposure device than the whole body so that the film badge would indicate the maximum radiation dose. Based on the distance the radiographer was away from the exposure device, the RSO calculated the radiation dose to be somewhere between 9 rems to 36 rems (0.09 Sv to 0.36 Sv). The estimate was based on the worst case scenario where the whole body was exposed to an unshielded source of 94 curies of iridium-192 for a period of four minutes at distances of one foot and two feet.

10 CFR 20.2202(a)(1)(i) requires, in part, that the licensee shall immediately report any event involving licensed material that may have caused or threatens to cause an individual to receive a total effective dose equivalent of 25 rems (0.25 Sv) or more. On February 28, 1996, the RSO's calculation included a result that was greater than 25 rems (0.25 Sv), but the licensee did not report the event to NRC as required. Failure of the licensee to immediately report the event is an apparent violation of 10 CFR 20.2202(a).

The RSS sent the film badge to the vendor for immediate processing. The RSO removed the radiographer from RT operations until further notice and waited for a reply from the film badge vendor. On February 29, 1996, the vendor reported to the RSO that the film badge indicated a radiation dose of 4.6 rems (0.046 Sv). Based on the film badge report and his understanding that the film badge location was closer to the exposure device than the whole body, the RSO assigned the 4.6 rems (0.046 Sv) value to the radiographer's personal radiation exposure record and suspended the radiographer from any further involvement with the licensee's radiation sources for the remainder of 1996. Later, the GM implemented disciplinary actions against the radiographer and directed him to prepare a lessons learned training session to be conducted for other licensee RT personnel.

10 CFR 20.1501 requires that each licensee make or cause to be made surveys that may be necessary for the licensee to comply with the regulations in Part 20 and that are reasonable under the circumstances to evaluate the extent of radiation levels, concentrations or quantities of radioactive materials, and the potential radiological hazards that could be present. 10 CFR 20.1003 defines the term *survey* to mean an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. 10 CFR 20.1201(c) requires, in part, that the assigned deep-dose equivalent must be for the part of the body receiving the highest radiation exposure. The deep-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure. The licensee's RSO and radiographer did not complete an exact time/motion study at the scene of the event to determine the locations of the whole body, film badge, and exposure device exit port while the radiographer was positioned on the ladder to simulate the event. Also, photographs of the scene that were obtained later did not include the position of the radiographer, so that there was no preservation of the information concerning relative locations of the radiographer, film badge, and exposure device. The RSO relied solely on the radiographer's explanation of the event and the photographs that were obtained later. The RSO assumed that the calculated range of radiation dose, 9 rems to 36 rems (0.09 Sv to 0.36 Sv), was the worst case scenario and most likely over estimated the actual radiation dose. Failure of the license to complete surveys that were reasonable under the circumstances to evaluate the radiation levels and to assess the radiation dose to the part of the body that received the highest potential radiation exposure when the film badge was not worn in the region of highest radiation exposure is an apparent violation of 10 CFR 20.1501(a)(2) and 10 CFR 20.1201(c).

In addition, on February 27, 1996, prior to continuing RT operations after the event, the second radiographer inspected the involved RT equipment and found no defects or mechanical problems with the drive

cable control unit or drive cable connection to the source assembly, the exposure device automatic locking mechanism, selector ring operation, projector lock, guide tube or collimator. Also, the radiation detection survey instrument was operating and reliable.

3.2.3. Conclusions

Two apparent violations of NRC requirements were identified for failure to immediately report the event to the NRC once it was known that the dose could potentially exceed 25 rems (0.25 Sv) TEDE and for failure to complete surveys that were reasonable under the circumstances to evaluate the radiation dose to the part of the body that received the highest potential radiation exposure when the film badge was not worn in the region of highest potential radiation exposure. The RSO's investigation was weakened because an exact time/motion study was not completed at the scene and photographs of the scene did not include the position of the radiographer. The RSO relied solely on the radiographer's explanation of the event and photographs of the event scene that were obtained later. The RSO assumed that the calculated range of radiation dose, 9 rems to 36 rems (0.09 Sv to 0.36 Sv), was the worst case scenario and most likely over estimated the actual radiation dose. As such, the licensee's assessment of the radiation dose was inadequate.

3.3 Results of NRC Inspection

3.3.1. Inspection Scope

The inspectors evaluated the equipment that had been used by the radiographer on February 27, 1996, including the DRD, AR, the survey instrument, and the exposure device. Region III management initiated a telephone conference with the licensee's Senior Vice President and the RSO to discuss the event and subsequently issued a Confirmatory Action Letter (CAL) to the licensee on April 5, 1996. The CAL included a provision to conduct a re-enactment of the circumstances surrounding the event at the licensee's Gary facility. The inspectors participated with the RSO and the radiographer in the re-enactment of the event using a ladder and a dummy exposure device at a location in the licensee's facility that would simulate the location of the overhead pipes the radiographer was working on at the time of the event. The inspectors performed an independent dose assessment for the event based on the measurements obtained during the re-enactment. In addition, based on the exposure results, arrangements were made with the licensee to have a cytogenetic analysis performed on the radiographer by the Oak Ridge Institute for Science and Education (ORISE).

3.3.2. Observations and Findings

On April 2, 1996, the inspectors observed a licensee radiographer that had not been involved with the event set up the exposure device that had been involved with the event and perform about 10 exposures. After each exposure, the radiographer properly secured the source assembly in the

exposure device. No mechanical problem or defect in the operation of the exposure device was apparent. In particular, no malfunction of the automatic locking mechanism occurred. The inspectors also confirmed that the DRD and AR were operational and reliable.

On April 11, 1996, the radiographer re-enacted the event for the inspectors and RSO. The radiographer climbed the ladder and assumed the positions that were necessary to remove the collimator and guide tube from the pipe and to exchange the film on the weld. The distances from the exit port of the exposure device to the film badge and various parts of the whole body were measured. Also, thicknesses of the radiographer's upper left leg and torso were measured. These measurements were taken at appropriate angles to indicate direct exposure of the whole body and the film badge. A copy of the record of the measurements was provided to the RSO. The RSO concluded that the radiographer's position on the ladder differed from his previous understanding of the event because the radiographer's demonstration did not match the RSO's understanding of the information provided to the RSO during his interview of the radiographer on February 28, 1996.

The licensee also provided the results of the film badge evaluation. The film badge vendor reported that the film appeared to be typical of occupational exposure. However, the film also appeared to be partially shielded as evidenced by a lighter exposure on the left side of the film. The nonuniform exposure of the film did not interfere with determination of the reported radiation dose of 4.6 rems (0.046 Sv). The position of the film badge on the body could not be discerned.

Based on the physical measurements of time, distance, and the film badge dose (4.6 rems) (0.046 Sv), the inspectors calculated the apparent activity of the source that was partially shielded in the exposure device. The dose assessment completed by the inspectors assumed the physical constants associated with iridium-192, the distances re-enacted by the radiographer, and the film badge dose (4.6 rems) (0.046 Sv). The variables associated with the dose assessment included the durations of the radiographer's two positions that were associated with exchanging the film on the weld. The apparent activity was used to assess the range of possible radiation doses to various aspects of the whole body. The upper left leg was closest to the exit port of the exposure device.

The lower limit of the range of doses the NRC calculated to the upper left leg was 6.6 rems (0.066 Sv), which is a conservative value in that it assumes the most shielding afforded to the source by the exposure device, and it assumes the radiographer was facing the exposure device for <u>three minutes</u> while he was removing the collimator, guide tube, and film from the weld. It also assumes a <u>one minute</u> duration for the radiographer to replace the second film on the weld and reposition the collimator and guide tube before exiting the vacuum pump room. However, during the interviews, the radiographer indicated times of one minute and three minutes, respectively, for the two positions.

If the times were reversed (one minute for removal activities and three minutes for replacement activities), the dose calculated to this location ranges from 15 rems (0.15 Sv) to a maximum of 86.0 rems (0.86 Sv), with a best estimate of 34 rems (0.34 Sv).

Because the upper range of the calculated dose was above 25 rems (0.25 Sv), NRC arranged for ORISE to complete a cytogenetic analysis of the radiographer. ORISE reported the results as less than 20 rems (0.2 Sv). This value was considered to be the upper limit of the radiation dose, in that it assumes the cytogenetic study results effectively set the upper limit because of the conspicuous absence of chromosomal anomalies in the radiographer's blood sample.

10 CFR 20.1201(a)(1)(i) requires, in part, that the licensee control the occupational dose to individual adults to an annual dose limit of 5 rems (0.05 Sv) total effective dose equivalent. Failure of the licensee to control the occupational dose of the radiographer to an annual dose limit of 5 rems (0.05 Sv) total effective dose equivalent is an apparent violation of 10 CFR 20.1201(a)(1)(i).

3.3.3 Conclusions

One apparent violation of NRC requirements was identified for failure of the licensee to control the annual dose of the radiographer to less than 5 rems (0.05 Sv), TEDE. The NRC estimated that the radiographer received a radiation dose in the range of 6 rems (0.06 Sv) to 20 rems (0.2 Sv), total effective dose equivalent, during the event on February 27, 1996.

3.4 NRC Identified Root Causes and Contributing Factors

3.4.1. Inspection Scope

The inspectors interviewed the radiographer and RSO about time constraints on the job and the licensee's internal audit program. The inspectors reviewed the licensee's training program materials and required examinations for RT personnel with respect to the O&E procedures for properly securing the source assembly in the exposure device after each exposure.

3.4.2. Observations and Findings

The radiographer indicated that the client had recently complained about the lack of RT productivity. The licensee extended the 8-hour shifts to 10 or 12 hour shifts to accommodate the client's request. The radiographer stated that he felt he was constrained by time to complete RT of the assigned welds during his shift. The radiographer indicated that he felt rushed at the time of the event.

According to the RSO and radiographer, the licensee's internal audit program did not specifically evaluate RT personnel performance of the O&E procedure to properly secure the source assembly in the exposure

device after each exposure when multiple exposures were completed from a single RT set up. Typically, the auditor would observe the RT personnel complete a single radiographic exposure so that the individual would properly secure the source assembly in the exposure device just prior to disconnecting the drive cable from the source assembly. However, in the case of the event that occurred on February 27, 1996, the radiographer was completing multiple exposures from the same RT set up and was not properly securing the source assembly in the exposure device after each exposure.

An area of concern was identified regarding the inability of the licensee's internal audit program to evaluate RT personnel securing of the source assembly in the exposure device after each exposure when multiple exposures were completed from a single RT set up.

The inspectors reviewed the licensee's program for training RT personnel. The list of topics included the use of exposure devices and the licensee's O&E procedures for the Amersham 660B exposure device. However, the written examination that was based on the training program did not address the procedure to properly secure the source assembly in the exposure device after each exposure when multiple exposures were completed from a single RT set up. As noted above in the discussion of the audit program, the field examination that was given to evaluate the trainee's understanding of the licensee's O&E procedure to properly secure the source assembly in the exposure device after each exposure was based on a single exposure RT set up.

An additional area of concern was identified regarding the weaknesses in the licensee's training program given that it did not test the trainee's understanding of the proper procedure to secure the source assembly in the exposure device after each exposure in the written examination or in the field examination.

3.4.3. Conclusions

The root cause of the event appears to be human error, with contributing factors including: (1) the time constraints placed on the radiographer to complete RT of a specific number of welds during that shift, (2) failure of the radiographer to follow the licensee's written operating procedure to secure the source assembly in the exposure device after each exposure, (3) weaknesses in the licensee's internal audit program to observe the radiographer when multiple exposures were completed at a single set up location and ensure proper securing of the source assembly, and (4) weaknesses in the licensee's training program for RT personnel in that the written test of the licensee's operating procedures did not address the proper procedure to secure the source assembly in the exposure device after each exposure and the field exam did not require the radiographer to demonstrate a proper understanding of the procedure to secure the source assembly in the exposure device after each exposure.

3.5 Licensee Corrective Actions

3.5.1. Inspection Scope

The inspectors interviewed the RSO and radiographer about the radiographer's current involvement in the use of licensed material. The inspectors evaluated the RSO memo dated February 29, 1996, that described the event to the Radiation Safety Personnel. The inspectors interviewed other radiographers about their understanding of the RSO's instructions.

3.5.2. Observations and Findings

The RSO and radiographer confirmed that since February 27, 1996, the radiographer had not been assigned to any use of licensed material and will remain uninvolved for the remainder of 1996.

The RSO's memo dated February 29, 1996, to Radiation Safety administrative personnel instructed all RT personnel to properly secure the source assembly in the exposure device after each exposure. In response to the CAL, the licensee directly notified all RT personnel of same. Other of the licensee's radiographers indicated that their understanding was clarified by the licensee so that they now routinely secure the source assembly in the exposure device after each exposure by rotating the selector ring and depressing the projector lock after each exposure.

3.5.3. Conclusions

No violation of NRC requirements was identified. It appears that the licensee's instructions to Radiation Safety administrative personnel and RT personnel effectively clarified the licensee's procedure so that all personnel understood the requirement.

4. Other Areas Inspected

4.1. Inspection Scope

Other program areas inspected included: training, internal audits of personnel, inspection and maintenance of RT equipment, facilities, materials, instrumentation, radiation surveys, radiation protection, receipt and transfer of material, independent measurements, audible and visible alarms, posting, and labeling. The inspectors reviewed records located at the Gary field office from the period of September 1993 to March 1996. The inspectors observed a radiographer complete exposures in the Gary permanent radiographic facility.

4.2. Observations and Findings

The inspectors reviewed the training and experience qualifications of the two radiographers that performed work at the company in Indianapolis, IN, on February 27, 1996. Both individuals were

previously employed as radiographers by other licensees and were requalified by the licensee in accordance with RSAM 5.0. The radiographers were audited at three month intervals, and the audit records were unremarkable with regard to the radiographers' practices. Records of quarterly inspection and maintenance of exposure devices indicated no major equipment problems occurred. Records of receipt and transfer of radiographic sources and devices indicated no excessive radiation levels and no unauthorized devices for transfer and storage of sealed sources. A review of the sealed sources and devices on the premises indicated no unauthorized material was present. Except for the event that occurred on February 27, 1996, the records of personnel radiation dosimetry indicated that no individual received an annual radiation dose in excess of 2.23 rems (0.0223 Sv), TEDE. Audible and visible alarms were operating properly during radiographic exposures completed in the Gary permanent radiographic facility. The inspectors also completed radiation exposure surveys near the facility during radiographic exposures. The radiation exposure rates were less than 0.5 millirem per hour (0.005 mSv per hour). The facility was posted with NRC Form NRC-3, Caution Radioactive Materials, Caution Radiation Area, and Caution High Radiation Area.

The Gary RSS described the procedure for the calibration of survey instruments. The calibration labels that were applied to four survey instruments, calibrated on March 14, 1996, were signed by an individual who was not authorized to use the instrument calibration source. The RSS indicated that he completed a training session with the individual who actually used the instrument calibration source under his supervision. Later, the RSS recalibrated the survey instruments himself. During the repeat calibrations, no adjustments were necessary because the survey instruments had been properly calibrated earlier. The RSS relabeled the survey instruments with calibration labels that were signed by the RSS. The RSS also indicated that during the training session, the trainee was not wearing a film badge or DRD. License Condition 26 requires that the licensee shall follow the procedures contained in the O&E that was included with the licensee's application dated March 29, 1993. O&E Item 5.1 requires, in part, that trainees wear a film badge and a DRD at all times when working with ionizing radiation. Failure of the licensee's trainee to wear a film badge and DRD while calibrating survey instruments with a sealed source of licensed material is an apparent violation of License Condition 26.

4.3. Conclusions

One apparent violation of NRC requirements was identified for failure of a trainee to wear a film badge and DRD while calibrating survey instruments with a calibration source of licensed material. Other records for the period of September 1993 to March 1996 appeared to be adequate. The licensee's facilities and equipment at the Gary office appeared to be adequate.

5. Exit Summary

On November 12, 1996, the inspectors held a telephone conference with the licensee to explain the apparent violations. Licensee participants included Michael Creech, Senior Vice President; Randy Sweet, GM; Robert Slack, RSO; and Ron Wilson, Assistant RSO. The inspectors summarized the scope and findings of the inspection, including the apparent violations identified. The inspectors also discussed the two areas of concern. The licensee did not identify any information contained in the report as proprietary.

PERSONNEL CONTACTED

Michael Creech, Senior Vice President

Robert Slack, Radiation Safety Officer

Randy Sweet, General Manager, Gary Office

Steve Fay, Radiation Safety Supervisor, Gary Office

Larry Hiestand, Lab. Foreman, Gary Office

William Chastain, Radiographer, Gary Office

LIST OF ACRONYMS

AR	Alarming Ratemeter
DNMS	NRC, Region III, Division of Nuclear Material Safety
CAL	Confirmatory Action Letter, dated April 5, 1996
CFR	Code of Federal Regulations
DRD	Direct Reading Dosimeter
GM	General Manager
O&E	Operating and Emergency Procedure Manual that was submitted with the licensee's application dated March 29, 1993
ORISE	Oak Ridge Institute for Science and Education
RSAM	Radiation Safety Administrative Procedures Manual that was submitted with the licensee's application dated March 29, 1993
RSO	Corporate Radiation Safety Officer
RSS	Radiation Safety Supervisor
RT	Radiographic Testing
TEDE	Total Effective Dose Equivalent

SYNOPSIS

On April 8, 1996, an investigation was initiated by the U.S. Nuclear Regulatory Commission (NRC), Office of Investigations (OI), Region III (RIII), to determine if an untrained, Conam Inspection, Inc. (Conam), employee at the Gary, Indiana, office, deliberately calibrated a survey meter; to determine if a Conam employee deliberately failed to wear a film badge while calibrating survey instruments with a radiation source; to determine if Conam management deliberately failed to take appropriate action when a safety concern was brought to their attention; to determine if a Conam radiographer deliberately failed to follow the licensee's procedure in the operation of an exposure device, which resulted in an overexposure to himself; to determine if Conam radiographers deliberately failed to follow the licensee's procedure in the operation of exposure devices; and to determine if a Conam supervisor deliberately falsified a 90-day inspection report regarding an exposure device.

Based upon the evidence developed during the OI investigation, it is concluded that there was no substantiation to the allegation that an untrained Conam employee deliberately calibrated survey instruments; that there was no substantiation to the allegation that a Conam employee deliberately failed to wear a film badge while calibrating a survey meter with a radiation source; that there was no substantiation to the allegation that Conam management deliberately failed to take appropriate action when a safety concern was brought to their attention; that there was substantiation to the allegation that a Conam radiographer wilfully failed to follow the licensee's procedure in the operation of an exposure device, which resulted in an overexposure to himself; that there was substantiation to the allegation that Conam radiographers wilfully failed to follow the licensee's procedure in the operation of exposure devices; and it was not substantiated that a Conam supervisor deliberately falsified a 90-day inspection report regarding an exposure device.