June 20, 2008

EA-08-156 & 166
NMED No. 070046

Mr. Michael Lange, Chief Executive Officer
MISTRAS Holding Group
d/b/a: Conam Inspection and Engineering Services
Quality Services Laboratories, Inc.
161 Tower Drive
Burr Ridge, IL 60527

SUBJECT: NRC REACTIVE INSPECTION REPORT NO. 030-35114/2008-001(DNMS)
AND INVESTIGATION REPORT NO. 3-2007-011

Dear Mr. Lange:

This refers to the reactive inspection conducted on January 22 through 25, 2007, at MISTRAS Holding Group, d/b/a Conam Inspection and Engineering Services/Quality Services Laboratories, Inc.'s Trainer, Pennsylvania office and a temporary job site at a Sunoco Refinery in Philadelphia, Pennsylvania, with continued NRC in-office review through March 27, 2008. The NRC's continued in-office review included receipt and review of information that was unavailable during the onsite inspection. The purpose of the inspection was to follow up on a reported, possible overexposure event that occurred on January 20, 2007. The enclosed report presents the results of this inspection. A telephonic exit meeting between you, members of your staff, and members of the NRC staff was conducted on February 27, 2007, to discuss the preliminary inspection findings. Another telephonic exit meeting between Robert Slack of your staff, and members of the NRC staff was conducted on April 4, 2007, to discuss the preliminary inspection findings. A final telephonic exit meeting between you and members of your staff and me and other members of the NRC Region III staff was conducted on May 29, 2008, to discuss the inspection findings.

In addition to the reactive inspection, the NRC Office of Investigations (OI) conducted an investigation into the actions surrounding your compliance with NRC regulatory requirements. A summary of the OI report and the NRC's conclusions is enclosed.

Based on the results of this inspection and the OI investigation, five apparent violations were identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy that is included on the NRC's Web site at www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html. The apparent violations involve: (1) willful failure to secure the sealed source in the shielded position at the end of the exposure time; survey the area, camera, and source tube to verify that the source is stored in the shielded position; note the position of the camera's lock slide; rotate the selector ring to the "lock" position; and depress the plunger lock after the third radiographic exposure on January 20, 2007; (2) willful failure to wear an operating alarm rate meter at all times during the first three radiographic exposures on January 20, 2007; (3) deliberate failure to wear an

operating alarm rate meter at all times during the fourth radiographic exposure on January 20, 2007; (4) deliberate failure to stop radiographic operations after the third radiographic exposure on January 20, 2007, when a radiographer's pocket chamber was identified as being off-scale; and (5) failure to ensure that the individual named as the Radiation Safety Officer (RSO) in the license served as the RSO.

Before the NRC makes its enforcement decision, we are providing you an opportunity to: (1) attend a predecisional enforcement conference (PEC), or (2) request Alternative Dispute Resolution (ADR) to resolve this issue.

If you decide to attend a PEC, it would be closed to public observation and transcribed. The decision to hold a PEC does not mean that the NRC has determined that a violation has occurred or that enforcement action will be taken. This conference would be held to obtain information to assist the NRC in making an enforcement decision. This may include information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned. The conference will provide you an opportunity to present your perspective on these matters and any other information that you believe the NRC should take into consideration in making an enforcement decision. In presenting your corrective actions, you should be aware that the promptness and comprehensiveness of your actions will be considered in assessing any civil penalty for the apparent violation. The guidance in the enclosed excerpt from NRC Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," may be helpful. Please contact Patrick Louden of my staff at 630-829-9627 within 7 days of the date of this letter if you are interested in attending a PEC.

In lieu of a PEC, you may request Alternate Dispute Resolution (ADR) with the NRC in an attempt to resolve this issue. Alternate Dispute Resolution is a general term encompassing various techniques for resolving conflicts using a third party neutral. The technique that the NRC has decided to employ is mediation. Mediation is a voluntary, informal process in which a trained neutral (the "mediator") works with parties to help them reach resolution. If the parties agree to use ADR, they select a mutually agreeable neutral mediator who has no stake in the outcome and no power to make decisions. Mediation gives parties an opportunity to discuss issues, clear up misunderstandings, find areas of agreement, and reach a final resolution to the issues. Additional information concerning the NRC's program can be obtained at http://www.nrc.gov/about-nrc/regulatory/enforcement/adr.html. The Institute on Conflict Resolution (ICR) at Cornell University has agreed to facilitate the NRC's program as a neutral third party. Please contact ICR at 877-733-9415 within 7 days of the date of this letter if you are interested in pursuing resolution of this issue through ADR.

Since the NRC has not made a final determination in this matter, a Notice of Violation is not being issued for these inspection findings at this time. In addition, please be advised that the number and characterization of the apparent violations described in the enclosed inspection report may change as a result of further NRC review.

You will be advised by separate correspondence of the results of our deliberations on this matter. No response regarding the apparent violations is required at this time.

In accordance with 10 CFR Part 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Sincerely,

/RA/

Steven A. Reynolds, Director
Division of Nuclear Materials Safety

Docket No. 030-35114
License No. 12-16559-02

Enclosures:
1. OI Report Summary
2. Inspection Report No. 030-35114/2008-001(DNMS)
3. Excerpt from NRC Information Notice 96-28

cc w/encl.: Daryl Istre, Radiation Safety Officer

bcc w/encl.: David Allard, Department of Environmental Protection
Daren Perrero, Illinois Emergency Management Agency

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Letter to Mr. Michael Lange from Steven A. Reynolds dated June 20, 2008

SUBJECT: NRC REACTIVE INSPECTION REPORT NO. 030-35114/2008-001(DNMS)
AND INVESTIGATION REPORT NO. 3-2007-011

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SUMMARY OF OFFICE OF INVESTIGATIONS REPORT 3-2007-011 AND NRC CONCLUSIONS

On January 20, 2007, the licensee notified the NRC that a possible overexposure of a radiographer had occurred, due to his failure to retract the source upon completion of a radiographic shot. On February 13, 2007, the licensee submitted a 30-day report that identified that the radiographer had received a dose of approximately 5 rem to his left hand. The licensee's 30-day report also identified that the radiographer continued radiographic operations after identifying that the source had not been retracted when he placed the film and repositioned the source guide tube.

The Office of Investigations initiated an investigation to determine if the radiographer willfully continued radiographic operations contrary to NRC regulations. The Office of Investigations interviewed numerous individuals either directly involved in the event or immediately afterwards. During the interviews, the radiographer acknowledged that he did not always lock the camera after each shot, and that, following his realization that he had exposed himself, he continued with the fourth shot because he wanted to complete the job.

Based upon the evidence developed during the investigation, the Office of Investigations determined that the radiographer willfully conducted the fourth radiographic shot knowing that: (1) he had not retracted the source and locked the camera following the third shot, (2) his survey meter may not have been functioning, (3) he did not have his alarm rate meter on him, and (4) his pocket chamber dosimeter was off-scale.

The NRC concluded that the apparent violations that occurred before the radiographer realized he had been exposed to radioactive material were willful, but not deliberate. After the radiographer realized that he had been exposed to radioactive material, he knew his conduct in taking the final radiographic exposure was in violation of NRC regulations and the licensee's Operating and Emergency Manual. Therefore, the NRC concluded that the apparent violations that occurred after the radiographer realized he had been exposed to radioactive material were the result of deliberate misconduct.

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No.:	030-35114
License No.:	12-16559-02
Report No.:	030-35114/2008-001(DNMS)
Licensee:	Mistras Holding Group, d/b/a Conam Inspection and Engineering Services, Inc./Quality Services Laboratory, Inc.
Address:	161 Tower Drive Burr Ridge, IL 60527
Locations Inspected:	Sunoco Refinery 3144 Passyunk Avenue Philadelphia, Pennsylvania Conam Trainer Office 5 Nealy Boulevard Trainer, Pennsylvania
Inspection Dates:	January 22 through 25, 2007 (onsite)
Inspectors:	Farrah Gaskins, Health Physicist, Region I James Schmidt, Health Physicist, Region I Robert G. Gattone, Jr., Senior Health Physicist, Region III
Approved By:	Patrick Louden, Chief Materials Inspection Branch, Region III

EXECUTIVE SUMMARY

Mistras Holding Group, d/b/a Conam Inspection and Engineering Services, Inc./ Quality Services Laboratory, Inc. NRC Inspection Report 030-35114/2008-001(DNMS)

The inspectors conducted a reactive inspection to review the circumstances associated with a radiation exposure event that occurred on January 20, 2007. The event involved a radiographer who changed the film package and repositioned the radiography exposure head while an iridium-192 sealed source was still positioned in the exposure head. The exposure event resulted in estimated doses to the radiographer of 0.597 rem Total Effective Dose Equivalent (TEDE), 0.606 rem Lens Dose Equivalent (LDE), and 4.449 rem Shallow Dose Equivalent (SDE) to the maximally exposed extremity. The exposure event did not result in an individual receiving a radiation dose in excess of regulatory limits.

The inspectors identified five apparent violations involving the licensee's: (1) willful failure to secure the sealed source in the shielded position at the end of the exposure time; survey the area, camera, and source tube to verify that the source is stored in the shielded position; note the position of the camera's lock slide; rotate the selector ring to the "lock" position; and depress the plunger lock after the third radiographic exposure on January 20, 2007; (2) willful failure to wear an operating alarm rate meter at all times during the first three radiographic exposures on January 20, 2007; (3) deliberate failure to wear an operating alarm rate meter at all times during the fourth radiographic exposure on January 20, 2007; (4) deliberate failure to stop radiographic operations after the third radiographic exposure on January 20, 2007, when a radiographer's pocket chamber was identified as being off-scale; and (5) failure to ensure that the individual named as the Radiation Safety Officer (RSO) in the license served as the RSO.

The inspectors identified that the root cause of the exposure event was failure to implement required actions when approaching the camera after perceived source retraction. The inspectors determined that the radiographer becoming distracted from licensed activities when he became engaged in a conversation with an equipment elevator operator was a contributing factor for the event.

The licensee's corrective actions to address the apparent violations included: (1) removing the radiographer from licensed activities; (2) briefing all Trainer, Pennsylvania, facility personnel regarding the circumstances and root causes associated with the event; (3) implementing new Trainer facility source retraction procedures that require dual, independent verification that the camera lock indicates that the source is secured within the camera; and that dual, independent surveys are conducted to verify that the source is properly shielded within the camera; and (4) requesting a license amendment to name the new RSO on the license.

Report Details

1 Program Overview

1.1 Licensed Activities and Inspection History

Nuclear Regulatory Commission (NRC) License No. 12-16559-02 authorized Mistras Holding Group, d/b/a Conam Inspection and Engineering Services, Inc./Quality Services Laboratory, Inc. (licensee) to conduct industrial radiography at temporary job sites where the NRC maintains jurisdiction; and to store, use and dispatch licensed material from three field stations located in Woodbridge, New Jersey; Noblesville, Indiana; and Trainer, Pennsylvania.

The licensee has been involved with recent NRC escalated enforcement action associated with licensed activities conducted by licensee staff dispatched from the Trainer field station. Escalated enforcement action resulted from an NRC inspection conducted in June and July 2006. On February 21, 2007, the NRC issued a Notice of Violation and Proposed Imposition of a Civil Penalty for failure to fully implement NRC requirements.

Escalated enforcement action resulted from NRC inspections conducted in October through December 2005. On April 6, 2006, the NRC issued a Notice of Violation and Proposed Imposition of Civil Penalties for failure to: (1) limit an annual dose to an extremity to the regulatory limit; (2) perform a survey of the radiographic exposure device (camera) and guide tube after completing a radiographic exposure; (3) secure a sealed source in the shielded position after the source was returned to the shielded position; (4) have at least one radiographer and either another radiographer or a radiographer's assistant/trainee present when radiography was performed at a temporary job site; (5) have a radiographer present and directly observing the performance of a radiographer's assistant during radiographic operations; (6) maintain security and control of a radiography camera containing iridium-192; (7) immediately report to the NRC missing licensed material, iridium-192 in a camera, that could result in an exposure to persons in an unrestricted area; and (8) survey the perimeter of the posted radiation area as soon as the source was exposed to assure proper posting of the radiation area. The violations were associated with licensed activities conducted by licensee staff dispatched from the Trainer field station.

Escalated enforcement action resulted from an NRC inspection conducted in May and June 2005. On August 17, 2005, the NRC cited a Severity Level III violation for failure to maintain security and control of a camera containing iridium-192 at a Sunoco Refinery temporary job site in Philadelphia, Pennsylvania. The violation was associated with licensed activities conducted by licensee staff dispatched from the Trainer field station.

2 Program Management

2.1 Inspection Scope

The inspectors reviewed program management by interviewing selected staff and reviewing selected records.

2.2 Observations and Findings

The licensee's Corporate Radiation Safety Officer (RSO) was stationed in Carol Stream, Illinois, and each field office had an assigned assistant RSO. Company-wide radiography procedures and policies, including formal operating and emergency procedures, were developed by the corporate staff. Day-to-day implementation of the procedures was supported by the assistant RSOs located at each field station.

The individual who served as the RSO was named as such on the license. However, the RSO left the licensee's employ on January 8, 2007. An individual, who was formerly authorized as the RSO on the license, immediately began acting as the licensee's RSO on January 8, 2007. The licensee did not submit a license amendment request to name that individual as the RSO on the license because the individual immediately began acting as the licensee's RSO and he thought it was acceptable to wait until a new, permanent RSO was found before requesting an amendment so that the change could be addressed in one license amendment.

Condition 11 of License No. 12-16559-02 requires that a named individual is the licensee's RSO. The licensee's failure to ensure that the individual named in Condition 11 of the license was the RSO is an apparent violation of Condition 11 of the license.

After being informed about the violation by the inspectors on April 3, 2007, the acting RSO promptly submitted a request, dated April 3, 2007, to amend the license to achieve compliance with Condition 11. On April 6, 2007, Condition 11 of License No. 12-16559-02 was amended accordingly to name the new RSO on the license.

2.3 Conclusions

The inspectors identified an apparent violation of NRC requirements involving licensee failure to ensure that the individual named as the RSO in the license served as the RSO from January 8 to April 6, 2007.

3 Exposure Event Summary

3.1 Inspection Scope

The inspectors evaluated the circumstances related to an exposure event which occurred on January 20, 2007, at a temporary job located at the Sunoco Refinery in Philadelphia, Pennsylvania. The inspectors toured the event location, interviewed selected licensee personnel, reviewed selected licensee records, and observed re-enactments of the event.

3.2 Observations and Findings

a. Work Preparation

On January 20, 2007, at about 4:00 a.m., a three-person radiography crew consisting of a radiographer and two assistants conducted radiography on a pipe weld located outdoors on the 244-foot elevation of a fluid catalytic cracking unit. The radiography

crew used a camera containing an iridium-192 source to perform four radiographic exposures. Additional radiography equipment used for the job included a 4.3 half-value-layer collimator and a 25-foot control drive mechanism (crank).

The job site required personnel access via scaffolds. The equipment was positioned such that the crank was located on scaffolding near the normal personnel walkway, and the crank cables were extended to the camera located about 25 feet away. The camera was located several feet from the pipe weld that was approximately 5 feet above the scaffolding floor. The radiographer assigned a radiographer's assistant (Assistant 1) to remain with him on the scaffolding. Assistant 1 was tasked with conducting restricted area surveys and monitoring personnel access from a temporary equipment elevator that was located outside of the restricted area. The radiographer assigned a second radiographer's assistant (Assistant 2) to the 170-foot elevation to conduct surveys and control access at the stairs to the job site.

The crew used two NDS Products, Model ND-2000 survey instruments to conduct radiation surveys. One instrument was used at the 244-foot elevation by the radiographer and Assistant 1 and the other was used at the 170-foot elevation by Assistant 2. One of the assistants conducted operability checks on both instruments and determined that they were operable at the start of the shift.

Prior to the job, the night shift supervisor determined that each crew member possessed their assigned personnel dosimeter, alarm rate meter, and zeroed pocket chamber. Since the radiographer was not wearing a belt, he kept his alarm rate meter in the rear pants pocket of his fire retardant coveralls. However, prior to the first radiographic exposure, the radiographer's alarm rate meter fell out of his pants pocket without his knowledge. Therefore, the radiographer did not have a rate meter with him during radiography activities.

During radiography activities, Assistant 1 conducted perimeter surveys at the 244-foot elevation and noted that the survey instrument was functional on the X1 scale.

b. <u>Securing Source and Conducting Radiation Surveys Post Exposure</u>

The radiography crew completed the first two radiographic exposures without incident, and they initiated the third exposure. The radiographer did not verify that he was wearing an alarm rate meter during the first three radiographic exposures; therefore, he did not realize he was not wearing an alarm rate meter.
Title 10 CFR 34.47(a) requires, in part, that the licensee not permit any individual to act as a radiographer unless, at all times during radiographic operations, each individual wears, on the trunk of the body, an operating alarm rate meter. Condition 20 of License No. 12-16559-02 requires, in part, that the licensee conduct its program in accordance with the procedures contained in the letter dated August 10, 2004. Attached to the letter is the licensee's Operating and Emergency Procedures Manual (O & E Manual). Section 5.1.9 of the O & E Manual requires that all radiographic personnel use an alarming rate meter when performing radiography at locations other than a permanent radiographic installation equipped with audible and visible alarm systems or interlocks. The radiographer's failure to wear an alarming rate meter while conducting the first three radiographic exposures is an apparent violation of 10 CFR 34.47(a) and Condition 20 of License No. 12-16559-02.

While radiography was in progress for the third exposure, an equipment elevator operator unexpectedly brought the elevator to the 244-foot elevation to inquire when the radiography team would be finished. The radiographer was nearby preparing to crank the sealed source back into the camera because the exposure was almost complete. The radiographer walked to the elevator and instructed the operator to take the elevator below until the radiography work was done. After this brief distraction, when the radiographer approached the crank position, he erroneously assumed that he had retracted the sealed source back into the camera before he spoke to the operator. Therefore, the radiographer was unaware that the iridium-192 source was still positioned within the collimator.

Carrying the survey instrument, the radiographer walked past the crank to the camera. When he arrived at the camera, the radiographer did not note the position of the camera's lock slide when approaching the camera after source retraction, rotate the selector ring to the "lock" position, or depress the plunger lock. The radiographer conducted a survey to verify that the sealed source had been retracted back into the shielded position. The radiographer reported that he had the survey instrument set on the times ten (X10) scale (instrument range 2 to 100 milliroentgens per hour (mR/hr)) and he was watching the meter for deflections that would indicate that the sealed source was in the unshielded position outside of the camera. The radiographer reported that he saw no movement of the survey meter display needle during the survey.

Condition 20 of License No. 12-16559-02 requires, in part, that the licensee conduct its program in accordance with the procedures contained in the letter dated August 10, 2004. Attached to the letter is the licensee's O & E Manual. Section 15.9.1, Steps 18, 20, and 21 of the O & E Manual require, in part, that during use of an AEA Technology QSA, Inc./Amersham Tech Ops Model 660 System (camera), radiography personnel retract the source in the shielded position at the end of the exposure time; survey the area, camera, and source tube to verify that the source is stored in the shielded position; note the position of the camera's lock slide; rotate the selector ring to the "lock" position; and depress the plunger lock. The radiographer's failure to secure the sealed source in the shielded position at the end of the exposure time; survey the area, camera, and source tube to verify that the source is stored in the shielded position; note the position of the camera's lock slide; rotate the selector ring to the "lock" position; and depress the plunger lock after the third radiographic exposure is an apparent violation of Condition 20 of License No. 12-16559-02. As a result of this and the previously discussed apparent violation regarding failure to wear an alarm rate meter, the licensee missed two opportunities to identify that the sealed source was in the collimator.

c. Discovery of Exposure Event

Believing that the sealed source was shielded in the camera, the radiographer proceeded to change the radiography film and relocate the exposure head/collimator during preparations for the final radiography exposure. Upon completion of the new exposure setup, the radiographer attempted to unlock the camera so he could reel the source out for the final exposure; however, he noted that the position of the camera's lock slide did not indicate that the sealed source was in the shielded position. The radiographer checked his survey instrument again and it read zero. The radiographer immediately returned to the control crank and attempted to crank the sealed source out

to the exposed position and found that it could not be cranked out. He then attempted to crank the sealed source back into the camera and he was able to do so.

The radiographer immediately checked his pocket chamber and found it was off-scale. When he looked for his alarm rate meter, which should have provided him an audible alarm, he found that it was missing from his pants pocket and not on his person. The radiographer communicated to Assistant 1 that his survey meter was not functioning and that, because he had failed to retract the source back into the camera before preparing for the final radiographic exposure, he may have been exposed to high radiation exposure rates.

d. Resumption of Work

After realizing that he had set up for the fourth exposure while the source was outside of the camera and without discussing his next actions with the two assistants, the radiographer initiated and completed the fourth exposure knowing that he had an off-scale pocket chamber and he was not wearing an alarm rate meter. The radiographer's failure to wear an alarming rate meter while conducting the final radiographic exposure is an apparent violation of 10 CFR 34.47(a) and Condition 20 of License No. 12-16559-02.

10 CFR Part 34.47(d) requires that, if an individual's pocket chamber is found to be off-scale, or if his/her electronic personal dosimeter reads greater than 200 millirem, and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personal dosimeter must be sent for processing within 24 hours. In addition, the individual may not resume work associated with licensed material use until a determination of the individual's radiation exposure has been made by the RSO or the RSO's designee. Condition 20 of License No. 12-16559-02 requires, in part, that the licensee conduct its program in accordance with the procedures contained in the letter dated August 10, 2004. Attached to the letter is the licensee's O & E Manual. Sections 5.1.4 and 20.4 of the O & E Manual require, in part that, if at anytime during a work shift it is observed that an employee's pocket dosimeter has gone off-scale, productive work must stop immediately. The radiographer's resumption of work after he found that his pocket chamber was off-scale and before a determination of his radiation exposure was made by the RSO or the RSO's designee is an apparent violation of 10 CFR Part 34.47(d) and Condition 20 of License No. 12-16559-02.

After the fourth exposure, the radiographer directed that Assistant 2's survey instrument be brought to the 244 foot elevation where it was used to conduct the required survey post source retraction without incident. The crew disassembled the radiography equipment and returned it to the storage location within the radiography truck. The radiographer then returned to the licensee's temporary offices at the Sunoco Refinery and called the licensee's Trainer operations manager to explain what happened.

e. NRC Office of Investigations Activities

The Office of Investigations initiated an investigation to determine if the radiographer willfully continued radiographic operations contrary to NRC regulations. The Office of Investigations interviewed numerous individuals either directly involved in the event or immediately afterwards. During the interviews, the radiographer acknowledged that he

did not always lock the camera after each shot, and that, following his realization that he had exposed himself, he continued with the fourth shot because he wanted to complete the job.

3.3 Conclusions

The radiation source was in a collimator when the radiographer conducted preparations for the fourth radiographic exposure, resulting in a radiation exposure event. Based upon the evidence developed during an investigation conducted by the Office of Investigations, the NRC concluded that the apparent violations that occurred before the radiographer realized he had been exposed to radioactive material (i.e., failure to secure the sealed source and conduct a required survey after the third radiographic exposure, and failure to wear an operating alarm rate meter during the first three radiographic exposures) were willful but not deliberate. In addition, the NRC concluded that the apparent violations that occurred after the radiographer realized he had been exposed to radioactive material (i.e., failure to wear an operating alarm rate meter during the fourth radiographic exposure, and failure to stop radiographic operations after the third radiographic exposure when a radiographer's pocket chamber was identified as being off-scale) were the result of deliberate misconduct.

4 Licensee Event Response

4.1 Inspection Scope

The inspectors reviewed the licensee's response to the exposure event by interviewing selected licensee staff and reviewing selected records.

4.2 Observations and Findings

The licensee reported the event to the NRC Operations Center at 1:41 p.m. Eastern Time on January 20, 2007. The licensee reported that an extremity exposure in the range of 44-55 rem may have occurred. After notification of the event, the licensee initiated a number of actions to determine the cause of the event and to understand the consequences.

The licensee immediately removed the radiographer from duty and sent his personnel dosimeter for processing. The Trainer Assistant RSO checked the calibration status and operation of the survey instrument that was used by the radiographer. The licensee reported that the instrument was appropriately calibrated and operable. The licensee found the radiographer's alarm rate meter on the seat of the radiographer's truck and concluded that it had fallen out of the radiographer's pocket. In addition, the licensee briefed all personnel conducting radiography from the Trainer office about the event and the associated root causes.

On January 20, 2007, the licensee revised its O & E Manual. The revision required that personnel conducting radiography from the Trainer facility verbally communicate each time the source is retracted. In addition, the revision required dual, independent verification that the camera lock indicates that the source is secured within the camera;

and that dual, independent surveys are conducted after radiographic exposures with different survey instruments to verify that the source is properly shielded within the camera.

The licensee submitted its written exposure report to the NRC dated February 13, 2007, and it met the requirements in 10 CFR Part 20.2203.

4.3 Conclusions

The licensee made verbal and written event notifications as required. The inspectors did not identify any violations of NRC regulatory requirements.

5 Dose Assessment

5.1 Inspection Scope

The inspectors interviewed selected licensee staff, observed event re-enactments conducted by the licensee, reviewed the radiographer's personnel dosimeter processing results, and reviewed the licensee's initial and final dose estimates. The inspectors also performed independent dose calculations.

5.2 Observations and Findings

On January 23, 2007, the personnel dosimeter processor reported that the cumulative dose to the radiographer for January 2007 was 0.628 rem Deep-Dose Equivalent (DDE), 0.637 rem Lens Dose Equivalent (LDE), and 0.680 rem Shallow Dose Equivalent (SDE). Based on licensee records of dose to the radiographer prior to the event, the licensee concluded that the radiographer's Total Effective Dose Equivalent (TEDE) and LDE were 0.597 and 0.606 rem, respectively.

The licensee conducted event re-enactments that were observed and digitally recorded by the inspectors. The re-enactments involved three separately timed walkthroughs by the radiographer. The inspectors determined that the details of the re-enactments were consistent with the information obtained during employee interviews.

The licensee used a consultant to calculate the radiographer's whole body, lens, and extremity dose estimates. The dose calculations were provided to the NRC on February 7, 2007. The licensee estimated that the radiographer's maximum doses from the event were 0.597 rem TEDE, 0.606 rem LDE, and 4.449 rem SDE to an extremity. The licensee's basis for TEDE and LDE was the radiographer's personnel dosimeter processing results. The basis for the SDE was dose calculations based, in part, on stay times obtained from the event re-enactments.

The licensee enrolled the radiographer in a medical surveillance program at a local medical center. No physical symptoms related to an acute radiation exposure were identified during the medical surveillance program.

The inspectors' independent dose calculations included the stay times obtained from the event re-enactments. The inspectors' dose estimates were from 0.440 rem to 0.549 rem TEDE and LDE, and from 7.2 rem to 8.6 rem maximum SDE to an extremity. The

inspectors determined that their estimates were consistent with the licensee's dose estimates. Based on the dose calculations conducted by the licensee and the inspectors, the exposure event did not result in an individual receiving a radiation dose in excess of regulatory limits.

5.3 Conclusions

The licensee's estimates of maximum radiation doses received by an individual as a result of the exposure event were adequate. Based on the dose calculations conducted by the licensee and the inspectors, the exposure event did not result in an individual receiving a radiation dose in excess of regulatory limits. No violations of NRC regulatory requirements were identified.

6 Training

6.1 Inspection Scope

The inspectors evaluated radiation safety training by interviewing the radiography crew involved with the event and the individual who evaluated the radiographer's practical examination during the training process. In addition, the inspectors reviewed the crew's training and certification records.

6.2 Observations and Findings

The radiographer involved with the event was formally trained in Non-Destructive Testing. He worked intermittently as a contractor for the licensee since 1996, and he obtained his American Society for Nondestructive Testing Industrial Radiography Radiation Safety Certification Card in June of 2002 (valid for five years). He was most recently authorized by the licensee as a radiographer on November 15, 2006, after he completed a written examination on November 14, 2006, and a practical examination on November 15, 2007. These examinations included the licensee's specific requirements regarding personnel dosimetry usage, source locking after source retraction, and the proper use of survey instruments.

Both radiographer's assistants involved with the event were Conam employees initially trained by the licensee. Assistant 1 was qualified on October 5, 2006, and Assistant 2 was qualified on December 7, 2006.

6.3 Conclusions

No training deficiencies were identified. The inspectors did not identify any violations of NRC regulatory requirements.

7 Survey Instrument Evaluation

7.1 Inspection Scope

The inspectors evaluated the operability of the survey instrument that was used by the radiographer during the exposure event. The inspectors conducted a physical inspection of the survey instrument and evaluated its response relative to a calibrated NRC survey instrument.

7.2 Observations and Findings

The licensee's instrument that was used by the radiographer during the exposure event was last calibrated on September 13, 2006. Using the same batteries that were used during the exposure event, the inspectors noted that the battery voltage was around the minimum acceptable voltage threshold. A comparison of the licensee's instrument's response to the inspectors' Ludlum Model 14C instrument calibrated with a Ludlum Model 44-7 probe (NRC serial number 9660, calibration due date August 11, 2007) indicated agreement within 20 percent. The inspectors noted that the licensee's instrument was operable and no intermittent survey instrument operability problems were identified.

7.3 Conclusions

The inspectors did not identify any survey instrument operability problems.

8 Root Cause and Contributing Factors

8.1 Inspection Scope

The inspectors assessed the root cause and contributing factors for the event by interviewing selected licensee staff, inspecting the condition of selected equipment, observing re-enactments of the event, and reviewing selected records.

8.2 Observations and Findings

The licensee determined that the root causes for the event are failure of the radiographer to properly retract the sealed source back into the camera and follow written safety practices. The inspectors determined that the root causes identified by the licensee are consistent with the facts associated with the event.

The inspectors determined that the root cause of the exposure event was failure to implement the following required actions when approaching the camera after perceived source retraction: (1) conducting adequate radiation surveys; (2) noting the position of the camera's lock slide; (3) rotating the selector ring to the "lock" position; (4) depressing the plunger lock; and (5) wearing an alarm rate meter. As a result, the licensee missed opportunities to identify that the sealed source was positioned in the collimator rather than in the shielded position within the camera.

The inspectors identified that a contributing factor for the event was the radiographer's distraction from licensed activities when he became engaged in a conversation with an equipment elevator operator. As a result, the radiographer erroneously thought that he had retracted the sealed source into the camera.

8.3 Conclusions

The inspectors identified that the root cause of the exposure event was failure to implement required actions when approaching the camera after perceived source retraction. The inspectors identified that the radiographer's distraction from licensed activities when he became engaged in a conversation with an equipment elevator operator was a contributing factor for the event.

9 Exit Meeting

The inspectors discussed the preliminary conclusions described in this report with licensee management by telephone during a preliminary exit meeting on February 27, 2007. Another exit meeting was conducted by telephone on April 4, 2007. The final exit meeting was conducted by telephone on May 29, 2008. The licensee did not identify any information reviewed during this inspection and selected for inclusion in this inspection report as proprietary in nature.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

#+ Dennis Bertollotti, President
Collin Eckerd, General Manager
+ Daryl Istre, Corporate RSO
# Rick Javorka, Laboratory Manager
#+ Michael Lang, Chief Executive Officer
Al Renshaw, Night Shift Supervisor at Sunoco Facility
#*+ Robert Slack, Regulatory Affairs Officer
+ Chris Smith, Compliance Officer
Ray Walls, Day Shift Supervisor at Sunoco facility
Rick Wick, Trainer RSO

Pennsylvania Bureau of Radiation Protection

Meredith Martin, Radiation Protection Specialist

Sunoco

Matthew Richards, Sr. Health and Safety Specialist

participated in the telephone exit on February 27, 2007
* participated in the telephone exit on April 4, 2007, and March 27, 2008
+ participated in the final telephone exit on May 29, 2008