

U. S. NUCLEAR REGULATORY COMMISSION

REGION I

Report No. 030-29882/90-001

Docket No. 030-29882

License No. 37-28004-01 Category C-1 Priority 1 Program Code 3320

Licensee: TEI Analytical Services, Inc.

Inspection at: 35 West Point Road
Washington, Pennsylvania

Inspection Conducted: January 4, 17 and 18, 1990

Inspectors: *[Signature]*
for David J. Collins, Health Physicist

1/22/90
date

[Signature]
James P. Dwyer, Health Physicist

1/22/90
date

Approved by: *[Signature]*
John R. White, Chief
Nuclear Materials Safety Section C

1/22/90
date

Inspection Summary: Special, announced safety inspection conducted January 4, 17 and 18, 1990 (Inspection Report No. 030-29882/90-001).

Areas Inspected: Activities related to a hand exposure incident with a radiography exposure device on December 14, 1989; radiographer training, radiation survey performance, transportation of licensed materials, maintenance of radiography devices.

Results: Five apparent violations: Extremity exposure exceeding the limits allowed by 10 CFR 20.101(a)(par 3.1); Failure to supervise an assistant radiographer properly (par 3.2); Failure to lock the sealed source in the shielded position after each exposure(par 3.3); Failure to survey a radiography device after each exposure (par 3.4); Failure to register properly with NRC as a user of shipping packages (par 5).

DETAILS

1. Persons Contacted

*Gary E. Weiss, Radiation Safety Officer
*James Nicolosi, Consultant
Pamela Martin, Office Assistant

Other individuals were also interviewed during this inspection.

The information provided in this report was derived from personnel interviews, licensee documentation, and observations by the inspector.

2. Radiography Exposure Incident

2.1 Summary

An inadvertent hand exposure occurred about 4:45 p.m., December 14, 1989, at a field radiography site near Gould City, Michigan. While performing radiography on a natural gas pipeline in a trench, the assistant radiographer (working under the supervision of the radiographer), apparently failed to fully retract the 68.7 curie (68.7 Ci) iridium-192 (Ir-192) sealed source into the radiography camera (Automation Industries Model 520). Following, the assistant apparently did not sufficiently survey the camera device to detect the error.

After recovering the radiographic film on the opposite side of the pipeline, the assistant radiographer began to disconnect the source guide tube from the camera. Upon disconnection, the assistant discovered that the source was still partially extended out of the camera. Neither the retaining locking ball at the end of the pigtail nor the connector were visible to the assistant. The assistant then notified the radiographer, who completed the retraction of the source.

The incident was reported to the Radiation Safety Officer at 6:00 p.m. December 14, 1989. After reviewing the details by telephone, the radiography team returned to the site with a second team to reconstruct the event. The assistant was immediately restricted from all radiation work. The individual's film badge (which was worn on the chest) was sent for immediate evaluation.

The film badge exposure was reported to the licensee on December 15, 1989 as 578 mrem. The Radiation Safety Officer reported the event, to NRC Region I, including a preliminary exposure evaluation on December 15, 1989. The preliminary evaluation indicated that the assistant could have received as much as 72 rem to his hand extremity. On January 18, 1990, a more refined evaluation indicated that the individual's extremity exposure (right hand) was about 36.27 rem.

2.2 Event Chronology

This event occurred on December 14, 1989 at about 4:45 p.m. (EST). The radiography team was examining a 36 inch diameter natural gas pipeline tie-in weld repair. The pipeline was in a 14 foot deep trench; the camera was on sandbags about 14 inches off the floor. The weld area being examined was on the opposite side of the pipe. A 3 foot long source guide tube and collimator were used. The radiography exposure device was an Automation Industries Model 520 camera containing a 68.7 Ci Ir-192 sealed source.

After performing the final exposure of the day, the assistant radiographer (acting under the supervision of the radiographer) retracted the source, observed a "normal" increase and decrease response on the survey meter, and approached the camera. The assistant reported that he held the survey meter in his left hand as he surveyed the device.

According to the assistant, he surveyed both sides of the camera, observing "normal" readings of 30 mr/hr. The assistant placed the survey meter down behind the camera, locked the camera, removed the key, and threw the key to the radiographer who was standing on top of the trench, 14 feet above.

The radiographer was above on the right-of-way, about 16 feet from the camera location. From this position, the radiographer's view of the camera during the survey and lockdown was blocked by the assistant's body.

The assistant then climbed over the pipe, retrieved the film cassette, climbed back over the pipe and passed the cassette to the radiographer for processing. The radiographer left the immediate vicinity to develop the film. The assistant then approached the camera from the rear and reached over the camera with his right hand to disconnect the guide tube. When the guide tube was disconnected from the camera, the assistant saw that the source cable was still partially extended and immediately dropped the guide tube. The assistant withdrew from the ditch and notified the radiographer.

Upon notification, the radiographer entered the ditch and approached the camera from the rear with a survey meter. The source and approximately 4-5 inches of cable could be seen protruding from the camera. The radiographer unlocked the camera and cranked the source into the device. The radiographer completed the disassembly of the camera, inserted the safety plugs, and removed the camera from the ditch.

The assistant radiographer's 200 millirem direct reading dosimeter was off-scale. The radiographer's 200 millirem direct reading dosimeter indicated 60 millirem exposure.

The team left the field site to notify the Radiation Safety Officer (RSO). Notification was made at 6 p.m. (EST), December 14. The RSO instructed the team to return to the site and with assistance from a second team, perform a re-enactment (without source exposure) of the event to verify exposure times and source-to-personnel distances. The measurements were conveyed to the RSO by telephone at 8:20 p.m. the same evening.

2.3 Incident Evaluation

The exposure evaluation was performed by the RSO, with the assistance of a consultant. The RSO's preliminary evaluation was submitted to NRC Region I on December 22, 1989, and indicated a possible 72 rem exposure to the palm of the right hand.

The preliminary evaluation was later refined with small differences in measurements and times. The inspector noted that source size and geometry would cause exposure to vary greatly with small distance corrections in accord with the inverse square law.

A final evaluation was submitted by the licensee on January 18, 1990, and indicated that the assistant was exposed to 36.27 rem, extremity; and 578 mrem, whole body, for this event. The evaluation appeared to be plausible and reasonable upon review by the inspector.

The radiographer and the assistant radiographer claim that the exposure device lock was engaged by the assistant radiographer. So far, the licensee has been unable to recreate the situation of locking the camera with the source partially extended from the device. However, it was recognized that there was a considerable difference relative to the environmental temperature at the time of the event (about -20°F) as compared to the temperature where recreation of the locking was attempted (about 70°F).

2.4. Corrective Actions

The licensee implemented the following corrective actions as a result of this event:

2.4.1. The assistant radiographer was immediately restricted to non-radiation work for the balance of the quarter.

2.4.2. The assistant radiographer's operating qualifications were immediately suspended pending satisfactory completion of retraining.

2.4.3. All radiography personnel were informed of the particulars of the exposure. Action was initiated to examine and replace guide tubes as necessary.

2.4.4. An outside consultant was employed to perform an independent review of the incident and review the licensee's program for effectiveness.

3. Inspector Findings

The inspector reviewed the documentation of the incident and interviewed the assistant radiographer and the Radiation Safety Officer. The inspector determined that the licensee's incident report provided a plausible description of the event; and that the evaluation of the exposure was reasonable for the circumstances described.

Accordingly, the inspector determined that:

- 3.1 The assistant radiographer's hand exposure of 36.27 rem in the fourth calendar quarter of 1989 exceeded 18.75 rem, the permissible exposure limit to the hands and forearms. This is an apparent violation of 10 CFR 20.101.
- 3.2 The radiographer may have failed to supervise the assistant adequately by directly overseeing the assistant's performance of radiological surveys and locking of the radiography exposure device. This is a possible violation of 10 CFR 34.44.
- 3.3 The assistant radiographer may have failed to secure the radiography exposure device with the sealed source in the shielded position. This is a possible violation of 10 CFR 34.22(a).
- 3.4 The assistant radiographer failed to perform the survey of the radiography exposure device and guide tube. This is an apparent violation of 10 CFR 34.43(b).

4. Transportation of Radioactive Materials

The inspector reviewed the program for transportation of radioactive materials against the requirements of 10 CFR 71.12, the General License granted to all users of NRC approved packages. The requirement specifies that the licensee must register with NRC prior to first use of approved shipping packages.

The licensee transports licensed radioactive materials in NRC-approved packages, among them the Automation Industries Model 520 exposure device, NRC Certificate of Compliance No. 9007; and the Source Production and Equipment Company source changer, Model C-1, NRC Certificate of Compliance No. 9036.

The inspector determined that the licensee, as of January 4, 1990, has not registered as required with the NRC as a user of the shipping packages, an apparent violation of 10 CFR 71.12.

5. Licensee Actions on Previously Identified Items

(Closed) Inspection Report 88-001, Violation of license condition 14, failure to leak test a sealed source. The source was removed from storage and shipped without having been leak tested within the previous six months.

The licensee's corrective actions have proven to be adequate to preclude recurrence. Procedures now require the leak testing of sources prior to shipment.

6. Radioactive Source Controls

The inspector reviewed the controls for leak testing, inventory and replacement of sealed sources as required by 10 CFR 34.25 and 34.26.

A running inventory of sealed sources as they are placed into or removed from the storage vault is maintained. There is also verification made of each camera in the field as indicated by the daily utilization logs. Log sheets are maintained for all source transfers and shipments.

While sufficient documentation is available to support the maintenance of an accurate quarterly inventory, the licensee stated that a more discrete quarterly inventory system was being considered.

No violations were identified.

7. Radiation Exposure Dosimetry, Film Badges and Instruments

The inspector reviewed the dosimetry and radiation measurement programs against the requirements of 10 CFR 20.101, 20.202, 34.24, and 34.33. The licensee uses a properly accredited dosimetry supplier, and maintains appropriate dosimetry records for each individual. The licensee requires each team to have two portable survey instruments in the field. The licensee calibrates survey meters appropriately, and maintains the proper records. Self-reading dosimeters are calibrated and drift checked annually, and the appropriate records are maintained.

No violations were identified.

8. Training

The inspector reviewed the licensee's training program for radiographers and assistant radiographers against the requirements of 10 CFR 34.31 and 34.32. The inspector reviewed the training provided to the radiographer, assistant radiographer and other selected radiography personnel.

No violations were identified.

9. Inspection and Maintenance of Exposure Devices and Source Changers

The inspector reviewed the licensee's program for inspection, maintenance and repair of radiographic exposure devices and source changers as required by 10 CFR 34.28.

No violations were identified.

10. Exit Interview

An exit interview was held at the conclusion of the inspection with the individuals indicated in paragraph 1. The inspector discussed the scope and summarized the findings of this inspection.

A telephone exit interview was conducted on January 19, 1990 summarizing the NRC's evaluation of the licensee's final exposure assessment.