

U. S. NUCLEAR REGULATORY COMMISSION  
REGION III

Report No. 030-05064/90003(DRSS)

Docket No. 030-05064

License No.: 24-00188-02

Licensee: St. Louis Testing Laboratories, Inc.  
2810 Clark Avenue  
St. Louis, MO 63103

Inspection Conducted: August 28, 1990

Inspectors: Bryan A. Parker 09/20/90  
Bryan A. Parker Date  
Radiation Specialist

Gary L. Shear 9/20/90  
Gary L. Shear Date  
Senior Radiation Specialist

Reviewed By: Roy J. Caniano 9/20/90  
Roy J. Caniano, Chief Date  
Nuclear Materials Safety  
Section 2

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John A. Grobe, Chief Date  
Nuclear Materials Safety Branch

Inspection Summary

Inspection Conducted on August 28, 1990 (Report No. 030-05064/90003(DRSS))

Areas Inspected: This was an announced, special inspection conducted in response to the report of an apparent overexposure received by a radiographer's assistant which occurred on August 23, 1990, and was reported to NRC Region III on August 24, 1990. The inspection included a review of the circumstances and a reenactment of the course of events leading up to the apparent overexposure. The inspection also included a review of selective utilization, instrument calibration, personnel dosimetry, and training records.

Results: Four apparent violations of NRC requirements were identified during the inspection:

1. Failure to limit a radiation worker's total whole body dose to 1250 millirem per calendar quarter, 10 CFR 20.101(a), (Section 4);
2. Failure to secure the sealed source assembly during radiographic operations each time the source was returned to that position, License Condition No. 22, (Section 4);
3. Failure to survey the entire circumference of the exposure device after each exposure, 10 CFR 34.43(b), (Section 4); and
4. Failure to position the control drive cables such that no bend radii of less than 36 inches exists. License Condition No. 22, (Section 4).

## DETAILS

### 1. Persons Contacted

\*Frederick W. Wiese, President  
\*Ed Osaben, Radiation Safety Officer  
\*Scott Zimmer, NDT Manager  
Pamela Garrett, Radiographer  
Alphonzo Travis, Assistant Radiographer

\*Indicates present at exit meeting held August 28, 1990.

### 2. Licensed Program

St. Louis Testing Laboratories, Inc. (STL) is authorized by NRC License No. 24-00188-02 to use iridium-192 (Ir-192) and cobalt-60 (Co-60) in the conduct of industrial radiography. The license also authorizes the use of cesium-137 (Cs-137) for survey instrument calibration and nickel-63 (Ni-63) for use in gas chromatographs for sample analysis. All of the licensed material authorized may be used at the licensee's facilities located at 2810 Clark Avenue, St. Louis, Missouri. Ir-192 and Co-60 may be used at temporary jobsites anywhere in the United States where the NRC maintains jurisdiction for regulating the use of byproduct material.

The radiation safety program is managed by Scott Zimmer and the Radiation Safety Officer is Edward Osaben. STL currently employs approximately nine radiographers and five radiographer's assistants.

### 3. Inspection History

The last inspection of this licensee was conducted on June 27, 1990, in response to an allegation. One violation of NRC requirements was identified involving the failure to provide an exposure termination report to a former employee within 30 days.

A special inspection conducted from December 20, 1989 through January 17, 1990, was initiated by a number of allegations. Nine violations of NRC requirements were identified: (1) failure to conduct a survey after each radiographic exposure; (2) failure to send a film badge in for immediate processing; (3) failure to report an event which may have caused or threatened to cause an exposure in excess of the limits specified in 10 CFR 20.403(b)(1); (4) failure to conduct an adequate evaluation of the hazards associated with the exposure of an individual to a 91-curie (Ci) Ir-192 sealed source; (5) exposure of an individual in excess of three rem in a calendar quarter; (6) unauthorized Radiation Safety Officer; (7) failure to conduct training as required; (8) failure of an individual whose dosimeter had discharged beyond its range to cease radiographic operations; and (9) failure to return a sealed source to its shielded position at the conclusion of a radiographic exposure. The multiple violations indicated a Severity Level III management breakdown. A civil penalty of \$5000.00 was imposed on March 6, 1990.

A routine inspection conducted in 1988 identified no violations of NRC requirements.

4. Description of the Incident

On August 23, 1990, a radiographer and assistant were performing radiographic operations during evening hours utilizing an Amersham-Tech/Ops Model 660 exposure device housing approximately 96.9 Ci of Ir-192. The work was being accomplished at a temporary jobsite in the St. Louis, Missouri area and consisted of radiographing pipe welds. Two calibrated survey meters were on hand during operations and both meters had undergone and passed operational checks prior to their use that evening. Both individuals were wearing whole body film badges and pocket dosimeters which had been recharged prior to the beginning of their shift.

All of eight exposures occurred during the evening. Due to the location of the pipe welds, the equipment set-up for this particular job consisted of suspending the exposure device approximately 25 feet above the ground. The drive cables were hanging from the exposure device with the controls resting on the ground. This created a bend of approximately 90 degrees at the drive cable-exposure device connection point which resulted in a significant amount of tension at the exposure device selector ring. License Condition No. 22 (superseded by License Condition No. 23 of the renewed license dated August 28, 1990) requires the licensee to conduct its program in accordance with the statements, representations, and procedures contained in certain referenced documents. Section V, Part 1, "Assembly", of the manual, "Amersham-Tech/Ops Model 660 Series Gamma Radiography Systems", submitted with the referenced letter dated April 15, 1988, requires the drive cables to be laid out with no bend radii less than 36 inches. On August 23, 1990, the drive cables utilized during radiographic operations in conjunction with the exposure device were laid out such that a bend of nearly 90 degrees developed near the drive cable-exposure device connection point. As a near-90 degree bend corresponds to a bend radii of less than 36 inches, the failure to properly lay out the control drive cables constitutes an apparent violation of License Condition No. 22.

Interviews of the radiographer and assistant involved in the incident were performed on the day of the inspection addressing the operating procedures utilized during the operations. Due to the height, a "cherry picker"-type lift was used to move from the ground to the work area to survey, move the guide tube, exchange films, etc. Throughout the operations, one of the aforementioned survey meters remained in the lift and was used for the surveys between exposures. The other meter remained near the control crank to verify movement of the source during exposures. During the first seven exposures, the radiographer and assistant alternated the duties of exposing and retracting the source and performed surveys together after each exposure. While in the lift, one would operate the lift controls while the other performed the survey with meter in hand. However, after

the eighth and final exposure of the evening, the assistant went alone in the lift. The assistant performed the survey on this occasion by leaving the meter on the floor of the lift and periodically referring to it as he ascended to the exposure device and moved along the guide tube. All of the surveys that evening consisted of sweeping by the exposure device at a distance of approximately three feet and then proceeding along the guide tube at approximately the same distance. Upon reaching the end of the guide tube, the films would be retrieved. According to licensee representatives, the meter in the lift remained on zero throughout all of the surveys that evening and the meter at the control crank fell from the "pegged" position to zero each time the source was retracted. 10 CFR 34.43(b) requires that the entire circumference of the exposure device be surveyed after each exposure to determine that the sealed source has returned to its shielded position. According to statements made by licensee representatives interviewed on the day of the inspection, the entire circumference of the exposure device was not surveyed after any of the eight exposures made on August 23, 1990, to determine that the sealed source had returned to its shielded position. The failure to survey the entire circumference of the exposure device after each exposure constitutes an apparent violation of 10 CFR 34.43(b).

License Condition No. 22 (superseded by License Condition No. 23 of the renewed license dated August 28, 1990) requires the licensee to conduct its program in accordance with the statements, representations, and procedures contained in certain referenced documents. Section V, Part 2, "Operation", of the manual, "Amersham-Tech/Ops Model 660 Series Gamma Radiography Systems", submitted with the referenced letter dated April 15, 1988, requires that when the source is properly stored in the exposure device, the selector ring is to be rotated to the LOCK position and secured with the exposure device lock. According to statements made by licensee representatives interviewed on the day of the inspection, the sealed source assembly was not secured in the shielded position after the first seven of the eight exposures made on August 23, 1990. This appears to be routine practice for the licensee. As will be discussed later, securing the sealed source assembly by locking the device was accomplished only after the last exposure of the evening. The failure to lock the exposure device between exposures constitutes an apparent violation of License Condition No. 22.

As previously mentioned, after the eighth and final exposure of the evening, the assistant was alone in the lift. After completing the survey and retrieving the films, the assistant attempted to lock the camera as required by License Condition No. 22. The selector ring on the exposure device would not rotate to the LOCK position on the first try. The assistant lifted up on the drive cables to relieve the tension at the

drive cable-exposure device connection point. The ring would still not rotate and the assistant realized that something may be wrong. He then descended to the ground to consult with the radiographer who was nearby (within sight and "shouting" distance) reviewing blueprints. According to the assistant, the meter in the lift was reading zero. The radiographer and assistant approached the control crank and the meter located near the crank. They both observed that the meter near the crank was reading off-scale-high. The radiographer gave the crank a "slight" turn (less than 1/4 turn) and the meter near the crank fell back to zero. Both individuals checked their pocket dosimeters. The assistant's was off-scale-high (greater than 500 milliRoentgen (mR)), but the radiographer's only read 10 mR. They both entered the lift with the meter that had been located near the control crank and ascended to the exposure device. The meter remained on zero as they approached the exposure device. On this attempt, the selector ring on the exposure device rotated easily. The device was then locked and the setup dismantled. The crew ceased operations and contacted the RSO.

The licensee withdrew the assistant from radiation work for the remainder of the calendar quarter and sent the assistant's film badge in for immediate processing. NRC Region III was notified by telephone on August 24, 1990, that a possible overexposure had occurred involving a radiographer's assistant. The licensee estimated that the whole body dose could be as high as 9.6 rem. The results from the assistant's film badge indicated a whole body dose of 1.62 rem. This value is comparable to the dose assessment performed by the NRC following a reenactment of the event. It appears that the licensee's initial assessment was estimated as 9.6 rem due to an assumption that the assistant was exposed to a direct beam of radiation from a fully exposed source. The NRC reenactment indicates that the assistant never interacted with a direct beam of radiation.

A review of the assistant's dosimetry records revealed that the dose received from the incident brought the assistant's total whole body dose for the third quarter of 1990 to 1630 millirem (mrem). 10 CFR 20.101(a) limits the whole body exposure of an individual in a restricted area to one and one quarter rems (1250 mrem) per calendar quarter, except as provided by 20.101(b). Paragraph (b) allows a whole body exposure of three rems per calendar quarter provided the licensee maintains a Form NRC-4 (or the equivalent) signed by the individual disclosing all occupational doses after the age of 18. The licensee did not maintain a Form NRC-4 for the assistant at the time of the incident. The failure of the licensee to limit the whole body exposure of an individual in a restricted area to 1250 mrem per calendar quarter constitutes an apparent violation of 10 CFR 20.101(a).

During the licensee's initial review of the incident, it was learned that the survey meter located in the lift had what appeared to be a "short" in the circuitry which caused the meter to periodically cease functioning. The meter would indicate a reading of zero when it would "short out". This was verified by inspectors during the inspection. When first

examining it, the meter appeared to function properly, but when one of the inspectors shook the meter slightly, the meter "shorted out" and could not be made to work again. Therefore, it appears that on the evening of the incident, the survey meter located in the lift "shorted out" some time during the work shift and was not working after the eighth and final exposure was completed. As previously mentioned, statements from licensee representatives and a review of records indicate that the meter was checked and found to be functioning prior to the commencement of radiographic operations on August 23, 1990.

Four apparent violations of NRC requirements were identified.

5. NRC Reenactment

A reenactment of the August 23, 1990, incident was performed at the request of inspectors during the August 28, 1990, inspection. A setup comparable to the one involved in the incident was recreated in the licensee's fixed bay area by hanging an exposure device from the ceiling. The drive cables were connected to the device and weight equivalent to the full weight of a 25 foot control drive cable system was attached to recreate the tension on the exposure device selector ring. The inspectors demonstrated that the selector ring on the exposure device was either very difficult or, in some cases, impossible to rotate under these conditions. In fact, during one of the demonstrations, the control cable crank rotated slightly while attempting to rotate the selector ring by lifting up on the cables to relieve the tension at the connection point. Radiation levels in the room did not increase, but the demonstration seemed to further support the theory that on the date of the incident, the crank turned slightly causing the source to become partially exposed when the assistant lifted the control cables while attempting to rotate the selector ring to the LOCK position.

6. Other Areas Inspected

A review of the training records of the radiographer and assistant involved in the incident revealed that each was fully trained and qualified to perform their assigned duties. Both had performed well on all training and retraining examinations and both received good ratings during licensee audits.

A review of survey instrument calibration records revealed that the instruments used on the date of the incident were properly calibrated. A review of the utilization log for the date of the incident revealed that operational checks had been performed on the instruments prior to their use.

No violations of NRC requirements were identified.

7. Exit Meeting

An exit meeting was held on August 28, 1990, with those individuals indicated in Section 1 of this report. The incident and inspection findings were discussed as were the apparent violations and the NRC Enforcement Policy. In addition, the licensee did not indicate that any information discussed during the inspection was proprietary in nature.