

U. S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 30-10749/81-01

Docket No. 30-10749

License No. 48-16296-01

Licensee: Midwest Inspection Services, Ltd.
Green Bay, WI

Investigation At: Marquette, MI, and Green Bay, WI

Dates of Investigation: April 1-2, 1981

Investigators:

G. A. Phillip

5/14/81
Date

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5/14/81
Date

Approved By:

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Investigation Summary

Investigation on April 1-2, 1981 (Report No. 30-10749/81-01)

Areas Investigated: Following receipt of a concern that the licensee may have conducted radiography in an unsafe manner at a field job site, an investigation was initiated. The investigation involved 16 investigation-hours by two NRC representatives.

Results: Information obtained during the investigation provided no evidence that unsafe conditions occurred during radiographic operations at the field job site. No items of non-compliance were identified during this investigation.

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REASON FOR INVESTIGATION

On March 26, 1981, Mr. Dave Anthony, an aide to U.S. Senator Carl Levin, advised Region III by telephone that he had received a complaint that nonradiation workers may have received radiation overexposures while the licensee was performing radiographic operations at a field job site in Marquette, Michigan.

SUMMARY OF FACTS

A representative of the United Steelworkers of America via the office of U.S. Senator Carl Levin expressed concern that individuals may have received radiation overexposures as a result of radiographic operations performed intermittently by the licensee at Lakeshore, Inc., Marquette, Michigan. An examination of the conditions under which radiography was performed and a review of pertinent records combined with interviews of the complainant, Lakeshore employees and management, and the licensee's radiographers provided no information that the radiographic operations were conducted in an unsafe manner or that any personnel received radiation exposures in excess of regulatory limits. No items of noncompliance were identified during this investigation.

An inspection of the licensee's activities was conducted concurrently with this investigation. Three items of noncompliance unrelated to the subject of the investigation were identified.

DETAILS

1. Personnel Contacted

Lakeshore, Incorporated

Samuel D. Howell, Site Manager
Peter J. Webb, Safety and Health Administrator
Daniel Kalisch, Mechanic and Union Representative
George Dionne, Burner Operator
Long Nguyen, Inspector
Robert Webb, Union Representative
John Armatti, Crane Operator

Midwest Inspection Services, Ltd.

Donald Paschen, President
Kent Wolfcale, Radiographer
James Norman, Radiographer

2. Introduction

On March 26, 1981, Region III received a telephone call from Mr. Dave Anthony, an aide to U.S. Senator Carl Levin of Michigan, advising he had received a complaint regarding the licensee. He stated that an official of the United Steelworkers of America, Local 3111, Marquette, Michigan, had expressed concern that members of the public may have received radiation overexposures while the licensee was performing radiographic operations on the premises of Lakeshore, Inc., Marquette, Michigan. Anthony provided the name and telephone number of the individual to contact for further details concerning the complaint.

3. Complaint

During a telephone conversation on March 27 and a personal interview on April 1, 1981, the union official provided the following information.

On three or four occasions during the preceding two-month period personnel employed by the licensee had spent from one to three days at Lakeshore, Inc. performing radiography on steel girder welds. He stated that he had not personally observed the radiographic operations but had received information from Lakeshore, Inc. personnel regarding these activities. He indicated that George Dionne, a Burner Operator, and Long Nguyen, Inspector, could provide additional information. He advised that Nguyen was assigned to work with the radiographers whenever they were at Lakeshore, Inc.

He said that during the first visit, licensee personnel had performed the radiography in a roped off area outside. He also advised that the radiography personnel who first visited the facility appeared to be conscientious while those visiting the plant more recently seemed interested only in getting the work done in a hurry. During later visits they roped off an area and posted signs inside a building known as the Plate Shop. During the last visits the radiographers had not roped off the area.

The union official also stated on one occasion the radiography personnel had indicated it was necessary to place several steel plates against the wall of the building to assure radiation levels outside the building would not be too high. During recent radiographic operations, however, no steel plates were used. He indicated this caused him concern because members of the public sometimes walked along some railroad tracks which ran alongside the building about twelve feet from the building wall. In addition, there were residences located about an additional 35 feet from the building.

It was indicated that the radiography was performed at night and on one occasion plant employees were not allowed to enter the area for about 45 minutes or an hour when they arrived for work at 7:00 a.m. On subsequent occasions, however, they were permitted to enter the area immediately or within a few minutes after their arrival.

The union official advised that the licensee personnel transported the radioactive source in a barrel which was not anchored to the bed of their camper pickup truck. He also said the truck was not placarded with radioactive warning signs.

4. Discussions with Samuel Hoyt, Plant Manager, Lakeshore, Inc.

On April 1, 1981, discussions were held with Samuel Hoyt, Plant Manager, Lakeshore, Inc. He was advised of the purpose of the visit and requested to provide information concerning the work performed by the licensee at his plant.

Hoyt advised that on several occasions over the past few years licensee personnel had provided required radiographic services. Regarding recent activities, he determined from his records that during the period January 27 through February 25, 1981, his company had been billed for a total of 224 exposures made by the licensee during that period. He said during 1981 radiography had been performed on the following dates: January 27-29, February 3, 4, 11, 12, 18, and 25, 1981. Hoyt indicated that the same two individuals had performed all of the radiography at his plant during 1981. Prior to 1981, however, other licensee personnel had done the work. He indicated that, although he was not knowledgeable on the subject of radiation safety requirements applicable to radiography, the licensee personnel had never done anything to cause him concern in that regard. He advised that his firm's safety officer, who is based in Iron Mountain, Michigan, was visiting the Marquette plant and could provide additional information regarding the licensee's work.

5. Interview with Peter J. Webb, Safety and Health Administrator, Lakeshore, Inc.

On April 1, 1981, Peter J. Webb, Safety and Health Administrator, Lakeshore, Inc. provided the following information.

Webb advised that licensee personnel had described to him the precautions they were taking. He said he was present when they performed radiography on two or three occasions. He said they used a radiation survey instrument to establish a boundary around the work area and told him they had checked the radiation levels around the outside walls of the Plate Shop where the radiography was performed. He said they used a survey meter to show him that the radiation levels were low where they had parked their truck and that the readings increased as they approached the radioactive source where the radiography was being performed. He said they posted warning signs on the outside doors and assured the outside door of an office adjoining the area was locked. They also roped off the area from the adjoining plant area and posted warning signs along the ropes. Webb advised that a collimator was used for all radiographic operations.

Webb said the two girders on which radiography was performed were located more than twelve feet from the outside wall. He said he did not recall whether there was anything located between the girders and the outside wall. He estimated that the distance between the two girders was not more than six or eight feet. He recalled that the radiographers timed the radiographic exposures (shots). Although he did not know the duration of the shots, he estimated each one took about seven minutes.

Webb said that with one exception, all radiography was performed at night beginning at about 11:00 p.m. or midnight. He observed some of this work and recalled that some of the shots were done with the source pointed toward the floor. On one occasion it was necessary to perform one or two shots during the lunch hour and all employees were kept out of the area. In that regard he said he had no knowledge of anyone entering the area while radiography was being performed.

6. Tour of Radiography Work Area

A tour of the plant area was made with Webb who pointed out the position of the girders at the time the radiography was performed. According to Webb the girders were situated parallel to each other and parallel to the building wall alongside of which ran the railroad tracks. The closest girder was about fifteen feet from the wall. One girder was present in the area and it was noted that the welds requiring radiography were located on two parallel 3/8" steel plates, so that using a collimator the primary beam of radiation would be directed away from the wall or toward it. In the latter case, at least two thicknesses of 3/8" steel would provide attenuation.

Webb also pointed out where the radiographers' truck had been located, as well as the location of the rope and warning signs which separated the area from the remainder of the plant. Subsequently, a sketch of the area was obtained, a copy of which is attached to this report as Exhibit A.

7. Interview with George Dionne, Burner Operator

On April 1, 1981, George Dionne, Burner Operator, Lakeshore, Inc. was interviewed. Present during this interview was Robert Webb, an employee union representative, and Peter Webb, Safety and Health Administrator.

Dionne said that the first time radiography was performed by the licensee it was accomplished outside the plant in a controlled area.

(Investigator's Note: It was subsequently determined that radiography outside the plant was performed by other licensee personnel prior to 1981, possibly two years ago, but that all radiography performed during 1981 was accomplished in the area described above.)

Dionne stated that on one occasion he observed the two licensee radiographers perform some dye-penetrant work. He said, however, he had no firsthand knowledge of the circumstances under which they performed radiography since he had not been present. He said he worked the day shift and the radiography was performed at night.

Dionne inquired as to how much time should pass after radiographic operations were completed before it was safe to enter the area. It was explained to Dionne that there is no residual radiation in the area after radiography is performed and that the area needs to be controlled only while the radioactive source is exposed, i.e., outside the shielded container. A brief description of a radiographic operation was provided to illustrate that when the radioactive source has been secured in the shielded container individuals may safely enter the work area.

Dionne advised that in addition to Long Nguyen, John Armatti, a crane operator, was present when radiography was performed.

8. Interview with John Armatti, Crane Operator

On April 1, 1981, John Armatti, Crane Operator was interviewed. Present during the interview were Robert Webb and Peter Webb.

Armatti advised that, at the time radiography was performed, he was a helper in the Plate Shop. He said he worked on the second shift and was present when grinding was done on the girder welds in preparation for their being radiographed. He said most of the radiography was performed during the third shift. He said, however, on at least one occasion he was in the plant while radiography was performed. He said the outside doors were posted with warning signs and the area inside

the plant was roped off. He said the workers who had been in the area were required to leave and they went to drink coffee in an area about three to four hundred yards away.

9. Interview with Long Nguyen, Inspector

On April 1, 1981, Long Nguyen, Inspector was interviewed. Present during this interview was Daniel Kalisch, an employee union representative.

Nguyen confirmed that the girders were about 15 to 20 feet from the outside wall of the building when radiography was performed. He said to his knowledge a collimator was always used and that the radiographers used survey meters to check the radiation levels around the perimeter of the area. He said that warning signs were posted on the doors and the area was roped off from the remainder of the plant. He indicated that the placement of warning signs along the ropes was such that it was possible they would not be noticed. He said, however, that at least one radiographer was present near the truck at all times such that he could maintain surveillance of the roped portion of the perimeter. He said he never saw anyone enter the area while radiography was being performed.

During this interview the question again arose concerning a hazard to personnel entering an area after radiography has been performed. A similar explanation as that given to Dionne was provided.

10. Review of Licensee Records

On April 2, 1981, licensee records pertaining to the work performed at Lakeshore, Inc. were reviewed at the licensee's facility in Green Bay, Wisconsin.

These records showed that an iridium-192 sealed source, Serial No. 10⁰ 011, contained in a Gamma Century exposure device, Serial No. 2204, was used to perform radiographic operations at Lakeshore, Inc. during the following periods: January 27-29, February 3, 4, 11, 12, 18 and 25, 1981. The records showed that a lead collimator, measuring 1 7/8" thick and 4 1/2" in diameter, was used during these operations. A Gamma Industries leak test and decay chart showed that the source, a Model A-2A, was wipe tested and assayed as 102 curies on January 21, 1981. The two individuals who performed the above radiography were Kent Wolfcale and James Norman.

11. Interview with Kent Wolfcale, Radiographer

On April 2, 1981, Kent Wolfcale, Radiographer, was interviewed. Wolfcale stated that he and Norman were the only two licensee employees who have worked at Lakeshore, Inc. during 1981. He indicated that about two years earlier, other radiographers had done some work at Lakeshore, some of which he understood was done outside the plant. He said he was also aware that this earlier work involved radiography on some small pieces. Several plates were set up against the wall in a corner of the Plate Shop to establish a shielded area for that work.

Wolfcale estimated that the girders, which were at least fifty feet long and about six feet high, were located about twenty feet from the outside wall. He stated a survey was performed when they initially began work during their first visit to Lakeshore to assure that the radiation levels outside the building were less than 2 mR per hour. He said the survey was made while the source was exposed between the two girders with the collimator opening facing the outside wall. The radiation levels at the wall would have been the highest in this configuration of all the configurations in which radiography was performed. He said it was his recollection that there was a welding machine located between the girders and the outside wall. He also indicated, but was uncertain, that there also may have been one or more metal plates leaning against the wall at that location.

He said the outside door of an office adjoining the area was locked as well as one large rollup vehicular door. Both doors were posted with signs reading: "Caution Radiation Area - Do Not Enter. Contact Operator Concerning Hazards In This Area." He said there was another pedestrian door adjacent to a rollup door through which they drove their truck. Both of these doors were kept under their surveillance as well as the roped off area.

Wolfcale advised that Norman operated the exposure device and he developed and read the film. He said all work was done after midnight with the exception of two exposures which were made at noontime. On the latter occasion, all Lakeshore personnel were some distance from the area having lunch. Wolfcale said no one entered the area while radiography was being performed.

Wolfcale stated that the vehicle, which was used to transport the radioactive source, was placarded and that the radiography device was transported in a locked box which is anchored to the floor of the truck's darkroom. Subsequent to this interview, several of the licensee's vehicles were noted to be placarded and the interior of one vehicle was examined and it was noted to have a locked box anchored to the floor of the darkroom.

12. Interview with James Norman, Radiographer

On April 2, 1981, James Norman, Radiographer, was interviewed. Norman corroborated the information previously provided by Wolfcale.

13. Calculations of Radiation Levels

On the basis of the information obtained through interviews and a review of licensee records, calculations were made to determine whether radiation levels outside the building wall, which was a matter of concern, were within the required limits.

Since the outside wall consisted of 20 gauge sheet metal, plasterboard and insulation, it provided negligible shielding and was not considered in the calculations. The calculations are as follows:

Constants

1/ ρ_{Fe} (density of iron) = 7.9 g/cm³

2/ μ/ρ (mass absorp. coeff)_{Fe} = .102 (assume \bar{E}_{Ir-192} = 350 keV)

3/ Γ (gamma constant)_{Ir-192} = 5.1 R/M/mCi @ 1 cm

Decay -

Source received 1/21/81 = 102 curies

used 1/27/81 (6 days decay) = (102 ci)(.9456) = 96.45 ci

Exposure Rate (from source) -

(96.45 ci)(5.1 R/hr/mCi)($\frac{1E3 \text{ mCi}}{\text{Ci}}$) = 4.92 E5 R/hr @ 1cm

Inverse Square -

$I_2 = I_1 \left(\frac{d_1}{d_2}\right)^2$ where: $I_1 = 4.92 \text{ E5 R/hr}$

$d_1 = 1 \text{ cm}$

$d_2 = 610 \text{ cm (20 ft.)}$

$I_2 = \frac{(4.92 \text{ E5})(1)}{(3.716 \text{ E5})}$
= 1.326 R/hr @ 20 ft.

Attenuation by Stainless Steel (Fe): $x = (2)(3/8") = 3/4"$
 $(3/4")(2.54 \text{ cm/in}) = 1.9 \text{ cm}$

$I = I e^{-(\mu/\rho)(\rho)(x)}$
= (1.326)($e^{-(.102)(7.9)(1.9)}$)
= (1.326)(.22)
= 0.292 R/hr @ 20 ft. thru 3/4" Fe
= 292 mR/hr outside wall

- 1/ From Introduction to Health Physics, Cember
2/ From Radiological Health Handbook, 1970 Edition
3/ From Gamma - Industries handbook

Exposure Rate - (outside wall) per shot

$$.292 \text{ R/hr} = 292 \text{ mR/hr}; 292 \text{ mR/hr} / \frac{1 \text{ hr}}{60 \text{ min.}} = 4.87 \text{ mR/min}$$

~5.5 min/shot

$$1 \text{ shot} = (5.5 \text{ min})(4.87 \text{ mR/min}) = \frac{26.785 \text{ mR/shot}}{\text{(outside bldg)}}$$

Based upon the above, if an individual was in contact with the outside wall during one of the radiographic operations, in which the configurations would result in the highest radiation level at the wall, he would receive about 27 millirem. The licensee's survey record (See Exhibit A) shows that the radiation level at the wall with the source in the same configuration was 2 mR/hr. The cause of the difference between the above calculations and the survey results could not be determined. The presence or absence of objects near the wall during actual radiographic operations that might reduce the radiation levels could not be determined. Also, the validity of the survey readings recorded by the radiographers could not be formally established or disproved.

An individual present at the wall while radiographic operations were being performed in the other known configurations would receive less exposure. An individual walking along the wall or standing a few feet from the wall would receive little, if any, radiation dose.

If it is assumed the calculated radiation levels did exist, the following are some considerations which reduce the likelihood that anyone outside the building received any significant exposures during radiographic operations.

- a. All but two shots were made in the late night/early morning hours.
- b. Less than 25% of the shots were made in the configuration which would have resulted in the highest radiation levels at the wall.
- c. The source was exposed about two or three times per hour for five minutes each.

14. Management Discussion

On April 2, 1981, the findings of the investigation were discussed with Donald Paschen, President. He was advised that no items of non-compliance were identified during the investigation. The results of the inspection of his program, which was conducted concurrently with this investigation, were also discussed with him.

Attachment: Exhibit A,
Sketch of Radiography Area

POOR ORIGINAL

LESS THAN 2MR ON SURFACE

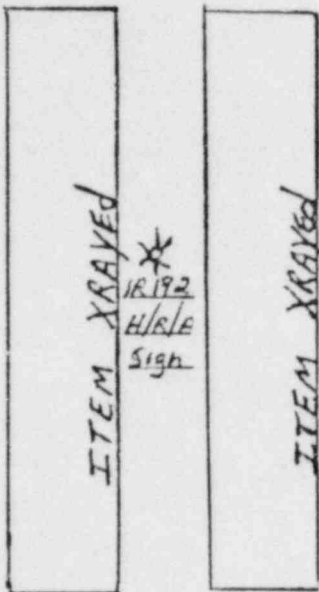
R/A = RADIATION AREA
H/R/A = High Radiation Area

LESS THAN 2MR ON SURFACE

NO ENTRY ON THIS WALL

NO ENTRY ON THIS WALL

IR 192
H/R/A

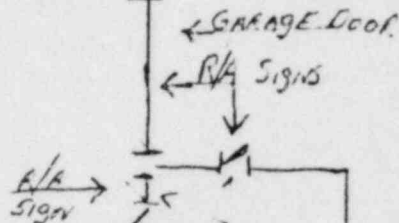
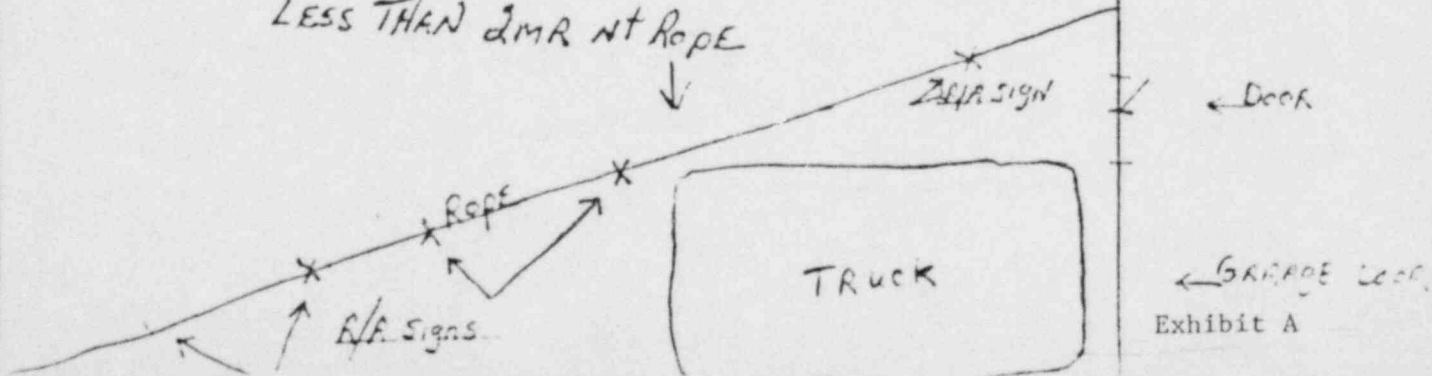


IR 192
H/R/A SIGN

IR 192 SOURCE
EQUIPPED WITH
COLLIMATOR

ALL ENTRIES WITH R/A
SIGNS LESS THAN 2MR ON THIS
SIDE

LESS THAN 2MR AT ROPE



R/A SIGN

DOOR
R/A SIGN

R/A SIGN

CLOSED

GARAGE DOORS

R/A SIGNS

DOOR

GARAGE DOOR

2MR SIGN

DOOR

GARAGE DOOR

Exhibit A