ENCLOSURE 1

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.:	030-12319
License No.:	35-17178-01
Report No.:	030-12319/98-01
Licensee:	Tulsa Gamma Ray, Inc.
Facility:	Tulsa Gamma Ray, Inc.
Location:	Tulsa, Oklahoma
Dates:	September 14, 1998 through December 14, 1998
Inspector:	Richard A. Leonardi, Jr. Radiation Specialist
Approved By:	Elmo Collins, Chief Nuclear Materials Inspection Branch
Attachment:	Supplemental Inspection Information

EXECUTIVE SUMMARY

Tulsa Gamma Ray, Inc..
NRC Inspection Report 030-12319/98-01

This was a reactive, announced inspection conducted in response to initial notifications made in a Tulsa Gamma Ray, Inc. (TGR) report dated August 14, 1998, and telephone call to NRC Region IV offices on September 2, 1998, by TGR of two potential occupational radiation doses in excess of NRC limits. The inspection included a review of activities relating to use of radiographic and personal monitoring equipment, the administrative aspects of the licensee's radiation safety program, a selective examination of procedures and representative records, and interviews of licensee personnel.

Program Overview

- Tulsa Gamma Ray, Inc., is authorized under NRC License 35-17178-01 to use byproduct material for industrial radiography. This nondestructive testing company performs industrial radiography at numerous fabrication shops in the Tulsa, Oklahoma area and performs radiography on oil/gas pipelines throughout the United States (Section 1).

Background And Purpose of Inspection

- On August 31, 1998, NRC Region IV received a 30-day written report from the licensee documenting a radiation dose to a radiographer of 2.95 rems for June 1998. This radiation dose brought the total dose for calendar year 1998 to greater than 5 rems. On September 2, 1998, the licensee reported by telephone to NRC Region IV that it had received a second vendor report of a high radiation dose to a radiographer's assistant's (RA) film badge. The reported dose was 7.56 rems for July 1998 (Section 2).

- A reactive inspection to review the reported high radiation doses was initiated on September 14, 1998 (Section 2).

Dosimetry Vender Evaluation

- The dosimetry vendor's re-evaluations of the film badge readings determined that the reported doses were accurate. There was no evidence that the film badges had been damaged. Film filter patterns were inconclusive as to whether the films were exposed to radiation in a static or dynamic environment (Section 3).

Licensee's Evaluation

- The licensee was not able to determine the cause for the 2.95 rems dose reported for the radiographer in June 1998. This radiation dose resulted in a total radiation dose of 5.64 rems for calendar year 1998. The failure to limit the occupational dose to an individual adult to 5 rems during calendar year 1998 is an apparent violation of 10 CFR 20.1201 (Section 4).

- The licensee concluded that the dose of 7.56 rems reported for a radiographer's assistant for July 1998 did not represent the dose received by the individual. The licensee assigned a radiation dose of 320 mrem for the radiographer's assistant for July 1998. Based on NRC Region IV's independent review of the reported dose to the RA, it was concluded that the reported dose of 7.56 rems did not represent the radiation dose received by the radiographer's assistant for July 1998 (Section 4).

Notification and Reports

- Upon notification from the dosimetry vendor, the licensee properly reported to the NRC the high radiation doses (Section 5).

Licensee Evaluation and Corrective Actions

- The radiographer received a radiation dose in excess of NRC regulations. Although a reasonable review was conducted, the licensee was not able to determine the cause for the high radiation dose (Section 6).

- The licensee's review of a reported high radiation dose to a radiographer's assistant determined that the radiation dose on the film badge did not represent the radiation dose received by the individual. Based on the inspection findings, the licensee's conclusions appeared reasonable. The licensee's assignment of pocket dosimeter readings as the radiographer's assistant's radiation dose of record was deemed acceptable based on a review of other TGR radiographers and radiographer's assistant's doses received for similar work activities. The dose assigned to the RA appeared consistent with doses received by other TGR radiography personnel (Section 6).

Report Details

1 Program Overview (87120, 83822, 87103)

Tulsa Gamma Ray, Inc., (TGR) is authorized under NRC License 35-17178-01 to use byproduct material for industrial radiography. This nondestructive testing company performs industrial radiography at numerous fabrication shops in the Tulsa area and performs radiography on pipelines throughout the United States. The licensee possesses both cobalt-60 and iridium-192 sources for use in industrial radiography and a cesium-137 source for calibrating survey instruments. The licensee maintains a shielded radiography vault in Tulsa. The licensee employs about 70 personnel, including 12 radiography personnel assigned to pipeline work primarily and 30 radiography personnel involved in fabrication shop work. The cobalt-60 and iridium-192 sources are used in Amersham Model 680, Model 660A, and Model 660B exposure devices. The licensee performs radiography on a daily basis. Occasionally, the licensee conducts licensed activities in Agreement States under reciprocity provisions. The licensee performs radiography at permanent field locations including the Port of Catoosa in north Tulsa.

2 Background And Purpose of Inspection (87120, 83822, and 87103)

On August 31, 1998, NRC Region IV received a 30-day written report from the licensee in accordance with 10 CFR 20.2203. The report was dated August 14, 1998. The report indicated that a radiographer had received a radiation dose of 2.95 rems total effective dose equivalent (TEDE) for June 1998. When added to his accumulated dose for 1998, the total radiation dose received by this radiographer was 5.64 rems for calendar year 1998. Additionally, on September 2, 1998, the licensee reported to NRC Region IV that a radiographer's assistant (RA) film badge had received a dose of 7.56 rems for July 1998. The licensee suspended the radiographer and radiographer's assistant from licensed operations and initiated an investigation to determine the reasons for the reported high radiation doses.

A reactive inspection in response to the two reported high radiation doses was initiated on September 14, 1998.

3 Reported High Radiation Doses By Dosimetry Vendor (87120, 83822, and 87103)

3.1 Inspection Scope

The inspector interviewed licensee personnel, reviewed licensee records, examined the licensee's personnel monitoring equipment, and interviewed dosimetry representatives.

3.2 Observations and Findings

a. *Radiographer's Reported Radiation Dose of 2.95 Rems*

The licensee's dosimetry vendor had reported telephonically to the licensee on August 1, 1998, that a film badge assigned to a radiographer received 2.95 rems deep dose equivalent (DDE) during June 1998. The licensee contacted the dosimetry vendor and requested that the film badge be re-evaluated. The dosimetry vendor reported the results of the re-evaluation to the licensee by letter dated August 10, 1998.

The dosimetry vendor found that the film badge was undamaged. The film badge had been checked by an operator and a laboratory supervisor. The reported dose level was judged to be accurate. The dosimetry vendor also indicated that it had reviewed the serial number, the process calibration, quality control, and the condition of the film packet. The dosimetry vendor was unable to determine if the dose received was static (fixed geometry with definite film filter patterns) or dynamic (film pattern consistent with an object in motion).

During discussions with the licensee's dosimetry vendor, the inspector also determined that the radiographer's film was exposed inside the badge holder. The filter patterns on the film, while not ruling out a static exposure, were consistent with a dynamic exposure.

b. *Radiographer's Assistant Reported Dose of 7.56 Rems*

On September 1, 1998, the licensee's dosimetry vendor reported to the licensee that a film badge assigned to a radiographer's assistant received 7.56 rems DDE for July 1998. The licensee requested that the dosimetry vendor conduct a re-evaluation of the film. The dosimetry vendor reported the results of the re-evaluation in a letter dated September 2, 1998.

The dosimetry vendor conducted an independent quality assurance evaluation of the film. Senior technical staff assessed the exposure information and judged the reported dose to be accurate. The dosimetry vendor indicated that the film had been re-evaluated and checked for heat and light damage. No evidence of damage was identified. The dosimetry vendor was not able to determine if the badge exposure was received under static or dynamic conditions.

3.3 Conclusions

The dosimetry vendor's re-evaluations of the film badges determined that the reported doses were accurate. There was no evidence that the film badges had been damaged. Film filter patterns were inconclusive as to whether the films were exposed to radiation in a static or dynamic environment.

4 Licensee's Dose Evaluation (87120, 83822, 87103)

4.1 Inspection Scope

The inspector interviewed licensee personnel and reviewed licensee records and reports related to the activities of the affected personnel, and reviewed the licensee's evaluation of the reported doses.

4.2 Observations and Findings

The licensee's evaluation of the reported radiation doses consisted of: (1) interviews with affected personnel involved with the reported high doses and the receipt of written statements from them, (2) reviews of the reported doses for each month prior to the month of the reported high dose, (3) checks of the pocket dosimeters and alarm ratemeters used during the months of the reported high doses, (4) reviews of the doses recorded for pocket dosimeters on daily radiation reports for the months involving the reported high doses, (5) interviews with other radiography personnel who had worked with the involved personnel during the month each individual received the reported high doses, and (6) reviews of the dosimetry vendor.

a. *Evaluation of Radiographer's Reported High Dose*

Upon notification of the high radiation dose for the radiographer, the licensee removed the radiographer from occupational radiation work. During the NRC interview with the radiographer, he stated that he had voluntarily terminated his employment with the licensee on September 3, 1998, to seek other employment.

The radiographer stated that he was not aware of any circumstances which would account for his reported high dose. The radiographer was confident that he had worn his personal monitoring devices and an alarm ratemeter during radiographic operations. The radiographer was also confident that he had not been involved in any activity in which his film badge might have dropped or otherwise have been exposed to radiation while the film badge was off his person. The radiographer stated that he handled his film badge properly when the badge was not being used by storing it away from potential sources of radiation. He also stated that he protected his film badge from heat sources and other environmental factors.

The licensee's evaluation of the reported high radiation dose to the radiographer did not identify a cause for the high reading or an event where the high radiation dose may have been received.

The radiographer's daily radiation dose records for June 1998 indicated that he had recorded a pocket dosimeter dose for each day of use. The recorded dose was a total of 141 mrem for the month of June 1998. A review of recorded doses by TGR's dosimetry vendor for all TGR personnel for the June 1998 monitoring period revealed that no other TGR personnel had received an abnormally high film badge reading The inspector found

by review of calibration records, that the safety devices which were used had been within the required calibration intervals during June 1998.

A review of the radiographer's training records revealed that the radiographer had been employed by the licensee without any previous radiography experience on August 22, 1997. He became a qualified radiographer's assistant in August 1997 and was fully qualified as a radiographer after completing the 40-hour radiation safety course on September 13, 1997. He worked as a radiographer's assistant for 6 more months before he was allowed to work independently as a radiographer. The licensee's records indicated that the radiographer's work had been audited four times prior to June 1998, and he was audited again on June 22, 1998. The five audits did not identify any unsafe work practices or procedure problems.

In the 30-day written report to the NRC dated August 14, 1998, the licensee raised questions about the accuracy of the dosimetry results received from its vendor. The RSO conducted an audit of film badges worn by licensee personnel. The RSO had assigned two film badges to two radiography personnel with instructions to wear the badges side-by-side. The reported doses from the two film badges worn side-by-side were compared. The RSO noted a 22 percent difference in the dose readings in both pairs of film badges. The licensee postulated that the radiographer's reported high dose of 2.95 rems could have been over reported by as much as 22 percent. The licensee's evaluation did not consider the possibility that the radiographer's radiation dose could have been under reported by 22 percent. The inspector concluded that the results of the licensee's audit of film badges did not form a reasonable basis to change the radiation dose reported by the dosimetry vendor.

10 CFR 20.1201(a)(1)(i) requires that a licensee control the occupational dose to individual adults to an annual dose limit of 5 rems Total Effective Dose Equivalent (TEDE). The licensee did not limit the annual occupational dose to an adult radiographer to 5 rems TEDE. The radiographer received 2.95 rems (deep dose equivalent) during June 1998. This resulted in a TEDE of 5.64 rems for calendar year 1998. This is an apparent violation (030-12319/9801-01).

b. *Evaluation of Radiographer's Assistant Reported High Dose*

The licensee's dosimetry vendor reported a DDE of 7.56 rems to a film badge worn by a RA for July 1998. The reported dose for the RA for the month of July 1998 brought the total dose for the RA to 7.93 rems for calendar year 1998.

The licensee's evaluation concluded that the reported July 1998 radiation dose received by the film badge was not the true dose received by the radiographer's assistant, since the RA's film badge had been exposed when not worn by the RA. While working at a temporary job site in Iowa on July 5 - 18, 1998, the RA unknowingly dropped his film badge during the conduct of radiographic operations. Several exposures were completed using an Amersham Model 660B exposure device containing a 53 curie iridium-192

source over an estimated 1.5 hour period. The film badge was located a few feet from the exposure device.

After the report of the high radiation dose to the radiographer's assistant film badge, the licensee's RSO calculated the potential exposure that the RA's film badge could have received under these circumstances. The RSO concluded that the film badge reading was consistent with the circumstances described by the RA.

The NRC inspector's interview with the RA confirmed that the RA had dropped his film badge. A review of the RA's pocket dosimeter readings on the daily radiation report records for July 1998 disclosed that the total dose recorded was not in agreement with the RA's film badge reading. The total pocket dosimeter dose recorded for the RA for the period July 5-18, 1998, was 60 millirem. This supported the conclusion that the radiation dose was not actually received by the RA. The inspector questioned the RA why he did not notify the radiographer when he dropped his film badge and inadvertantly exposed it during radiographic operations. The RA stated that he thought the exposure potential was minimal since the source had been collimated, the source activity was about half the original activity, and thus the incident did not warrant reporting. Also, the RA indicated that he had been reluctant to say anything to the RSO because of fear of reprimand. The NRC inspector found during the interview with the RA that he stated that he had worn his pocket dosimeter and alarm ratemeter during the radiographic operations. The RA stated that his dosimeter had not gone off-scale and that his alarm ratemeter had not alarmed.

The inspector found that daily radiation doses for the RA had been recorded for the period of time July 5 - 18, 1998. His pocket dosimeter recorded dose totaled 60 mrem for July 5 - 18, 1998. A review of several TGR personnel's total recorded pocket dosimeter doses for July 1998, indicated that the RA's recorded dose was consistent with doses recorded by other TGR personnel for the same exposure period. The inspector confirmed from review of calibration records that the pocket dosimeters and alarm ratemeters used by the radiographer and RA involved in the event had been calibrated within the specified calibration intervals during July 1998.

A review of the RA's training records indicated that he had been employed on June 1, 1998. He had completed the licensee's operating and emergency procedures training and passed the required test on June 1, 1998. During his on-the-job training as an assistant, his field work had been audited on June 10, and September 8, 1998. No safety problems had been identified in the safety audits.

The licensee removed the RA from work involving occupational radiation exposure after receiving notification that the RA's film badge had received a high dose. The inspection determined that licensee personnel had conducted an evaluation of the reported high dose for the RA and concluded that the reported dose did not appear to represent the true dose received by the RA.
The inspection determined that the licensee implemented the following corrective actions involving the RA. The corrective actions included: (1) requiring the RA to attend a radiation safety training re-orientation using a NRC-produced video tape, (2) a written test given the RA covering the licensee's operating and emergency procedures , and (3)

giving the RA an assignment to write an essay on the proper use and handling of personnel dosimetry.

The licensee assigned the RA an administrative radiation dose of 320 mrem for July 1998. The dose assignment was based on the total pocket dosimeter readings for July 1998. The RA was subsequently rescheduled for work involving occupational radiation exposure.

4.3 Conclusions

The licensee was not able to determine a cause for the reported radiographer radiation dose of 2.95 rems in June 1998. This radiation dose resulted in a total radiation dose of 5.64 rems for calendar year 1998 for the radiographer. The failure to limit the occupational dose to an individual adult to 5 rems during calendar year 1998 is an apparent violation of 10 CR 20.1201.

The licensee concluded that the reported high radiation dose to a radiographer's assistant of 7.56 rems for July 1998 did not represent the radiation dose received by the radiographer's assistant. The licensee assigned a radiation dose of 320 mrem for the radiographer's assistant for July 1998.

5 Notification And Reports (87120, 83822, 87103)

5.1 Inspection Scope

The inspector interviewed licensee personnel, reviewed licensee records, and reviewed NRC docketed material to determine if the licensee complied with the notification and reporting requirements contained in 10 CFR 20.2203.

5.2 Observations and Findings

The licensee, after becoming aware on August 10, 1998, of a radiographer's reported high radiation dose of 2.95 rems for June 1998 by the licensee's dosimetry vendor, determined that the radiographer's total dose for calendar year 1998 exceeded 5 rems TEDE. The licensee initiated an evaluation and submitted the required 30-day report dated August 14, 1998, to the NRC. The licensee notified NRC Region IV by telephone on September 2, 1998, after the licensee had received telephone notification on September 1, 1998, from its dosimetry vendor that a radiographer's assistant film badge had a reported radiation dose of 7.56 rems for July 1998. As discussed in Section 4 of this report, subsequent review by the licensee found that the radiographer's assistant did not receive a radiation dose in excess of NRC limits. The licensee was timely in notifying and reporting the reported high radiation doses to the NRC as required by 10 CFR 20.2203.

5.3 Conclusions

Upon notification from the dosimetry vendor, the licensee properly reported the high radiation doses to the NRC.

6 Licensee Evaluation and Corrective Actions (87120, 83822, 87103)

6.1 Inspection Scope

The inspector interviewed licensee personnel and reviewed licensee records.

6.2 Observations and Findings

Section 4 of this report discusses the licensee's evaluation and corrective actions in response to the reported high radiation doses to the radiographer and radiographer's assistant. The licensee's actions to remove the affected individuals from work involving occupation radiation exposure was appropriate. The licensee's evaluation of the reported high radiation dose received by the radiographer did not identify a single occurrence in which a high radiation dose may have been received by the radiographer. The licensee's evaluation did not identify a root cause for the reported high dose The review conducted by the licensee appeared reasonable, and the licensee subsequently assigned the reported film badge reading to the radiographer's dose record. NRC inspector interviews with the radiographer and other licensee personnel did not identify an occurrence which could explain the radiation dose. The assignment of the reported film badge reading as the radiographer's dose of record was deemed appropriate.

For the radiographer's assistant, the licensee's determination that he did not receive the radiation dose reflected by the film badge was reasonable. NRC inspector interviews with the radiographer's assistant confirmed that there was an occurrence where the radiographer's film badge had fallen off and was in the vicinity of an exposure device during radiographic operations. The assignment of the pocket dosimeter readings for the dose of the radiographer's assistant was acceptable. The licensee's action to conduct additional training with the radiographer's assistant was appropriate.

6.3 Conclusions

The radiographer received a radiation dose in excess of NRC regulations. Although a reasonable review was conducted, the licensee was not able to determine the occurrence or cause for the high radiation dose.

The licensee's review of the reported high radiation dose to a RA, determined that the radiation dose on the film badge did not represent the radiation dose to the individual. The licensee's review was reasonable. The licensee's assignment of pocket dosimeter readings as the radiographer's assistant's radiation dose of record was acceptable.

7 Exit Meeting Summary

Region IV staff presented the inspection results to licensee management via telephone on November 4, 1998. Licensee representatives acknowledged the inspector's findings and confirmed that no proprietary information was reviewed during the inspection.

ATTACHMENT

SUPPLEMENTAL INSPECTION INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

P. Moss, President
D. Potter, Radiation Safety Officer
J. Morris, Assistant Radiation Safety Officer
M. Deweese, Assistant Radiation Safety Officer
J. Ritter, Former TGR Radiographer
K. Knott, Radiographer's Assistant
M. Terry, Radiographer

Landauer Dosimetry Services

R. Knuth, Health Physicist
C. Yoder, Vice President of Operations

Oklahoma Department of Environmental Quality

P. Bishop, Senior Environmental Specialist
E. Shirley, Waste management Division

INSPECTION PROCEDURES USED

87100	Licensed Materials Programs
83822	Radiation Protection
87103	Inspection of Incidents at Nuclear Materials Facilities

ITEMS, OPENED, CLOSED AND DISCUSSED

Opened

030-12319/9801-01	APV	Failure to limit the occupational dose to an individual adult to a TEDE of 5 rems during calendar year 1998 as required by 10 CFR 20.1201(a)(1)(i).

Closed
None

Discussed
None

LIST OF ACRONYMS USED

APV	Apparent Violation
NRC	Nuclear Regulatory Commission
RSO	Radiation Safety Officer
RA	Radiographer's Assistant
TGR	Tulsa Gamma Ray
TEDE	Total Effective Dose Equivalent
DDE	Deep Dose Equivalent
NDT	Nondestructive Testing
MREM	Millirem