

SEC Petition Evaluation Report

Petition SEC-00139

Report Rev #: Addendum 1

Report Submittal Date: August 2, 2011

Subject Expert(s):		Robert Coblentz		
Site Expert(s):		N/A		
Petition Administrative Summary				
Petition Under Evaluation				
Petition #	Petition Type	Petition Receipt Date	Qualification Date	DOE/AWE Facility Name
SEC-00139	83.13	February 27, 2009	September 8, 2009	Hangar 481, Kirtland Air Force Base (AFB)
Class Evaluated by NIOSH				
All employees who worked at Hangar 481, Kirtland Air Force Base (AFB), from March 1, 1989 through February 29, 1996.				
NIOSH-Proposed Class(es) to be Added to the SEC				
None				
Related Petition Summary Information				
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status	
None				
Related Evaluation Report Information				
Report Title	DOE/AWE Facility Name			
SEC Petition Evaluation Report, SEC-00139, Rev. 1	Hangar 481, Kirtland Air Force Base (AFB)			
ORAU Lead Technical Evaluator: Robert Coblentz		ORAU Peer Review Completed By: Daniel Stempfley		
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Addendum to Hangar 481, Kirtland AFB (SEC-00139) Special Exposure Cohort Evaluation Report

NIOSH presented a Special Exposure Cohort (SEC) evaluation report (NIOSH, 2010) regarding the Hangar 481, Kirtland Air Force Base (AFB) site to the Advisory Board on Radiation and Worker Health (Advisory Board) during the Advisory Board's meeting held on November 17, 2010. In its report, NIOSH evaluated the feasibility of reconstructing radiation doses of all employees who worked at Hangar 481 from March 1, 1989 through February 29, 1996. During the Board meeting, additional issues and concerns were raised regarding the feasibility of reconstructing doses for all Hangar 481 workers. In response, NIOSH conducted a further review, which included additional data capture trips to records retention facilities, a visit to the Hangar 481 facility, and the development of a detailed questionnaire that was submitted to the Department of Energy, Office of Secure Transportation. This addendum reports on the results of these efforts.

NOTE: This Evaluation Report Addendum only addresses those sections in the Hangar 481, Kirtland AFB Evaluation Report that require discussion; therefore, the section numbering is not contiguous. The sections requiring additional discussion begin below.

3.2 Class Evaluated by NIOSH

The currently-established covered period identified by the Department of Labor (DOL) for Ross Aviation at Hangar 481 is March 1, 1989 through February 29, 1996. The petitioner has pointed out that DOE contracts with Ross existed back to 1970. NIOSH followed up on this issue with the U.S. Department of Energy Office of Secure Transport (DOE OST). DOE OST indicates that DOE work contracted with Ross starting in 1970 was not performed at Hangar 481; Ross relocated its operations to Hangar 481 in April 1984 (Personal Communication, 2011). DOE has determined that the facility is covered only for the currently-defined period; therefore, only that period and location will be evaluated as part of this review.

4.0 Data Sources Reviewed by NIOSH to Evaluate the Class

NOTE: Eberline was the TLD processor for Ross Aviation throughout the covered period except for 1996; no external monitoring results were recorded for 1996 because operations requiring monitoring had ceased. Eberline was later bought by Landauer, which now possesses the Eberline data.

At the time the ER was completed, NIOSH was working with Landauer to obtain the raw data represented in the Eberline summary reports. However, as of the date of the evaluation report, NIOSH had not been able to coordinate with Landauer for the review and release of the applicable data. Since then, NIOSH has received Eberline dosimetry data sheets from Landauer for Ross Aviation personnel for the years 1990 through 1994. These additional data are discussed in Section 6.0.

During the November 17, 2010 Advisory Board meeting, additional issues and concerns were raised by the petitioner and the petitioner's designated representative regarding the feasibility of reconstructing doses for all Hangar 481 workers. As a result, NIOSH initiated additional efforts to acquire additional Hangar 481 personnel data. NIOSH staff visited records retention facilities at the Sandia National Laboratories, in Albuquerque, New Mexico, and at the Oak Ridge National Laboratory, in Oak Ridge, Tennessee. In addition, a visit and tour were conducted at the Hangar 481 building and adjacent areas at Kirtland Air Force Base in Albuquerque, New Mexico. Through these efforts, NIOSH located radiation exposure data for Hangar 481 workers for the time period under evaluation. These additional data are discussed in Section 6.0. Issues raised at the November 17, 2010 Advisory Board meeting are discussed in Section 7.5. Additional documents provided by the petitioner and designated representative following their review of the Hangar 481 ER are listed in Section 4.7.

4.3 Facility Employees and Experts

To obtain additional information for an issue germane to this Addendum, NIOSH interviewed a staff member of the U.S. Department of Energy Office of Secure Transport.

- Personal Communication, 2011, *Personal Communication [Name redacted]*, summary of telephone call and follow-up email with staff member at the U.S. Department of Energy Office of Secure Transport (DOE OST); July 27, 2011; SRDB Ref ID: 100320

4.4 Previous Dose Reconstructions

NIOSH reviewed its NIOSH OCAS Claims Tracking System (NOCTS) to locate EEOICPA-related dose reconstructions that might provide information relevant to the petition evaluation. Table 4-1 summarizes the results of this review. (NOCTS data available as of July 26, 2011)

Table 4-1: No. of Hangar 481 Claims Submitted Under the Dose Reconstruction Rule	
Description	Totals
Total number of claims submitted for dose reconstruction	3
Total number of claims submitted for energy employees who meet the definition criteria for the class under evaluation (March 1, 1989 through February 29, 1996)	3
Number of dose reconstructions completed for energy employees who meet the definition criteria for the class under evaluation (i.e., the number of such claims completed by NIOSH and submitted to the Department of Labor for final approval).	1
Number of claims for which internal dosimetry records were obtained for the identified years in the evaluated class definition	0
Number of claims for which external dosimetry records were obtained for the identified years in the evaluated class definition	2

NIOSH reviewed the current Hangar 481, Kirtland AFB claims to determine whether internal and/or external personal monitoring records could be obtained for the employees. No internal dosimetry records have been found; however, external dosimetry records have been obtained for two of the claimants.

4.5 NIOSH Site Research Database

NIOSH also examined its Site Research Database (SRDB) to locate documents supporting the assessment of the evaluated class. Two hundred forty-seven (247) documents in this database were identified as pertaining to Hangar 481, Kirtland Air Force Base. This includes 52 documents acquired during recent data capture and research efforts. These documents were evaluated for their relevance to this petition. The documents include historical background on contracts between the U.S. Atomic Energy Commission and Ross Aviation, contracts between DOE and Ross Aviation, DOE Occupational Radiation Exposure Reports, periodic regulatory site inspection reports, radiological surveys of facilities and aircraft, shipping records, and site drawings and photos. Included in the additional acquired documents are personnel exposure reports for the years 1990 through 1994, site tour photographs, and various documents provided by the petitioner (see Section 4.7).

4.7 Documentation and/or Affidavits Provided by Petitioners

The petitioner and the petitioner's designated representative provided the following additional documents following their review of the Hangar 481 ER. NIOSH reviewed these documents as part of its research for this addendum.

- *Memo of [Name redacted]*, transcript of telephone interview with a former Ross Aviation pilot conducted by the SEC-00139 petitioner representative; November 11, 2010; SRDB Ref ID: 91418 (Personal Communication, 2010a)
- *Phone Interview of [Name redacted]*, transcript of telephone interview with a former Ross Aviation flight attendant by the SEC-00139 petitioner representative; November 11, 2010; SRDB Ref ID: 91417 (Personal Communication, 2010b)
- *Ross Aviation, Inc. Silver Anniversary*, inter-office memorandum commemorating the company's 25th Anniversary; November 18, 1994; SRDB Ref ID: 91410 (Ross Aviation 25th, 1994)
- *Supplemental Agreement: Contract Modification No. AC11*, excerpted pages from contract modification document addressing individual exposure records retention requirements; U.S. Department of Energy; April 30, 1979; SRDB Ref ID: 91411 (Ross Aviation, 1979)
- *Implementation Guide for Use with DOE O 460.2, Departmental Materials Transportation and Packaging Management*, excerpted pages briefly discussing loading methods and tie-down requirements; U.S. Department of Energy; November 15, 1996; SRDB Ref ID: 91412 (Implementation Guide, 1996)

- *Ross Aviation Contract No. DE-AC04-89AL52318*, excerpted pages discussing records retention requirements; U.S. Department of Energy; April 1984; SRDB Ref ID: 91414 (Ross Contract, 1984)
- *National Transportation Safety Board Safety Study: Public Aircraft Safety*, excerpted pages defining “public” vs. “private” aircraft as well as recent U.S. aircraft accidents; National Transportation Safety Board; January 2001; SRDB Ref ID: 91415 (NTSB, 2001)
- *Ross Aviation Contract Guide*, list of contracts and modifications from Feb 1970 to Mar 1994; undated, but from context, after March 1, 1994; SRDB Ref ID: 91416 (Ross, undated)
- *Implementation of New Department of Energy Contract*, inter-office memo from General Manager to all pilots; Ross Aviation; May 1, 1996; SRDB Ref ID: 91419 (Ross, 1996)
- *New Airfreight Service Manifest*, inter-office memorandum from Operations Director to all Operations Department personnel describing changes to manifest form; Ross Aviation; December 7, 1994; SRDB Ref ID: 91420 (Ross, 1994)
- Office of Environmental Management Table I-1. *Status of All DOE Facilities/Sites Subject to Section 120 of CERCLA*, designates Ross Aviation with soil/chemical contamination; U.S. Department of Energy Office of Environmental Management; undated, but from context, after 1996; SRDB Ref ID: 91421 (OEM Table I-1, undated)
- *Audit Report: The U.S. Department of Energy’s Aircraft Activities*, report describing number of aircraft and costs of operation; U.S. Department of Energy Office of Inspector General, Office of Audit Services; January 1999; SRDB Ref ID: 91422 (DOE Audit Report, 1999)
- *1994 Radiation/Hazardous Materials Recurrency*, memo from Chief Pilot to all pilots, flight mechanics, flight attendants, dispatchers, terminal personnel, and counter personnel with excerpted pages of DOT shipping requirements; Ross Aviation; December 27, 1994; SRDB Ref ID: 91423 (Training, 1994)
- *Comparison of Shielding Performances of the AT-400A, Model FL, and Model AL-R8 Containers*, report describing containers with calculated exterior dose rate estimates on loaded containers; Lawrence Livermore National Laboratory; UCRL-JC-120849; April 28, 1995; SRDB Ref ID: 91413 (Shielding, 1995)

5.0 Radiological Operations Relevant to the Class Evaluated by NIOSH

In response to questions and concerns raised by the Hangar 481 SEC petitioner and petitioner representative, and by the Advisory Board on Radiation and Worker Health, a questionnaire was assembled and submitted to the U.S. Department of Energy Office of Secure Transport (DOE OST) for their evaluation and knowledge input (DOE OST, 2011).

In addition, a site visit and tour was conducted at the Hangar 481 building and adjacent areas at Kirtland Air Force Base in Albuquerque, New Mexico by NIOSH staff, the petitioner, the petitioner representative, and other former Hangar 481 workers. During this visit, additional questions were posed to DOE OST staff.

5.1 Hangar 481, Kirtland AFB Plant and Process Descriptions

U.S. DOE Office of Secure Transport Questionnaire and Responses

As previously stated, NIOSH assembled a questionnaire and submitted it to the U.S. Department of Energy Office of Secure Transport (DOE OST) for its evaluation and knowledge input (DOE OST, 2011). The topics addressed were:

- Facility Information
- Radiological Activities
- External Dosimetry Program
- Internal Dosimetry Program

In addition, a meeting was conducted in conjunction with the Hangar 481 facility tour, during which other questions were asked by NIOSH and by the petitioner/representative (DOE OST, 2011).

NOTE: The subsections below provide a summary of the DOE OST responses. Figures 5-1 through 5-3 supersede Figure 5-1 in the SEC-00139 Hangar 481 Rev. 1 Evaluation Report. Figures 5-4 through 5-7 were taken by NIOSH staff during the site tour.

5.1.1 DOE OST Responses Regarding the Hangar 481 Facilities

DOE OST staff stated that contracted activities began at the Hangar 481 facilities around 1970 and remained unchanged. They provided layout drawings that designate locations for Hangar 481, adjacent facilities, Hot Pads 2 and 5, personnel lockers inside Hangar 481, and the location inside the hangar where non-destructive radiographic testing was performed. Starting in 1985, facilities operated 24 hrs/day, 7 days/wk with about 200 employees. After 1987, operations were only two shifts/day, 5 days/wk with staffing levels reducing down over time to about 80 employees in 1996. Administrative personnel only worked on day shift with no overtime.

5.1.2 DOE OST Responses Regarding Hangar 481 Radiological Activities

DOE OST staff stated that no radiological activities were performed in Hangar 481 and facilities and there was no license to do so. Rather, packages containing radioactive materials were handled and loaded only at Hot Pads 2 and 5. Unmonitored personnel were not allowed to come in contact with packages containing radioactive materials. The packages contained predominately tritium.

Radiographic testing of airplanes was performed only once per year for a few minutes. Testing was performed in the center of the Hangar 481 building during either the evening or night shift when only radiography personnel were present. Strict controls were in place during radiography, including warning banners, dosimeters, area Geiger counters, and strict access controls.

5.1.3 DOE OST Responses Regarding the Hangar 481 External Dosimetry Program

DOE OST staff state that Ross Aviation's dosimetry program was developed and managed by the Ross Safety Office with monitoring for various periods subcontracted to outside organizations (e.g., Eberline, Sandia). Individual dosimetry records exist from 1990 to 1994 from Eberline; NIOSH has obtained these reports.

The only radiological materials handled by Ross personnel were those loaded and unloaded at the Hot Pads, which were at least three kilometers from Hangar 481. Only Cabin Safety Specialists and Pilots were allowed access to the Hot Pads; no non-badged personnel were permitted access. Access controls included the isolation of the Hot Pad from the rest of Ross operations and the presence of Air Force security teams.

No area dosimetry of Hangar 481 was performed. Neutron dosimetry was never provided for this location. Personal dosimetry badges were kept in the facility's administration area when not in use by flight line personnel. In addition, no X-rays conducted for medical reasons (required as a condition of employment) occurred at the covered facility; personnel routine medical X-rays were conducted by the individual employees' medical providers.

Regarding the increased reported annual personnel doses in 1994, DOE OST did not know the reason. However, NIOSH has since determined that this increase is the result of a data transfer error in which the individual lifetime dose values were transferred from the dose reports into the REIRS database (rather than the appropriate 1994 annual personnel doses). This error resulted in overstated annual doses for personnel in the REIRS database for the year 1994.

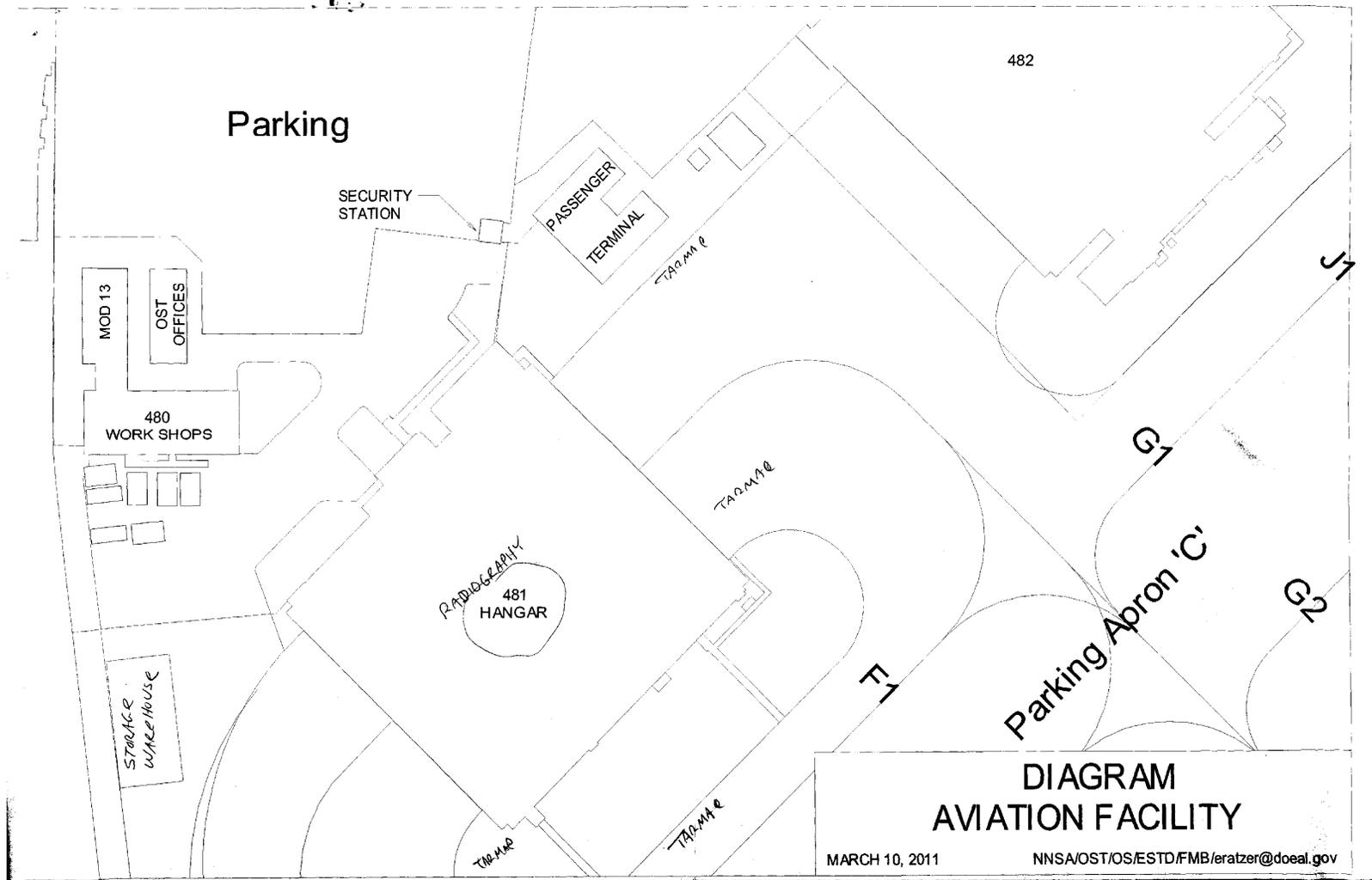


Figure 5-1: Hangar 481 and Surrounding Buildings
(Figures 5-1, 5-2, and 5-3 in this Addendum supersede Figure 5-1 in the SEC-00139 Hangar 481 Rev. 1 Evaluation Report)

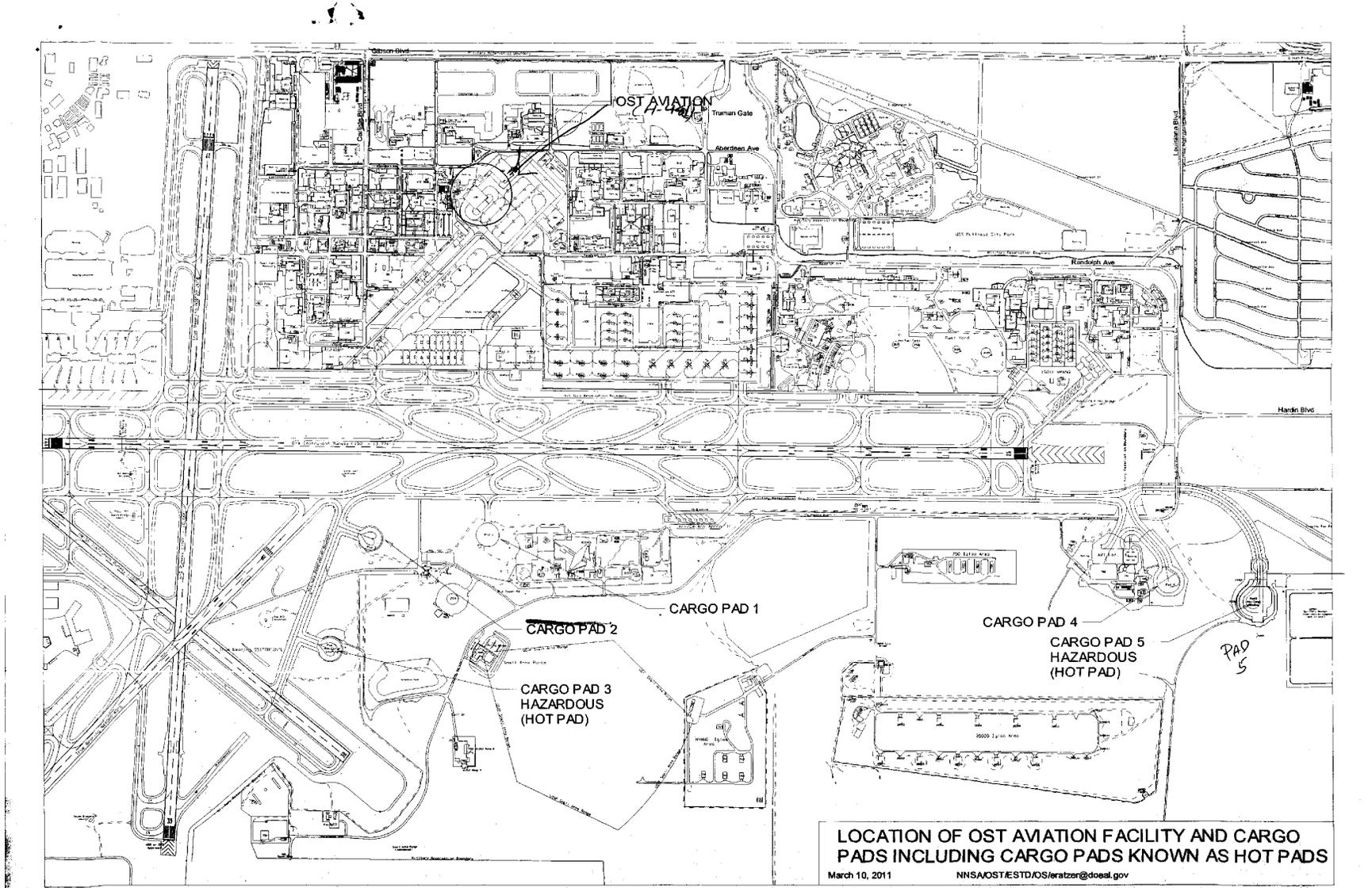


Figure 5-2: Location of OST Aviation and Hot Pads
(Figures 5-1, 5-2, and 5-3 in this Addendum supersede Figure 5-1 in the SEC-00139 Hangar 481 Rev. 1 Evaluation Report)



Figure 5-4: Photo of Hangar 481 and Associated Shop Buildings



Figure 5-5: Front of Hangar 481 Building

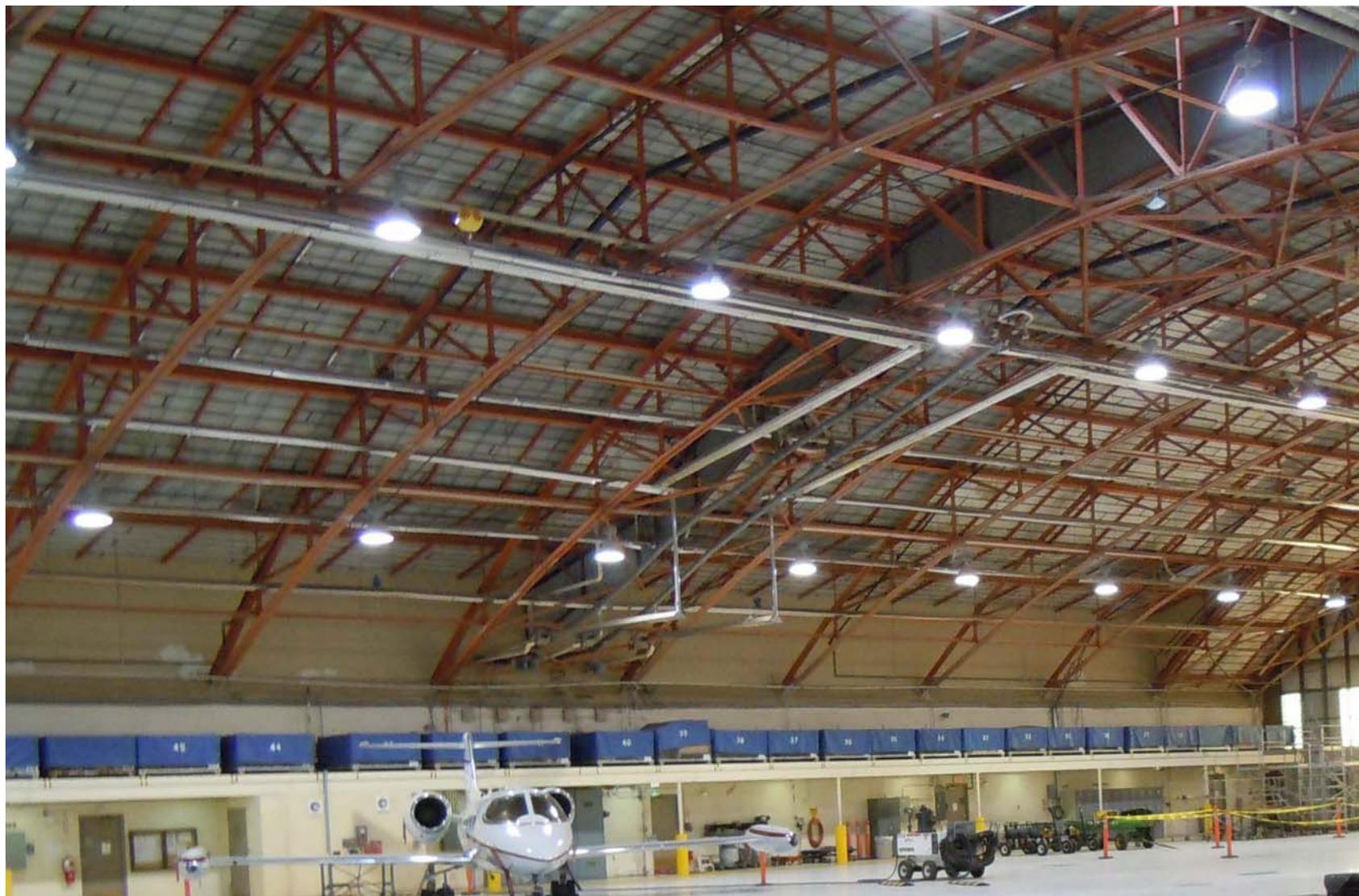


Figure 5-6: Hangar 481 Inside View

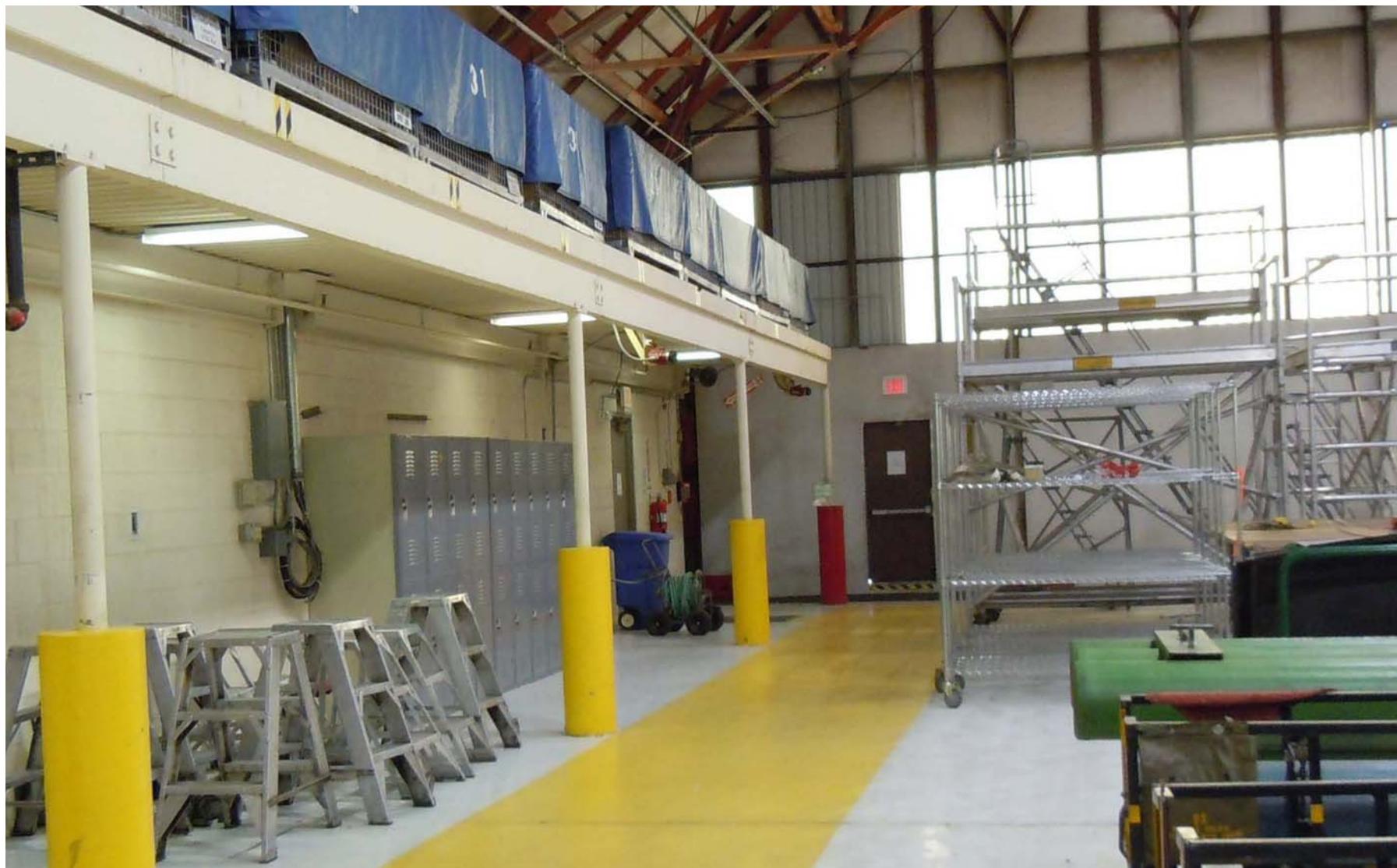


Figure 5-7: Hangar 481 Personnel Lockers

5.1.4 DOE OST Responses Regarding the Hangar 481 Internal Dosimetry Program

DOE OST staff stated that no bioassay program was ever implemented at Hangar 481. Furthermore, no Ross facilities were monitored for contamination (because there was no need to perform surveys due to lack of use/storage of radioactive materials at the facility; all surveys were performed where radioactive materials were handled; i.e., on the Hot Pads).

DOE OST personnel indicated that no radiological accidents occurred at Hangar 481. They also confirmed that no thoriated welding rods (or associated thorium-bearing materials) were present or used at Ross facilities.

5.1.5 DOE OST Responses to the Hangar 481 Site Visit and Tour Questions

During the Hangar 481 site visit and tour, DOE OST staff made or reiterated the following points:

- Ross Cabin Security Specialists and Pilots, who handled the loading and unloading of containers containing radiological contents, were badged and monitored for radiation exposure.
- According to the former Ross Aviation Director of Safety, no containers were ever delivered to the flight line adjacent to Hangar 481.
- The Ross Aviation organization does not have records to indicate that containers having radioactive contents were delivered only to the Hot Pads rather than to the flight line adjacent to Hangar 481.
- All containers were owned by the Air Force or Sandia and controlled by them until custody was transferred to Ross or transferred from Ross at the Hot Pads.
- Delivering the containers to any areas other than the Hot Pads would constitute a security violation.
- No radiation monitoring was performed inside Hangar 481, the adjacent flight lines, or the adjacent buildings and structures.
- No radiological monitoring was performed in and around the Hangar 481 building (because there was no need to perform surveys due to lack of use/storage of radioactive materials at the facility; all surveys were performed where radioactive materials were handled; i.e., on the Hot Pads).
- No personnel are aware of thoriated welding (or associated thorium-bearing materials) being performed (or present) at the Hangar 481 facilities.

5.2.2 External Radiological Exposure Sources from Hangar 481 Operations

5.2.2.3 Neutron

At the time the evaluation report was completed, it appeared from the REIRS database that neutron monitoring had taken place at Hangar 481. This conclusion was based on REIRS database entries for neutron values showing as zero. It was known that neutron generators were frequently transported by aircraft at Hangar 481. These devices emit neutron radiation only when powered and energized (Procedure, 1990). Since these devices were only being transported, neutron exposure was infeasible. Based on this information, the ER concluded that neutron exposure was not a factor for the Hangar 481 site.

In their response to NIOSH's questionnaire (see Section 5.1), DOE OST staff stated that shipments predominantly contained tritium, which does not emit neutrons. They further stated that no personnel neutron exposure monitoring was performed for Ross Aviation personnel.

The above information supports the previous evaluation report's original conclusion that there is no credible potential for personnel neutron exposure to Hangar 481 personnel.

6.2 Available Hangar 481 External Monitoring Data

External personnel monitoring data (TLD data) are available for Hangar 481 personnel during the covered period at the site, with the exception of 1996. For a two-month covered period in 1996, external personnel monitoring was not performed because operations requiring external monitoring and reporting had ceased (DOE/EH-0575, pdf p. 64 footnote). In addition, the *DOE Occupational Radiation Exposure, 1997 Report* lists Ross Aviation as "not reported" for 1996 (DOE/EH-0575, pdf p. 61).

At the time the evaluation report was completed, NIOSH was working to obtain Eberline data from Landauer to support a data pedigree review for this evaluation. Since the ER's completion, additional Eberline data has been received from Landauer. These data include Eberline dosimetry data sheets for Ross Aviation personnel for the years 1990 through 1994.

In response to issues raised by the petitioner and the Advisory Board, NIOSH initiated additional efforts to acquire Hangar 481 personnel data. NIOSH staff visited records retention facilities at the Sandia National Laboratories, in Albuquerque, New Mexico, and at the Oak Ridge National Laboratory, in Oak Ridge, Tennessee. No additional documentation or data supportive of internal or external dose assessment for this evaluation were found.

7.1.2 External Monitoring Data Pedigree Review

External monitoring data from TLD results are available for individuals who were monitored at Kirtland AFB, Hangar 481. The data are annual summaries for each individual who was monitored for all years of the evaluation period except for 1996. Eberline was the TLD processor throughout the covered period except for 1996. Based on occupation codes included in the REIRS database tables, and from interviews with former Ross employees, those who were monitored included mechanics, pilots, and personnel involved with handling or securing packages (Personal Communication, 2009b;

Personal Communication, 2009e; Ross, 2009). These individuals were expected to have received the highest exposures because their work activities frequently put them in close proximity to the source (radioactive packages). Monitored individuals were issued TLDs that were changed out on a quarterly basis.

The Eberline TLD data received from Landauer were compiled and compared to the annual summaries listed in the REIRS exposure database. All values were confirmed for the associated years. However, during the data analysis, it was apparent that the reported whole-body photon doses for 1994 were anomalous because they were unusually high compared to all other years. To illustrate the anomalous nature of 1994 values, Table 7-1 shows the yearly maximum whole-body photon doses and total person-rem as reported in the REIRS database from 1989 to 1995.

Year	Total Monitored	Maximum Individual Shallow Dose (mrem)	Maximum Individual Deep Dose (mrem)	Total Person-mrem
1989	95	77	58	246
1990	89	89	89	201
1991	87	61	44	207
1992	70	51	48	203
1993	67	47	37	163
1994	66	83	172	1501
1995	56	77	54	445

As a part of the review, assistance was requested of the Program Manager for Occupational Exposure and Worker Health – Center for Epidemiologic Research (OEW-H-CER) to determine the cause of the higher reported doses in 1994. Through detailed comparison of the REIRS database values with the values listed on the copies of the original Eberline exposure reports, it became apparent that during the transfer of data from the reports into REIRS in 1994, the individual worker lifetime whole-body exposure values from the Eberline data sheets were transferred into the REIRS database instead of the appropriate annual whole-body exposure values. This was apparent because the 1994 REIRS database annual exposure values matched the individual lifetime exposure values listed on the 1994 Eberline data sheets. The OEW-H-CER Program Manager concurs with this conclusion and is working to correct the relevant 1994 values in the REIRS database. All other exposure values were in agreement for all associated years.

The REIRS database covers years 1987 through 1995 for Ross Aviation employees, and is regarded as a secondary data source. However, data for five of the years under evaluation and covered by the REIRS database have now been confirmed by copies of the original Eberline exposure reports, which are primary data documents.

7.3.1 Evaluation of Bounding Process-Related External Doses

The original evaluation concluded that bounding process-related doses for Hangar 481 personnel would be based on external monitoring data that was available at the time the ER was completed. Subsequent data capture efforts have acquired additional data that support the existing conclusion.

7.3.1.1 Personnel Dosimetry Data

The original evaluation based bounding Hangar 481 personnel occupational radiation exposures on the data contained in the Radiation Exposure Information and Reporting System (REIRS), which is managed by the U.S. Nuclear Regulatory Commission (NRC). The data contained in REIRS are not, however, a primary data source. Additional data capture efforts conducted subsequent to the original Hangar 481 petition evaluation acquired primary exposure reports that confirm five of the years covered in REIRS for Hangar 481 personnel (Eberline, 1990-1994). The highest individual annual whole-body exposure of 89 millirem was reported in 1990. Individual annual doses are summarized in the Table 7-2 and reflect pending corrections to the REIRS database.

Year	Total Monitored	Maximum Individual Shallow Dose (mrem)	Maximum Individual Deep Dose (mrem)	Total Person-mrem
1989	95	77	58	246
1990	89	89	89	201
1991	87	61	44	207
1992	70	51	48	203
1993	67	47	37	163
1994	66	83	49	224
1995	56	77	54	445

Photon

Hangar 481 personnel most likely to receive external dose were pilots and flight mechanics who would have directly handled packages containing radioactive materials. Since all the shipments were packaged in sealed containers, the primary exposure source was from photon radiation penetrating through the package materials. However, the majority of the packages handled through Kirtland AFB contained only tritium, which only emits low-level beta radiation; therefore, annual photon doses would have been low.

7.3.3 Hangar 481 Occupational X-ray Examinations

DOE OST responses to questions and interviews with former Hangar 481 workers indicate that annual occupational X-ray examinations were not performed at Hangar 481. Based on this information, medical X-ray dose for Hangar 481 personnel has been excluded for the purposes of the review of this evaluation.

7.3.5 External Dose Reconstruction Feasibility Conclusion

After reviewing the additional information and data obtained subsequent to the original evaluation, NIOSH has concluded that the original feasibility determination is confirmed. Specifically, given the availability of TLD data for the covered years of employment, it is feasible to bound the evaluated worker class external dose (reconstruct external doses with sufficient accuracy). The TLD data available from 1989 through 1995 is believed to adequately assess the radiological exposures at Kirtland AFB Hangar 481 during this timeframe and is, therefore, adequate for performing dose reconstructions. Using the methods described in ORAUT-OTIB-0008, dose for 1996 can be over-estimated by using the highest individual dosimetry data for all previous covered years (1989 through 1995).

7.5 Other Potential SEC Issues Relevant to the Petition Identified During the Evaluation

During the November 17, 2010 Advisory Board meeting, additional issues and concerns were raised by the petitioner and the petitioner's designated representative regarding the feasibility of reconstructing doses for all Hangar 481 workers. The petitioner and designated representative also provided additional documents following their review of the Hangar 481 ER (see Section 4.7). As a result, NIOSH conducted additional research and data capture activities. Through these efforts, NIOSH located radiation exposure summary data for Hangar 481 workers for the time period under evaluation (see Section 6.0). Issues raised at the Advisory Board meeting and NIOSH responses in light of its further research are provided below.

- **ISSUE:** Raw dosimetry data are lacking or not available. Secondary summary data were used for the evaluation.

Additional data capture efforts have acquired primary-source dosimetry data which have been used to validate the accuracy secondary-source data contained in the REIRS database.

- **ISSUE:** Contracts existed back to 1970. The covered period should be changed to cover earlier dates back to 1970.

The currently-established covered period identified by the Department of Labor for Ross Aviation at Hangar 481 is March 1, 1989 through February 29, 1996. NIOSH followed up on the 1970 issue with the U.S. Department of Energy Office of Secure Transport (DOE OST). DOE OST indicates that DOE work contracted with Ross starting in 1970 was not performed at Hangar 481; Ross relocated its operations to Hangar 481 in April 1984 (Personal Communication, 2011). DOE has determined that the facility is covered only for the currently-defined period; therefore, only that period and location will be evaluated as part of this review.

The Department of Labor and Department of Energy coordinate to establish appropriate covered periods for the designated covered sites. Should either DOE or DOL re-evaluate the covered period for Hangar 481, this evaluation may be expanded to include the earlier time period.

- ISSUE: Newly-available documents have not been evaluated.

All available documents (including additional documents acquired through recent data capture efforts) have been evaluated and incorporated into this review.

- ISSUE: Radioactive shipments were delivered to the Hangar 481 building and stored. The “hot pads” were used to load explosive materials. Reliance on an interview with one former worker as the basis for determination that all radioactive shipments were handled at the “hot pads” was criticized.

Per the response from DOE OST, no radioactive materials were stored or handled at the Hangar 481 facility or adjacent areas, and all loading/unloading of radioactive shipments were performed at the areas known as Hot Pads 2 and 5. This is substantiated by a documented Occupational Safety and Health Inspection report dated December 2, 1992, that states, “Ross does not handle, store, or use radioactive materials in the Albuquerque facilities” (Ross, 1992).

- ISSUE: Radioactive shipments were made using the AL-R8 container, which was found in 1991 to be inadequate to shield the contents (shielding for alpha and beta radiations was not disputed).

NIOSH has acquired additional primary-source exposure documents for Hangar 481 workers which support/confirm the data contained in the REIRS database. All personnel who handled, or came in contact with, packages containing radioactive material were monitored for radiation exposure. Therefore, it is reasonable to assume that hypothetical doses from inadequately-shielded containers would be included in the personnel exposure data.

- ISSUE: The evaluation report’s ambient external methods are not bounding.

Given that no radioactive materials were stored or handled at the Hangar 481 facilities, and that radiological surveys of transport aircraft show no indication of contamination or loss of package integrity, there is no credible potential for personnel internal exposures from ambient sources related to Ross shipment activities. Therefore, the only credible source for ambient exposure is from work activities at the Sandia National Laboratory directly adjacent to the Kirtland Air Force Base, as described in the Hangar 481 evaluation report, Section 7.2.1 (NIOSH, 2010). The ER states:

Because Kirtland AFB is located immediately adjacent to Sandia National Laboratory-Albuquerque (SNL-A), it might have been possible for individuals at Kirtland, and therefore Hangar 481, to receive low-level ambient environmental internal exposure from SNL’s radioactive effluent releases. Ambient environmental doses for individuals who worked at SNL-A have been researched and assessed (ORAUT-TKBS-0037). Considering the effect that the additional distance beyond the SNL-A boundary would have had on the dispersion of airborne radiological contaminants, the ambient environmental exposures assessed for workers in the SNL-A Site Profile document would have been considerably higher than those for individuals working at an off-site location. Therefore, the ambient environmental internal exposure assessment method defined for SNL-A workers in the environmental section of the SNL-A Site Profile will serve to bound any ambient internal doses for individuals at Kirtland AFB and Hangar 481.

- **ISSUE:** One individual states that barrels were stacked at the hangar which may have been nuclear waste, and there is no apparent indication of “sweeps” that were done in the hangar building or adjacent areas.

NIOSH has discovered no information that supports the assumption that barrels “may have been nuclear waste.” DOE OST states that no radioactive materials were stored or handled at the Hangar 481 facility or adjacent areas, and that all loading/unloading of radioactive shipments were performed at the areas known as Hot Pads 2 and 5. DOE OST did state that radiological monitoring was not performed inside Hangar 481, the adjacent flight lines, or the adjacent buildings and structures; however, if no radioactive materials were stored or handled at the hangar, radiological monitoring would not necessarily be needed or required. The information available to NIOSH indicates that radiological monitoring was performed inside the aircraft used for transporting radioactive materials and the results showed no indication of contamination.

- **ISSUE:** One pilot left his dosimeter in his locker and had an abnormally high dose reading when the badge was processed.

DOE OST confirms that no radioactive materials were stored or handled at the Hangar 481 facility or adjacent areas, and that all loading/unloading of radioactive shipments were performed at the areas known as Hot Pads 2 and 5. The circumstance in which a pilot’s dosimeter badge was inadvertently left inside a locker, and subsequently showed elevated dose values, was possibly caused by the badge being subjected to dose rates resulting from radiographic activities performed in the hangar during either evening or night shift. No incident reports or other explanations are available to explain any abnormal personnel dosimeter readings

7.6 Summary of Feasibility Findings for Petition SEC-00139

The SEC-00139 Evaluation Report evaluated the feasibility of reconstructing radiation doses of all employees who worked at Hangar 481 from March 1, 1989 through February 29, 1996 (NIOSH, 2010). When the ER was presented at the Advisory Board’s meeting on November 17, 2010, additional issues and concerns were raised regarding the feasibility of reconstructing doses for all Hangar 481 workers. In response, NIOSH conducted a further review, which included additional data capture trips to records retention facilities, a visit to the Hangar 481 facility, and the development of a detailed questionnaire that was submitted to the Department of Energy, Office of Secure Transportation. This addendum has reported on the results of these efforts.

ADDENDUM CONCLUSIONS: After reviewing all recently-received information and data, NIOSH has arrived at the following feasibility findings:

1. External deep and shallow occupational dose can be bounded based on available personal monitoring data, using the methods described in ORAUT-OTIB-0008, *A Standard Methodology for Overestimating External Doses Measured with Thermoluminescent Dosimeters*. For unmonitored workers, the maximum dose to monitored individuals can be applied.
2. There is no credible potential for personnel neutron exposures.

3. Potential doses from radiographic testing would be included in the reported personal monitoring exposures.
4. Internal occupational dose is determined to be insignificant based on the types of work performed, and workers handling only DOT-compliant, sealed packages.
5. Ambient environmental internal doses can be bounded by the ambient dose reconstruction methods described in ORAUT-TKBS-0037, *Site Profile for Sandia National Laboratories in Albuquerque, New Mexico, and the Tonopah Test Range, Nevada*.
6. Ambient environmental external doses are accounted for in the personnel external monitoring data.
7. Because medical X-ray examinations were not performed at the Hangar 481 facility, medical X-ray exposures are excluded from Hangar 481 dose reconstructions.

The monitoring records, process descriptions, and source term data now available are sufficient to complete dose reconstructions for the evaluated class of employees. Consequently, the feasibility findings remain as issued in the SEC-00139, Rev. 1, Hangar 481 Evaluation Report (NIOSH, 2010), as shown in Table 7-2 below.

Table 7-3: Summary of Feasibility Findings for SEC-00139 March 1, 1989 through February 29, 1996		
Source of Exposure	Reconstruction Feasible	Reconstruction Not Feasible
Internal	X	
External	X	
- Gamma	X	
- Beta	X	
- Neutron	N/A	N/A
- Occupational Medical X-ray	N/A	N/A

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10.0 References (for this Addendum)

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ORAUT-TKBS-0037, *Site Profile for Sandia National Laboratories in Albuquerque, New Mexico, and the Tonopah Test Range, Nevada*, Rev 00; Oak Ridge Associated Universities; June 22, 2007; SRDB Ref ID: 32531

Personal Communication, 2010a, *Memo of [Name redacted]*, transcript of telephone interview with a former Ross Aviation pilot conducted by the SEC-00139 petitioner representative; November 11, 2010; SRDB Ref ID: 91418

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Shielding, 1995, *Comparison of Shielding Performances of the AT-400A, Model FL, and Model AL-R8 Containers*, report describing containers with calculated exterior dose rate estimates on loaded

containers; Lawrence Livermore National Laboratory; UCRL-JC-120849; April 28, 1995; SRDB Ref ID: 91413

Training, 1994, *1994 Radiation/Hazardous Materials Recurrency*, memo from Chief Pilot to all pilots, flight mechanics, flight attendants, dispatchers, terminal personnel, and counter personnel with excerpted pages of DOT shipping requirements; Ross Aviation; December 27, 1994; SRDB Ref ID: 91423

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Attachment 2: Data Capture Synopsis

Table A2-1: Data Capture Synopsis for Hangar 481, Kirtland AFB			
Data Capture Information	General Description of Documents Captured	Date Completed	Uploaded To SRDB
<p><u>Primary Site/Company Name:</u> Hangar 481 March 1, 1989 - February 29, 1996; DOE</p> <p><u>Other Site Names:</u> Ross Aviation, Inc. Pierce Air Pierce Enterprises, Inc.</p> <p><u>Physical Size of the Site:</u> The exact dimensions of Hangar 481 are not known. However, its size may be inferred from its photographs in the SRDB.</p> <p><u>Size of the Site Population:</u> In 1990, 93 Ross Aviation employees were on the TLD service. In 1994, 65 Ross Aviation employees were on the TLD service. In 1992, 100 Ross Aviation employees were eligible for discount rates for contract-related travel.</p>	<p>On 06/03/2009 the ORAU Team was informed by [Name redacted], former Ross Aviation employee, that dosimetry records are in the possession of the DOE. Radiological surveys were performed by Sandia National Laboratory.</p> <p>On 08/25/2009 the ORAU Team confirmed with [Name redacted], former Ross Aviation employee, that Ross Aviation went out of business in 2008.</p> <p>On 12/28/2010 the ORAU Team confirmed with [Name redacted], former TMA Eberline Laboratory Manager, that TMA Eberline provided the dosimetry service for Ross Aviation, and that Ross Aviation dosimetry records would have been transferred to R.S. Landauer when Eberline sold its dosimetry business to Landauer. NIOSH requested the records, which were uploaded to the SRDB on 01/27/2011.</p>	08/25/2009	0
State Contacted: [Name and title redacted], New Mexico Radiation Control Bureau [Phone No. redacted]	No relevant data identified. The New Mexico Radiation Control Bureau does not hold records for Hangar 481 or Ross Aviation.	10/12/2009	0
DOE Albuquerque Office (DOE AL)	Contract documents pertaining to Ross Aviation contracts with the AEC and DOE.	04/16/2009	20
DOE Hanford	Keyword search request submitted 07/07/2011.	OPEN	NA
DOE Hangar 481	Photographs in and around Hangar 481.	01/11/2011	22
DOE Idaho National Laboratory	A 1988 DOELAP application and 1988 and 1993 DOELAP accreditations.	06/11/2009	3
DOE National Nuclear Security Administration (NNSA) - Service Center	1997 Ross Aviation Safety Manual.	08/10/2009	1
DOE Nevada Test Site Records Center	Radioactive material shipping records, checklists, and documentation.	07/16/2009	61
DOE Office of Secure Transportation (OST)	The Transportation Safeguards Division technical basis for eliminating intakes as a credible source of exposure.	07/28/2009	1

Table A2-1: Data Capture Synopsis for Hangar 481, Kirtland AFB			
Data Capture Information	General Description of Documents Captured	Date Completed	Uploaded To SRDB
DOE Sandia National Laboratory, New Mexico (SNL, NM)	Contamination surveys of aircraft and associated equipment, a computed exposure report, documents regarding annual environmental reports, statement of work for providing external dosimetry services and the associated NEPA determination, DOE appraisals, occupational radiation exposure reports, drawings and photos of Hangar 481, drawings of pads 2 and 5, Ross Aviation organizational chart, shipping surveys and documentation, a roster of employees authorized for official government travel, and requirements for TLD storage and use.	10/20/2010	88
Internet - DOE Comprehensive Epidemiologic Data Resource (CEDR)	No relevant data identified.	10/23/2009	0
Internet - DOE Hanford Declassified Document Retrieval System (DDRS)	No relevant data identified.	10/23/2009	0
Internet - DOE OpenNet	No relevant data identified.	10/23/2009	0
Internet - DOE OSTI Energy Citations	No relevant data identified.	10/23/2009	0
Internet - DOE OSTI Information Bridge	No relevant data identified.	10/23/2009	0
Internet - Google	Occupational radiation exposure reports, an audit of aircraft activities, fire protection review, brief mentions of Ross Aviation as a transporter of weapons components, and a listing by state of EEOICPA covered facilities and contractors. NOTE: 2 documents were added during site association reviews.	10/23/2009	15
Internet - Health Physics Journal	No relevant data identified.	07/05/2011	0
Internet - Journal of Occupational and Environmental Hygiene	No relevant data identified.	07/05/2011	0
Internet - National Academies Press (NAP)	No relevant data identified.	10/23/2009	0
Internet - National Nuclear Security Administration (NNSA) - Nevada Site Office	No relevant data identified.	10/23/2009	0
Internet - NRC Agencywide Document Access and Management (ADAMS) (Downloadable Files)	No relevant data identified.	10/23/2009	0
Internet - NRC Agencywide Document Access and Management (ADAMS) (Microform Citations)	No relevant data identified.	06/30/2011	0
Internet - Washington State University (U.S. Transuranium and Uranium Registries)	No relevant data identified.	10/23/2009	0
National Archives and Records Administration - Atlanta	Results of the DOE Indoor Radon Study. Hangar 481 was included in the study.	08/09/2004	1

Table A2-1: Data Capture Synopsis for Hangar 481, Kirtland AFB			
Data Capture Information	General Description of Documents Captured	Date Completed	Uploaded To SRDB
NIOSH	Contract documents pertaining to Ross Aviation contracts with the AEC and DOE, a contract implementation guide, the new air freight manifest, an aircraft safety study, a comparison of the shielding performance of various containers, and process knowledge interviews with former Ross Aviation personnel.	01/07/2011	15
ORAU Team	The seventh through eleventh annual reports of contractor radiation exposures, and process knowledge interviews with former Ross Aviation, DOE AL, NNSA, and OST personnel.	12/28/2010	12
ORISE	Ross Aviation external dosimetry data from the REMS/REIRS Database, and the 1996 transmittal letter that accompanied Ross' submittal to the REIRS Database.	12/16/2009	2
R. S. Landauer	Annual external exposure results by individual employee, 1990 - 1994.	01/19/2011	1
SAIC	Radiation exposure summaries from 1970 and 1972.	09/02/2004	2
Unknown	DOE Occupational Exposure Report 1992-1994.	N/A	1
TOTAL			245

Table A2-2: Databases Searched for Hangar 481, Kirtland AFB			
Database/Source	Keywords / Phrases	Hits	Selected
NOTE: Database search terms employed for each of the databases listed below are available in the Excel file called "Hangar 481 Rev 01, (83.13) 07-08-11"			
DOE CEDR http://cedr.lbl.gov/ COMPLETED 10/23/2009	See Note above	0	0
DOE Hanford DDRS http://www2.hanford.gov/declass/ COMPLETED 10/23/2009	See Note above	0	0
DOE OpenNet http://www.osti.gov/opennet/advancedsearch.jsp COMPLETED 10/23/2009	See Note above	1	0

Table A2-2: Databases Searched for Hangar 481, Kirtland AFB			
Database/Source	Keywords / Phrases	Hits	Selected
DOE OSTI Energy Citations http://www.osti.gov/energycitations/ COMPLETED 10/23/2009	See Note above	52	0
DOE OSTI Information Bridge http://www.osti.gov/bridge/advancedsearch.jsp COMPLETED 10/23/2009	See Note above	52	0
Google http://www.google.com COMPLETED 10/23/2009	See Note above	47,437	13
HP Journal http://journals.lww.com/health-physics/pages/default.aspx COMPLETED 07/05/2011	See Note above	1	0
Journal of Occupational and Environmental Health http://www.ijoh.com/index.php/ijoh COMPLETED 07/05/2011	See Note above	0	0
National Academies Press http://www.nap.edu/ COMPLETED 10/23/2009	See Note above	31	0
NNSA - Nevada Site Office www.nv.doe.gov/main/search.htm COMPLETED 10/23/2009	See Note above	0	0
NRC ADAMS Reading Room http://www.nrc.gov/reading-rm/adams/web-based.html COMPLETED 10/23/2009	See Note above	6	0
NRC ADAMS Reading Room http://wba.nrc.gov.8080/ves/ COMPLETED 06/30/2011	See Note above	13	0
U.S. Transuranium & Uranium Registries http://www.ustur.wsu.edu/ COMPLETED 10/23/2009	See Note above	0	0

Table A2-3: OSTI Documents Requested			
Document Number	Document Title	Requested Date	Received Date
No documents ordered.			