



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION IV  
611 RYAN PLAZA DRIVE, SUITE 400  
ARLINGTON, TEXAS 76011-4005**

October 14, 2005

Mr. J. William Vinzant  
Regional Environmental Manager  
Corporate Environmental Affairs  
Kaiser Aluminum and Chemical Corporation  
9141 Interline Avenue, Suite 1A  
Baton Rouge, Louisiana 70809-1957

**SUBJECT: NRC INSPECTION REPORT 040-02377/05-005**

Dear Mr. Vinzant:

On August 22-25, 2005 an NRC inspection was conducted at the former Kaiser Aluminum Specialty Products facility in Tulsa, Oklahoma. The preliminary inspection findings were discussed with you and members of your staff during the exit briefing conducted on August 25, 2005. Following receipt of remaining laboratory sample results on October 3, 2005, the final inspection findings were discussed with you and members of your staff on October 6, 2005. The enclosed report presents the scope and results of that inspection.

The purposes of the inspection were to determine whether decommissioning and remediation activities were being conducted in accordance with the NRC-approved Decommissioning Plan for Phase II Remediation. Within these areas, the inspection consisted of selected examination of procedures, work plans, representative records, and interviews with personnel as they related to safety and compliance with the Commission's rules and regulations. This inspection consisted of confirmatory surveys of survey units in the pond parcel area, the Former Operational Area, and the concrete slabs removed from the former Flux Building foundation. The results of the confirmatory surveys are provided in the enclosed inspection report. No deviations from NRC commitments were identified, and no response to this letter is required.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room). To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

Kaiser Aluminum and Chemical Corp. - 2 -

Should you have any questions concerning this inspection, please contact Ms. Beth Schlapper at (817) 860-8169 or the undersigned at (817) 860-8191.

Sincerely,

*/RA/*

D. Blair Spitzberg, Ph.D., Chief  
Fuel Cycle and Decommissioning Branch

Docket No.: 040-02377  
License No.: STB-472 (terminated)

Enclosure:  
NRC Inspection Report  
040-02377/05-005

cc w/enclosure:  
Mr. Paul Handa, Site Administrator  
Kaiser Aluminum & Chemical Corporation  
7311 East 41st Street  
Tulsa, Oklahoma 74145

Mr. Doug Wilson  
Manager, Environmental Services  
Office of Environmental Services  
City of Tulsa  
4818 South Elwood Avenue  
Tulsa, OK 74107-8129

Mr. George Brozowski, Regional Health Physicist  
U.S. Environmental Protection Agency, Region VI  
1445 Ross Avenue  
Mail Stop-6PDT  
Dallas, Texas 75202

Allyn M. Davis, Director  
Hazardous Waste Management Division  
U.S. Environmental Protection Agency  
Region VI  
1445 Ross Avenue  
Dallas, TX 75202-2733

Mr. Stan Koop  
Office of Attorney General  
State of Oklahoma  
2300 N. Lincoln Blvd., Suite 112  
Oklahoma City, OK 73105-4894

Mr. Tim Thompson  
Creek Nation of Oklahoma  
Creek Nation Tribal Complex  
Hwy 75, Loop 56  
P.O. Box 586  
Okmulgee, OK 74447

P. L. Bishop, Senior Environmental Specialist  
Radiation Management Section  
Waste Management Division  
Department of Environmental Quality  
State of Oklahoma  
P.O. Box 1677  
Oklahoma City, Oklahoma 73101-1677

Mike Broderick, Radiation Control Program Director  
Radiation Management Section  
Waste Management Division  
Department of Environmental Quality  
State of Oklahoma  
P.O. Box 1677  
Oklahoma City, Oklahoma 73101-1677

bcc w/enclosure (via ADAMS e-mail distribution):

- LDWert
- JTBuckley, NMSS/DWMEP
- THYoungblood, NMSS/DWMEP
- DBSpitzberg
- BASchlapper
- RJEvans
- KEGardin
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**ENCLOSURE**

U. S. NUCLEAR REGULATORY COMMISSION  
REGION IV

Docket No.: 040-02377

License No.: STB-472 (Terminated in March 1971)

Report No.: 040-02377/05-005

Property Owner: Kaiser Aluminum & Chemical Corporation

Facility: Former Kaiser Aluminum Specialty Products Facility

Location: 7311 East 41<sup>st</sup> Street  
Tulsa, Oklahoma 74145

Inspection Dates: August 22 - 25, 2005

Inspectors: Beth Schlapper, Health Physicist  
Fuel Cycle & Decommissioning Branch

Robert J. Evans, PE, CHP, Senior Health Physicist  
Fuel Cycle & Decommissioning Branch

Accompanied By: Aaron McCraw, NSPDP Participant  
Office of State and Tribal Programs

Approved By: D. Blair Spitzberg, Ph.D., Chief  
Fuel Cycle & Decommissioning Branch

Attachments: Supplemental Inspection Information

## **EXECUTIVE SUMMARY**

### Former Kaiser Aluminum Specialty Products Plant NRC Inspection Report 040-02377/05-005

This was an inspection of the Kaiser Aluminum Specialty Products facility, formerly occupied by Standard Magnesium Company. This inspection consisted of confirmatory surveys of survey units in the pond parcel area, the Former Operational Area, and the concrete slabs removed from the former Flux Building foundation. The inspectors also discussed and closed a previous inspection finding.

#### Radiation Protection

- Kaiser was conducting soil sorting operations in accordance with Decommissioning Plan requirements (Section 1).

#### Closeout Inspection and Survey

- Independent confirmatory radiological surveys were conducted by the inspectors in three final status survey units. Results of confirmatory surveys were generally consistent with measurements taken by Kaiser. Ten soil samples were collected and analyzed for uranium and thorium concentrations. The final sample results for both Kaiser and NRC were below the NRC-approved wide area derived concentration guideline level (Section 2).
- Confirmatory surveys of the concrete slabs from the former Flux Building foundation were performed. The surveys did not identify any areas that exceeded the free release criteria of 230 dpm/100 cm<sup>2</sup> total average contamination (Section 2).

#### Followup

- Inspection Followup Item (IFI) 040-02377/0502-01, involving an observed discrepancy between horizontal and vertical surface measurements, was closed during the inspection. Kaiser previously submitted a technical explanation for the discrepancy to the NRC. In addition, the discrepancy was not safety significant because none of the sample results exceeded the NRC-approved release criteria (Section 3).

## Report Details

### Summary of Site Status

Since the previous inspection, Kaiser continued to conduct Phase II decommissioning of the site in accordance with the NRC-approved Decommissioning Plan (DP). Kaiser had completed the remediation of 19 survey units in the pond parcel area and excavated approximately 101,000 tons of contaminated soil and dross. Nine survey units in the Former Operational Area (FOA) have also been completed. As of August 25, 2005, Kaiser has successfully shipped 453 rail gondola cars amounting to more than 45,000 tons of material to an offsite disposal site.

## **1 Radiation Protection (83822)**

### 1.1 Scope

The inspectors examined Kaiser's radiation protection program for consistency with the requirements of 10 CFR Parts 19 and 20 and the DP.

### 1.2 Observations and Findings

As described in Section 8.0 of the DP, a specialized soil sorting system was installed to ensure accurate segregation of radiologically contaminated soil. The soil was to be segregated, based on thorium-232 concentration, for either onsite burial or offsite disposal. During the inspection, Kaiser's representatives demonstrated the startup, daily calibration, and operation of the soil sorter system.

Startup testing included verification of conveyor belt weight and contamination monitor operability. The inspectors compared the operation of the sorter system to the instructions provided in the applicable work plan. The equipment operators conducted a system startup in accordance with the guidance provided in the work plan.

During the inspection, Kaiser was sorting material that was pre-staged as landfill material (material with thorium concentrations greater than 32.2 pCi/g). The sorter appeared fully functional. The vibrating screen was removing all material greater than 6-inches in diameter. The conveyor belt was transferring the material past the contamination monitor for measurement of radioactivity level. After radiological surveying, the material was being loaded into dump trucks and moved to a staging area for loading into railcars.

The inspectors interviewed site personnel about pre-staging of material to be sorted. According to the work supervisor, material was staged for sorting based on field technician determination of potential radioactivity concentrations. The sorting process confirmed whether the soil was to be disposed offsite or buried onsite. The sorting equipment also has a set-point for diversion of soil containing unusually high concentrations of thorium for down-blending. According to the work supervisor, to date, no material has been identified with elevated thorium concentrations above the set-point.

The inspectors determined that the soil pre-staging and sorting process was in agreement with the requirements established in the DP.

### 1.3 Conclusion

Kaiser was conducting soil sorting operations in accordance with DP requirements.

## 2 **Closeout Inspection and Survey (83890)**

### 2.1 Scope

The inspectors performed confirmatory surveys to verify if Kaiser was remediating and decontaminating the site to acceptable radiological levels for unrestricted release.

### 2.2 Observations and Findings

#### a. Pond Parcel Area Survey Units FSS-018 & FSS-019

Final status survey units FSS-018 and FSS-019 were located on the eastern side of the pond parcel area, just west of FSS-016. The survey units were both 1,581.6 m<sup>2</sup> in size. Included within these survey units were excavated grounds. The confirmatory survey consisted of gamma scans of the soil surface and collection of soil samples.

The inspectors performed the gamma radiation level scans of the soil surfaces using a Ludlum Model 18 survey meter (NRC No. 012778, calibration due date of November 10, 2005) with a SPA-3 scintillation probe assembly (NRC No. 20795G). A site background of 10,000 cpm was established. The soil surface survey measurements ranged from 13,000 cpm to 36,000 cpm in these survey units because of the proximity to areas still containing contaminated soil and dross material, or previously backfilled areas with below criterion material (32.2 pCi/g thorium-232). Based on information provided in the draft final status survey report, Kaiser's survey results for FSS-018 ranged from 14,140 cpm to 24,731 cpm with an average survey unit background of 21,742 cpm. Kaiser's survey results for FSS-019 ranged from 15,984 cpm to 22,600 cpm with an average survey unit background of 20,057 cpm.

The inspectors performed a gamma scan of FSS-018 and FSS-019, in part, to identify locations for soil sampling based on any elevated readings detected. Areas in each survey unit were selected for sampling based on elevated readings as discussed following Table 1. The samples were collected and split onsite using in-situ mixing. The nine soil samples were transferred through chain-of-custody records to Oak Ridge Institute for Science and Education (ORISE) for analysis. The samples were analyzed by gamma spectroscopy for uranium and thorium concentrations. The sample results are listed in Table 1 below:

**Table 1**  
**Concentrations of Uranium and Thorium Isotopes**  
**In Survey Units FSS-018 and FSS-019 Soil Samples**

NRC Region IV Sample ID	Survey Unit	Radionuclide Concentrations <sup>a,d</sup> (pCi/g wet weight)						
		U-238	U-235	Total U <sup>b</sup>	Th-230	Th-228	Th-232	Total Th <sup>c</sup>
NRC-05-05-02	FSS-018	1.40±1.20	0.11±0.19	2.9±1.7	17±10	7.08±0.64	6.87±0.60	13.95±0.88
NRC-05-05-03	FSS-018	0.67±0.83	0.09±0.22	1.4±1.2	1.1±7.8	5.80±0.50	4.78±0.50	10.58±0.71
NRC-05-05-04	FSS-019	2.60±1.20	0.19±0.26	5.4±1.7	36±14	9.56±0.76	10.15±0.85	19.7±1.1
NRC-05-05-05	FSS-018	1.70±0.97	-0.15±0.18	3.3±1.4	-1.7±6.1	4.20±0.39	3.60±0.40	7.80±0.56
NRC-05-05-06	FSS-018	0.7±0.6	0.01±0.10	1.4±0.8	0.5±3.7	0.94±0.08	0.85±0.15	1.79±0.17
NRC-05-05-07	FSS-018	1.1±0.7	-0.04±0.12	2.2±1.0	-1.6±4.2	0.99±0.10	0.96±0.18	1.95±0.21
NRC-05-05-08	FSS-019	0.6±0.6	0.05±0.09	1.3±0.8	-2.0±3.7	0.83±0.08	0.85±0.16	1.68±0.18
NRC-05-05-09	FSS-019	0.73±0.60	0.06±0.10	1.5±0.9	1.0±3.1	0.76±0.08	0.72±0.12	1.48±0.14
NRC-05-05-10	FSS-019	0.98±0.69	0.09±0.13	2.1±1.0	-0.9±4.8	1.42±0.12	1.47±0.24	2.89±0.27

<sup>a</sup> The average MDCs for these radionuclides ranges from 0.06 pCi/g for Th-228 by Pb-212 to 7.3 pCi/g for Th-230

<sup>b</sup> Total uranium is the sum of (2\*U-238) + U-235

<sup>c</sup> Total Thorium is the sum of Th-228 and Th-232

<sup>d</sup> Uncertainties represent the 95 percent confidence level, based on total propagated uncertainties

The NRC-approved wide area derived concentration guideline level (DCGL<sub>w</sub>) for thorium-232 in soil in the stockpile and processing areas is 3.0 pCi/g with a background of 1.1 pCi/g. Three areas were initially identified as having elevated measurements, two in FSS-018 (NRC-05-05-02 and NRC-05-05-03) and one in FSS-019 (NRC-05-05-04). Initial onsite measurements of these soil samples by Kaiser confirmed that the NRC approved DCGL<sub>w</sub> had been exceeded. Kaiser had a silt fence in place to prevent migration of below-criterion material from adjacent areas. Prior to the NRC inspection, an unusually heavy rain event occurred which allowed material to bypass the silt fence and migrate into the area being surveyed. Following discussions with Kaiser, NRC agreed that the likely cause for the elevated areas was washed-in soil from an adjacent, previously backfilled area. The three areas in question were decontaminated, and additional soil samples were taken (NRC-05-05-05, NRC-05-05-06 and NRC-05-05-08). All thorium-232 sample results following decontamination were less than the NRC approved DCGL<sub>w</sub>.

As part of the final status survey process, Kaiser collected ten soil samples from each survey unit. The minimum number of samples required to be collected was nine from each survey unit. Kaiser submitted nine of the samples for each survey unit based on the highest field measurements to a state-licensed laboratory for analysis. Kaiser's sample results ranged from 0.423 ± 0.050 to 2.76 ± 0.197 pCi/g for thorium-232 in FSS-018 and 0.509 ± 0.034 to 1.1 ± 0.087 pCi/g for thorium-232 in FSS-019.

During the confirmatory surveys of FSS-018 and FSS-019, Kaiser collected and split nine samples with the NRC. Two of nine samples (NRC-05-05-03 and NRC-05-05-05) were analyzed by Kaiser’s contract laboratory.

The comparison of the thorium-232 sample results are provided in Table 2 below:

**Table 2**  
 Comparison Of Split Soil Samples by Gamma Spectroscopy  
 In Survey Units FSS-018 and FSS-019  
 Th-232 by Ac-228, including background (1.1 pCi/g)

Sample ID		Survey Unit	NRC Analysis (Wet) pCi/g*	NRC (Wet) % Moisture	Kaiser Analysis (Wet) pCi/g	Kaiser % Moisture
NRC - RIV	Kaiser					
NRC 05-05-03	K-984	FSS-018	4.78±0.50	15	6.07±0.22	14.8
NRC 05-05-05	K-986	FSS-018	3.60±0.40	15	2.76±0.197	15.7

\*Uncertainties represent the 95 percent confidence level, based on total propagated uncertainties

The sample results for both Kaiser and NRC (post-decontamination) were below the NRC approved DCGL<sub>w</sub> of 4.1pCi/g thorium-232 with background included.

b. Former Operational Area Survey Unit FSS-FOA-009

The NRC inspectors conducted confirmatory surveys in FSS-FOA-009, which was located to the west of FSS-FOA-005. The survey unit was 19.5 m<sup>2</sup> and included an excavated dirt wall. The confirmatory survey consisted of gamma scans of the soil surface and collection of one soil sample.

The inspectors performed the gamma radiation level scans of the soil surfaces using a Ludlum Model 18 survey meter with a SPA-3 scintillation probe assembly. The background in this specific survey unit varied from 10,000 cpm to 12,000 cpm. The soil surface survey measurements (including background) ranged from 10,000 cpm to 15,000 cpm.

The inspectors performed a gamma scan of the area, in part, to identify locations for soil sampling based on any elevated readings detected. One area of the survey unit was selected for sampling. The sample was collected and split onsite using in-situ mixing. The soil sample was transferred through chain-of-custody records to ORISE for analysis. The sample was analyzed by gamma spectroscopy for uranium and thorium concentrations.

The sample result is listed in Table 3 below:

**Table 3**  
**Concentrations of Uranium and Thorium Isotopes**  
**In Survey Unit FSS-FOA-009 Soil Samples**

NRC Region IV Sample ID	Radionuclide Concentrations <sup>a,d</sup> (pCi/g wet weight)						
	U-238	U-235	Total U <sup>b</sup>	Th-230	Th-228	Th-232	Total Th <sup>c</sup>
NRC-05-05-01	0.83±0.68	-0.04±0.13	1.6±1.0	7.3±6.6	1.70±0.14	1.72±0.28	3.42±0.31

<sup>a</sup> The average MDCs for these radionuclides ranges from 0.06 pCi/g for Th-228 by Pb-212 to 7.3 pCi/g for Th-230

<sup>b</sup> Total uranium is the sum of (2\*U-238) + U-235

<sup>c</sup> Total Thorium is the sum of Th-228 and Th-232

<sup>d</sup> Uncertainties represent the 95 percent confidence level, based on total propagated uncertainties

The NRC-approved DCGL<sub>w</sub> for thorium-232 in soil in the stockpile and processing areas is 3.0 pCi/g with a background of 1.1 pCi/g. The sample result was less than the NRC approved DCGL<sub>w</sub>.

During the side-by-side survey, Kaiser collected and split the soil sample with the NRC. Kaiser did not submit the sample to the offsite laboratory for analysis. The sample results for the NRC indicated that the sample was below the NRC approved DCGL<sub>w</sub> of 4.1pCi/g thorium-232 with background included.

c. Confirmatory Survey of Concrete Slabs

Confirmatory surveys were performed on concrete slabs staged for off-site disposal at a local landfill. The surveys were conducted using an Eberline E600 survey meter (NRC Tag No. 079977, calibration due date: May 31, 2006) with an Eberline SHP-380AB alpha-beta probe (NRC Tag No. 079976) . The surveys included surface scans for gross alpha and beta radioactivity and 1-minute static measurements. Swipe sampling was not required because Kaiser is releasing the concrete slabs based on the state criteria of indistinguishable from background levels, which is lower than the NRC-approved removable contamination free release criteria for structures removed from the site of 50 dpm/100cm<sup>2</sup>.

Background measurements were obtained from similar concrete located in an offsite area that was unimpacted by previous plant operations. Background measurements ranged from 28 - 290 dpm/100cm<sup>2</sup> with an average of 125 dpm/100cm<sup>2</sup>.

The DP amendment states the free release criteria for structures removed from the site as 230 dpm/100 cm<sup>2</sup> total average contamination with 700 dpm/100 cm<sup>2</sup> maximum contamination and 50 dpm/100 cm<sup>2</sup> removable contamination. Kaiser had 24 concrete slabs that were surveyed and staged for free release. One slab had failed the State of Oklahoma criterion of indistinguishable from background, and 2 additional slabs failed following correction of an error in calculations. The inspectors performed confirmatory surveys on 6 of the 21 remaining concrete slabs. An additional 21 slabs were surveyed by Kaiser during the site visit. The inspectors performed confirmatory surveys on 18 of the 21 additional concrete slabs. The three slabs that failed the State of Oklahoma criterion were sent for offsite disposal at a low-level waste facility.

Three 1-minute alpha particle counts were obtained from each concrete slab for comparison to the NRC-approved average gross alpha DCGL of 230 dpm/100 cm<sup>2</sup>. The static measurements included both fixed and removable alpha contamination on the surfaces. The gross alpha particle measurements ranged from 1 dpm/100 cm<sup>2</sup> to 41 dpm/100 cm<sup>2</sup>.

In summary, neither Kaiser's nor NRC's concrete sample results exceeded the NRC-approved GA-DCGL for structures for free release of 230 dpm/100 cm<sup>2</sup> total average contamination with 700 dpm/100 cm<sup>2</sup> maximum contamination.

### 2.3 Conclusion

Independent confirmatory radiological surveys were conducted by the inspectors in three final status survey units. Results of confirmatory surveys were generally consistent with measurements taken by Kaiser. Ten soil samples were collected and analyzed for uranium and thorium concentrations. The final sample results for both Kaiser and NRC were below the NRC-approved DCGL<sub>w</sub>.

Confirmatory surveys of the concrete slabs from the former Flux Building foundation were performed. The surveys did not identify any areas that exceeded the free release criteria of 230 dpm/100 cm<sup>2</sup> total average contamination.

## 3 **Followup**

(Closed) Inspection Followup Item 040-02377/0502-01: Discrepancy in count rates between horizontal and vertical surface measurements

During the March 2005 inspection, the inspectors observed that horizontal surfaces in the FOA exhibited elevated count rate measurements as compared to adjacent vertical surfaces whether or not the area was classified as impacted. At that time, the inspectors collected six static measurements. The horizontal ledges averaged 254 dpm/100 cm<sup>2</sup> while the vertical ledges averaged 84 dpm/100 cm<sup>2</sup>. The average of the six samples was 169 dpm/100 cm<sup>2</sup>. This issue was tracked as an IFI pending Kaiser's review of the count rate discrepancy.

Kaiser submitted a Technical Memorandum to the NRC on July 5, 2005, that addressed the discrepancy. Kaiser's investigation concluded that the reasons for the observed differences included: (1) buildup of radon progeny on horizontal surfaces, (2) better shielding of naturally occurring radioactive material in concrete on the painted vertical surfaces as compared to horizontal surfaces, and (3) more efficient counting geometry on horizontal versus vertical surfaces. As part of its review, Kaiser collected nine sets of samples from unimpacted concrete located on an adjacent property. Kaiser's average alpha sample result was 122 dpm/100 cm<sup>2</sup> on horizontal surfaces and 78 dpm/100 cm<sup>2</sup> on vertical surfaces, indicating that the count rate discrepancy was also present on non-impacted concrete.

By letter dated May 5, 2005, Kaiser requested a proposed revision to the NRC-approved acceptance criteria for surface contamination. Kaiser proposed changing the release criteria to 230 dpm/100 cm<sup>2</sup> average total alpha contamination, 700 dpm/100 cm<sup>2</sup> maximum total alpha contamination, and 50 dpm/100 cm<sup>2</sup> removable alpha contamination. On June 22, 2005, the NRC approved Kaiser's request. The inspectors noted that the average alpha sample results from both the NRC's and Kaiser's previous sampling events were less than the NRC-approved average total alpha contamination limit of 230 dpm/100 cm<sup>2</sup> and the maximum limit of 700 dpm/100 cm<sup>2</sup>.

During the current inspection, ten additional sets of samples were collected by the inspectors on horizontal and vertical surfaces in the FOA. The average alpha sample result was 199 dpm/100 cm<sup>2</sup> on horizontal surfaces and 142 dpm/100 cm<sup>2</sup> on vertical surfaces. All sample results were below the NRC-approved acceptance criteria for surface contamination. Since the count rate discrepancy exists both inside and outside of the radiologically restricted area and since none of the sample results exceeded the NRC-approved release criteria, this issue was determined not to be safety significant.

### **3 Exit Meeting Summary**

The inspectors reviewed the scope and findings of the inspection during a preliminary exit briefing that was conducted on August 25, 2005, at the conclusion of the onsite inspection. A discussion of the confirmatory survey results was conducted onsite on October 6, 2005, following receipt of laboratory samples. Kaiser did not identify as proprietary any information provided to, or reviewed, by the inspectors.

**ATTACHMENT**

**SUPPLEMENTAL INFORMATION**

**PARTIAL LIST OF PERSONS CONTACTED**

Kaiser Aluminum & Chemical Corp.

Bill Vinzant, Program Manager  
P. Handa, Site Administrator, Kaiser Aluminum & Chemical Corp.  
L. Max Scott, Radiation Safety Officer

Penn E&R

David Weyant, Data Manger  
David Duffey, HP Technician

Civil & Environmental Consultants, Inc.

Andy Lombardo, Final Survey Oversight

ReCon

Jerry Pionesa, QA Manager  
Joel Nowack, HP Technician  
Tyrone Trent, HP Technician  
Jeremy Buchheit, Health and Safety Manager  
Danny Brown, Foreman  
Ron Griffith, Site Supervisor  
Paul Klein, Conveyor Operator

Shonka & Associates

Greg Morgan, Sorter Supervisor

**INSPECTION PROCEDURES USED**

IP 83822	Radiation Protection
IP 83890	Closeout Inspection and Survey
IP 92701	Followup

**ITEMS OPENED, CLOSED AND DISCUSSED**

Opened

None

Closed

IFI 040-02377/0502-01 The inspectors observed that horizontal surfaces in the FOA, whether or not the area was classified as impacted, exhibited elevated count rate measurements as compared to the adjacent vertical surfaces.

Discussed

None

**LIST OF ACRONYMS USED**

CFR	Code of Federal Regulations
cpm	counts per minute
DCGL <sub>w</sub>	wide area derived concentration guideline level
DP	NRC-Approved Decommissioning Plan
FOA	Former Operational Area
FSS	Final Status Survey
GA-DCGL	gross alpha derived concentration guideline level
IFI	Inspection Follow-up Item
IP	Inspection Procedure
pCi/g	picocuries per gram
dpm/100 cm <sup>2</sup>	disintegrations per minute per 100 square centimeters
m <sup>2</sup>	square meters
ORISE	Oak Ridge Institute for Science and Education
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual