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PROCEDURE: REC-WP-2-08

**Ludlum Model 2221 Scaler/Ratemeter with the  
Model 43-5 Detector  
Thorium Remediation Project  
Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

Date:

PROCEDURE: REC-WP-2-08

# **Ludlum Model 2221 Scaler/Ratemeter with the Model 43-5 Detector**

**Thorium Remediation Project  
Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Allen A. Crawford 3-29-04  
Prepared by: Date:

Richard L. Lewis 3/29/04  
Quality Control Supervisor: Date:

Title: Ludlum Model 2221 Scaler/Ratemeter with  
the Model 43-5 Detector

## 1.0 PURPOSE

The purpose of this procedure is to provide basic operational instruction for the Ludlum Model 2221 Scaler/Ratemeter with the Model 43-5 Detector.

## 2.0 DEFINITIONS

**Background:** A measurement taken by an instrument to determine the amount of naturally occurring radiation at a given time at a given location.

**Calibration source:** A National Institute of Standards and Technology- (NIST) traceable check source of a known value used to calibrate or verify the response efficiency of an *instrument*.

**Detector:** The portion of the *instrument* that transmits a signal to a *meter* based upon the radioactive activity present. The model 43-3 detector is attached to the model 2221 *meter*.

**Instrument:** A meter-detector combination that has been calibrated as a single unit. Some instruments are capable of being calibrated with several detectors simultaneously.

**Meter:** The portion of this *instrument* that receives and translates signals from the *detector* into a user observable result.

**Efficiency:** A measure of this instrument's ability to detect radiological activity. It is calculated by using the formula below:

$$E = ((C-B_r)/D)$$

Where:

E = Instrument efficiency

C = Displayed value from the instrument count of the calibration source (count rate)

B<sub>r</sub> = Background count rate

D = Known decay-corrected disintegrations per minute (dpm) value of the calibration source

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Any person operating a radiological survey instrument must be trained in its use or supervised during its operation by a qualified instructor.
- 3.2 Failure of any preoperational check will result in the instrument being removed from operation and repaired as necessary.
- 3.3 Any operator repair that may affect the efficiency response of the detector requires that the new efficiency response be within 10 percent of the calibration value but does not necessarily require a new calibration. If the new efficiency response is not within 10 percent of the calibration value, the instrument will be removed from operation and recalibrated.
- 3.4 An operator repair such as replacing batteries or cables does not require the instrument to be recalibrated. However, the efficiency of the instrument should be recalculated.

Title: Ludlum Model 2221 Scaler/Ratemeter with  
the Model 43-5 Detector

- 3.5 All manufacturer's recommendations regarding use, calibration, and/or maintenance of an instrument will be followed unless otherwise documented in this or other written procedure(s).
- 3.6 Additional guidance for operating an instrument can be found in the appropriate procedure and/or the manufacturer's manual for that instrument.
- 3.7 REC-WP-2-01, "Basic Instrument Operation"
- 3.8 REC-WP-2-02, "Instrument Minimum Detectable Concentration Calculations"

## 4.0 EQUIPMENT

- Ludlum Model 2221 Scaler/Ratemeter, or equivalent
- Ludlum Model 43-5 Detector, or equivalent

## 5.0 PROCEDURE

### 5.1 Preoperational Checks

- 5.1.1 Turn the instrument on and perform a battery check or verify that the power is on. Replace batteries (or charge battery as appropriate) if necessary.
- 5.1.2 Adjust the audible volume so that the alpha and beta/gamma clicks can be easily heard.

### 5.2 Operational Checks

- 5.2.1 Prior to using the counting system, the source check acceptance criteria of the average response will be determined. If the instrument is recalibrated at any point, the source check acceptance criteria will need to be re-established, in accordance with Procedure REC-WP-2-01.
- 5.2.2 Each day the instrument is used, determine ambient background and record on appropriate form.
- 5.2.3 Each day that a counting system is used, the response will be checked using an appropriate source, as follows.
  - 5.2.4.1 Perform the source count by placing the appropriate alpha source beneath the detector in a fixed-count geometry. This count is performed on alpha sources.
  - 5.2.4.2 The net counts per minute value is compared to the acceptance criteria to determine a pass or fail status.
  - 5.2.4.3 Record the source check readings on the appropriate form.
- 5.2.4 Check the source check result against the established postcalibration acceptance criteria. Failed source checks will be repeated. Consecutive failures will result in additional testing of the instrument. Refer to instrument manual.

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the Model 43-5 Detector

- 5.2.5 Survey data acquired prior to an instrument failing a source check will be reviewed to determine the validity of the data. This review will be documented.
- 5.2.6 Determine the minimum detectable concentration for the instrument as required, in accordance with Procedure REC-WP-2-02.

## 6.0 REFERENCES

NA

## 7.0 ATTACHMENTS

Form REC-WP-2-08-1

Daily Check for Ludlum Model 2221 with a 43-5 Detector

**Form REC-WP-2-08-1**

**Form REC-WP-2-08-1 Daily Check Log**  
**Ludlum Model 2221 with 43-5 Detector**

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PROCEDURE: REC-WP-2-09

**Dosimeter Issuance and Tracking**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

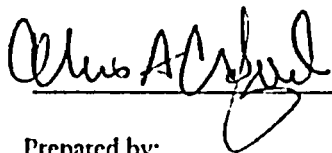
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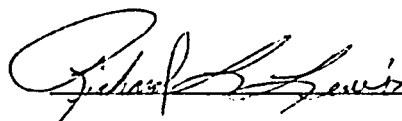
PROCEDURE: REC-WP-2-09

**Dosimeter Issuance and Tracking**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3-29-04  
Prepared by: Date:

 3/29/04  
Quality Control Supervisor: Date:

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Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-2-09

Title: RADIATION BADGE ISSUANCE

## **1.0 PURPOSE**

The purpose of this procedure is to provide instruction for the issuance and tracking of radiation badges.

## **2.0 DEFINITIONS**

NA

## **3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS**

- 3.1 Personnel will have successfully completed Radiation Health and Safety Plan (RHASP) training requirements.
- 3.2 Personnel shall have completed Cumulative Occupational Dose History, U.S. Nuclear Regulatory Commission (NRC) Form 5.
- 3.3 Personnel shall not knowingly take dosimeter off site.
- 3.4 Personnel shall notify the Recon Radiation Safety Officer when they have undergone medical procedures involving radioactive materials or procedures involving the use of radiation.

## **4.0 EQUIPMENT**

- 4.1 Appropriate check source(s) or calibration source(s), as necessary.

## **5.0 PROCEDURE**

### **5.1 Radiation Badge Issuance (Dosimeter)**

- 5.1.1 Dosimeter will be issued to all individuals as per the Radiation Health and Safety Plan, section 6.0.
- 5.1.2 Individuals shall wear dosimetry when entering the Restricted Area at all times.
- 5.1.3 After exiting the Restricted Area dosimeters will be returned to Access Control.
- 5.1.4 At least one control dosimeter shall be posted in Access Control to assess normal background radiation.
- 5.1.5 Lost or damaged dosimeters shall be reported to the Recon RSO immediately.
- 5.1.6 Lost or damaged dosimeters shall be documented on form REC-WP-2-09-1.

### **5.2 Review/Notification/Reports**

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Procedure: REC-WP-2-09

Title: RADIATION BADGE ISSUANCE

- 5.2.1 Individual exposure results will be maintained on NRC Form 4 in the RHASP Attachment 8.
- 5.2.2 Dosimetry will be reviewed quarterly and annually by the Recon RSO.
- 5.2.3 Abnormal results will be investigated and reported by the Recon RSO to the Kaiser Aluminum and Chemical Corporation RSO.
- 5.2.4 Copies of individual exposure results will be provided to each individual at the end of each year.

### **6.0 REFERENCES**

- 6.1 Radiation Health and Safety Plan, Attachment 8 (NRC Form 5)

### **7.0 ATTACHMENTS**

Form REC-WP-2-09-1

Lost or Damaged Dosimeter Report

**Form REC-WP-2-09-1**

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(281) 955-2442

**Form REC-WP-2-09-1**  
**Lost or Damaged Dosimeter Report**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

SSN: \_\_\_\_\_ Date Lost or Damaged: \_\_\_\_\_

Dosimeter Number: \_\_\_\_\_

Location Lost: \_\_\_\_\_

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Radiation Safety Officer

Actions Taken: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Reviewed By

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PROCEDURE: REC-WP-3-01

**Gross Gamma Surveys**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

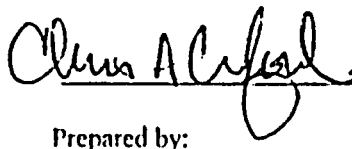
Date:


PROCEDURE: REC-WP-3-01

**Gross Gamma Surveys**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3-29-04  
Prepared by: Date:

 3/29/04  
Quality Control Supervisor: Date:

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Procedure: REC-WP-3-01

Title: Gross Gamma Surveys

## 1.0 PURPOSE

The purpose of this procedure is to provide written instruction for measuring gross gamma activity on soil or structure surfaces during the Thorium Remediation Project.

## 2.0 DEFINITIONS

*Site Background Count:* A measurement taken by an instrument to determine the amount of naturally occurring radiation at a given time at a given location.

*Shine:* Radiation detected from radioactive material in the vicinity of the area that is being surveyed, in addition to natural background radiation.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Instrument must pass preoperational and operational checks as outlined in Procedure REC-WP-2-01 and the appropriate instrument procedure.
- 3.2 A site background may have been established.
- 3.3 Procure any drawings of the survey area which indicate the facility features and reference locations.
- 3.4 Background count rates may vary by area and time of day. Background should be established in discrete areas based on variations in the background count rate and should be established at least daily for each such area. Variations in background as the elevation of the measurement changes should be accounted for. For example, shine from surrounding structures may be shielded at a lower elevation but may increase background as elevation increases.
- 3.5 Before initiating a gross gamma soil survey be sure to record the instrument serial number(s), calibration date(s), date of survey, time of survey, study area and survey unit and person conducting survey.
- 3.6 Ensure the preoperational and source checks have been completed prior to initiating survey.

## 4.0 EQUIPMENT

- 4.1 Ludlum Model 19, or equivalent.

## 5.0 PROCEDURE

- 5.1 The background count rate (in counts per minute [cpm]) should be established for each discrete area to be surveyed and each time (at least daily) that a survey is performed.
- 5.2 Background count rate should be established at approximately 1 meter above the surface to be scanned. If shine causes the background count rate at 1 meter above the surface to exceed the count rate at the surface, note on the survey map and/or other survey documentation.
- 5.3 Record the background established for the survey area, the date and time of the background counts for each area, and the average background count rate (cpm) on the appropriate form.

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Procedure: **REC-WP-3-01**

Title: **Gross Gamma Surveys**

- 5.4 Using the guidance provided in Procedure REC-WP-2-02, calculate the scan Minimum Detectable Concentration prior to surveying the area.
- 5.5 Position the detector as close to the surface as reasonable but not greater than 10 centimeters from the surface to be surveyed.
- 5.6 Slowly pass the detector across the surface at a rate of lateral motion not to exceed 0.5 meters per second.
- 5.7 Listen for a change in the audible response and watch the analog or digital readout for a change.
- 5.8 If an increase in the audible count rate is detected, pause and allow the reading to stabilize (approximately 15 to 30 seconds) and complete the following:
  - 5.8.1 Perform a station fixed-time count (e.g., 1-minute fixed-time count on contact with the soil).
  - 5.8.2 Subtract background established for the grid from the fixed-count result and record the net.
- 5.9 Mark any areas of elevated activity using paint, grease pencil, survey flags, or other methods, depending on the survey location.
- 5.10 Continue traversing the survey unit (area) until the required survey coverage is achieved.
- 5.11 Record the results in the appropriate survey documentation.
- 5.12 Attach drawings, pictures, and/or supporting data.

## REFERENCES

NA

## ATTACHMENTS

REC-WP-3-01-1

Survey Data Log

**Form REC-WP-3-01-1**

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**Form REC-WP-3-01-1**  
**Survey Data Log**

Instrument Model:	
Instrument S/N:	
Detector Model:	
Detector S/N:	

Date of Survey:	
Units of Measure:	$\mu\text{R/hr}$ / cpm
Radiation Detected:	$\beta$ $\gamma$
Calibration Due:	

[illegible]

Technician:	
Prepared By:	Date:
Reviewed By:	Date:

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PROCEDURE: REC-WP-3-02

**Personnel Radiation Survey (Frisking)**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Approved, Bill Vinzant

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

Date:



PROCEDURE: REC-WP-3-02

**Personnel Radiation Survey (Frisking)**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Allen A. Crawford 3-29-04

Prepared by:

Date:

Richard L. Lewis 3/29/04

Quality Control Supervisor:

Date:

# Work Plan Procedures Manual

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Procedure: REC-WP-3-02

Title: Personnel Radiation Survey (Frisking)

## 1.0 PURPOSE

The purpose of this procedure is to provide written instructions to measure for the possible presence of radioactive material on the body or clothing.

## 2.0 DEFINITIONS

*Standoffs:* Spacers used to keep the detector a specified distance from a surface.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 When performing a personnel radiation survey the detector must be within one half inch of the body or clothing being surveyed.
- 3.2 Instrument must pass preoperational checks as outlined in Procedure REC-WP-2-01 and the appropriate instrument procedure.
- 3.3 Only qualified and trained personnel may complete these surveys.
- 3.4 Additional guidance on performing personnel radiation surveys is provided in NUREG-1575.

## 4.0 EQUIPMENT

- 4.1 Appropriate calibrated survey meter and detector.

## 5.0 PROCEDURE

### 5.1 Presurvey

- 5.1.1 When exiting a restricted area, proceed to the boot wash station and wash boots.
- 5.1.2 Carefully remove all other PPE as per site specific briefing and dispose in appropriately marked containers before entering access control.
- 5.1.3 Proceed to frisking station.

### 5.2 Scan Survey

- 5.2.1 Prior to picking up the probe carefully frisk hands to prevent cross contamination as per the Radiation Health and Safety Plan.
- 5.2.2 The whole body will be frisked (see illustration) at a rate not to exceed 3 inches per second. Due to the delicate nature of the probe face, care must be taken to avoid coming in contact with rough surfaces or sharp objects that could cause damage.

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Procedure: REC-WP-3-02

Title: Personnel Radiation Survey (Frisking)

- 5.2.3 Listen for a change in the audible count rate and observe for changes in needle deflection.
- 5.2.4 If contamination is detected, step away from the meter and notify the Recon Radiation Safety Officer or designee prior to any decontamination attempt.
- 5.2.5 Decontamination efforts will be taken prior to conducting another frisk.
- 5.2.6 Personal clothing or other articles that are unable to be decontaminated will not be allowed to leave the access control area and will be placed in appropriately marked containers.
- 5.2.7 Repeat sub-steps 5.2.1, 5.2.2 and 5.2.3 as necessary.
- 5.2.8 After completing the frisk wash face and hands and sign out on the Access Control Log.

## **6.0 REFERENCES**

Radiation Health and Safety Plan, Attachment 4 (Access Control Log)

## **7.0 ATTACHMENTS**

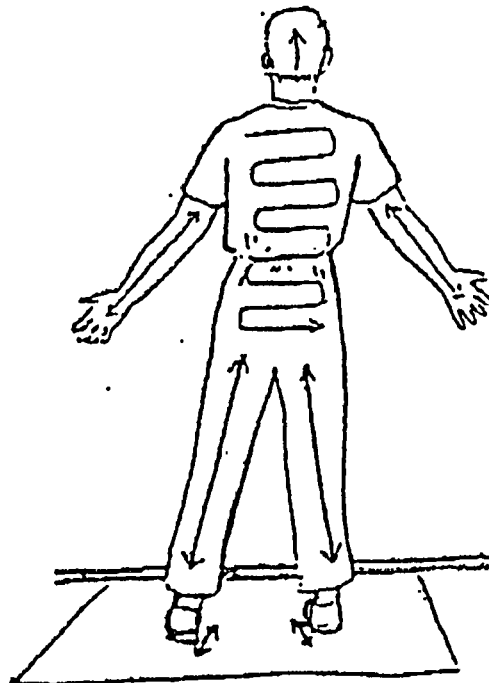
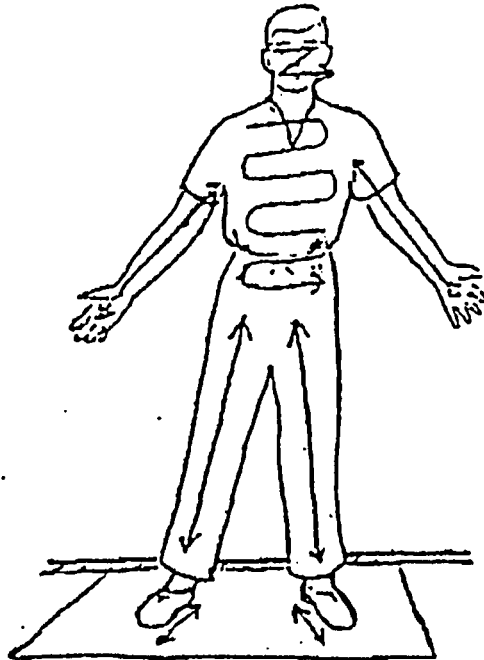
Max Scott Illustration of Frisking Techniques

**Max Scott Illustration of Frisking Techniques**

## ATTACHMENT A

### PROTOCOL FOR SURVEYING PERSONNEL FOR CONTAMINATION

- (1) Have a person stand on a step-off pad.
- (2) Instruct the person to stand straight, feet spread slightly, arms extended with palms up and fingers straight out.
- (3) Monitor both hands and forearms to the elbow palms up, then repeat with hands and arms turned over.
- (4) Starting at the top of the head, cover the entire front of the body, monitoring carefully the forehead, nose, mouth, neck line, torso, knees, and ankles.
- (5) Have the subject turn around, and repeat the survey on the back of the body.
- (6) Monitor the soles of the feet.



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PROCEDURE: REC-WP-3-03

**Entrance or Unrestricted Release Survey**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

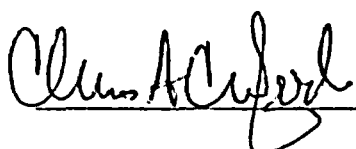
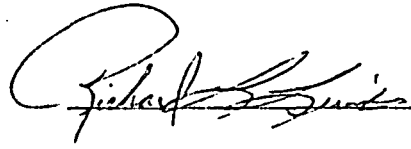
Date:

PROCEDURE: REC-WP-3-03

**Entrance or Unrestricted Release Survey**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3-29-04  3/29/04

Prepared by: Date: Quality Control Supervisor: Date:



# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
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Procedure: REC-WP-3-03

Title: Entrance or Unrestricted Release Survey

## 1.0 PURPOSE

The purpose of this procedure is to provide written instruction for the collection of removable alpha/beta surface contamination samples and to survey fixed beta/gamma contamination.

## 2.0 DEFINITIONS

*Swipe:* A cloth or paper disc that is wiped on the surface of an area or object being surveyed. Also referred to as a *smear*.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Ensure the area surveyed by the swipe is approximately 100 square centimeters (cm<sup>2</sup>).
- 3.2 Additional guidance on performing removable contamination surveys is provided in NUREG-1575.
- 3.3 Scanned tools or equipment exceeding limits will not be released.

## 4.0 EQUIPMENT

- 4.1 Swipes
- 4.2 Gloves (latex, nitrile, canvas, etc.)
- 4.3 Using appropriate instrument
- 4.4 Ludlum Model 2929 with 43-10-1 Detector

## 5.0 PROCEDURE

- 5.1 Label the swipe to ensure the result is associated with the proper area. Some swipes come with an adhesive-type back and are adhered to a cover paper with an area for labeling. These swipes are preferred.
- 5.2 Hold the swipe so that the collection area will contact the surface being surveyed.
- 5.3 Wipe the area to be surveyed over a 100 cm<sup>2</sup> area (about a 4-inch-by-4-inch area) in a back-and-forth motion. An alternate method is to wipe the surface using an "S" motion that is 9 inches from top to bottom and from side to side.
- 5.4 Close the cover of the swipe or place in an envelope or bag. Several swipes may be placed in one envelope or bag, depending on the potential for cross contamination.
- 5.5 Label the bag as appropriate.
- 5.6 Count on an appropriate counter (e.g., Ludlum Model 2929, et al.) utilizing appropriate procedures; or

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(281) 955-2442

Procedure: REC-WP-3-03

Title: Entrance or Unrestricted Release Survey

- 5.7 Log the swipe including the date, time taken, and results of the counting (if available) on Form REC-WP-3-05-1 and the Entrance / Unrestricted Form.
- 5.8 If counted per Step 5.6, convert the counts per minute result to disintegrations per minute (dpm)/100 cm<sup>2</sup> using the following equation:

$$\text{dpm}/100\text{cm}^2 = \frac{(c_s/t_s) - (c_b/t_b)}{E}$$

Where:

$c_s$  = counts recorded for sample  
 $c_b$  = counts recorded for background  
 $E$  = the detection efficiency of the instrument in counts per disintegration  
 $t_s$  = the time period (in minutes) over which the count was recorded for the sample  
 $t_b$  = the time period (in minutes) over which the count was recorded for the background sample

- 5.9 Fixed contamination is measured using appropriate instrument. Each selected survey location is scanned at the rate of 3 inches per second. The CPM will be documented for conversion to DPM on the appropriate form(s). The release limits for fixed contamination will be those of 10 CFR Part 835, Appendix D.

## 6.0 REFERENCES

- 6.1 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG/CR-1575, August 2000, Rev. 1.
- 6.2 Radiation Health and Safety Plan, Attachment 5 (Entrance/Unrestricted Release Form)
- 6.3 Radiation Health and Safety Plan, Attachment 6 (Release Limit Criteria)

## 7.0 ATTACHMENTS

Form REC-WP-3-05-1

Sample Log for Ludlum Model 2929 with a 43-10-1 Detector

**Form REC-WP-3-05-1**

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Houston, TX 77064  
(281) 955-2442

## Form REC-WP-3-05-1

### Sample Log for Ludlum Model 2929 with 43-10-1 Detector

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PROCEDURE: REC-WP-3-04

**Exposure Rate Surveys**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

Date:

PROCEDURE: REC-WP-3-04

**Exposure Rate Surveys**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Allen A. Cuford 3-29-04

Prepared by:

Date:

Richard L. Lewis 3/29/04

Quality Control Supervisor:

Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
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(281) 955-2442

Procedure: REC-WP-3-04

Title: Exposure Rate Surveys

## 1.0 PURPOSE

The purpose of this procedure to provide written instruction for measuring gamma exposure rate levels.

## 2.0 DEFINITIONS

*Background Exposure Rate:* A radiation exposure rate that occurs naturally in the environment. Background exposure rate would include exposure to cosmic radiation from outer space, terrestrial radiation from the radioactive elements in rocks and soil, and radiation from radon and its decay products in air.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 The instrument to be used must pass the preoperational checks as outlined in Procedure REC-WP-2-01 and the appropriate instrument procedure.
- 3.2 Background measurements for land areas should be collected at locations which are unaffected by effluent releases (upwind and upstream) and other site operations (upgradient from disposal areas).
- 3.3 Locations of potential runoff from areas of surface contamination and locations that may have been affected or disturbed by nonsite activities should also be avoided.

## 4.0 EQUIPMENT

- 4.1 A Ludlum Model 19 $\mu$ R, or equivalent.

## 5.0 PROCEDURE

### 5.1 All Surveys

- 5.1.1 Complete the preoperational checks in accordance with Procedure REC-WP-2-01 and the appropriate instrument procedure.
- 5.1.2 Establish the background exposure rate for the area to be surveyed. Background is determined by measurements at locations on site or in the immediate vicinity of the site (out to several kilometers from the site boundary), which are unaffected by site operations. All measurements should be taken at approximately 1 meter above ground. Take measurements in accordance with Section 5.2.
- 5.1.3 To obtain an accurate background measurement, six to 10 measurements will be taken above unaffected areas and a confidence level of 95 percent determined to ensure accuracy. The equation for determining the number of samples is as follows:



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Procedure: REC-WP-3-04

Title: Exposure Rate Surveys

$$n_B = \left[ \frac{t_{95\%, df} * S_x}{0.2 * \bar{X}_B} \right]^2$$

Where:

- $n_B$  = Number of background measurements required
- $\bar{X}_B$  = Mean of initial background measurements
- $S_x$  = Standard deviation of background measurements
- $t_{95\%, df}$  = t Statistic for 95 percent confidence at  $df = n-1$  degrees of freedom, where  $n$  is the number of initial background data points. A table of t values is provided in Procedure ESC/HPM/M-2-1.

- 5.1.4 If the above calculation indicates that additional background measurements are needed, it is recommended that they be collected uniformly over the area, using the same methodology as that used for the initial measurements. The average background is then recalculated using all data points.

## 5.2 General Area Survey

- 5.2.1 Position the detector approximately 1 meter above the surface to be surveyed.
- 5.2.2 Listen for a change in audible response and watch for needle deflection on the analog readout.
- 5.2.3 Record result on Form REC-WP-3-01-1.

## 5.3 Contact Survey

- 5.3.1 Position the detector within one-quarter inch (0.6 centimeter [cm]) of the surface to be surveyed.
- 5.3.2 Listen for a change in the audible count rate and observe for changes in needle deflection.
- 5.3.3 Mark any areas of elevated activity, utilizing flagging tape or spray paint.
- 5.3.4 Record the results in the appropriate survey documentation (e.g., survey maps, Form REC-WP-3-01-1).

## 5.4 Scan Survey

- 5.4.1 Position instrument within 10 cm of the surface to be scanned.
- 5.4.2 Slowly move the instrument across the surface to be scanned at a rate of lateral motion not to exceed 0.5 meter per second.
- 5.4.3 Listen for a change in audible response and watch for needle deflection on the analog readout.
- 5.4.4 Mark any areas of elevated activity, as necessary and record the results on Form REC-WP-3-01-1.

## **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-3-04

Title: Exposure Rate Surveys

### **6.0 REFERENCES**

- 6.1 NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG/CR-1575, August 2000, Rev. 1.

### **ATTACHMENTS**

Form REC-WP-3-01-1

Survey Data Log

**Form REC-WP-3-01-1**

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-3-01-1**  
**Survey Data Log**

Instrument Model:	
Instrument S/N:	
Detector Model:	
Detector S/N:	

Date of Survey:	
Units of Measure:	$\mu\text{R/hr}$ / cpm
Radiation Detected:	$\beta$ $\gamma$
Calibration Due:	

[illegible]

Technician:	
Prepared By:	Date:
Reviewed By:	Date:

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PROCEDURE: REC-WP-3-05

**Removable Alpha and Beta/Gamma  
Contamination Surveys**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

Date:


PROCEDURE: REC-WP-3-05

## Removable Alpha and Beta/Gamma Contamination Surveys

Thorium Remediation Project  
Tulsa, Oklahoma

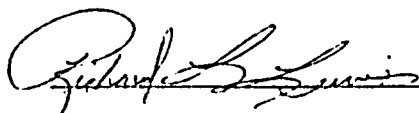
REVISION: 01

EFFECTIVE DATE: MARCH 2004

 3-29-04

Prepared by:

Date:

 3/29/04

Quality Control Supervisor:

Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-3-05

Title: Removable Alpha and Beta/Gamma  
Contamination Surveys

## 1.0 PURPOSE

The purpose of this procedure is to provide written instruction for the collection of removable alpha/beta structural surface contamination samples.

## 2.0 DEFINITIONS

*Swipe:* A cloth or paper disc that is wiped on the surface of an area or object being surveyed. Also referred to as a *smear*.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Ensure the area surveyed by the swipe is approximately 100 square centimeters (cm<sup>2</sup>).
- 3.2 Additional guidance on performing removable contamination surveys is provided in NUREG-1575.

## 4.0 EQUIPMENT

- 4.1 Swipes
- 4.2 Gloves (latex, nitrile, canvas, etc.)

## 5.0 PROCEDURE

- 5.1 Label the swipe to ensure the result is associated with the proper area. Some swipes come with an adhesive-type back and are adhered to a cover paper with an area for labeling. These swipes are preferred.
- 5.2 Hold the swipe so that the collection area will contact the surface being surveyed.
- 5.3 Wipe the area to be surveyed over a 100 cm<sup>2</sup> area (about a 4-inch-by-4-inch area) in a back-and-forth motion. An alternate method is to wipe the surface using an "S" motion that is 9 inches from top to bottom and from side to side, both methods are approved for proper collection of samples.
- 5.4 Close the cover of the swipe or place in an envelope or bag, as long as there is no potential for cross contamination.
- 5.5 Label the bag as appropriate.
- 5.6 Count on an appropriate counter (e.g., Ludlum Model 2929, et al.) utilizing appropriate procedure, REC-WP-2-07.
- 5.7 On selected samples we will complete a COC and submit to the selected laboratory for analysis.
- 5.8 Log the swipe including the date, time taken, and results of the counting (if available) on Form REC-WP-3-05-1 and Attachment 7 "Area Survey Form" found in the Radiation Health and Safety Plan.
- 5.9 If counted per Step 5.6, convert the counts per minute result to disintegrations per minute (dpm)/100 cm<sup>2</sup> using the following equation:



# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-3-05

Title: Removable Alpha and Beta/Gamma  
Contamination Surveys

$$\text{dpm}/100\text{cm}^2 = \frac{(c_s/t_s) - (c_b/t_b)}{E}$$

Where:

$c_s$  = counts recorded for sample

$c_b$  = counts recorded for background

$E$  = the detection efficiency of the instrument in counts per disintegration

$t_s$  = the time period (in minutes) over which the count was recorded for the sample

$t_b$  = the time period (in minutes) over which the count was recorded for the background sample

## 6.0 REFERENCES

6.1 Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG/CR-1575, August 2000, Rev. 1.

6.2 Radiation Health and Safety Plan Attachment 7 (Area Survey Form)

## 7.0 ATTACHMENTS

Form REC-WP-3-05-1

Sample Log for Ludlum Model 2929 with a 43-10-1 Detector

**Form REC-WP-3-05-1**

Form REC-WP-3-05-1  
Removable Alpha Beta/Gamma Survey Sample Log Detector

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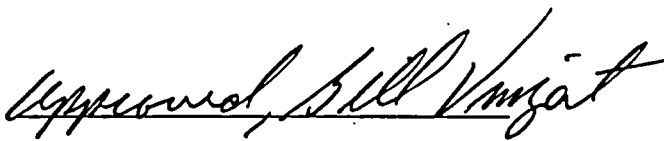
22

PROCEDURE: REC-WP-4-01

**Surface Soil Sampling**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004



J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

Date:

PROCEDURE: REC-WP-4-01

**Surface Soil Sampling**  
Thorium Remediation Project  
Tulsa, Oklahoma


REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3/29/04

Prepared by:

Date:

 3/29/04

Quality Control Supervisor:

Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-01  
Title: Surface Soil Sampling

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for the collection of surface soil samples.

## 2.0 DEFINITIONS

*Chain of Custody:* An unbroken trail of accountability that ensures the physical security of samples, data, and records.

## 3.0 PREREQUISITES PRECAUTIONS/LIMITATIONS

- 3.1 Surface soil contamination criteria specify the average concentration in the upper 15 centimeters (cm) (6 inches) of soil. For this reason, care must be used to ensure that surface soil samples are collected only from the upper 15 cm of soil.
- 3.2 Check the applicable health and safety guidance for the site to be sampled. Ensure the proper protocol and other precautions delineated in the appropriate documents (e.g., Environmental Health and Safety Plan, Radiation Health and Safety Plan, Safe Work Permit, etc.) are followed.
- 3.3 Additional guidance on performing soil sampling surveys is provided in NUREG-1575.

## 4.0 EQUIPMENT

- 4.1 Garden trowel, spoon, or shovel
- 4.2 Plastic bags and twist ties or "ziplock"-type bags, or equivalent sample containers
- 4.3 Masking tape
- 4.4 Indelible marking pens
- 4.5 Sampling equipment cleaning supplies
- 4.6 Logbook or data sheets

## 5.0 PROCEDURE

### 5.1 Preparation

- 5.1.1 Remove rocks, vegetation, and other obstructions in the area selected for surface soil sampling.
- 5.1.2 Loosen the soil at the selected sampling locations to a depth of 15 cm (6 inches) using a trowel or other digging implement.
- 5.1.3 Prepare an appropriate sample container for sample collection. The laboratory that will receive the sample may specify a preferred sample container.
- 5.1.4 Label the container with indelible marker in accordance applicable guidance for the site.

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-01  
Title: Surface Soil Sampling

## 5.2 Collection

- 5.2.1 A surface soil sample will be taken at each sample point, for a given location at a depth of 15 cm (6 inches).
- 5.2.2 Collect an appropriate aliquot (e.g., approximately 1 kilogram) of soil and place it into the prepared container. Be sure that the soil is thoroughly mixed.
- 5.2.3 Record the sample identification, location, and any other pertinent information and complete a *chain of custody* in accordance to the laboratory instructions.
- 5.2.4 Clean the sampling tools, as necessary, prior to proceeding to the next sample collection point.

## 6.0 REFERENCES

NA

## 7.0 ATTACHMENT

NA



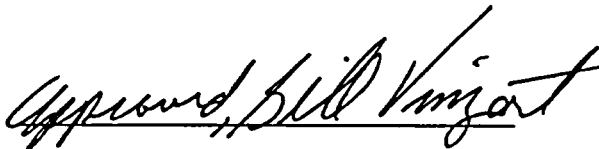
23

PROCEDURE: REC-WP-4-02

**Air Sampling**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004



J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

Date:

PROCEDURE: REC-WP-4-02

**Air Sampling**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Chen A. Chou 3-25-04

Prepared by:

Date:

Richard B. Lewis 3/29/04

Quality Control Supervisor:

Date:

# **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-02

Title: Air Sampling

## **1.0 PURPOSE**

The purpose of this procedure is to provide instruction for the collection of air samples.

## **2.0 DEFINITIONS**

NA

## **3.0 PREREQUISITES PRECAUTIONS/LIMITATIONS**

- 3.1 Air samples are performed in specific work areas to determine the extent of the airborne radiological hazards, establish radiological protective measures/controls and control personnel exposure.
- 3.2 Check the applicable health and safety guidance for the site. Ensure the proper protocol and other precautions delineated in the appropriate documents (e.g., Environmental Health and Safety Plan, Radiation Health and Safety Plan, Safety Work Permit, etc.) are followed.
- 3.3 Additional guidance on performing air sampling is provided in NUREG-1575.

## **4.0 EQUIPMENT**

- 4.1 Air Sample Data Log (REC-WP-4-02-1) and Air Sampler Filter Envelope(s) (REC-WP-4-02-2).
- 4.2 Black ink pen (indelible)
- 4.3 Cellulose-ester filters or other appropriate filters
- 4.4 High Volume Sampler

## **5.0 PROCEDURE**

### **5.1 Preparation**

- 5.1.1 Obtain air sample envelope(s) and fill out with the appropriate information: Date, Serial Number, and Placement Location.
- 5.1.2 Load filter head with appropriate filter and start pump.
- 5.1.3 Record time meter flow rate on sample envelope form REC-WP-4-02-2.

### **5.2 Collection**

- 5.2.1 Record final pump stop time and ending flow rate on sample envelope.
- 5.2.2 Remove filter from sampling head and place in sample envelope.
- 5.2.3 Determine total elapsed time and enter on envelope and data log.

# **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-02

Title: Air Sampling

- 5.2.4 Multiply total elapsed time by the average flow rate to determine volume sampled in liters of cubic feet as appropriate and enter on envelope.
- 5.2.5 Place sample media on a planchet and insert in Ludlum Model 2929 and record results on REC-WP-3-05-1.

## **6.0 REFERENCES**

NA

## **7.0 ATTACHMENT**

Form REC-WP-3-05-1

Form REC-WP-4-02-1

Form REC-WP-4-02-2

Sample Log for Ludlum Model 2929 with a 43-10-1 Detector

Air Sampling Data Log

Air Sampling Envelope

**Form REC-WP-3-05-1**

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

## Form REC-WP-3-05-1

## Removable Alpha Beta/Gamma Contamination Survey Sample Log

[illegible]

**Form REC-WP-4-02-1**



Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Form REC-WP-4-02-1  
Air Sample Data Log

Date of Survey:				Ambient Conditions:		
Instrument Serial #:						
Calibration Due Date:						
BKG Counts:						
Placement Location	Flow Rate (lpm)	Pump Start Time	Pump Stop Time	Elapsed Time	Volume Collected	Comments
Prepared By:					Date:	
Reviewed By:					Date:	

**Form REC-WP-4-02-2**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-4-02-2**  
**Air Sample Envelope**

Date: \_\_\_\_\_ Sample # \_\_\_\_\_

Time On: \_\_\_\_\_ Sampler ID # \_\_\_\_\_

Time Off: \_\_\_\_\_ Total Min: \_\_\_\_\_

Flow: \_\_\_\_\_ Volume: \_\_\_\_\_

Technician: \_\_\_\_\_

Location: \_\_\_\_\_

Reason: \_\_\_\_\_

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PROCEDURE: REC-WP-4-03

**Storage Tank Water Sampling**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

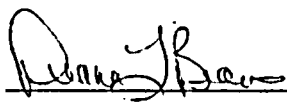

Date:

PROCEDURE: REC-WP-4-03

**Storage Tank Water Sampling**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

			
<u>3/29/04</u>	<u>3/29/04</u>		
Prepared by:	Date:	Quality Control Supervisor:	Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-03

Title: Storage Tank Water Sampling

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for the collection of water samples from the temporary storage tanks prior to discharge into the City of Tulsa Sanitary Sewer System.

## 2.0 DEFINITIONS

*Chain of Custody:* An unbroken trail of accountability that ensures the physical security of samples, data, and records.

## PREREQUISITES PRECAUTIONS/LIMITATIONS

- 2.1 All liquid samples collected will be handled as radioactive liquids until analyzed as being non-radioactive.
- 2.2 Liquids which are suspected to have come into contact with contaminated items or liquids found in controlled areas with unknown history will be analyzed.
- 2.3 Samples will be analyzed to meet the requirements as specified in the City of Tulsa Ordinance 19991 and with the requirements set by 10 CFR Part 20 (Standards for the Protection Against Radiation).

## 3.0 EQUIPMENT

- 3.1 Sample containers
- 3.2 Black ink pen (indelible)
- 3.3 Absorbent towels
- 3.4 Plastic bags
- 3.5 Chain of Custody

## 4.0 PROCEDURE

### 4.1 Preparation

- 4.1.1 Obtain 1 gallon sample container (supplied by laboratory), indelible marker, absorbent towels and plastic bags.
- 4.1.2 Mark sample container with location, time, date and name of person collecting sample.

### 4.2 Collection

- 4.2.1 Fill container by submerging sample container into the liquid to be sampled. Replace cap and seal with tape across top of container and cap.

# **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-4-03

Title: Storage Tank Water Sampling

- 4.2.2 Wipe off container and place container in plastic bag along with used absorbent towels and seal bag. Place a second bag over the first.
- 4.2.3 Complete chain of custody.
- 4.2.4 Transportation of samples to the laboratory for analysis shall be done by Recon or a laboratory technician.

## **5.0 REFERENCES**

5.1 City of Tulsa Ordinance 19991

5.2 10 CFR Part 20 (Standards for the Protection Against Radiation)

## **ATTACHMENT**

Chain of Custody Record



## **Chain of Custody Report**

**311 North Aspen**  
**Broken Arrow, OK 74012**  
**Phone: (918) 251-2515**  
**Fax: (918) 251-0008**

## CONTACT

ADDRESS

CITY

STATE

ZIP

PHONE

**FAX**

**BILL TO:**

## CONTACT

ADDRESS

CITY

STATE

ZIP

PHONE

FAX

### CHAIN OF CUSTODY RECORD

PROJECT NO.

PROJECT NAME

TURNAROUND TIME

## SAMPLER

(SIGNATURE)

● ● ● ● ● ● ● ● ● ●

**COMMENTS**

REND 13-63 H°

141

TIME

RECEIVED

WINDMILLER

DATE 1961

## RESULTS

**REPORT**

158

**TIME**

**REVENUE**

## NEEDS-DRIVEN

**NAME**

157707

REMARKS:

25

PROCEDURE: REC-WP-5-01

**Check Source Accountability**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

  
J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

Date:

PROCEDURE: REC-WP-5-01

**Check Source Accountability**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Alan A. C. [Signature] 3-29-04  
Prepared by: Date:

[Signature] 3/29/04  
Quality Control Supervisor: Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-5-01

Title: Check Source Accountability

## 1.0 PURPOSE

The purpose of this procedure is to ensure that the check sources that are used for daily instrument checks are kept under positive control.

## 2.0 DEFINITIONS

*Positive control:* The ensurement that access to sources is restricted.

*Check source:* Sources of radiation that are used to periodically assure the operation of calibrated instruments.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 This procedure is only to be implemented on sealed sources that do not fall under the exempt quantities limits set by 10 Code of Federal Regulations (CFR) 39.35.
- 3.2 Sealed sources that only emit alpha particles require leak testing every 3 months.
- 3.3 Sealed sources that are neutron, beta, gamma, or a combined alpha emitter require leak testing every 6 months.
- 3.4 It is recommended that the surveying individuals handling the sealed source wear surgeons' gloves or forceps. The natural oils that are released by the human body can, over time, degrade the finish of the electroplated isotopes. Also, a build up of oil may cause inaccuracy when using the sealed sources as check sources.

## 4.0 EQUIPMENT

- Smears or Swipes
- Dionized (DI) water
- Sample containers
- Appropriate instrumentation (i.e., gas proportional)
- Surgical gloves
- Forceps

## 5.0 PROCEDURE

### 5.1 Accountability

- 5.1.1 All check sources that are to be used for instrument calibration shall be kept under positive control by the on-site employee(s) of Remedial Construction Services, L.P. (Recon). Positive control on location includes locking up sources in storage locker when not in use. Recon will maintain documentation when check sources are used for calibration checks, and supervision of the check source when it is being used.

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-5-01

Title: Check Source Accountability

## 5.2 Leak Testing

### 5.2.1 Establish Background

- 5.2.1.1 Background will be established by following the guidance provided by the manufacturer. Recon will use a blank swipe for determining background. This will ensure that the counting of the surveys contains the same geometry as the background counting.

### 5.2.2 Surveying Sealed Sources

- 5.2.2.1 Record all information on form REC-WP-3-05-1 that accompanies each particular sealed source (i.e., serial number, isotope, origin date, responsible person, decay method, date, time, and survey interval).
- 5.2.2.2 The survey is done by swiping all edges, seams, and openings where it may be possible for the sealed source to "leak" or breakdown.
- 5.2.2.3 Only one swipe is usually required per source. However, this may vary due to the physical dimensions of some particular sources.
- 5.2.2.4 After swiping is complete, each swipe is placed in a labeled sample container until it is counted on model 2929 with a 43-10-1 detector to ensure that the source has retained its physical integrity.
- 5.2.2.5 Record all information obtained from counting the swipes REC-WP-3-05-1.
- 5.2.2.6 If elevated readings are obtained from performing a survey on a sealed source the survey may be performed again. If the surveyor is confident that the initial results are accurate then the source must be disposed of in accordance with Nuclear Regulatory Commission guidelines for the disposal of that particular isotope.

## 6.0 REFERENCES

- 6.1 10 CFR 39.35, "Leak Testing of Sealed Screens"

## 7.0 ATTACHMENTS

Form REC-WP-3-05-1

Sample Log for Ludlum 2929 with a 43-10-1 Detector

**Form REC-WP-3-05-1**



**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

## Form REC-WP-3-05-1

### Sample Log for Ludlum Model 2929 with 43-10-1 Detector

Instrument Model:	2929
Instrument S/N:	
Detector Model:	43-10-1
Detector S/N:	
Calibration Due:	

Source S/N:	N/A	N/A
Source Amount	N/A	N/A
Radiation Detected:	Alpha	Beta
Acceptable Range:		
(Refer to REC-WP-2-01-1)		

[illegible]

Prepared By:	Date:
Reviewed By:	Date:

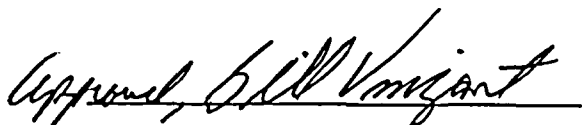
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PROCEDURE: REC-WP-6-01

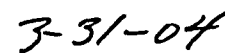
**Chain-of-Custody Procedures**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004



J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation



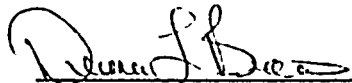
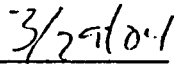

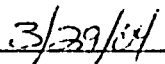
Date:

PROCEDURE: REC-WP-6-01

**Chain-of-Custody Procedures**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

			
Prepared by:	Date:	Quality Control Supervisor:	Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-6-01

Title: Chain-of-Custody Procedures

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for filling out the necessary chain-of-custody forms for sampling procedures.

## 2.0 DEFINITIONS

*Chain of Custody:* An unbroken trail of accountability that ensures the physical security of samples, data, and records.

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

3.1 A chain of custody must be filled out before relinquishing control of the sample.

3.2 Exert positive control of radioactive or potentially radioactive samples. Samples shall not be left unattended at any time.

## 4.0 EQUIPMENT

4.1 Chain-of-Custody Forms

## 5.0 PROCEDURE

### 5.1 Laboratory Chain of Custody

- Project name.
- Project number.
- Sampler – Name of person taking the sample (printed and signed).
- Relinquished by – Name of person giving up custody (printed and signed).
- Date and time – Enter date and time that the sample was turned over to a new custodian.
- Received by – Name of person taking custody (printed and signed).
- Date and time – Enter date and time that the sample was received from the old custodian.
- Enter the client sample identification number.
- Date and time – Enter date and time that the sample was taken.
- Enter the matrix type.
- Enter the number of containers.
- Enter container size and type – either plastic or glass.
- List what preservatives (if any) were used. If none, then list "NA".
- List any remarks that are pertinent to the samples being analyzed.
- Enter the address of the party receiving the results.
- Enter the address of the party responsible for the billing.
- Enter requested turnaround time.
- Verify information on the sample container is the same as on the chain-of-custody form.

## 6.0 REFERENCES

NA

## **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: **REC-WP-6-01**

Title: **Chain-of-Custody Procedures**

### **7.0 ATTACHMENTS**

Outreach Technologies, Inc.

Chain of Custody Record

### **Chain of Custody Record**

311 North Aspen  
Broken Arrow, OK 74012  
Phone: (918) 251-2515  
Fax: (918) 251-0008

**FAX**

FAX

CHAIN OF CUSTODY RECORD

PROJECT NO.

PROJECT NAME

TURNAROUND TIME

## SAMPLER

(SIGNATURE)

100-1-2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100-101-102-103-104-105-106-107-108-109-110-111-112-113-114-115-116-117-118-119-120-121-122-123-124-125-126-127-128-129-130-131-132-133-134-135-136-137-138-139-140-141-142-143-144-145-146-147-148-149-150-151-152-153-154-155-156-157-158-159-160-161-162-163-164-165-166-167-168-169-170-171-172-173-174-175-176-177-178-179-180-181-182-183-184-185-186-187-188-189-190-191-192-193-194-195-196-197-198-199-200-201-202-203-204-205-206-207-208-209-210-211-212-213-214-215-216-217-218-219-220-221-222-223-224-225-226-227-228-229-230-231-232-233-234-235-236-237-238-239-240-241-242-243-244-245-246-247-248-249-250-251-252-253-254-255-256-257-258-259-260-261-262-263-264-265-266-267-268-269-270-271-272-273-274-275-276-277-278-279-280-281-282-283-284-285-286-287-288-289-290-291-292-293-294-295-296-297-298-299-300-301-302-303-304-305-306-307-308-309-310-311-312-313-314-315-316-317-318-319-320-321-322-323-324-325-326-327-328-329-330-331-332-333-334-335-336-337-338-339-340-341-342-343-344-345-346-347-348-349-350-351-352-353-354-355-356-357-358-359-360-361-362-363-364-365-366-367-368-369-370-371-372-373-374-375-376-377-378-379-380-381-382-383-384-385-386-387-388-389-390-391-392-393-394-395-396-397-398-399-400-401-402-403-404-405-406-407-408-409-410-411-412-413-414-415-416-417-418-419-420-421-422-423-424-425-426-427-428-429-430-431-432-433-434-435-436-437-438-439-440-441-442-443-444-445-446-447-448-449-450-451-452-453-454-455-456-457-458-459-460-461-462-463-464-465-466-467-468-469-470-471-472-473-474-475-476-477-478-479-480-481-482-483-484-485-486-487-488-489-490-491-492-493-494-495-496-497-498-499-500-501-502-503-504-505-506-507-508-509-510-511-512-513-514-515-516-517-518-519-520-521-522-523-524-525-526-527-528-529-530-531-532-533-534-535-536-537-538-539-540-541-542-543-544-545-546-547-548-549-550-551-552-553-554-555-556-557-558-559-560-561-562-563-564-565-566-567-568-569-570-571-572-573-574-575-576-577-578-579-580-581-582-583-584-585-586-587-588-589-590-591-592-593-594-595-596-597-598-599-600-601-602-603-604-605-606-607-608-609-610-611-612-613-614-615-616-617-618-619-620-621-622-623-624-625-626-627-628-629-630-631-632-633-634-635-636-637-638-639-640-641-642-643-644-645-646-647-648-649-650-651-652-653-654-655-656-657-658-659-660-661-662-663-664-665-666-667-668-669-670-671-672-673-674-675-676-677-678-679-680-681-682-683-684-685-686-687-688-689-690-691-692-693-694-695-696-697-698-699-700-701-702-703-704-705-706-707-708-709-710-711-712-713-714-715-716-717-718-719-720-721-722-723-724-725-726-727-728-729-730-731-732-733-734-735-736-737-738-739-740-741-742-743-744-745-746-747-748-749-750-751-752-753-754-755-756-757-758-759-760-761-762-763-764-765-766-767-768-769-770-771-772-773-774-775-776-777-778-779-780-781-782-783-784-785-786-787-788-789-790-791-792-793-794-795-796-797-798-799-800-801-802-803-804-805-806-807-808-809-810-811-812-813-814-815-816-817-818-819-820-821-822-823-824-825-826-827-828-829-830-831-832-833-834-835-836-837-838-839-840-841-842-843-844-845-846-847-848-849-850-851-852-853-854-855-856-857-858-859-860-861-862-863-864-865-866-867-868-869-870-871-872-873-874-875-876-877-878-879-880-881-882-883-884-885-886-887-888-889-890-891-892-893-894-895-896-897-898-899-900-901-902-903-904-905-906-907-908-909-910-911-912-913-914-915-916-917-918-919-920-921-922-923-924-925-926-927-928-929-930-931-932-933-934-935-936-937-938-939-940-941-942-943-944-945-946-947-948-949-950-951-952-953-954-955-956-957-958-959-960-961-962-963-964-965-966-967-968-969-970-971-972-973-974-975-976-977-978-979-980-981-982-983-984-985-986-987-988-989-990-991-992-993-994-995-996-997-998-999-1000-1001-1002-1003-1004-1005-1006-1007-1008-1009-1010-1011-1012-1013-1014-1015-1016-1017-1018-1019-1020-1021-1022-1023-1024-1025-1026-1027-1028-1029-1030-1031-1032-1033-1034-1035-1036-1037-1038-1039-10

ANALYSIS REQUEST

**COMMENTS**

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REMARKS:



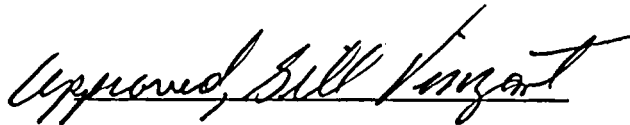
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PROCEDURE: REC-WP-7-01

**Discharging Water From Holding Tanks**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004



J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

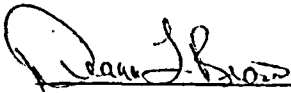
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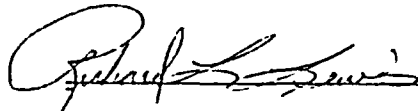
PROCEDURE: REC-WP-7-01

**Discharging Water From Holding Tanks**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3/29/04  
Prepared by: Date:

 3/29/04  
Quality Control Supervisor: Date:

# **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-01

Title: Discharging Water from Holding Tanks

## **1.0 PURPOSE**

The purpose of this procedure is to provide instruction for discharging water to the City of Tulsa Sanitary Sewer System.

## **2.0 DEFINITIONS**

NA

## **3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS**

- 3.1 Sample results will be verified to be below criteria set by the City of Tulsa, Ordinance 19991 and the requirements and limitations set by 10 CFR Part 20, Standards for the Protection Against Radiation.

## **4.0 EQUIPMENT**

- 4.1 Black Pen
- 4.2 Form REC-WP-7-01-1 "Discharge to Sanitary Sewer Log"

## **5.0 PROCEDURE**

### **5.1 Discharging Water**

- 5.1.1 Analytical results will be sent to the City of Tulsa, Public Works Department, Environmental Compliance Division via e-mail or fax for approval to discharge.
- 5.1.2 Upon receipt of approval to discharge from the City of Tulsa, Public Works Department, Environmental Compliance Division, the Field Supervisor will be notified that approval has been given to discharge.
- 5.1.3 Record date, time and previous gross total of flow meter on form REC-WP-7-01-1.
- 5.1.4 Open flow regulator valve all the way.
- 5.1.5 Confirm tank identification to be discharged from.
- 5.1.6 Place suction hose into tank to be discharged.
- 5.1.7 Check pump and fill out Equipment Inspection Form prior to starting.
- 5.1.8 Start pump.
- 5.1.9 Ensure pump has been primed and has begun to discharge.
- 5.1.10 Return to flow meter and regulator valve, confirm flow is within approved City of Tulsa, Public Works Department, Environmental Compliance Division requirements and working properly.
- 5.1.11 Periodically check system to ensure proper flow is being maintained, record flow rate on REC-WP-7-01-1.
- 5.1.12 When discharge is complete shut pump off.

## **6.0 REFERENCES**

City of Tulsa Ordinance 19991  
10 CFR Part 20, Standards for the Protection Against Radiation

## **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: **REC-WP-7-01**

Title: **Discharging Water from Holding Tanks**

### **7.0 ATTACHMENTS**

Form REC-WP-7-01-1

Discharge to Sanitary Sewer Log

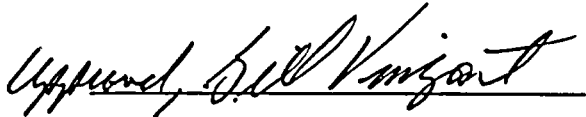
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PROCEDURE: REC-WP-7-02

**Excavation**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004



J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation



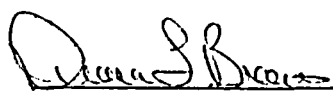

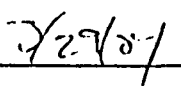
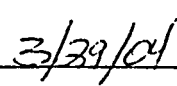
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PROCEDURE: REC-WP-7-02

**Excavation**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

	
Prepared by:	Quality Control Supervisor:
	
Date:	Date:



# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-02

Title: Excavation

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for Excavation.

## 2.0 DEFINITIONS

N/A

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Review Safe Work Permit (SWP) for safe work practices.
- 3.2 All excavation activities will be conducted in accordance with Occupational Health and Safety Administration (OSHA) guidelines.
- 3.3 Review appropriate specifications for activity.
- 3.4 Only qualified operators will be allowed to operate equipment.

## 4.0 EQUIPMENT

- 4.1 Excavator(s)
- 4.2 Dozer(s)
- 4.3 Articulated Dump Truck(s)
- 4.4 Skid Steer(s)
- 4.5 Front End Loader(s)

## 5.0 PROCEDURE

### 5.1 Excavation

- 5.1.1 Check equipment and fill out Equipment Inspection Form.
- 5.1.2 Inspect work area; be aware of any above or below ground utility locations, environmental hazards and indigenous biological hazards.
- 5.1.3 All topsoil and subsoil will be excavated as required by the Project Specifications and the Decommissioning Plan and Decommissioning Plan Addendum for remediation activities.
- 5.1.4 Unsuitable material (debris) encountered during excavation will go into a separate stockpile to be either decontaminated and loaded into roll off boxes for offsite disposal at an approved disposal facility or loaded onto a rail car for disposal at the U.S. Ecology disposal facility.
- 5.1.5 Begin excavation as described in section I.A.6.2 of the Work Plan.
- 5.1.6 Operator will load excavated material into articulated dump truck(s) to be transported to appropriate area i.e.: drying area, above criteria (Th-232>31.1 pCi/g net) stockpile or below criteria (Th-232 <31.1 pCi/g net) stockpile as described in section I.A.6.2 of the Work Plan. Material will be loaded in articulated dump truck(s) so that spillage will be kept to the very minimum so as not to spread contamination within the excavated area or en-route to the above mentioned areas.
- 5.1.7 Water that accumulates in the excavation area will be pumped into weir tanks as described in section I.A.5.3 of the Work Plan.

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-02

Title: Excavation

- 5.1.8 Excavation will continue until all soil with concentrations greater than Th-232 3 pCi/g net above background is removed. Verification samples will be collected in accordance with procedure REC-WP-4-01 Surface Soil Sampling.

## 5.2 Stockpile Construction

- 5.2.1 Above and below criteria stockpiles will be located as approved by the Owner or designee.
- 5.2.2 Stockpiles will be built in accordance with section 02220 of the Project Specifications and the Decommissioning Plan and Decommissioning Plan Addendum.
- 5.2.3 Material shall be dumped in the stockpile area and spread in even layers as the stockpile is built.
- 5.2.4 A water truck or other effective means will be utilized to control dust.

## 6.0 REFERENCES

Project Specifications, Decommissioning Plan and Decommissioning Plan Addendum.  
Occupational Health and Safety Administration  
Recon Work Plan

## 7.0 ATTACHMENTS

Equipment Inspection Form

**Equipment Inspection Form**

# Equipment Inspection Form

Thorium Remediation Project  
Tulsa, Oklahoma

Job # \_\_\_\_\_

Name: \_\_\_\_\_

Daily Equipment Check List			Remarks	Hours Last Serviced
Date				Please note the hour reading recorded on the oil, air, fuel and hydraulic filters on the equipment.
Equipment				
Operator				
Hour Meter				
Start				
End				
Fluids Check List				
	Ok	Add		
Fuel Grease				
Oil				
Brake/Hydraulic				
Water				
Transmission				
Equipment Condition				
	Ok	Repair		
Glass				
Horn				
Lights				
Mirrors				
Seat Belt				
Step/Ladder				
Travel Alarm				
Wipers				
Tires				
Belts				
Air Filter				
Fuel Leaks				
Oil Leaks				
Hyd. Cylinders				
Steering				
Brakes				
Hoses				
Fire Extinguisher				

Comments

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29

PROCEDURE: REC-WP-7-03

**Backfill**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

3-31-04

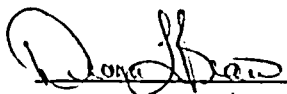
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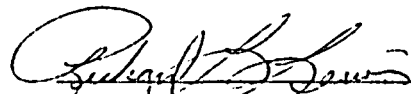
PROCEDURE: REC-WP-7-03

**Backfill**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

 3/29/04  
Prepared by: Date:

 3/29/04  
Quality Control Supervisor: Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-03

Title: Backfill

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for Backfill operations.

## 2.0 DEFINITIONS

N/A

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Review Safe Work Permit (SWP) for safe work practices.
- 3.2 Review appropriate specifications for activity.
- 3.3 Only qualified operators will be allowed to operate equipment.
- 3.4 All clean offsite material will be characterized for existing radiological and chemical quality as required by the specifications before any material is brought onsite.
- 3.5 Clean offsite backfill material and topsoil will be analyzed for soil classification as required by the specifications. Verified results will be submitted to the engineer prior to the material being brought onsite.

## 4.0 EQUIPMENT

- 4.1 Excavator(s)
- 4.2 Dozer(s)
- 4.3 Articulated Dump Truck(s)
- 4.4 Compactor(s)
- 4.5 Front End Loader(s)
- 4.6 Water Truck(s)

## 5.0 PROCEDURE

### 5.1 Backfill

- 5.1.1 Check equipment and fill out Equipment Inspection Form.
- 5.1.2 Once analytical verification and Final Status Survey clearance has been obtained backfill operations will begin using below criteria material or clean offsite material.
- 5.1.3 Place below criteria or clean offsite material in 8 inch lifts and compact as required by section 02220 of the specifications.
- 5.1.4 Geotechnical subcontractor will perform in place compaction tests as required in section 02220 of the Specifications to verify each lift has met compaction requirements per section 02220 of the Specifications. Test results will be submitted to the engineer within 24 hours of the time the tests were taken as required. Below criteria material will be radiologically surveyed for each 2 foot lift placed.
- 5.1.5 Approval from engineer or designee will be obtained before placing each lift.
- 5.1.6 Repeat steps 5.1.4 thru 5.1.6 until backfill area is at the lines and grades indicated on Figure 7 of the Contract Drawings or as directed by the engineer.



## **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-03

Title: Backfill

- 5.1.7 Six inches of topsoil will be placed and fine graded to within the tolerances as specified in section 02220 of the specifications.
- 5.1.8 All clean offsite material will be delivered to the site by dump trucks. All drivers will go through the site specific safety training as per the Recon Radiation and Environmental Health and Safety Plan requirements.
- 5.1.9 Dump trucks will remain on non-contaminated surfaces at all times.

### **6.0 REFERENCES**

Project Specifications, Decommissioning Plan and Decommissioning Plan Addendum.  
Recon Radiation Health and Safety Plan  
Recon Environmental Health and Safety Plan

### **7.0 ATTACHMENTS**

Equipment Inspection Form

**Equipment Inspection Form**

# Equipment Inspection Form

Thorium Remediation Project  
Tulsa, Oklahoma

Job # \_\_\_\_\_

Name: \_\_\_\_\_

Daily Equipment Check List			Remarks	Hours Last Serviced
Date				Please note the hour reading recorded on the oil, air, fuel and hydraulic filters on the equipment.
Equipment				
Operator				
Hour Meter				
Start				
End				
Fluids Check List				
	Ok	Add		
Fuel Grease				
Oil				
Brake/Hydraulic				
Water				
Transmission				
Equipment Condition				
	Ok	Repair		
Glass				
Horn				
Lights				
Mirrors				
Seat Belt				
Step/Ladder				
Travel Alarm				
Wipers				
Tires				
Belts				
Air Filter				
Fuel Leaks				
Oil Leaks				
Hyd. Cylinders				
Steering				
Brakes				
Hoses				
Fire Extinguisher				

Comments

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30

PROCEDURE: REC-WP-7-04

**Loading Vibrating Screen**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

Date:

PROCEDURE: REC-WP-7-04

**Loading Vibrating Screen**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Alvin A. Craig 3-29-04  
Prepared by: Date:

Richard E. Lewis 3/29/04  
Quality Control Supervisor: Date:

# **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-04

Title: Loading Vibrating Screen

## **1.0 PURPOSE**

The purpose of this procedure is to provide instruction for Loading Vibrating Screen.

## **2.0 DEFINITIONS**

N/A

## **3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS**

- 3.1 Review Safe Work Permit (SWP) for safe work practices.
- 3.2 Stockpile will be located so that feeding of the vibrating screen can be implemented with an excavator.
- 3.3 Only qualified operators will be allowed to operate equipment.

## **4.0 EQUIPMENT**

- 4.1 Vibrating Screen
- 4.2 Excavator
- 4.3 Skid Steer
- 4.4 Water Truck(s)

## **5.0 PROCEDURE**

- 5.1 Loading Vibrating Screen
  - 5.1.1 Check equipment and fill out Equipment Inspection Form prior to operating equipment.
  - 5.1.2 Excavator will begin feeding the vibrating screen and maintain a steady feed rate, belt speed can be adjusted on the vibrating screen to help maintain feed rate.
  - 5.1.3 The Vibrating Screen allows materials smaller than six inches to fall onto the vibrating screen conveyor and be transferred to the sorting conveyor.
  - 5.1.4 Material greater than six inches that won't pass through the vibrating screen (i.e. rocks, concrete, construction debris) will go into a separate stockpile to be either reprocessed, decontaminated and loaded into roll off boxes for offsite disposal at an approved disposal facility or loaded onto a rail car for disposal at the U.S. Ecology disposal facility.
  - 5.1.5 Water truck(s) or a misting system will be utilized to control dust.

## **6.0 REFERENCES**

N/A

## **7.0 ATTACHMENTS**

Equipment Inspection Form

## Equipment Inspection Form



# Equipment Inspection Form

Thorium Remediation Project  
Tulsa, Oklahoma

Job # \_\_\_\_\_

Name: \_\_\_\_\_

Daily Equipment Check List			Remarks	Hours Last Serviced
Date				Please note the hour reading recorded on the oil, air, fuel and hydraulic filters on the equipment.
Equipment				
Operator				
Hour Meter				
Start				
End				
Fluids Check List				
	Ok	Add		
Fuel Grease				
Oil				
Brake/Hydraulic				
Water				
Transmission				
Equipment Condition				
	Ok	Repair		
Glass				
Horn				
Lights				
Mirrors				
Seat Belt				
Step/Ladder				
Travel Alarm				
Wipers				
Tires				
Belts				
Air Filter				
Fuel Leaks				
Oil Leaks				
Hyd. Cylinders				
Steering				
Brakes				
Hoses				
Fire Extinguisher				

Comments

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31

PROCEDURE: REC-WP-7-05

**Loading Rail Cars**  
**Thorium Remediation Project**  
**Tulsa, Oklahoma**

REVISION: 00

EFFECTIVE DATE: MARCH 2004

*Approved, Bill Vinzant*

J. W. (Bill) Vinzant  
Kaiser Aluminum & Chemical Corporation

*3-31-04*

Date:

PROCEDURE: REC-WP-7-05

**Loading Rail Cars**  
Thorium Remediation Project  
Tulsa, Oklahoma

REVISION: 00

EFFECTIVE DATE: MARCH 2004

Richard D. Brown 3/27/04      Richard D. Brown 3/29/04  
Prepared by:                      Date:                      Quality Control Supervisor:                      Date:

# Work Plan Procedures Manual

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-05

Title: Loading Rail Cars

## 1.0 PURPOSE

The purpose of this procedure is to provide instruction for Loading Rail Cars.

## 2.0 DEFINITIONS

N/A

## 3.0 PREREQUISITES/PRECAUTIONS/LIMITATIONS

- 3.1 Review Safe Work Permit (SWP) for safe work practices.
- 3.2 Only qualified operators will be allowed to operate equipment.
- 3.3 Initial calibration will be conducted onsite by the manufacturers representative before scale is put into service. An object will be selected by the manufactures representative to perform daily checks. The object selected will be taken to a certified scale so that the weight of the object can be verified, this documentation will be kept onsite in Recon's project records. Re-calibration will be in accordance with the manufactures specifications.

## 4.0 EQUIPMENT

- 4.1 Front End Loader with a "LOADRITE model LD940" bucket scale and "LOADRITE model LD941 Data Module.
- 4.2 Water Truck(s)

## 5.0 PROCEDURE

- 5.1 Calibration of Bucket Scale
  - 5.1.1 A daily check will be done each day that rail cars are loaded to verify the bucket scale is within calibration. A Daily Bucket Scale Check Log (Form REC-WP-7-05-1) will be completed and become part of Recon's project records.
- 5.2 Loading Rail Cars
  - 5.2.1 Check equipment and fill out Equipment Inspection Form.
  - 5.2.2 Operator will input information into the LD940 data module i.e. ticket number, rail car number, project etc. Then proceed to designated stockpile, begin loading bucket, operator will be responsible for not overloading the bucket to avoid spillage during transport to the rail car. Operator will "ADD" bucket weight as described in LOADRITE Reference Manual and then proceed to rail car and deposit the bucket of material into the rail car. This step will be repeated until the rail car is loaded (98 - 100 tons).
  - 5.2.3 Once the rail car is loaded the operator will "Clear" as described in LOADRITE Reference Manual to produce ticket associated with the loaded rail car.
  - 5.2.4 Repeat steps 5.2.2 and 5.2.3 for each rail car that is loaded.
  - 5.2.5 Water truck(s) or a misting system or equivalent will be utilized to control dust.

## 6.0 REFERENCES

LOADRITE Reference Manual

## **Work Plan Procedures Manual**

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

Procedure: REC-WP-7-05

Title: Loading Rail Cars

### **7.0 ATTACHMENTS**

Equipment Inspection Form  
REC-WP-7-05-1

Daily Bucket Scale Check Log

**Equipment Inspection Form**

# Equipment Inspection Form

Thorium Remediation Project  
Tulsa, Oklahoma

Job # \_\_\_\_\_

Name: \_\_\_\_\_

Daily Equipment Check List			Remarks	Hours Last Serviced
Date				Please note the hour reading recorded on the oil, air, fuel and hydraulic filters on the equipment.
Equipment				
Operator				
Hour Meter				
Start				
End				
Fluids Check List				
	Ok	Add		
Fuel Grease				
Oil				
Brake/Hydraulic				
Water				
Transmission				
Equipment Condition				
	Ok	Repair		
Glass				
Horn				
Lights				
Mirrors				
Seat Belt				
Step/Ladder				
Travel Alarm				
Wipers				
Tires				
Belts				
Air Filter				
Fuel Leaks				
Oil Leaks				
Hyd. Cylinders				
Steering				
Brakes				
Hoses				
Fire Extinguisher				

Comments

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**Form REC-WP-7-05-1**

**Remedial Construction Services, L.P. (Recon)**  
**9720 Derrington**  
**Houston, TX 77064**  
**(281) 955-2442**

**Form REC-WP-7-05-1**  
**Daily Bucket Scale Verification Log**

[illegible]

Reviewed by: \_\_\_\_\_

A



## Form Numbers and Descriptions

### Thorium Remediation Project

Form No.	Title	Effective Date	Revision No.
REC-WP-2-01-1	PERFORMANCE CHECK VALUES	March 2004	00
REC-WP-2-02-1	MONTHLY STATIC MDC COUNT TIME CALCULATION	March 2004	00
REC-WP-2-02-2	MONTHLY BETA MDC COUNT TIME CALCULATION	March 2004	00
REC-WP-2-02-3	MONTHLY ALPHA MDC COUNT TIME CALCULATION	March 2004	00
REC-WP-2-02-4	MONTHLY GAMMA MDC COUNT TIME CALCULATION	March 2004	00
REC-WP-2-03-1	DAILY CHECK LOG LUDLUM 2224 W/ 43-93 DETECTOR	March 2004	00
REC-WP-2-04-1	DAILY CHECK LOG LUDLUM 3 W/ 43-93 DETECTOR	March 2004	00
REC-WP-2-05-1	DAILY CHECK LOG LUDLUM 19uR	March 2004	00
REC-WP-2-06-1	DAILY CHECK LOG LUDLUM 177 W/44-9 DETECTOR	March 2004	00
REC-WP-2-07-1	DAILY CHEK LOG LUDLUM 2929 W/43-10-1 DETECTOR	March 2004	00
REC-WP-2-08-1	DAILY CHECK LOG LUDLUM 2221 W/43-5 DETECTOR	March 2004	00
REC-WP-2-09-1	LOST OR DAMAGED DOSIMETER REPORT	March 2004	00
REC-WP-3-01-1	SURVEY DATA LOG	March 2004	00
REC-WP-3-05-1	REMOVABLE ALPHA BETA/GAMMA SURVEY SAMPLE LOG	March 2004	00
REC-WP-4-02-1	AIR SAMPLING DATA LOG	March 2004	00
REC-WP-4-02-2	AIR SAMPLING ENVELOPE	March 2004	00
REC-WP-7-01-1	DISCHARGE TO SANITARY SEWER LOG	March 2004	00
REC-WP-7-05-1	DAILY BUCKET SCALE VERIFICATION LOG	March 2004	00
NRC FORM 5	OCCUPATION DOSE RECORD FOR A MONITORING PERIOD	March 2004	00
	OUTREACH LABORATORY CHAIN OF CUSTODY	March 2004	00
	EQUIPMENT INSPECTION FORM	March 2004	00

B

**Form REC-WP-2-01-1**  
**Performance Check Values**

Project Number:		Project Name:	
Instrument Model:		Technician:	
Instrument S/N:		Date:	
Calibration Due:		Detector Model:	
Radiation Detected:		Detector S/N:	
Source Isotope & S/N:		Detector Type:	
Bkg Count Rate:			

Data Point	Gross Count	Net Count	DPM
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Average Net Count:		
Standard Deviation of Net Count (Scalers):		
20% of Net Count (Ratemeters):		
Average minus 2 X standard deviation (Scalers):		
Average plus 2 X standard deviation (Scalers):		
Average minus 20% (Ratemeters):		
Average plus 20% (Ratemeters):		

<b>Formulas</b>	
<p>Where: n = number of 1 min the counts (20)</p> <p><math>\bar{x}</math> = average of (20) 1 min counts</p> <p><math>x_i^2</math> = each count result squared</p>	$StdDev = \sqrt{\frac{n \sum_{i=1}^n x_i^2 - \left( \sum_{i=1}^n \bar{x}_i \right)^2}{n(n-1)}}$
Comments:	
Prepared By:	Date:
Reviewed By:	Date:

C

# Form REC-WP-2-02-1 Monthly Static MDC and Count Time Calculation

Instrument Serial Number: Detector Serial Number: Radiation Detected:	Cal. Due: Cal. Due:
---	------------------------

<div style="display: flex; justify-content: space-between;"> <div> <i>E<sub>i</sub></i> (Instrument Efficiency): (cpd)  <i>E<sub>s</sub></i> (Source Efficiency): (-)  <i>E<sub>tot</sub></i> (Total Efficiency): (cpd)            A (Active Probe Area): (cm<sup>2</sup>)         </div> <div style="text-align: right;"> <math display="block">MDC_{static} = \frac{3 + 3.29 \sqrt{B_r \cdot t_s \cdot (1 + \frac{t_s}{t_b})}}{t_s \cdot E_{tot} \cdot \frac{A}{100}}</math> </div> </div>
--

	D date	B background (counts)	t <sub>b</sub> background count time (min)	B <sub>r</sub> background count rate (cpm)	t <sub>s</sub> sample count time (min)	MDC <sub>static</sub> min. detectable concentration (dpm/100cm <sup>2</sup> )
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
Comments:						
Prepared By:					Date:	
Reviewed By:					Date:	

Notes:

- E<sub>tot</sub>* = *E<sub>i</sub>* x *E<sub>s</sub>*.
- Source Efficiency (*E<sub>s</sub>*) is also referred to as Contamination Source Efficiency or Surface Efficiency.
- E<sub>s</sub>* is equal to 0.25 for all alpha emissions and beta emissions with maximum energy between 0.15 and 0.4 Mev. For maximum beta energies > 0.4 MeV, *E<sub>s</sub>* is equal to 0.5.



D

Form REC-WP-2-02-2  
 Monthly Beta Scan MDC Calculation

Instrument Serial Number:	Cal. Due:
Detector Serial Number:	Cal. Due:
Radiation Detected: Beta	

E <sub>i</sub> (Instrument Efficiency):	(cpd)
E <sub>s</sub> (Source Efficiency):	(-)
E <sub>tot</sub> (Total Efficiency):	(cpd)
A (Active Probe Area):	(cm <sup>2</sup> )

$$MDC_{scan} = \frac{d' \sqrt{b_i} \sqrt{(60/i)}}{\sqrt{p} \cdot E_{tot} \cdot \frac{A}{100cm^2}}$$

	D date	b <sub>i</sub> background count rate (cpm)	I scan time (seconds)	p surveyor E (0.5 - 0.75) (-)	d' MARSSIM Table 6.5 (-)	MDC <sub>scan</sub> min. detectable concentration (dpm/100cm <sup>2</sup> )
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
Comments:						
Prepared By:					Date: .	
Reviewed By:					Date:	

Notes:

1. E<sub>tot</sub> = E<sub>i</sub> x E<sub>s</sub>.
2. Source Efficiency (E<sub>s</sub>) is also referred to as Contamination Source Efficiency or Surface Efficiency.
3. E<sub>s</sub> is equal to 0.25 for all alpha emissions and beta emissions with maximum energy between 0.15 and 0.4 Mev. For maximum beta energies > 0.4 MeV, E<sub>s</sub> is equal to 0.5.
4. p = surveyor efficiency, ranges from 0.5 to 0.75, 0.5 is conservative.
5. d' = desired performance variable (usually 1.38 corresponding to alpha and beta errors of 0.05).

E

Form REC-WP-2-02-3  
 Monthly Alpha Scan MDC Calculation

Instrument Serial Number:	Cal. Due:
Detector Serial Number:	Cal. Due:
Radiation Detected: Alpha	

Probability of observing 2 or more counts:

$$P(n \geq 2) = 1 - \left( 1 + \frac{(GE + B)d}{60v} \right) \left( e^{-\frac{(GE+B)d}{60v}} \right)$$

Probability of observing a single count:

$$P(n \geq 1) = 1 - e^{-\frac{GE d}{60v}}$$

	D date	G Activity (dpm)	d Detector Width (cm)	E Instrument Efficiency (cpm)	v Scan Speed (cm/s)	B Background Countrate (cpm)	P Probability (-)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
Comments:							
Prepared By:						Date:	
Reviewed By:						Date:	

Note:

1. Instrument efficiency is the 4p instrument efficiency.

#

Remedial Construction Services, L.P. (Recon)  
 9720 Derrington  
 Houston, TX 77064  
 (281) 955-2442

# Form REC-WP-2-02-4

## Gross Gamma Scan MDC Calculation

Instrument Serial Number:	Cal. Due:
Detector Serial Number:	Cal. Due:
Radiation Detected: Gamma	Type of Detector:

$$\text{MDCR} = \frac{d' \sqrt{b_i} (60 / i)}{\sqrt{p}}$$

$$\text{Scan MDC}_{\text{surveyor}} = \frac{d' \sqrt{b_i} (60 / i)}{\sqrt{p} \epsilon_i}$$

$$\text{Scan MDC} = \frac{d' \sqrt{b_i} (60 / i)}{\sqrt{p} \epsilon_i \text{ CF}}$$

D date	Radio- nuclide	b <sub>i</sub> background count rate (cpm)	E <sub>i</sub>	I scan time (seconds)	r surveyor E (0.5 - 0.75) (-)	d' MARSSIM Table 6.5 (-)	MDCR min. detectable count rate (cpm)	Scan MDC <sub>surveyor</sub> min. detectable concentration (mR/hr)	CF conversion factor (pCi/g / mR/hr)	Scan MDC min. detectable concentration (pCi/g)

Comments:	
Prepared By:	Date:
Reviewed By:	Date:

Notes:

CF = Conversion factor (Microshield/NUREG-1507).

ncpm = Net counts per minute.

mR/h = microRoentgen per hour.

E<sub>i</sub> = Instrument efficiency (from Table 6.7 of MARSSIM).

pCi/g = Picocuries per gram.

G

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281)955-2442

**Form REC-WP-2-03-1 Daily Check Log**  
**Ludlum Model 2224 with 43-93 Detector**

Instrument/SN: Ludlum Model 2224 /						Check Source(s) Used:					
Detector/SN: Model 43-93 /						Date Calculated:					
EFF % α =    %, β=    %		Total EFF % α =    %, β=    %				Calc. By: Alpha Beta					
CALIB. SOURCE USED: _____ DATE OF CALIB.: _____ CALIB. DUE DATE: _____ PERFORMED BY: _____						Comments:   					
TECHNICIAN'S NAME	ALPHA / BETA	DATE	TIME	background count time (minutes)	background counts	GROSS READING	NET READING	BATT. CHECK	NEEDS CALIB.		
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
	α										
	β										
Prepared By:							Date:				
Reviewed By:							Date:				



H

**(281) 955-2442**

### Daily Check Log for Ludlum Model 3 with 44-9 Detector

Source S/N:	
Source DPM:	
Radiation Detected:	Beta/Gamma
Acceptable Range:	
(Refer to REC-WP-2-01-1)	

Comments:	
Prepared By:	Date:
Reviewed By:	Date:

I

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC/WP-2-05-1**  
**Daily Check Log for Ludlum Model 19  $\mu$ R Meter**

Instrument Model:	19 $\mu$ R
Instrument S/N:	
Detector Model:	N/A
Detector S/N:	N/A
Calibration Due:	

Source S/N:	
Source DPM:	N/A
Radiation Detected:	Gamma
Acceptable Range: (Refer to REC-WP-2-01-1)	

[illegible]

Comments:

Prepared By:	Date:
Reviewed By:	Date:

J

**(281) 955-2442**

## Form REC-WP-2-06-1

### Daily Check Log for Ludlum Model 177 with 44-9 Detector

Instrument Model:	177
Instrument S/N:	
Detector Model:	44-9
Detector S/N:	
Calibration Due:	

Source S/N:	
Source DPM:	
Radiation Detected:	Beta/Gamma
Acceptable Range: (Refer to REC-WP-2-01-1)	

[illegible]

Comments:

Prepared By:

Date:

Reviewed By:

Date:

K

**Remedial Construction Services, L.P. (Recon)**  
9720 Dermington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-2-07-1**  
**Daily Check Log for Ludlum Model 2929 with a 43-10-1 Detector**

[illegible]



L

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281)955-2442

**Form REC-WP-2-08-1 Daily Check Log**  
**Ludlum Model 2221 with 43-5 Detector**

Instrument/SN: Ludlum Model 2221 /		Check Source(s) Used:	
Detector/SN: Model 43-5 /		Date Calculated:	
EFF % $\alpha$ = % , $\beta$ = %	Total EFF % $\alpha$ = % , $\alpha$ = %	Calc. By: Alpha	
CALIB. SOURCE USED:		Comments:	
DATE OF CALIB.:			
CALIB. DUE DATE:			
PERFORMED BY:			

[illegible]

Prepared By:	Date:
Reviewed By:	Date:

M

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-2-09-1**  
**Lost or Damaged Dosimeter Report**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

SSN: \_\_\_\_\_ Date Lost or Damaged: \_\_\_\_\_

Dosimeter Number: \_\_\_\_\_

Location Lost: \_\_\_\_\_

Remarks: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Radiation Safety Officer

Actions Taken: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Reviewed By

N

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-3-01-1**  
**Survey Data Log**

Instrument Model:	
Instrument S/N:	
Detector Model:	
Detector S/N:	

Date of Survey:	
Units of Measure:	$\mu\text{R/hr}$ / cpm
Radiation Detected:	$\beta$ $\gamma$
Calibration Due:	

[illegible]

Technician:	
Prepared By:	Date:
Reviewed By:	Date:



Form REC-WP-3-05-1  
Removable Alpha Beta/Gamma Survey Sample Log Detector

[illegible]



P

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-4-02-1**  
**Air Sample Data Log**

Date of Survey:				Ambient Conditions:		
Instrument Serial #:						
Calibration Due Date:						
BKG Counts:						
Placement Location	Flow Rate (lpm)	Pump Start Time	Pump Stop Time	Elapsed Time	Volume Collected	Comments
Prepared By:					Date:	
Reviewed By:					Date:	

Q

Remedial Construction Services, L.P. (Recon)  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-4-02-2**  
**Air Sample Envelope**

Date: \_\_\_\_\_ Sample # \_\_\_\_\_

Time On: \_\_\_\_\_ Sampler ID # \_\_\_\_\_

Time Off: \_\_\_\_\_ Total Min: \_\_\_\_\_

Flow: \_\_\_\_\_ Volume: \_\_\_\_\_

Technician: \_\_\_\_\_

Location: \_\_\_\_\_

Reason: \_\_\_\_\_

R

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-7-01-1**  
**Discharge to Sanitary Sewer Log**

[illegible]

Reviewed by: \_\_\_\_\_

S

**Remedial Construction Services, L.P. (Recon)**  
9720 Derrington  
Houston, TX 77064  
(281) 955-2442

**Form REC-WP-7-05-1**  
**Daily Bucket Scale Verification Log**

[illegible]

Reviewed by: \_\_\_\_\_



T

NRC FORM 5  
(10-2001)  
10 CFR PART 20

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0006

EXPIRES: 10/31/2004

## OCCUPATIONAL DOSE RECORD FOR A MONITORING PERIOD

Estimated burden per response to comply with this mandatory information collection request: 20 minutes. This information is used to ensure that doses to individuals do not exceed regulatory limits. This information is required to record/annually report individual occupational exposure to radiation to ensure that the exposure does not exceed regulatory limits. Send comments regarding the burden estimate to the Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by Internet e-mail to [brs1@nrc.gov](mailto:brs1@nrc.gov), and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0006), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. NAME (LAST, FIRST, MIDDLE INITIAL)	2. IDENTIFICATION NUMBER	3. ID TYPE	4. SEX  <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	5. DATE OF BIRTH (MM/DD/YYYY)
---------------------------------------	--------------------------	------------	---	-------------------------------

6. MONITORING PERIOD (MM/DD/YYYY - MM/DD/YYYY)	7. LICENSEE NAME	8. LICENSE NUMBER(S)	9A. RECORD ESTIMATE	9B. ROUTINE PSE
--	------------------	----------------------	---------------------------	-----------------------

INTAKES				DOSES (in rem)	
10A. RADIONUCLIDE	10B. CLASS	10C. MODE	10D. INTAKE IN $\mu$ CI		
				DEEP DOSE EQUIVALENT (DDE)	11.
				LENS (EYE) DOSE EQUIVALENT (LDE)	12.
				SHALLOW DOSE EQUIVALENT, WHOLE BODY (SDE,WB)	13.
				SHALLOW DOSE EQUIVALENT, MAX EXTREMITY (SDE,ME)	14.
				COMMITTED EFFECTIVE DOSE EQUIVALENT (CEDE)	15.
				COMMITTED DOSE EQUIVALENT, MAXIMALLY EXPOSED ORGAN (CDE)	16.
				TOTAL EFFECTIVE DOSE EQUIVALENT (ADD BLOCKS 11 AND 15) (TEDE)	17. 0
				TOTAL ORGAN DOSE EQUIVALENT, MAX ORGAN (ADD BLOCKS 11 AND 16) (TODE)	18. 0
				19. COMMENTS	

20. SIGNATURE -- LICENSEE

21. DATE PREPARED

**INSTRUCTIONS AND ADDITIONAL INFORMATION PERTINENT TO THE  
COMPLETION OF NRC FORM 5**

*(All doses should be stated in rems)*

**PRIVACY ACT STATEMENT**

1. Type or print the full name of the monitored individual in the order of last name (include "Jr," "Sr," "III," etc.), first name, middle initial (if applicable).
2. Enter the individual's identification number, including punctuation. This number should be the 9-digit social security number if at all possible. If the individual has no social security number, enter the number from another official identification such as a passport or work permit.
3. Enter the code for the type of identification used as shown below:  
  

<b>CODE</b>	<b>ID TYPE</b>
SSN	U.S. Social Security Number
PPN	Passport Number
CSI	Canadian Social Insurance Number
WPN	Work Permit Number
PADS	PADS Identification Number
OTH	Other
4. Check the box that denotes the sex of the individual being monitored.
5. Enter the date of birth of the individual being monitored in the format MM/DD/YYYY.
6. Enter the monitoring period for which this report is filed. The format should be MM/DD/YYYY - MM/DD/YYYY.
7. Enter the name of the licensee.
8. Enter the NRC license number or numbers.
- 9A. Place an "X" in Record, Estimate, or No Record. Choose "Record" if the dose data listed represent a final determination of the dose received to the best of the licensee's knowledge. Choose "Estimate" only if the listed dose data are preliminary and will be superseded by a final determination resulting in a subsequent report. An example of such an instance would be dose data based on self-reading dosimeter results and the licensee intends to assign the record dose on the basis of TLD results that are not yet available.
- 9B. Place an "X" in either Routine or PSE. Choose "Routine" if the data represent the results of monitoring for routine exposures. Choose "PSE" if the listed dose data represents the results of monitoring of planned special exposures received during the monitoring period.

- If more than one PSE was received in a single year, the licensee should sum them and report the total of all PSEs.
- 10A. Enter the symbol for each radionuclide that resulted in an internal exposure recorded for the individual, using the format "Xx-###x," for instance, Cs-137 or Tc-99m.
  - 10B. Enter the lung clearance class as listed in Appendix B to 10 CFR Part 20.1001-2401 (D, W, Y, V, or O for other) for all intakes by inhalation.
  - 10C. Enter the mode of intake. For inhalation, enter "H." For absorption through the skin, enter "B." For oral ingestion, enter "G." For injection, enter "J."
  - 10D. Enter the intake of each radionuclide in  $\mu$ Ci.
  11. Enter the deep dose equivalent (DDE) to the whole body.
  12. Enter the eye dose equivalent (LDE) recorded for the lens of the eye.
  13. Enter the shallow dose equivalent recorded for the skin of the whole body (SDE, WB).
  14. Enter the shallow dose equivalent recorded for the skin of the extremity receiving the maximum dose (SDE, ME).
  15. Enter the committed effective dose equivalent (CEDE).
  16. Enter the committed dose equivalent (CDE) recorded for the maximally exposed organ.
  17. Enter the total effective dose equivalent (TEDE). The TEDE is the sum of items 11 and 15.
  18. Enter the total organ dose equivalent (TODE) for the maximally exposed organ. The TODE is the sum of items 11 and 16.
  19. **COMMENTS.**  
In the space provided, enter additional information that might be needed to determine compliance with limits. An example might be to enter the note that the SDE, ME was the result of exposure from a discrete hot particle. Another possibility would be to indicate that an overexposed report has been sent to NRC in reference to the exposure report.
  20. Signature of the person designated to represent the licensee.
  21. Enter the date this form was prepared.

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by Section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the U.S. Nuclear Regulatory Commission (NRC) on NRC Form 5. This information is maintained in a system of records designated as NRC-27 and described at 65 Federal Register 56434 (September 18, 2000), or the most recent Federal Register publication of the NRC's "Republication of Systems of Records Notices" that is available at the NRC Public Document Room, 11555 Rockville Pike, Rockville, Maryland or located in NRC's Agencywide Documents Access and Management System (ADAMS).

1. **AUTHORITY:** 42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, and 2201(o) (1996); 10 CFR 20.2106, 20.2201-20.2204, and 20.2206 (2000); Executive Order 9397, November 22, 1943.
2. **PRINCIPAL PURPOSE(S):** The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon your request.
3. **ROUTINE USE(S):** The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals monitored for radiation exposure while employed by or visiting or temporarily assigned to certain NRC licensed facilities; to return data provided by licensee upon request. The information may also be disclosed to an appropriate Federal, State, local or Foreign agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, local and Foreign agency to the extent relevant and necessary for an NRC decision about you or to the extent relevant and necessary for that agency's decision about you. Information from this form may also be disclosed, in the course of discovery and in presenting evidence, to a Congressional office to respond to their inquiry made at your request, or to NRC-paid experts, consultants, and others under contract with the NRC, on a need-to-know basis.
4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** It is voluntary that you furnish the requested information, including social security number (identification number); however, the licensee must complete NRC Form 5 on each individual for whom personnel monitoring is required under 10 CFR 20.2106. Failure to do so may subject the licensee to enforcement action in accordance with 10 CFR 20.2401. The social security number (identification number) is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birth dates among the large number of persons on who data is maintained.
5. **SYSTEM MANAGER(S) AND ADDRESS:**  
REIRS Project Manager  
Radiation Protection and Health Effects Branch  
Division of Regulatory Applications  
Office of Nuclear Regulatory Research  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

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**311 North Aspen**  
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**Phone: (918) 251-2515**  
**Fax: (918) 251-0008**

**FAX**

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REMARKS

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# Equipment Inspection Form

Thorium Remediation Project  
Tulsa, Oklahoma

Job # \_\_\_\_\_

Name: \_\_\_\_\_

Daily Equipment Check List			Remarks	Hours Last Serviced
Date				Please note the hour reading recorded on the oil, air, fuel and hydraulic filters on the equipment.
Equipment				
Operator				
Hour Meter				
Start				
End				
Fluids Check List				
	Ok	Add		
Fuel Grease				
Oil				
Brake/Hydraulic				
Water				
Transmission				
Equipment Condition				
	Ok	Repair		
Glass				
Horn				
Lights				
Mirrors				
Seat Belt				
Step/Ladder				
Travel Alarm				
Wipers				
Tires				
Belts				
Air Filter				
Fuel Leaks				
Oil Leaks				
Hyd. Cylinders				
Steering				
Brakes				
Hoses				
Fire Extinguisher				

Comments

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