Letter of Transmittal

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Date: December 9, 2004 **Project No.:** 4000-PA4072-02

To: Mr. John T. Buckley
U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Re: Kaiser Tulsa Site
Thorium Remediation Project

We are sending you the following item(s):

Quantity	Date	No.	Description
1	Decemebr, 2004		RECON Procedure: REC-WP-4-02 Rev 04

These are transmitted as checked below:

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Remarks: On behalf of Kaiser Aluminum & Chemical Corporation, the above referenced procedure revision is transmitted for your information. Please destroy all previous versions of this procedure.

Copy to: Distribution (see attached) **Signed:** Chuck Beatty

If enclosures are not as noted, please notify our office immediately.

NMSS01

Kaiser Plan and Procedure Distribution	
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RECON Procedure: REC-WP-4-02

Air Sampling

Thorium Remediation Project
Tulsa, Oklahoma

REVISION: 04

EFFECTIVE DATE: December 2004

Bill Vinzant 12-1-04
Approved by: J. W. (Bill) Vinzant – Project Manager Date:
Kaiser Aluminum and Chemical Corporation

12/03/04
Approved by: Danny P. Brown – Project Manager Date:
Remedial Construction Services, L. P.

12-03-04
Reviewed by: Jerry Pionessa – Quality Control Supervisor Date:
Remedial Construction Services, L. P.

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 & Analysis Log (REC-WP-4-02-1), Air Sampler Filter Envelope(s) (REC-WP-4-02-2) and PDR Data & Analysis Log (REC-WP-4-02-3).

4.2 Black ink pen (indelible)

4.3 Cellulose-ester filters or other appropriate filters

4.4 High Volume Sampler

4.5 Personal DataRAM (PDR)

5.0 PROCEDURE

5.1 Preparation for High Volume Air Sampling

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 start time and meter flow rate on sample envelope form REC-WP-4-02-2.

5.2 Collection of High Volume Air Sample

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.

5.2.4 Multiply total elapsed time by the average flow rate to determine volume sampled in liters or 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-4-02-1.

5.2.6 If the initial count indicates air concentrations of .3 DAC or greater the air sample filter will be recounted. The recount will be adjusted for radon in accordance with "On Site Air Sampling L. Max Scott 10/13/04". If the recount indicates air concentrations of .3 DAC or greater then the filter will be held until any radon daughters have decayed. The filter will be recounted and this will be considered the final result.

5.3 Preparation for PDR Air Sampling

5.3.1 Perform zero check and fill out Attachment 5 (Personal DataRAM Daily Inspection and Zero Form) located in RECON's Environmental Health and Safety Plan (EHASP).

5.3.2 Place PDR in designated monitoring location.

5.4 Retrieving PDR Data

5.4.1 Collect PDR samplers and download data onto computer.

5.4.2 Summarize data on form REC-WP-4-02-3

5.4.3 Table 2 in attachment titled "On-Site Air Sampling, L. Max Scott, 10/13/04" shall be used to determine the DAC as a function of weight by volume and specific activity by estimated concentration of exposure material (pCi/g Th-232)

6.0 REFERENCES

NA

7.0 ATTACHMENT

Form REC-WP-4-02-1	Air Sampling Data & Analysis Log
Form REC-WP-4-02-2	Air Sampling Envelope
Form REC-WP-4-02-3	PDR Data & Analysis Log

On-Site Air Sampling, L. Max Scott, 10/13/04

Form REC-WP-4-02-1

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

Sample #	Date of Sample

Instrument Type	
Instrument Serial #	
Detector Type	
Detector Serial #	
Cal. Due Date	

Pump Type	
Pump Serial #	
Cal. Due Date	

Derived Air Concentration Value (Th-232):			
2E-12	mCi/ml	Site Background Activity	

Ambient Conditions / Comments

Sample Collection Data					
Time Start	Time Stop	Elapsed Time (Min)	Flow Rate (lpm)	Total Volume (liters)	Technician Performing Count

Field Screening Count Data			
α Bkg Count Rate	α Gross Counts	α Net Count Rate	Technician Performing Count

Analysis Data				
Work Area Concentration Quick Count (mCi/ml)	DAC Fraction Quick Count (%)	Laboratory Result (pCi/F)	Laboratory Data Concentration (mCi/ml)	Laboratory DAC Fraction (%)

Reviewed By: _____

Form REC-WP-4-02-2

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

Date: _____ Sample # _____

Time On: _____ Sampler ID # _____

Time Off: _____ Total Min: _____

Flow: _____ Volume: _____

Technician: _____

Location: _____

Reason: _____

Form REC-WP-4-02-3

Form REC-WP-4-02-3
PDR Data Analysis Log

Date	Wind Direction/ Weather	Elasped Run Time	Up Wind Max STEL mg/m3	Up Wind Avg STEL mg/m3	Location	Elasped Run Time	Down Wind Max STEL mg/m3	Down Wind Avg STEL mg/m3	Location	Estimated TH-232 pCi/g Concentration	% DAC	Comments
4/12/2004					* Note 1	7h 36min	0.019	0.008	Down wind of job site	20	0.044	* Note 1 - No Data Collected
4/15/2004	South	9h 40min	0.168	0.051	Fence at Safety Trailer	9h 40min	0.128	0.022	North Fence Line	40	0.242	
4/16/2004	South	9h 30min	0.099	0.078	South Fence Line	9h 25min	0.070	0.036	North Fence Line	60	0.594	
4/17/2004	South	6h 0min	0.112	0.078	South Fence Line	6h 00min	0.041	0.030	50 feet from work	80	0.660	
4/19/2004	South	8h 05min	0.112	0.088	Fence at Safety Trailer	8h 00min	0.287	0.062	50 feet from work	100	1.705	
4/22/2004	South	7h 30min	0.150	0.084	Fence at Safety Trailer	7h 30min	0.112	0.031	50 feet from work	120	1.023	
4/26/2004	South	9h 40min	0.017	0.005	South Fence Line	9h 35min	0.014	0.006	50 feet from work	140	0.231	
4/27/2004	South	9h 35min	0.016	0.003	South Fence Line	9h 35min	0.026	0.009	50 feet from work	160	0.396	
4/28/2004	South	9h 15min	0.038	0.017	South Fence Line	9h 15min	0.055	0.025	50 feet from work	180	1.238	
5/3/2004	South	8hr 25min	0.028	0.007	South Fence Line @ Safety Trailer	7h 25min	0.037	0.013	50 feet from conveyor	200	0.715	

This form will be kept as a spreadsheet. The information above is example data.

RECON Work Plan & Procedures Manual

RECON Procedure: REC-WP-4-02

Air Sampling

On-Site Air Sampling, L. Max Scott, 10/13/04

Remedial Construction Services, L.P.
9720 Derrington
Houston, TX 77064

Revision 04
December 2004

ADA CONSULTANTS
L. MAX SCOTT, PhD
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October 13, 2004

Mr. J. W. (Bill) Vinzant
Kaiser Aluminum and Chemical Corporation
9141 Interline Ave. Suite 1A
Baton Rouge, LA 70809

RE: On-site Air Sampling Program

Dear Mr. Vinzant:

Attached is the write-up of the details of the on-site air sampling program. I believe that it addresses all of the air sampling concerns raised by the Nuclear Regulatory Commission Inspectors.

Sincerely,

L. Max Scott

L. Max Scott, Ph.D.

xc: Tulsa file

On-Site Air Sampling

Purpose:

To bring together in one document the steps used to evaluate air sampling results and the underlying rational.

Derived Air Concentration (DAC):

The weighted DAC for ^{232}Th, ^{228}Th, and ^{230}Th is 2×10^{-12}. Derived as follows
Activity ratio of 1:1:3.5
DAC ^{232}Th - 5×10^{-13} uCi/ml
DAC ^{228}Th - 4×10^{-12} uCi/ml
DAC ^{230}Th - 3×10^{-12} uCi/ml

Weighted DAC = $1/(((1/5.5) \times (5 \times 10^{-13}\ \text{uCi/ml})) + ((1/5.5) \times (4 \times 10^{-12}\ \text{uCi/ml})) + ((3.5/5.5) \times (3 \times 10^{-12}\ \text{uCi/ml}))) = 2.73 \times 10^{-12}$ uCi/ml.
round down to 2×10^{-12}.

There are 7 alpha emitters in the Thorium-232 decay chain - ^{232}Th, ^{228}Th, ^{224}Ra, ^{220}Rn, ^{216}Po, ^{212}Bi, and ^{212}Po.
In the derivation of the DAC and the evaluation of air sampling results no credit is taken for the contribution of ^{224}Ra or ^{220}Rn. Rn-220 and its daughters have short half-lives and will have essentially decayed away before the evaluation of air sampling is completed.
Due to the long half-life of ^{226}Ra (first daughter of ^{230}Th) this decay chain is not in equilibrium and for all practical purposes the only alpha emitter is ^{230}Th.

Collection of Air Samples:

Air samples are collected by two methods:

- Conventional hi-volume air samplers with the collection of particulate on a filter paper
- DataRAM pDR-1000 which measures weight per volume of respirable air particulate

Evaluation of Air Samples:

Conventional Air Sampling

Correction for Radon

Radon-222 is present in essentially all environments, and its daughters are collected on the filter paper. Since the radionuclides of concern at the Tulsa site include ^{232}Th in equlibrium with its daughters, ^{220}Rn and its daughters may be present in the environment, and if present wil be collected on the filter paper. For the initial evaluation of air concentrations, no correction is made for ^{220}Rn daughters. Where elevated air concentrations are observed (.30 DAC or greater), sampling filters will be held until all of the radon daughters have decayed and then recounted. This count shall be considered

the final result. Because the ^{222}Rn daughters have short halflives (controling half-life 26.8 minutes of ^{214}Pb), the comparison of results of a recount of a filter paper separated by 30 minutes to 2 hours lapse time is a good indicator of ^{222}Rn daughter contribution. Table 1 is to be used to estimate and correct for the ^{222}Rn daughter contribution. An example of its use is also shown.

Table 1
Fraction of Original Activity remaining vs Percent ^{222}Rn

	Percent ^{222}Rn									
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Lapse Time min.	Reduction Factor									
30	0.98	0.96	0.95	0.93	0.91	0.89	0.87	0.86	0.84	0.82
60	0.95	0.9	0.85	0.8	0.76	0.71	0.66	0.61	0.56	0.51
90	0.93	0.85	0.78	0.72	0.64	0.57	0.5	0.42	0.35	0.28
120	0.91	0.83	0.74	0.66	0.57	0.48	0.4	0.31	0.23	0.14

Table values derived as follows: For each fraction of ^{222}Rn, i.e., 10% ^{222}Rn and 90% thorium, the fraction of the original count remaining after the selected lapse time was calculated assuming the decay of the ^{222}Rn daughters and no decay of the thorium.

Example of use:

Initial count 540 cpm
Re-count after 60 minutes 325 cpm
325 ÷ 540 = .60
On the 60 minute lapsed time line find the table value equal to or just greater than ratio of the 2 counts (.60). Note that this is under the 80% column. This Indicates that 80% of the alpha activity was due to ^{222}Rn daughters. Thus, 325 x.2 = 65 cpm are attributed to thorium. Use this value to calculate percent of DAC in the usual manner. Correction for ^{220}Rn daughters is more difficult because of the 10.6 hour controlling half-life of ^{212}Pb. If the air sample result corrected for ^{222}Rn daughters exceeds .3 DAC the area shall be posted. The filter paper will be recounted after 48 hours to determine if the ^{220}Rn daughters contributed to the count. If the recount results in a calculated DAC less than .3, the posting shall be removed.

Background

No correction will be made for trace concentrations of uranium and thorium particulate in ambient air.

DataRAM pDR-1000

The pDR-1000 collect 1 minute samples and analzed for weight by volume of air particulate equal to or less than 10 micron in diameter (respirable particulate). If one knows the weight by volume and the specific activity of the particulate then the radionuclide air concentration or fraction of the DAC can be derived. Table 2 list the percent of DAC as a function of weight by volume and specific activity.

Table 2
DAC as a Function of Weight by Volume and Specific Activity

	Estimated Concentration of Exposure Material pCi/g Th-232									
	pCi/g 20	pCi/g 40	pCi/g 60	pCi/g 80	pCi/g 100	pCi/g 120	pCi/g 140	pCi/g 160	pCi/g 180	pCi/g 200
mg/ cu m	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC	% of DAC
0.1	0.55	1.1	1.65	2.2	2.75	3.3	3.85	4.4	4.95	5.5
0.2	1.1	2.2	3.3	4.4	5.5	6.6	7.7	8.8	9.9	11
0.3	1.65	3.3	4.95	6.6	8.25	9.9	11.55	13.2	14.85	16.5
0.4	2.2	4.4	6.6	8.8	11	13.2	15.4	17.6	19.8	22
0.5	2.75	5.5	8.25	11	13.75	16.5	19.25	22	24.75	27.5
0.6	3.3	6.6	9.9	13.2	16.5	19.8	23.1	26.4	29.7	33
0.7	3.85	7.7	11.55	15.4	19.25	23.1	26.95	30.8	34.65	38.5
0.8	4.4	8.8	13.2	17.6	22	26.4	30.8	35.2	39.6	44
0.9	4.95	9.9	14.85	19.8	24.75	29.7	34.65	39.6	44.55	49.5
1	5.5	11	16.5	22	27.5	33	38.5	44	49.5	55
2	11	22	33	44	55	66	77	88	99	110
3	16.5	33	49.5	66	82.5	99	115.5	132	148.5	165
4	22	44	66	88	110	132	154	176	198	220
5	27.5	55	82.5	110	137.5	165	192.5	220	247.5	275
6	33	66	99	132	165	198	231	264	297	330
7	38.5	77	115.5	154	192.5	231	269.5	308	346.5	385
8	44	88	132	176	220	264	308	352	396	440
9	49.5	99	148.5	198	247.5	297	346.5	396	445.5	495
10	55	110	165	220	275	330	385	440	495	550

NOTE: Thorium concentration shall be determined by taking at least 3 measurments at surface contact with a microR meter. Select the most representative reading and multiply by .3 to obtain pCi/g Th-232. (35 uR ~ 10 pCi/g Th-232 Dan Baker)

Example of use:
Sample an operation for 60 minutes with a resulting average concentration of .73 mg/m^3 (always round up to next table value). Estimated concentration of exposure material 110 pCi/g (always round up to next table value) . Table value under .8 mg/m^3 and 120 pCi/g 26.4 % of DAC.
L. Max Scott
10/13/2004