



Department of Energy

ROCKY FLATS FIELD OFFICE
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AUG 01 2000

00-DOE-01914

Mr. Timothy Rehder
U.S. Environmental Protection Agency, Region VIII
999 18th Street, Suite 500, EPR-FT
Denver, Colorado 80202-2466

Dear Mr. Rehder:

Enclosed for your information and records, please find a copy of the *Evaluation of OU7 Aeration Treatment System* (Report). This report summarizes sampling information gathered from November 1998 - October 1999, the first year of aeration treatment at Operable Unit (OU) 7. We have incorporated comments from the U.S. Environmental Protection Agency, Region VIII, and the Colorado Department of Public Health and Environment in this evaluation report. Since November 1998, samples have been collected in accordance with the November 1998 addendum to the *OU7 Passive Seep Interception and Treatment System Sampling and Analysis Plan* (Operable Unit 7 SAP). This addendum was based upon the July 1998 minor modification to the Proposed Action Memorandum, Passive Seep Interception and Treatment, Operable Unit 7 (OU 7 PAM). Pursuant to the minor modification the treatment system for the OU 7 seep was changed from a granular activated carbon to an passive aeration treatment. Quarterly reports updating the results and progress were sent to your agency.

We have revised the *Sampling and Analysis Plan for OU 7 Passive Aeration System* to reflect that sampling for the semi-volatiles will be continued. The Sampling and Analysis Plan will be sent to your agency shortly.

If you should have any questions regarding this report, please contact Norma I. Castaneda at (303) 966-4226 or contact me at (303) 966-5918.

Joseph A. Legare
Assistant Manager
for Environment and Infrastructure

Enclosure

cc w/Enc:
N. Castaneda, ERWM, RFFO
J. Lillich, EPA
S. Gunderson, CDPHE
C. Spreng, CDPHE
Administrative Record



ADMIN RECORD

A-3107-000-01

Y15



**Evaluation of OU7 Aeration Treatment System
November 1998-October 1999**

**Evaluation of OU7 Aeration Treatment System
November 1998-October 1999**

1.0 Objective

The purpose of this report is to summarize and evaluate analytical data for the first year of OU7 aeration treatment. These data will be used to determine if the system has performed adequately. The data will be compared to the performance objective analytes listed in Appendix A of *OU7 Passive Seep Interception and Treatment System Sampling and Analysis Plan*, RF/ER-96-0019, Rev.0., addendum dated November 11, 1998 (SAP). The performance objectives were based on the Rocky Flats Clean Up Agreement (RFCA) July 1996. RFCA was updated in April of 1997 and the analytical results will be compared to the RFCA Table 1 Action Levels & Standards (ALF), April 1997. The April 1997 standards are the standards that were in place when the samples were collected. The passive aeration system has been in operation since October 26, 1998.

2.0 Background

The OU7 Passive Seep Interception and Treatment System (PSITS) was the previous system using granular activated carbon (GAC) to reduce the concentrations of volatile organic compounds (VOC)s and semivolatile organic compounds (SVOC)s discharged to the East Landfill Pond. The OU7 PSITS was in operation between May 1996 and October 1998. The system was evaluated in the fall of 1998 for treatment objective efficiency. The evaluation indicated the main contaminants above the performance objectives are vinyl chloride and benzene, which do not load well on GAC. The complete removal of vinyl chloride would have required monthly GAC changeout. Therefore, the treatment system was modified on October 26, 1998 to allow aeration of landfill effluent water. The new system was expected to adequately remove vinyl chloride and benzene without generating secondary waste streams. The GAC system would have generated one 55-gallon drum of low-level mixed waste monthly.

The new passive aeration treatment system uses the existing equipment with a modified flow path. Water flows from a settling basin directly through the existing piping. The piping then passes directly through the former treatment vault without GAC treatment. The pipe then exits the treatment vault and flows over stepped flagstones. After the flagstone steps, the water flows over a bed of gravel for approximately six feet. Water samples were collected monthly for 12 months. Samples were collected from the flow equalization basin (SW00396) and from the treatment system endpoint (SW00196). The definition of sample location SW00196 was modified when the treatment system was changed. The original GAC system defined SW00196 as the location where the treatment system pipe ends. The aeration treatment defines SW00196 as the point six feet down stream of the last flagstone step. Sampling the treatment system endpoint satisfies the substantive requirements of the National Pollution Discharge Elimination System (NPDES) permit waiver under RFCA. Location SW00196 is not considered a point of compliance. Samples were collected as specified in the SAP.

Samples from SW00196 were analyzed for VOCs, SVOCs, Total Metals (including Mercury), Isotopic-Plutonium, Uranium, Americium; Tritium and Gross Alpha/Beta. Samples from SW00396 were analyzed for VOCs and SVOCs. The first aeration treatment system sample was collected November 17, 1998. Samples were then collected monthly. Total flow through the system from January 1997 until the end of December 1999 is estimated to be 2,761,984 gallons.

3.0 Results and Discussion

3.1 System Performance

Volatiles

This treatment system was designed to remove the VOCs listed in Appendix A of the SAP. The VOCs with performance objectives are: benzene, chloromethane, cis-1,2 -dichloroethene, ethylbenzene, methylene chloride, tetrachloroethene, toluene, total xylene, trichloroethene and vinyl chloride. Historical sampling has shown the main constituents in the influent requiring treatment are benzene and vinyl chloride. The results from SW00196 for VOCs listed in the SAP are shown in Table 3-1, OU7 Aeration Treatment System Effluent (SW00196) VOC Results-November 1998 - October 1999. Vinyl chloride results from SW00196 have not exceeded the RFCA standards in the past year. Vinyl chloride exceeded the RFCA standard twice during the seven samplings of the previous carbon system. Benzene results from SW00196 have exceeded the RFCA standards five times in the past year. The standards were exceeded in March, April, July, September and October. The values of the benzene exceedances were between 0.9 ppb and 1 ppb above the standard. Benzene did not exceed the RFCA standards during the seven samplings of the previous carbon system. The results from SW00396 for VOCs listed in the SAP are shown in Table 3-2, OU7 Aeration Treatment System Influent (SW00396) VOCs-November 1998-October 1999.

Semivolatiles

Although the system was designed to remove VOCs, some minor SVOC treatment may also be achieved. The SVOCs listed in Appendix A of the SAP are: 2,4-dimethylphenol, acenaphthene, bis(2-ethyl hexyl)phthalate, butylbenzylphthalate, diethylphthalate, di-n-butylphthalate, fluorene, naphthalene, phenanthrene and phenol. The results from SW00196 for SVOCs listed in Appendix A of the SAP are shown in Table 3-3, OU7 Aeration Treatment System Effluent (SW00196) SVOCs Results-November 1998-October 1999. The table shows two events, which may have exceeded the RFCA Standard for bis(2 ethylhexyl)phthalate. Both exceedances were either qualified as below the detection limit ("U") or the analyte was also detected in the laboratory blank ("B"). The February sample may be explained by laboratory sample contamination. Bis(2 ethylhexyl)phthalate is a common laboratory contaminant, and the result is qualified with a "B". The results from SW00396 for SVOCs listed in Appendix A of the SAP are shown in Table 3-4, OU7 Aeration Treatment System Influent (SW00396) SVOC Results-November 1998-October 1999. Bis(2ethylhexyl)phthalate was not detected above the performance objective in the influent or effluent during previous GAC treatment.

Di-n-butylphthalate may have exceeded the 10 ppb RFCA standard in June of 1999. The Di-n-butylphthalate concentration reported was 11 ppb with a "U" flag, meaning not detected at that level.

SVOC data for bis(2-ethylhexyl)phthalate and di-n-butyl phthalate collected from Nov 17, 1998 to October 11, 1999 shows sample results generally below the RFCA standards. Both analytes results are frequently qualified. Data is qualified to indicate that the sample result should be interpreted with caution. For example, "J" qualifiers indicate the sample result is an estimated value. This qualifier is usually used when a sample result is detected below the instrument detection limit. The accuracy and precision of the exact value are somewhat questionable. The "B" qualifier indicates the analyte was found in the laboratory prepared blank and the sample, this indicates possible laboratory contamination of the sample. When interpreting qualified data, caution must be used. For example, a bis(2-ethylhexyl)phthalate result of 2 J does not indicate a detected value of 2, it is an estimate of the value. The true value could be 1 or could be 9. The laboratory is still required to meet the 10 ug/l required detection limit, so the only definite is that the value is less than 10.

3.2 Additional Monitoring

Metals

The current aeration treatment system is not designed to remove metals from the landfill effluent. Metals analyses were performed at the request of the EPA to determine the trends in the results. No performance objective for metals is in place for the current system. Metals results are compared to RFCA (April 1997) for informational purposes. A settling basin is in place to allow dense materials in the influent to settle out. All the metals results reported are for total metals. The metals result tables and graphs are shown in Appendix A. Table A-1, OU7 Aeration Treatment System Effluent (SW00196) Total Metals, November 1998-October 1999, summarizes the total metals results.

Historical total metals results from the landfill effluent (SW097 and SW00196) were compared to determine the trend in metals results. Table A-2, OU7 Landfill Endpoint (SW0097 and SW00196) Total Metals-April 1989-October 1999, lists total metals results from the landfill. The results are compiled from previous samples collected at SW097 and SW00196. SW097 was the previous identifier for the landfill effluent. Graph A-1, OU7 Landfill Endpoint (SW0097 & SW00196) Total Aluminum; Graph A-2 OU7 Landfill Endpoint (SW0097 & SW00196) Total Iron; Graph A-3 OU7 Landfill Endpoint (SW0097 & SW00196) Total Manganese; and Graph A-4 OU7 Landfill Endpoint (SW0097 & SW00196) Total Zinc; show metals levels have consistently decreased since April of 1989. These four metals were selected because their current total metals levels are above the RFCA (April 1997) standards. The RFCA standards are for dissolved and total recoverable metals. Comparisons between the total metals results and the dissolved and total recoverable standards are for informational purposes only. The graphs show a linear time spread; however, the collection dates are sporadically spread over the ten-year time frame. The trend lines show a decreasing trend for the metals.

Radionuclides

The current aeration treatment system is not designed to remove radionuclides and no performance objectives exist. Radiochemistry results are compared to RFCA (April 1997) for informational purposes. The RFCA standards for Total Uranium-233/234, 235, 238; Plutonium-239/240, Americium-241 and Tritium were not exceeded. Radiological data is reported in Appendix A. Radiological data for November 1998-October 1999 is summarized in the following tables: Table A-3 Uranium, Table A-4 Plutonium and Americium, and Table A-5 Tritium. The results for gross alpha were exceeded once during the year. In December 1998, the gross alpha result was 21 pCi/l. The standard for gross alpha is 11 pCi/l. The average gross alpha result (including error) is 6.1 pCi/l. Table A-6 summarizes the Gross Alpha and Gross Beta results for November 1998-October 1999.

4.0 Conclusions

The treatment system effluent has generally met the RFCA standards. Aeration over the gravel bed may have been reduced as the bed filled in with sediment. Additional gravel was added in December 1999, and may increase aeration and reduce the benzene concentrations. Maintenance now includes grading the gravel in the streambed and adding new gravel as needed to improve aeration.

Based on the evaluation in this report, it is recommended that sampling for VOCs be continued, but that sampling for SVOCs, metals and radionuclides be discontinued.

**Evaluation of OU7 Aeration Treatment System
November 1998-October 1999**

Table 3-1

**OU7 Aeration Treatment System Effluent (SW00196) VOC Results
November 1998-October 1999**

All results in ug/l

Exceedances are boxed

DESCRIPTION	Standards	11/17/99	12/21/98	1/18/99	2/9/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99
BENZENE	1	1U	0.8J	1	1	1.1	2	1	1	2	1	2	2
CHLOROMETHANE	5.7	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
cis-1,2-DICHLOROETHENE	70	1U	1U	1U	1U	1U	0.3J	1U	0.5J	0.8J	1U	0.5U	0.5J
ETHYLBENZENE	680	1U	1U	3	3	2.4	4	4	5	5	3	4	4
METHYLENE CHLORIDE	5	1U	1U	3	3	0.58 JB	0.5 BJ	2B	0.4 BJ	0.8 BJ	1 BJ	0.4 BJ	0.2 BJ
TETRACHLOROETHENE	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.5U	1U
TOLUENE	1,000	1U	1U	1U	1U	1U	0.6J	0.8J	0.9J	0.8J	0.5J	0.7	0.7J
TOTAL XYLENES	10,000	1U	2	2	2	2.1J	3	1U	2	2	0.6J	0.4J	1
TRICHLOROETHENE	2.7	1U	1U	1U	1U	1U	0.4J	0.5J	0.5J	0.7J	0.6J	0.6	0.6J
VINYLCILORIDE	2	1U	1U	1U	1U	1U	2	1J	1	2	2J	2	2

U - Analyte not detected at the stated method detection limit

J - Estimated value, below the method detection limit

B - Analyte also found in laboratory blank and the sample

RFCA Standards from April 1997

4

Evaluation of OU7 Aeration Treatment System
November 1998-October 1999

Table 3-2
OU7 Aeration Treatment System Influent (SW00396) VOC Results

November 1998-October 1999

All results in ug/l

Exceedances are boxed

DESCRIPTION	Standard	11/17/98	12/21/98	1/18/99	2/9/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99
BENZENE	1	1U	2	2	2	1.8	2	2	2	2	2	2	2
CHLOROMETHANE	5.7	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
cis-1,2-DICHLOROETHENE	70	1U	1U	1U	1U	1U	0.4J	0.4J	0.7J	0.8J	1U	0.6	0.6J
ETHYLBENZENE	680	1U	7	4	5	4.4	6	.5	6	6	4	5	4
METHYLENE CHLORIDE	5	1U	1U	4	2	1.1B	0.6BJ	2B	0.7BJ	0.9BJ	1BJ	0.3BJ	0.2BJ
TETRACHLOROETHENE	1	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	0.1J	1U
TOLUENE	1,000	1U	0.8J	1U	1U	0.66J	0.8J	1J	1	1	0.7J	0.9	0.8J
TOTAL XYLENES	10,000	1U	7	4	3	3.4	4	1U	3	2	0.7J	0.5J	1
TRICHLOROETHENE	2.7	1U	1U	1U	1U	1U	0.5J	0.5J	0.8J	0.9J	0.7J	0.8	0.7J
VINYL CHLORIDE	2	1U	1U	1U	1U	1U	2	2U	3	3	2	3	2

U - Analyte not detected at the stated method detection limit

J - Estimated value, below the method detection limit

B - Analyte also found in laboratory blank and the sample

RFCA Standards from April 1997

Evaluation of OU7 Aeration Treatment System
November 1998-October 1999

Table 3-3

OU7 Aeration Treatment System Effluent (SW00196) SVOC Results

November 1998-October 1999

All results in ug/l

Exceedances are boxed

DESCRIPTION	RFCA Standard	11/17/98	12/21/98	1/18/99	2/9/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99
		99A3786-001	99A4114-001	99A4701-001	99A4962-001	99A5961-001	99A6619-001	99A7195-001	99A7879-001	99A8344-001	99A9456-001	99A0193-001	00A0408-001
2,4-DIMETHYLPHENOL	540	1 J	10 U	10 U	10 U	9.7 U	10 U	0.6 J	0.6 J	10 U	10 U	0.6 J	10 U
ACENAPHTHENE	520	3 J	10 U	2 J	3 J	2.1 J	3 U	2 J	3 J	3 J	3 J	4 J	4 J
BIS(2-ETHYLHEXYL)PHTHALATE	10	2 B J	10 U	10 U	1.40 B D	9.7 U	10 J	2 J B	11 U	1 J	0.8 J B	3 J B	10 U
BUTYL BENZYL PHTHALATE	3,000	10 U	10 U	10 U	10 U	9.7 U	10 U	10 U	11 U	10 U	10 U	10 U	10 U
DIETHYL PHTHALATE	23,000	10 U	10 U	10 U	10 U	9.7 U	10 J	0.8 J	11 U	0.8 J	0.9 J	1 J	1 J
DI-n-BUTYL PHTHALATE	10	10 U	10 U	10 U	10 U	9.7 U	2 J B	10 U	11 U	10 U	0.6 J	1 J B	0.9 J B
FLUORENE	1,300	2 J	10 U	2 J	2 J	2 J	2 U	2 J	2 J	3 J	2 J	3 J	3 J
NAPHTHALENE	620	6 J	10 U	8 J	5 J	4.6 J	6 U	6 J	14	8 J	6 J	11	5 J
PHENANTHRENE	10	4 J	10 U	3 J	4 J	3.1 J	3 U	3 J	4 J	3 J	4 J	5 J	4 J
PHENOL	2,560	10 U	10 U	10 U	10 U	9.7 U	10 U	0.5 J	11 U	10 U	0.7 J	10 U	10 U

U - Analyte not detected at the stated method detection limit

J - Estimated value, below the method detection limit

B - Analyte also found in laboratory blank and the sample

D - Identified at a secondary dilution factor

RFCA Standards from April 1997

Evaluation of OU7 Aeration Treatment System
November 1998-October 1999

Table 3-4
OU7 Aeration Treatment System Influent (SW00396) SVOC
November 1998-October 1999
All results in ug/l
Exceedances are shaded

DESCRIPTION	RFC	11/17/98	12/21/98	1/18/99	2/9/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99
Standards	99A3786-002	99A4114-002	99A4701-002	99A4962-002	99A5961-002	99A6619-002	99A7195-002	99A7879-002	99A8344-002	99A9456-002	99A0193-002	99A0408-002	
2,4-DIMETHYLPHENOL	540	10 U	10 U	11 U	11 U	10.1 U	10 U	10 U	0.5 J	10 U	10 U	10 U	10 U
ACENAPHTHENE	520	3 J	4 J	3 J	3 J	2.2 J	3 J	2 J	4 J	3 J	4 J	5 J	3 J
BIS(2-ETHYLHEXYL)PHTHALATE	10	13 B	10	11 U	23 B	10.1 U	1 J	10 U	10 U	2 J	2 JB	13 B	10 U
BUTYL BENZYL PHTHALATE	3,000	10 U	2 J	11 U	11 U	10.1 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
DIETHYL PHTHALATE	23,000	1 J	2 J	11 U	11 U	10.1 U	10 U	0.8 J	10 U	0.7 J	1 J	1 J	0.8 J
Di-n-BUTYL PHTHALATE	10	10 U	2 J	11 U	11 U	10.1 U	1 JB	10 U	10 U	0.6 JB	0.5 J	1 JB	10 U
FLUORENE	1,300	2 J	3 J	2 J	2 J	2.1 J	2 J	2 J	3 J	2 J	3 J	4 J	2 J
NAPHTHALENE	620	6 J	16	11	13	7.1 J	15	10 U	14	10 U	10	8 J	6 J
PHENANTHRENE	10	4 J	6 J	4 J	4 J	3.3 J	4 J	2 J	3 J	3 J	5 J	5 J	3 J
PHENOL	2,560	10 U	10 U	11 U	11 U	10.1 U	10 U	3 J	10 U	0.9 J	10 U	10 U	10 U

U - Analyte not detected at the stated method detection limit
 J - Estimated value, below the method detection limit
 B - Analyte also found in laboratory blank and the sample
 RFC A Standards from April 1997

Appendix A

Total Metals and Radiological Data

60

**Evaluation of OU7 Aeration Treatment System
November 1998-October 1999**

Table A-1

OU7 Aeration Treatment System Effluent (SW00196) Total Metals

RFCA is March 2000

+Dissolved

++Total Recoverable

All results in ug/l

DESCRIPTION	Standard	99A4114-001	99A4701-001	99A4962-001	99A5961-001	99A6619-001	99A7195-001	99A7879-001	99A8344-001	99A9456-001	99A0193-001	99A0408-001
		12/21/98	1/18/99	2/9/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99
ALUMINUM	87+	52.6 E	75.6	33.3 E	35.8	135	62.2	122	74	224	221	94
ANTIMONY	6	0.1 U	2 U	0.41 BN	0.98 B	1.2 B	0.48 U	0.84 B	0.62 U	0.62 U	0.62 U	0.62 U
ARSENIC	50	0.4 U	1.5 U	0.64 U	0.35 U	0.58 U	0.58 U	0.58 U	0.82 U	1 B	0.82 U	0.82 U
BARIUM	1000	724	807	744	726	622	671	625	581	632	606	673
BERYLLIUM	4	0.06 B	0.5 U	0.06 B	0.06 B	0.11 B	0.21 B	0.08 B	0.06 B	0.03 B	0.07 B	0.07 B
CADMIUM	1.5	0.05 UN	0.5 U	0.03 U	0.31 U	0.16 B	0.1 B	0.26 B	0.19 B	0.51 B	0.26 B	0.37 B
CALCIUM		141000 N*	141000	133000 E	150000	147000	149000	154000	141000	158000	149000	145000
CHROMIUM	50++	11.8	1.4 B	0.84 B	4	2.9	0.35 B	1.4 B	0.27 B	1.3 B	0.86 B	0.55 B
COBALT		1.4 B	1.5 U	1.1 B	1.1 BE	0.39 B	0.8 B	0.9 B	0.87 B	0.74 B	0.86 B	0.97 B
COPPER	16+	2.3 B	1 B	1.5 B	1.4 B	0.91 B	0.25 U	0.56 B	0.9 B	0.57 B	0.3 U	1.1 B
IRON	1000++	54900 N*	69500	44400	44400	46000	50000	46100	43000	45400	43100	50900
LEAD	6.5+	1.5 N	1 U	0.46 B	1.1 BE	1.7 B	0.96 B	0.94 B	0.52 U	2.7	2.8	0.65 B
LITHIUM		32.4 B	37 B	27 BN	43.3 B	56.2 B	47.5 B	37.2 B	32 B	36 B	32.1 B	29.3 B
MAGNESIUM		32500	32100	30900 N	31100	31800	33500	32100	31100	32200	31700	30300
MANGANESE	1000++	1180 *	1170 *	1300	1210	1230	1340	1300	1300	1340	1330	1290
MERCURY	1	0.1 U*	0.1 U	1.2	0.12 UN	0.69	0.35	0.1 U				
MOLYBDENUM		1 U	1 U	0.16 B	1.1 B	0.46 B	0.3 U	0.82 B	0.32 U	0.32 U	0.32 U	0.32 U
NICKEL	123+	7.5 B	2.6 B	4.8 B	7.9 BE	5.6 B	4.4 B	4.3 B	3.6 B	4.7 B	3.9 B	4.1 B
POTASSIUM		5830 EN	5860	5470 EN	5890	8110	8360	8200	5080	7590	7730	6900
SELENIUM	5	0.2 U	3.7	2 U	2.3 B	1.2 U	1.2 U	1.2 U	0.92 U	0.92 U	0.92 U	0.92 U
SILVER	0.6	0.05 U	0.05 U	0.35 B	0.66 B	0.35 U	0.35 U	0.35 U	0.25 U	0.25 U	0.25 U	0.25 U
SODIUM		65700 N*	64400 E	58600 E	66400	60400	58100	63700	50700	63700	57300	54100
STRONTIUM		1010	1000	1080	1050	959	1060	1020	962	993	976	938
THALLIUM		0.15 UN	0.15 UN	0.82 BN	0.76 BE	0.88 U	1.3 B	2 B	1.3 U	1.3 U	1.3 U	1.3 U
TIN		1.5 U	2 U	1.7 B	0.6 B	0.68 U	0.97 B	0.68	0.52 U	0.52 U	0.52 U	0.52 U
VANADIUM		4.2 B	3 B	2.6 B	0.73 U	2.4 B	3 B	2.7 B	2.2 B	2.4 B	2.7 B	2.9 B
ZINC	141+	180	287 *	183 N*	189	205	269	255	186	200	198	266

U - Analyte was analyzed for but below the stated detection limit.

B - Analyte is found in the associated blank as well as the sample.

E - Estimated value due to interference.

* - Duplicate analysis was not within control limits.

N - Spiked recovery not within control limits.

+ RFCA (April 1997) Standards are for informational purposes.

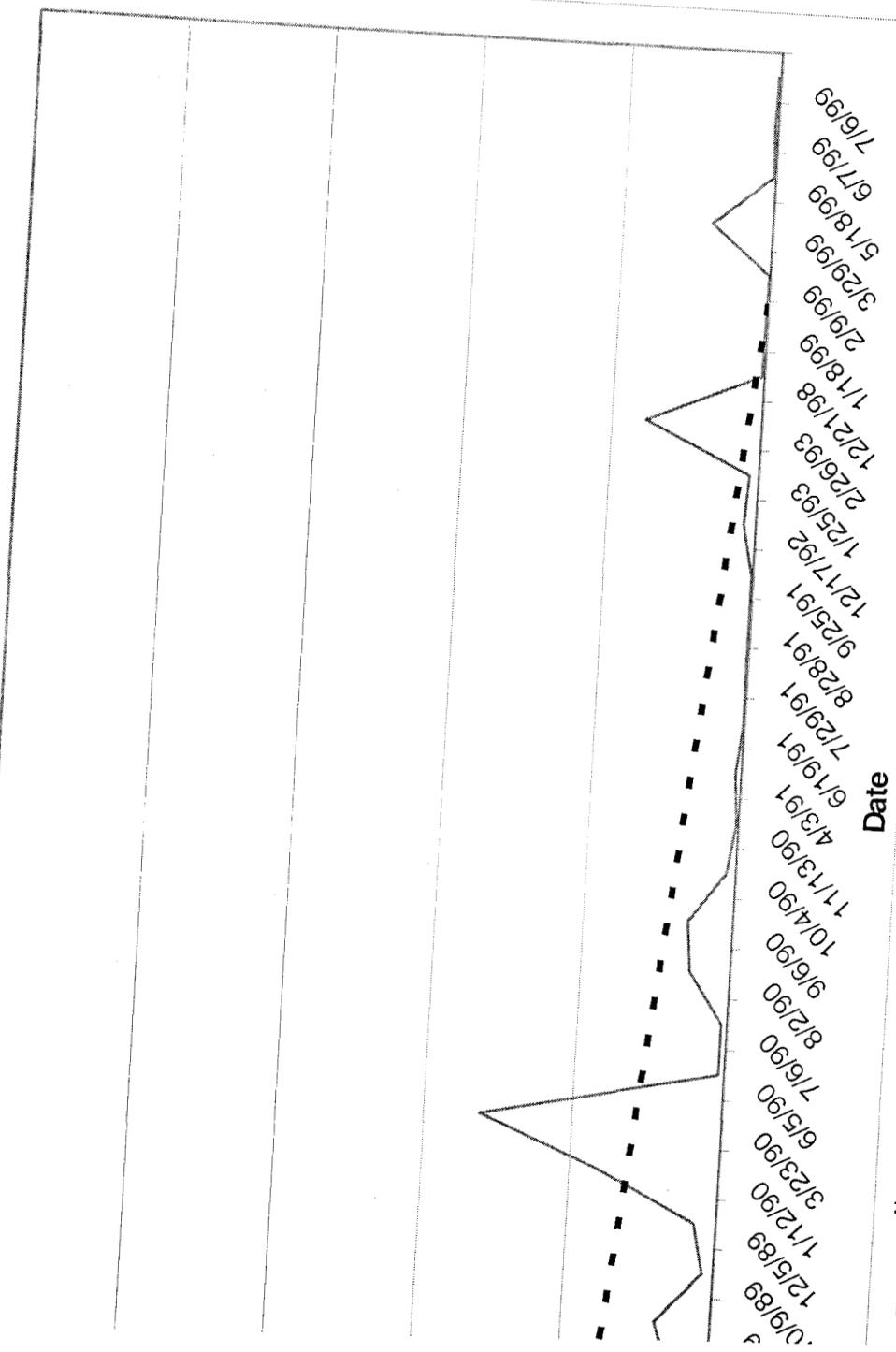
3/490	11/13/90	4/3/91	6/19/91	7/29/91	8/28/91	9/25/91	12/17/92	1/25/93	2/26/93	11/17/98	1/18/99	2/29/99	3/29/99	4/12/99	5/18/99	6/7/99	7/6/99	8/16/99	9/7/99	10/11/99		
2E+02	9.3E+01	2.0E+02	2.6E+01	6.4E+01	6.3E+01	4.4E+01	3.9E+02	3.1E+02	3.9E+03	5.3E+01	7.6E+01	7.2E+01	3.3E+01	2.0E+03	1.4E+02	6.2E+01	1.2E+02	7.4E+01	2.2E+02	2.2E+02	9.4E+01	
5E+01	2.2E+01	2.6E+01	1.1E+01	4.2E+01	4.2E+01	1.4E+01	2.0E+01	2.0E+01	1.0E+01	1.0E+01	2.0E+00	2.0E+00	4.1E+01	6.0E+02	1.2E+00	4.8E+01	8.4E+01	6.2E+01	6.2E+01	6.2E+01	6.2E+01	6.2E+01
1E+00	2.4E+00	2.2E+00	2.0E+00	9.0E+01	7.0E+01	2.0E+00	1.5E+00	1.4E+00	4.0E+01	1.5E+00	1.5E+00	6.4E+01	2.0E+03	5.8E+01	5.8E+01	5.8E+01	8.2E+01	8.2E+01	1.0E+00	8.2E+01	8.2E+01	8.2E+01
1E+02	5.6E+02	5.6E+02	5.4E+02	5.5E+02	5.5E+02	5.3E+02	6.2E+02	5.9E+02	7.6E+02	7.2E+02	8.1E+02	5.9E+02	7.4E+02	2.9E+03	6.2E+02	6.7E+02	6.3E+02	5.8E+02	6.3E+02	6.1E+02	6.7E+02	6.7E+02
3E+01	1.0E+00	5.0E+01	1.0E+00	6.0E+01	6.0E+01	1.0E+00	1.4E+00	9.0E+01	1.2E+00	6.0E+02	5.0E+01	5.0E+01	6.0E+02	5.1E+01	1.1E+01	2.1E+01	8.0E+02	6.0E+02	3.0E+02	7.0E+02	7.0E+02	7.0E+02
E+00	5.0E+00	1.7E+01	7.8E+00	4.6E+00	4.6E+00	1.0E+00	3.7E+00	2.7E+00	2.7E+00	5.0E+02	5.0E+01	5.0E+01	3.0E+02	5.0E+01	1.6E+01	1.0E+01	2.6E+01	1.9E+01	5.1E+01	2.6E+01	3.7E+01	3.7E+01
E+05	1.5E+05	1.3E+05	1.4E+05	1.4E+05	1.4E+05	1.4E+05	1.4E+05	1.5E+05	1.4E+05	1.4E+05	1.3E+05	1.6E+05	1.5E+05	1.5E+05	1.5E+05	1.5E+05	1.4E+05	1.5E+05	1.6E+05	1.5E+05	1.5E+05	1.5E+05
E+00	4.0E+00	2.1E+01	2.0E+00	2.8E+01	5.5E+00	2.0E+00	7.9E+00	3.1E+00	1.4E+01	1.2E+01	1.4E+00	8.4E+01	4.0E+00	2.0E+02	2.9E+00	3.5E+01	1.4E+00	2.7E+01	1.3E+00	8.6E+01	5.5E+01	5.5E+01
E+00	6.2E+00	4.0E+00	4.3E+00	7.3E+00	7.3E+00	5.0E+00	4.2E+00	5.8E+00	9.4E+00	1.4E+00	1.5E+00	1.1E+00	4.5E+02	3.9E+01	8.0E+01	9.0E+01	8.7E+01	7.4E+01	8.6E+01	9.7E+01	9.7E+01	9.7E+01
E+01	5.0E+00	4.7E+00	1.2E+01	5.4E+00	5.4E+00	5.8E+00	6.6E+00	4.1E+00	6.4E+00	2.3E+00	1.0E+00	1.5E+00	1.4E+00	2.3E+02	9.1E+01	2.5E+01	5.6E+01	9.0E+01	5.7E+01	3.0E+01	1.1E+00	1.1E+00
E+04	6.7E+04	7.5E+04	6.8E+04	7.2E+04	7.5E+04	7.7E+04	9.7E+04	9.6E+04	1.2E+05	5.5E+04	7.0E+04	4.4E+04	5.2E+04	4.5E+04	4.6E+04	5.0E+04	4.6E+04	4.3E+04	4.5E+04	4.3E+04	5.1E+04	5.1E+04
E+00	5.2E+00	4.7E+00	2.0E+00	4.3E+00	1.6E+00	1.7E+00	1.0E+00	1.7E+00	1.1E+01	1.5E+00	1.0E+00	1.0E+00	4.6E+01	5.1E+02	1.7E+00	9.6E+01	9.4E+01	5.2E+01	2.7E+00	2.8E+00	6.5E+01	6.5E+01
			4.9E+01	3.8E+01		3.4E+01																
E+04	3.4E+04	2.9E+04	3.1E+04	3.1E+04	3.0E+04	3.1E+04	3.2E+04	3.2E+04	3.3E+04	3.3E+04	3.2E+04	3.1E+04	3.0E+04	3.2E+04	3.4E+04	3.2E+04	3.1E+04	3.1E+04	3.2E+04	3.2E+04	3.0E+04	3.0E+04
E+03	1.6E+03	1.3E+03	1.5E+03	1.5E+03	1.5E+03	1.4E+03	1.5E+03	1.4E+03	1.5E+03	1.2E+03	1.2E+03	1.2E+03	1.3E+03	1.7E+03	1.2E+03	1.3E+03	1.3E+03	1.3E+03	1.3E+03	1.3E+03	1.3E+03	1.3E+03
E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	2.0E+01	1.0E+01	1.0E+01	1.0E+01	6.8E+01	7.5E+01	6.9E+01	3.5E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01	1.0E+01
			3.0E+00	1.0E+01		4.0E+00																
E+01	9.0E+00	1.5E+01	4.0E+00	1.1E+01	3.1E+01	5.0E+00	1.9E+01	2.2E+01	2.1E+01	7.5E+00	2.6E+00	4.8E+00	7.6E+00	4.7E+02	5.6E+00	4.4E+00	4.3E+00	3.6E+00	4.7E+00	3.9E+00	4.1E+00	4.1E+00
E+03	5.3E+03	6.0E+03	8.0E+03	7.6E+03	6.3E+03	6.1E+03	5.5E+03	6.3E+03	7.2E+03	5.8E+03	5.9E+03	5.5E+03	5.5E+03	1.1E+04	8.1E+03	8.4E+03	8.2E+03	5.1E+03	7.6E+03	7.7E+03	6.9E+03	6.9E+03
E+00	2.0E+00	1.1E+00	4.0E+00	1.2E+00	1.2E+00	2.0E+01	1.1E+00	1.3E+00	1.4E+00	2.0E+01	3.7E+00	2.0E+00	1.5E+00	2.0E+03	1.2E+00	1.2E+00	1.2E+00	9.2E+01	9.2E+01	9.2E+01	9.2E+01	9.2E+01
E+00	3.6E+00	5.0E+00	2.0E+00	6.8E+00	6.8E+00	5.0E+00	2.7E+00	3.6E+00	4.4E+00	5.0E+02	5.0E+02	3.5E+01	4.7E+01	3.5E+01	3.5E+01	3.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E+01
E+04	7.4E+04	6.2E+04	6.5E+04	6.0E+04	6.2E+04	6.1E+04	6.6E+04	6.3E+04	6.6E+04	6.6E+04	6.4E+04	5.9E+04	6.9E+04	7.0E+04	6.0E+04	5.8E+04	6.4E+04	5.1E+04	6.4E+04	5.7E+04	5.4E+04	5.4E+04
			9.0E+02	8.8E+02		8.3E+02																
E+00	2.0E+00	1.4E+00	1.0E+00	1.6E+00	1.6E+00	1.0E+00	1.6E+00	1.5E+00	1.5E+00	1.5E+01	8.2E+01	4.6E+01	1.9E+03	8.8E+01	1.3E+00	2.0E+00	1.3E+00	9.6E+02	9.9E+02	9.8E+02	9.4E+02	9.4E+02
			1.3E+01	5.7E+01		1.1E+01																
E+01	1.2E+01	5.7E+00	5.0E+00	6.5E+00	6.5E+00	5.6E+00	9.3E+00	1.5E+01	1.9E+01	4.2E+00	3.0E+00	2.6E+00	1.1E+01	6.2E+02	2.4E+00	3.0E+00	2.7E+00	2.2E+00	2.4E+00	2.7E+00	2.9E+00	2.9E+00
E+03	2.7E+03	2.6E+03	9.9E+02	2.1E+03	2.2E+03	2.2E+03	1.8E+02	2.2E+03	1.8E+02	2.9E+02	1.8E+02	1.9E+02	7.2E+02	2.1E+02	2.7E+02	2.1E+02	2.6E+02	1.9E+02	2.0E+02	2.0E+02	2.7E+02	2.7E+02



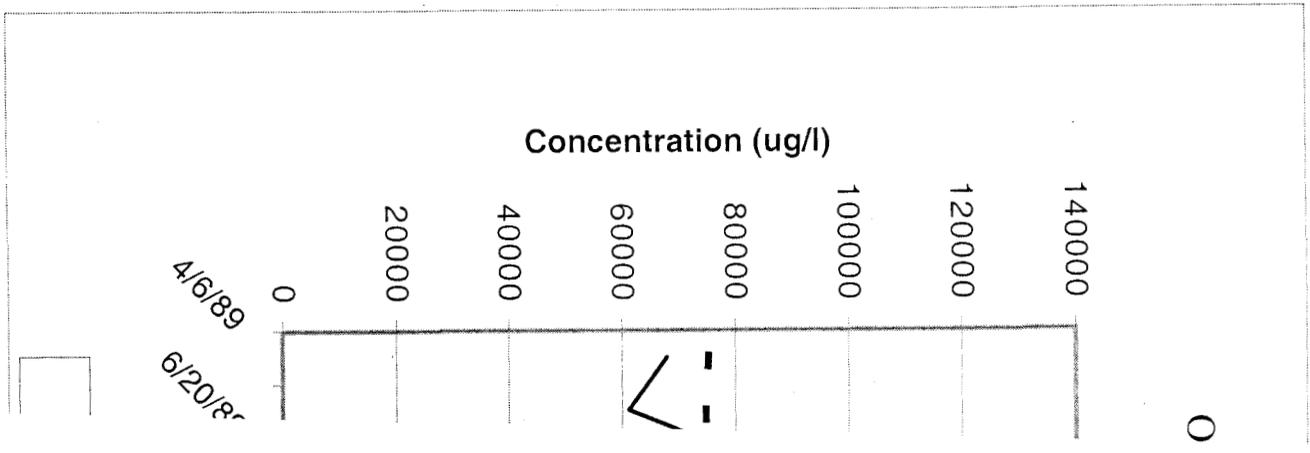
9

it System

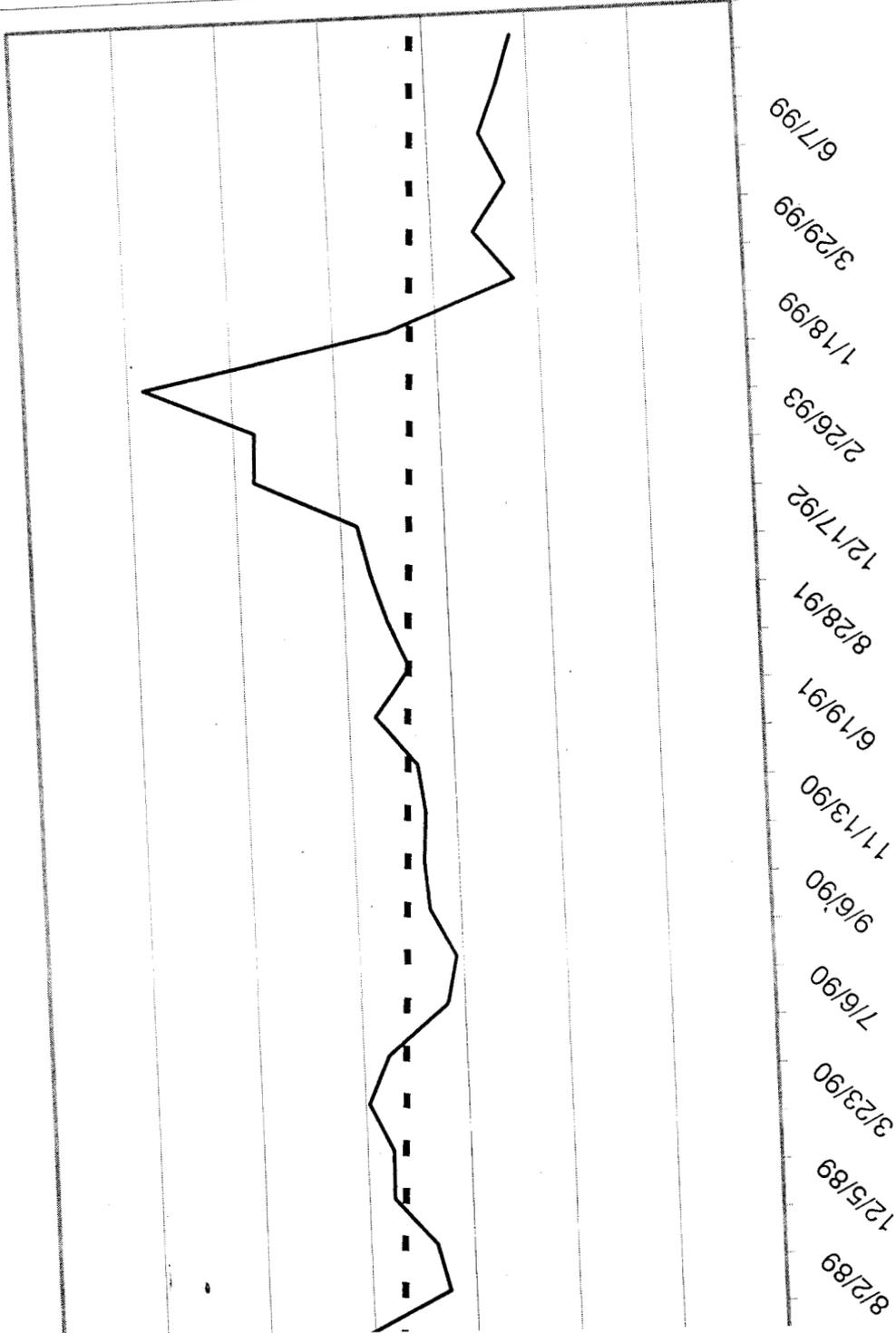
Graph A-1
 OU7 Landfill Endpoint (SW0097 & SW00196) Total Aluminum Concentration



Aluminum ———
 Linear Aluminum - - -

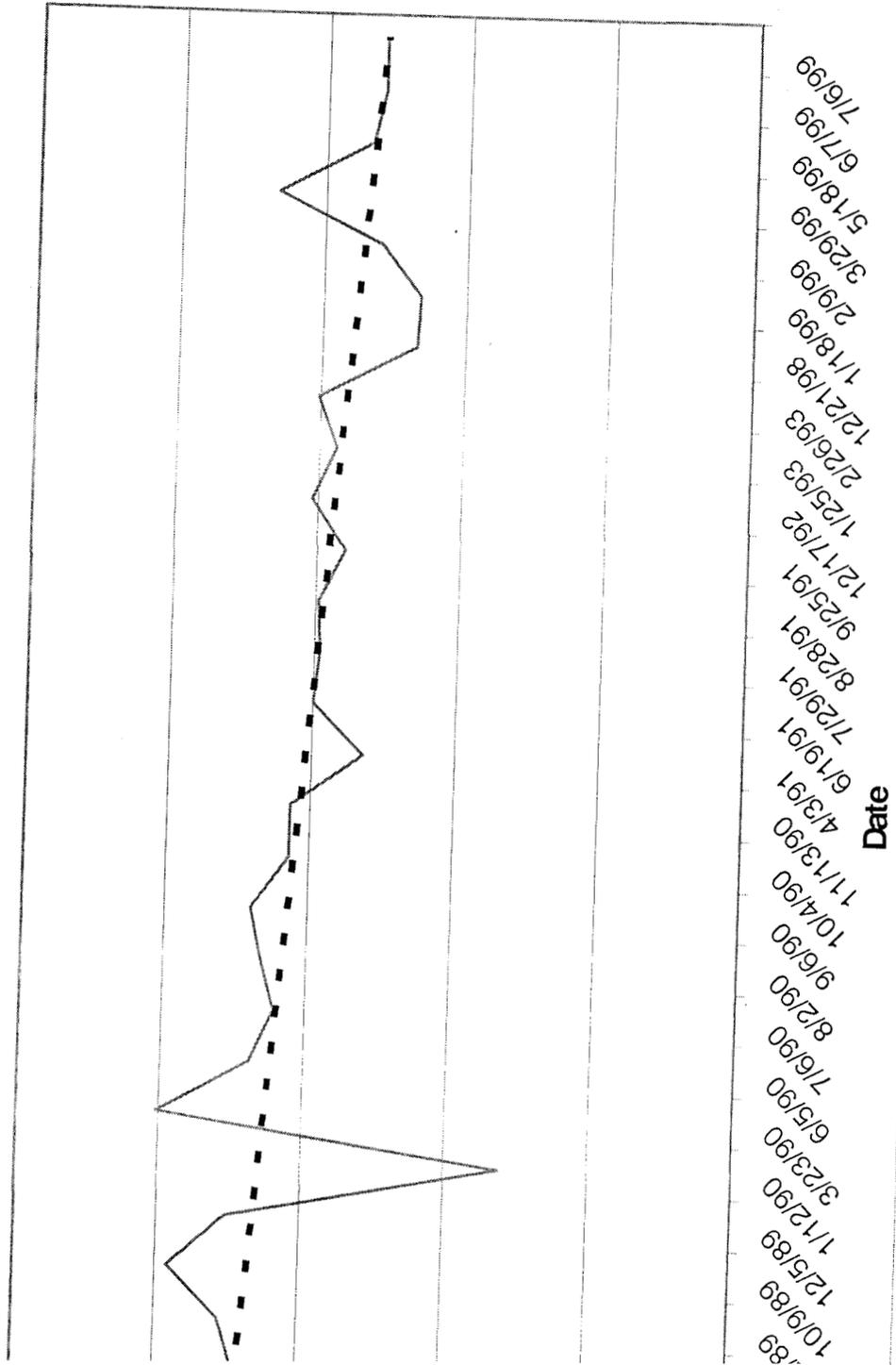


Graph A-2
7 Landfill Endpoint (SW0097 & SW00196) Total Iron Concentration



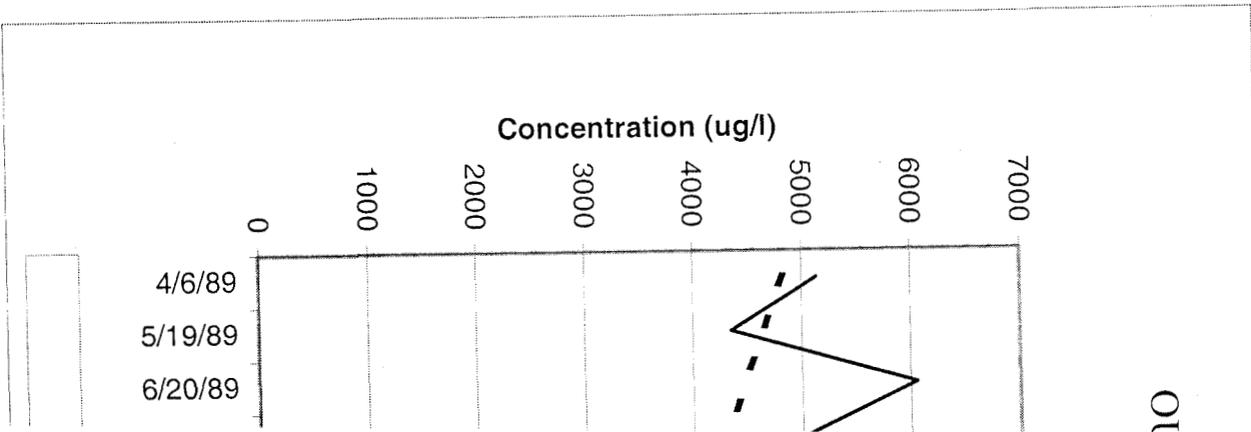
— Iron
- - - Linear (Iron)

Graph A-3
OU7 Landfill Endpoint (SW0097 & SW00196) Total Manganese Concentration

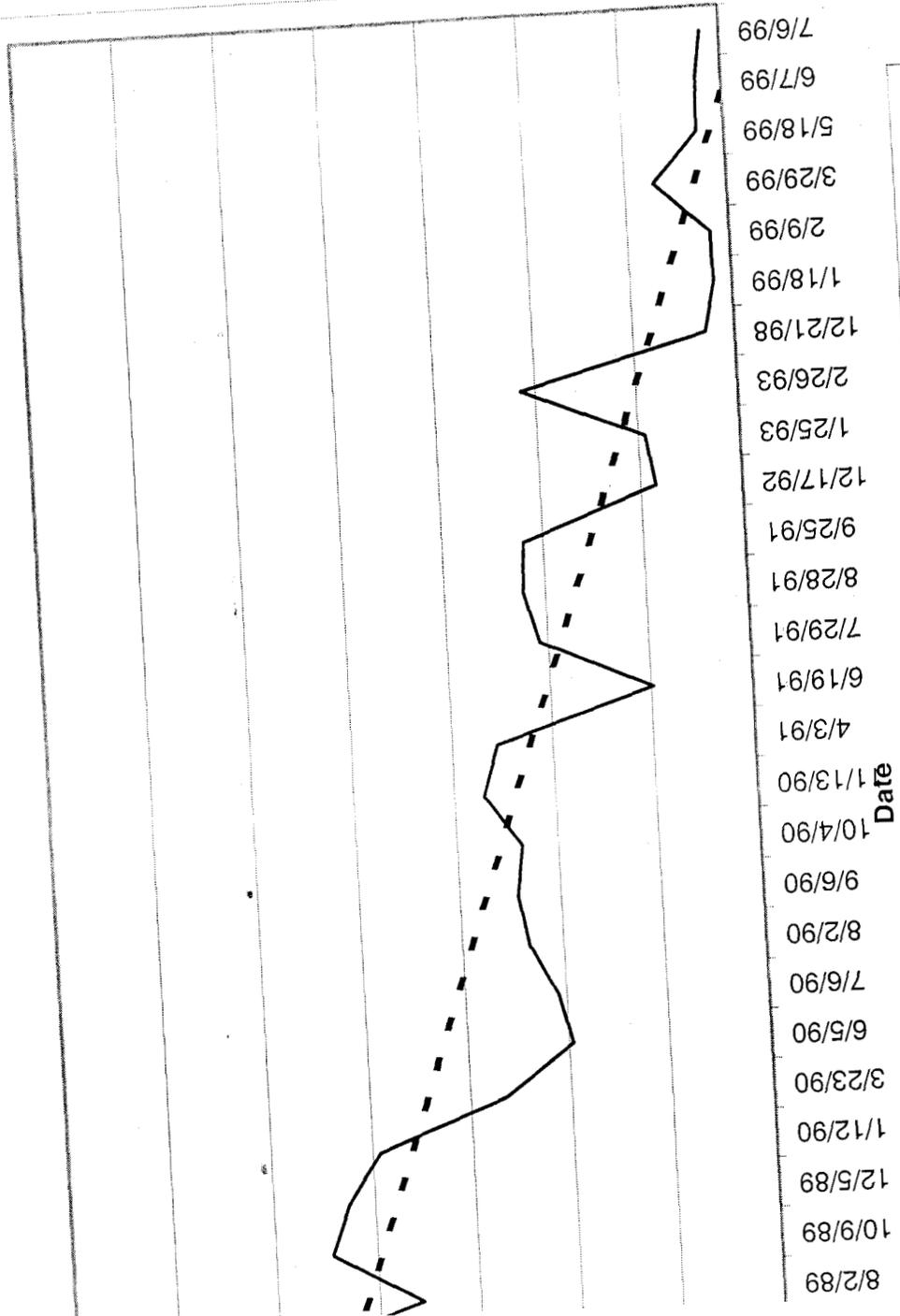


— MANGANESE

- - - Linear (MANGANESE)



Graph A-4
Landfill Endpoint (SW0097 & SW00196) Total Zinc Concentration



— Zinc

- - - Linear (Zinc)

13

System

Uranium-233/234, 235 and 238

+ RFCA (April 1997) are for info

Result	Total Error	Description	Result	Total Error	Description	Result	Total Error	Description	Result	Total Error	Result & Error	RFC Standard *
7.39E-01	2.11E-01	URANIUM-235	3.90E-02	3.40E-02	URANIUM-238	7.17E-01	2.11E-01	URANIUM-238	1.95E+00		1.95E+00	10
1.31E-01	6.50E-02	URANIUM-235	1.20E-02	1.90E-02	URANIUM-238	7.50E-02	5.60E-02	URANIUM-238	3.58E-01		3.58E-01	10
2.30E-01	9.30E-02	URANIUM-235	3.00E-03	1.50E-02	URANIUM-238	1.07E-01	6.70E-02	URANIUM-238	5.15E-01		5.15E-01	10
1.65E-01	8.20E-02	URANIUM-235	-1.00E-03	2.00E-03	URANIUM-238	1.33E-01	7.80E-02	URANIUM-238	4.59E-01		4.59E-01	10
1.12E-01	3.55E-02	URANIUM-235	-4.48E-03	1.00E-02	URANIUM-238	1.24E-01	3.42E-02	URANIUM-238	3.11E-01		3.11E-01	10
1.62E-01	7.40E-02	URANIUM-235	6.00E-03	1.40E-02	URANIUM-238	5.00E-02	4.60E-02	URANIUM-238	3.52E-01		3.52E-01	10
2.51E-01	9.50E-02	URANIUM-235	3.56E-02	4.08E-02	URANIUM-238	2.66E-01	9.16E-02	URANIUM-238	7.80E-01		7.80E-01	10
2.33E-01	8.12E-02	URANIUM-235	-2.50E-03	1.94E-02	URANIUM-238	1.21E-01	5.99E-02	URANIUM-238	5.12E-01		5.12E-01	10
1.92E-01	8.80E-02	URANIUM-235	2.00E-03	1.80E-02	URANIUM-238	1.14E-01	6.40E-02	URANIUM-238	4.78E-01		4.78E-01	10
2.53E-01	1.06E-01	URANIUM-235	3.50E-02	3.40E-02	URANIUM-238	3.19E-01	1.23E-01	URANIUM-238	8.70E-01		8.70E-01	10
1.50E-01	3.46E-02	URANIUM-235	9.10E-03	1.40E-02	URANIUM-238	1.01E-01	2.93E-02	URANIUM-238	3.38E-01		3.38E-01	10
1.53E-01	1.19E-01	URANIUM-235	4.93E-02	6.13E-02	URANIUM-238	1.54E-01	9.94E-02	URANIUM-238	6.33E-01		6.33E-01	10

for informational purposes.

Sample Number	Collection Date
99A3786-001	17-Nov-98
99A4114-001	21-Dec-98
99A4701-001	18-Jan-99
99A4962-001	9-Feb-99
99A5961-001	29-Mar-99
99A6619-001	12-Apr-99
99A7195-001	18-May-99
99A7879-001	7-Jun-99
99A8344-001	6-Jul-99
99A9456-001	16-Aug-99
99A0193-001	7-Sep-99
00A0408-001	11-Oct-99

Evaluation of OU7 Aeration Treatment System
 November 1998-October 1999
 Table A-4
 OU7 Landfill Effluent (SW00196) PI
 RFCA March 2000
 All units pCi/l

Plutonium-239/234 and Americium-241

Description	Result	Sigma Error	Result & Error	RFCA Standard ⁺
PLUTONIUM-239/240	7.00E-03	1.20E-02	1.90E-02	0.15
PLUTONIUM-239/240	4.00E-03	1.10E-02	1.50E-02	0.15
PLUTONIUM-239/240	5.00E-03	1.30E-02	1.80E-02	0.15
PLUTONIUM-239/240	7.00E-03	1.50E-02	2.20E-02	0.15
PLUTONIUM-239/240	1.18E-03	6.73E-03	7.91E-03	0.15
PLUTONIUM-239/240	-3.00E-03	1.10E-02	8.00E-03	0.15
PLUTONIUM-239/240	-4.40E-03	1.17E-02	7.30E-03	0.15
PLUTONIUM-239/240	2.40E-03	6.00E-03	8.40E-03	0.15
PLUTONIUM-239/240	2.00E-03	1.30E-02	1.50E-02	0.15
PLUTONIUM-239/240	1.30E-02	2.20E-02	3.50E-02	0.15
PLUTONIUM-239/240	-3.40E-03	8.70E-03	5.30E-03	0.15
PLUTONIUM-239/240	3.38E-03	5.98E-03	9.36E-03	0.15

Description	Result	Sigma Error	Result & Error	RFCA Standard ⁺
AMERICIUM-241	1.00E-03	1.50E-02	1.60E-02	0.15
AMERICIUM-241	4.00E-03	1.50E-02	1.90E-02	0.15
AMERICIUM-241	-2.00E-03	1.70E-02	1.50E-02	0.15
AMERICIUM-241	-3.00E-03	4.00E-03	1.00E-03	0.15
AMERICIUM-241	-5.89E-03	8.13E-03	2.24E-03	0.15
AMERICIUM-241	2.30E-02	4.30E-02	6.60E-02	0.15
AMERICIUM-241	-9.80E-03	1.03E-02	5.00E-04	0.15
AMERICIUM-241	-8.70E-03	6.10E-03	-2.60E-03	0.15
AMERICIUM-241	-6.00E-03	6.00E-03	0.00E+00	0.15
AMERICIUM-241	3.00E-03	1.20E-02	1.50E-02	0.15
AMERICIUM-241	-3.50E-03	8.10E-03	4.60E-03	0.15
AMERICIUM-241	-6.54E-03	6.79E-03	2.50E-04	0.15

for analytical purposes.

Evaluation of OU7 Aeration Treatment System
 November 1998-October 1999
 Table A-5

OU7 Landfill Effluent (SW00195) Tritium
 RFCA March 2000
 All units pCi/l

Sample Number	Collection Date	Description	Result	Units	Qualifie	Sigma Error	Detection Limit	Result & Error	RFCA Standard*
99A3786-001	17-Nov-98	TRITIUM	290	PCl/L	J	160	240	450	500
99A4114-001	21-Dec-98	TRITIUM	200	PCl/L	U	170	280	370	500
99A4701-001	18-Jan-99	TRITIUM	220	PCl/L	U	170	270	390	500
99A4962-001	09-Feb-99	TRITIUM	400	PCl/L		170	250	570	500
99A4962-001	09-Feb-99	TRITIUM	250	PCl/L	J	160	250	410	500
99A5961-001	29-Mar-99	TRITIUM	-120.0063	PCl/L	U	211.7394	385.0158	92	500
99A6619-001	12-Apr-99	TRITIUM	-118.1973	PCl/L	U	182.8125	316.0775	65	500
99A7195-001	18-May-99	TRITIUM	15.0274	PCl/L	U	151.3177	266.0631	166	500
99A7879-001	07-Jun-99	TRITIUM	-43.3371	PCl/L	U	146.7803	261.9099	103	500
99A8344-001	06-Jul-99	TRITIUM	170	PCl/L	U	170	280	340	500
99A8344-001	06-Jul-99	TRITIUM	130	PCl/L	U	160	280	290	500
99A9456-001	16-Aug-99	TRITIUM	240	PCl/L	U	170	280	410	500
99A0193-001	07-Sep-99	TRITIUM	125.8829	PCl/L	U	124.5193	205.0143	250	500
00A0408-001	11-Oct-99	TRITIUM	85.1	PCl/L	U	139	235	224	500

+ RFCA (April 1997) Standards are for informational purposes.

ss Alpha and Grass Beta

Description	Result	Sigma Error	Result & Error	RFCA Standard ⁺
GROSS ALPHA	5.0	2.0	7.0	11
GROSS ALPHA	21.0	4.0	25.0	11
GROSS ALPHA	3.0	1.0	4.0	11
GROSS ALPHA	-1.2	2.1	0.9	11
GROSS ALPHA	4.0	2.0	6.0	11
GROSS ALPHA	0.4	1.2	1.6	11
GROSS ALPHA	4.2	1.6	5.8	11
GROSS ALPHA	2.5	1.3	3.8	11
GROSS ALPHA	2.0	1.0	3.0	11
GROSS ALPHA	4.2	1.4	5.6	11
GROSS ALPHA	2.6	1.2	3.8	11
GROSS ALPHA	4.3	2.0	6.3	11

Description	Result	Sigma Error	Result & Error	RFCA Standard ⁺
GROSS BETA	9.0	2.0	11.0	19
GROSS BETA	17.0	3.0	20.0	19
GROSS BETA	8.0	1.0	9.0	19
GROSS BETA	0.56	3.1	3.7	19
GROSS BETA	11.0	2.0	13.0	19
GROSS BETA	6.0	2.6	8.6	19
GROSS BETA	10.4	1.6	12.0	19
GROSS BETA	8.4	1.4	9.8	19
GROSS BETA	8.0	1.1	9.1	19
GROSS BETA	8.7	1.4	10.1	19
GROSS BETA	7.3	1.4	8.7	19
GROSS BETA	9.4	1.5	10.9	19

r informational purposes.