



DEPARTMENT OF THE AIR FORCE

HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

28 JUL 1999

MEMORANDUM FOR NEW MEXICO ENVIRONMENT DEPARTMENT

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FROM: 49 CES/CEVC
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SUBJECT: Submittal of Fourth Quarter 1998 Monitoring Report, 20,000-Pound Open Detonation Unit (ODU) and Quality Assurance/Quality Control Results

1. Attached are the 20,000 Pound ODU *Fourth Quarter 1998 Monitoring Report* and the *Fourth Quarter 1998 Monitoring Report Quality Assurance/Quality Control Results* (Atchs 1 and 2, respectively). These reports are submitted requirements per New Mexico Environment Department (NMED) RCRA Permit for Open Detonation Treatment Unit, EPA Number NM6572124422. The quarterly monitoring report contains the results of soil sampling following a detonation. These results were then compared to background levels and site specific risk-based screening levels. Results from the analysis show that the ODU is effectively treating material and residual soil contaminants are below risk-based action levels.
2. The detonation event corresponding to *The Fourth Quarter 1998 Monitoring Report* was performed on 4 Dec 98. The soil sampling for the quarterly monitoring report occurred on 7 Dec 98, within 72-hours of the detonation event. All permit conditions related to the soil sampling and analysis were met for the quarterly monitoring report.
3. Also is a *Revised Final Third Quarter 1998 Monitoring Report* (Atch 3) dated May 1999. The original report contained an error in the text on page 5, section 2.2.2 Metals Results, last sentence. The error stated "The first quarter 1998 sampling results..." and has now been corrected to read "The third quarter 1998 sampling results...".
4. If you have any questions or require additional information, please contact Ms. Debbie Hartell at (505) 475-3931.


HOWARD E. MOFFITT
Deputy Base Civil Engineer

Attachments:

1. Fourth Quarter 1998 Monitoring Report 20,000-Pound Open Detonation Unit
2. Fourth Quarter 1998 Monitoring Report Quality Assurance/Quality Control Results
3. Revised Final Third Quarter 1998 Monitoring Report 20,000-Pound Open Detonation Unit

Global Power for America



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*Headquarters, Air Combat Command
Langley Air Force Base,
Virginia*

Final

*Fourth Quarter 1998 Monitoring Report
20,000-Pound Open Detonation Unit*

July 1999



*49 CES/CEV
Holloman Air Force Base,
New Mexico*

Part III—Fourth Quarter 1998 Monitoring Report
20,000-Pound Open Detonation Unit
Background Study and Quarterly Monitoring Program

Final

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July 1999

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LIST OF ACRONYMS

EOD.....	explosive ordnance disposal
HAFB	Holloman Air Force Base
NCP	National Contingency Plan
OD	open detonation
QA	quality assurance
QAPP.....	quality assurance project plan
QA/QC.....	quality assurance/quality control
QC.....	quality control
UTL	upper tolerance limit

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Executive Summary

During the fourth quarter of 1998, Holloman Air Force Base (HAFB) performed the fourth quarterly sampling event at the 20,000-Pound Open Detonation (OD) Unit in accordance with Attachment J of the facility's operating permit. Twelve locations were sampled for metals and explosives. The analytical results were compared to the decision criteria outlined on page 33 in Attachment J of the operating permit. None of the sample results exceeded the decision criteria. Detailed results are presented in Section 2.2.

No changes to operations at the 20,000-Pound OD Unit are recommended.

This report summarizes the field activities, results, and conclusions of the fourth quarter 1998 sampling event.

1.0 Field Operations

Field sampling was conducted on 7 December 1998. The sampling was performed within 72 hours of the detonation event that occurred on 4 December 1998. A total of 12 soil samples were obtained from three different strata within the boundaries of the 20,000-Pound OD Unit. Samples, including quality assurance/quality control (QA/QC) samples, were collected following the procedures outlined in the *20,000-Pound Open Detonation Unit Background Study and Quarterly Monitoring Work Plan* (Radian, 1997) and summarized in *Part I: Program Overview*. Samples were analyzed for metals and explosives as specified in the Quality Assurance Project Plan (QAPP) of the *Work Plan*.

During the field operations, the dimensions of each of the strata were measured and recorded. A grid was then developed based on these measurements. Random sampling locations were determined following the guidelines established in the *Work Plan*. Sampling locations are listed in Table 1-1.

Samples were labeled according to the following numbering sequence:

HOL20K-Qx-yzs, where:

x = **Quarter number**;

y = **Sample type**—The number 0 indicates a normal sample, 1 indicates a duplicate, and 2 indicates an equipment blank;

z = **Sample number**—these numbers correspond to those numbers listed in Table 1-2; and,

s = **Stratum (A, B, or C)**.

The area sampled was based on wind data recorded for detonations that had occurred since the previous sampling event (18 Sept 1998). The only detonation event that had occurred since the last event is that which occurred on 4 Dec 1998. The wind data for the detonation is listed in Table 1-3. It was assumed that any small particles from the detonation event would fall out downwind of the detonation location. By determining the area for sampling based on the prevalent wind direction for the detonation, the quarterly sampling data reasonably reflect constituent concentrations in the soil. Figure 1-1 illustrates the strata dimensions, grid layout, and sample locations.

2.0 Analytical Results

This section presents a QA/QC evaluation of the analyses and a discussion of the analytical results of the fourth quarter 1998 sampling event.

2.1 Quality Assurance/Quality Control Summary

Quality control data were reviewed to determine the usability and defensibility of the analytical measurement data. The review focused on field and laboratory blanks, duplicate field samples, matrix spikes, surrogate recoveries, and laboratory control samples. Overall, QC data associated with this program indicate that the measurement data are acceptable and defensible. The data indicate that the QC mechanisms were effective in ensuring measurement data reliability

Table 1-1
Fourth Quarter Sample Locations

Stratum: A
 Number of Samples: 4
 Number of Potential Sampling Locations (n): 16
 Scale Factor (n-1): 15

Sample Number	Random Number	Scaled Random Number ^a	Grid Node to Sample ^b
1	0.1933	2.90	A3
2	0.488	7.32	A8
3	0.8593	12.89	A13
4	0.8967	13.45	A14

Stratum: B
 Number of Samples: 4
 Number of Potential Sampling Locations (n): 20
 Scale Factor (n-1): 19

Sample Number	Random Number	Scaled Random Number ^a	Grid Node to Sample ^b
1	0.3747	7.12	B7
2	0.6874	13.06	B13
3	0.7289	13.85	B14
4	1.01	19.19	B19

Stratum: C
 Number of Samples: 4
 Number of Potential Sampling Locations (n): 17
 Scale Factor (n-1): 16

Sample Number	Random Number	Scaled Random Number ^a	Grid Node to Sample ^b
1	0.1319	2.11	C2
2	0.6281	10.05	C10
3	0.6794	10.87	C11
4	0.8731	13.97	C14

^a Scaled Random Number = Random Number * Scale Factor

^b Grid Node = Scaled Random Number rounded to the nearest integer

Table 1-2
Sample Node and Corresponding Sample Number

Strata	Node Number	Sample Number
A	3	1
	8	2
	13	3
	14	4
B	7	1
	13	2
	14	3
	19	4
C	2	1
	10	2
	11	3
	14	4

Table 1-3.
Wind Direction and Wind Speed During Days of
Open Detonation Activities - 4 December 1998

Time	Direction/Speed ¹
1300	146/12
1330	179/11
1400	164/9
1430	140/10
1500	146/8
1530	151/7
1600	146/5

¹ Wind direction is the direction from which the wind is blowing, wind direction is in degrees, wind speed is in knots.

² Data in bold type indicate hours during which open detonation events occurred.

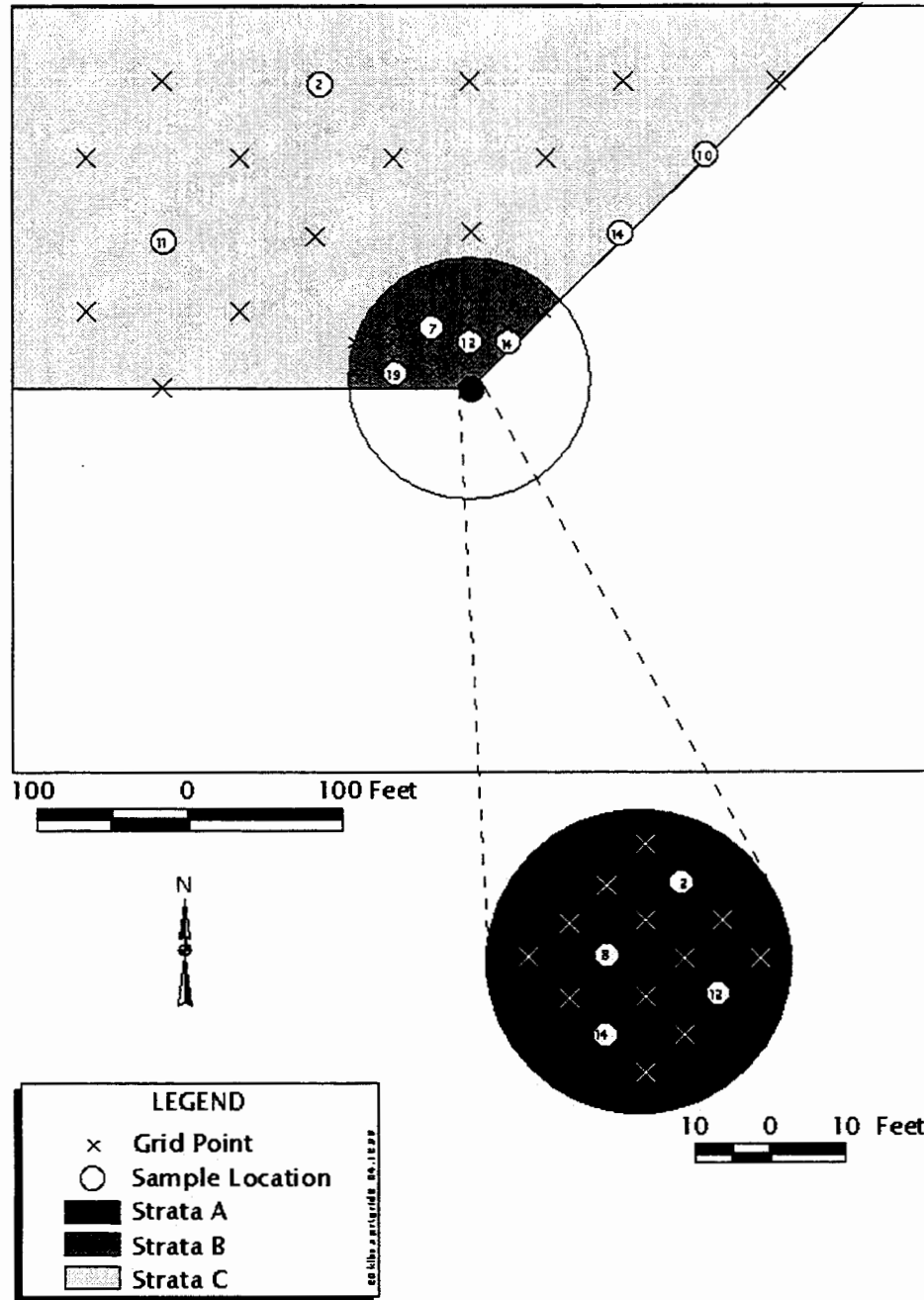


Figure 1-1. Grid Layout and Sample Locations

within the expected limits of sampling and analytical error.

The data reported for this monitoring event were censored at different levels. The reported data for explosives analyses (SW-846 Methods 8330 and 8332) were censored at the sample detection limit. A "J" flag was assigned to concentrations that were less than the quantitation limit but greater than the detection limit.

The data reported for metals were uncensored results. Traditionally, analytical chemistry data have been censored at a concentration (e.g., method detection limit, practical quantitation limit). The reported metals results are uncensored; all instrument response measurements (including instrument responses that correspond to negative values) are reported as measured concentrations. A "J" flag was assigned to concentrations that were less than the sample-specific detection limit. Measurement variability increases, due to analytical system limitations, as measured concentrations approach (or go below) the detection limit. The "J" flag indicates that there is less confidence in the reported concentration (i.e., estimated quantitation).

2.2 Results Summary

Samples were collected and analyzed for several key analytical parameters as specified in the operating permit and outlined in Table 2-1. Complete analytical results are provided in Appendix A. This section provides a summary of these results and a comparison of the samples from the site to background values.

2.2.1 Organic Results

Table 2-1 lists the organic constituents (i.e., explosives) for which samples were analyzed. No organic constituents were detected at the site above background upper tolerance limits (UTLs). A list of the background UTLs can be found in Part II: Background Study (December 1997).

2.2.2 Metals Results

Table 2-1 lists the metal constituents for which the samples were analyzed. These constituents were included in the analyses to determine if metal concentrations exceed naturally occurring concentrations. The analytical results were compared to the site-specific background upper tolerance limits (UTLs). A list of the background UTLs can be found in *Part II: Background Study* (December, 1997). The fourth quarter 1998 sampling results that exceeded background UTLs are flagged in Appendix A of this report and were carried forward to the risk calculation. The risk evaluation is described in Section 3.0 of this report.

3.0 Evaluation of Potential Risk

Constituents that exceeded background UTLs were further evaluated to determine if the levels present at the site pose a potential risk to human health. Based on the risk assessment, none of the constituents exceeded the decision criteria specified in Attachment J of the operating permit. This section describes the methodology that was used for this evaluation, as well as the results of the comparison.

3.1 Risk Assessment Methodology

The 20,000-Pound OD Unit is located in an isolated area of HAFB. Access to the area is restricted to authorized explosive ordnance disposal (EOD) personnel working at the site during a detonation. The evaluation of potential risk was based upon a realistic, but conservative, exposure scenario for these personnel. Unauthorized entry to the site is prevented by security fences and continuous surveillance in addition to warning signs.

Table 2-1
Analytical Parameters and Methods

SW6010 Metals	SW8330 Explosives
Antimony	1,3,5-Trinitrobenzene
Arsenic	1,3-Dinitrobenzene
Barium	2,4,6-Trinitrotoluene
Beryllium	2,4-Dinitrotoluene
Cadmium	2,6-Dinitrotoluene
Chromium (total)	2-Nitrotoluene
Copper	3-Nitrotoluene
Lead	4-Nitrotoluene
Nickel	HMX
Selenium	Nitrobenzene
Silver	RDX
	TETRYL
SW7471 Mercury	SW8332 Nitroamine Explosives
Mercury	Nitroglycerin
	PETN

The exposure scenario for the risk evaluation of the 20,000-Pound OD Unit is based on the frequency of detonations, the amount of time spent at the 20,000-Pound OD Unit for each detonation, and the length of time that the same person would be assigned to this duty. It is assumed that a maximum of ten detonations would be conducted in one year. This is a conservative estimate as the actual number of detonations per year is approximately seven.

It is also assumed that EOD personnel are at the 20,000-Pound OD Unit for two days during each detonation. Typically, the site is inspected on the day after the detonation so personnel are at the site for two days per detonation. However, this is still a very conservative assumption as personnel are there for only a fraction of each day. Finally, the exposure scenario assumes that the same personnel attend every detonation for five years. Five years is a conservative estimate as military personnel are frequently reassigned to different units or duties and no civilian employees are employed at the EOD office. The exposure scenario is further defined in the Risk Evaluation Calculation Sheet in Appendix B.

All inorganic constituents that exceeded background UTLs were included in the evaluation to address the potential for cumulative effects. The maximum detected concentration for each constituent was used to calculate risk. This assumes that the personnel are exposed to this maximum concentration throughout the length of the exposure scenario described above. This is also a conservative assumption. Table 3-1 presents the constituents and their maximum detected concentrations.

3.2 Results of Risk Evaluation

Table 3-2 presents the calculated hazard index and cancer risk estimate for each of the constituents, as well as the cumulative hazard index. The risk range goal in the National Contingency Plan (NCP) is a hazard index less than 1.0 and a cancer risk estimate less than $1\text{E-}06$. These are levels below which no adverse effects are anticipated. The levels calculated for the 20,000-Pound OD Unit are 0.038 for the hazard index and $6.29\text{E-}09$ for the total cancer risk estimate. These are well within the NCP goals indicating that no adverse effects are anticipated from exposure to the OD Unit.

4.0 Conclusions

Comparison of the fourth quarter 1998 monitoring data with the decision criteria indicates that treatment operations at the 20,000-Pound OD Unit are effective. Statistical analyses will be done on the data from the four quarterly monitoring events completed to date to determine if further monitoring will be recommended.

Table 3-1
Maximum Concentrations of Constituents Exceeding
Background UTLs

Constituent	Maximum Detected Concentration (mg/kg)
Arsenic	1.50
Copper	25.4
Lead	15.0

mg/kg = milligrams per kilogram

UTL = Upper Tolerance Limit

Table 3-2
Site Specific Risk Assessment Summary

Constituent	Maximum Concentration (mg/kg)	Oral RfD (mg/kg/d)	Slope Factor (risk per mg/kg/d)	Hazard Quotient (mg/kg)	Cancer Risk
Arsenic	1.50	3.0E-04	1.5 E+00	0.000196	6.3E-09
Copper	25.4	4.0E-02	NA	0.0000249	NA
Lead	15.0	NA ^a	NA	0.0357 ^b	NA
Hazard Index Quotient and Total Cancer Risk Estimate				0.038	6.3E-09

^a Lead does not have an oral RfD; however, the U.S. Environmental Protection Agency (EPA) has determined that a lead concentration of 400 parts per million (ppm) or less does not pose an unacceptable health risk.

^b The hazard quotient for lead was calculated by dividing the maximum lead concentration by 400 ppm.

mg/kg = milligrams per kilogram
 mg/kg/d = milligrams per kilogram per day
 NA = Not Applicable
 RfD = Reference Dose

5.0 References

1. Radian International , 1997. *20,000-Pound Open Detonation Unit Background Study and Quarterly Monitoring Work Plan.*

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APPENDIX A
Analytical Results

**Table A-1 Fourth Quarter Analytical Results
Inorganic Constituents**

Sample ID	HOL20K-Q4-01A	HOL20K-Q4-01B	HOL20K-Q4-01C	HOL20K-Q4-02A
Date and Time Sampled	07-DEC-98 @ 1410	07-DEC-98 @ 1400	07-DEC-98 @ 1335	07-DEC-98 @ 1415
Sample Depth (ft)	0-1	0-2	0-0.2	0-1
PARAMETER				
SW6010A – Metals (mg/kg)				
Antimony	-0.265 BJ (0.350) [1]	-0.0446 BJ (0.385) [1]	-0.0455 BJ (0.240) [1]	0.476 (0.420) [1]
Arsenic	0.891 (0.240) [1]	0.728 (0.265) [1]	0.472 (0.165) [1]	0.755 (0.288) [1]
Barium	29.1 (0.0267) [1]	26.1 (0.0294) [1]	27.7 (0.0183) [1]	30.9 (0.0320) [1]
Beryllium	-0.0553 BJ (0.0148) [1]	-0.0588 BJ (0.0163) [1]	-0.0590 BJ (0.0102) [1]	-0.0736 BJ (0.0178) [1]
Cadmium	0.130 B (0.0296) [1]	0.0490 B (0.0327) [1]	0.102 B (0.0204) [1]	0.147 (0.0356) [1]
Chromium	4.34 (0.0524) [1]	2.10 (0.0577) [1]	2.06 (0.0360) [1]	3.23 (0.0629) [1]
Copper	5.05 (0.128) [1]	2.34 (0.142) [1]	1.22 (0.0882) [1]	8.86 (0.154) [1]
Lead	4.09 (0.198) [1]	0.549 (0.218) [1]	0.819 (0.136) [1]	7.92* (0.237) [1]
Nickel	2.04 (0.0801) [1]	1.79 (0.0882) [1]	1.39 (0.0550) [1]	1.95 (0.0961) [1]
Selenium	-0.143 BJ (0.191) [1]	-0.0120 BJ (0.210) [1]	-0.0807 BJ (0.131) [1]	-0.0771 BJ (0.229) [1]
Silver	0.0168 J (0.0356) [1]	-0.0152 J (0.0392) [1]	0.0387 (0.0244) [1]	-0.00949 J (0.0427) [1]
SW7471A – Mercury (mg/kg)				
Mercury	-0.00778 J (0.00634) [1]	-0.00103 J (0.00587) [1]	0.00800 (0.00570) [1]	-0.00235 J (0.00670) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* - Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-1 (Cont.) Fourth Quarter Analytical Results
Inorganic Constituents**

Sample ID	HOL20K-Q4-02B	HOL20K-Q4-02C	HOL20K-Q4-03A	HOL20K-Q4-03B
Date and Time Sampled	07-DEC-98 @ 1355	07-DEC-98 @ 1340	07-DEC-98 @ 1420	07-DEC-98 @ 1350
Sample Depth (ft)	0-2	0-0.2	0-1	0-2
PARAMETER				
SW6010A – Metals (mg/kg)				
Antimony	0.00226 BJ(0.399) [1]	-0.0763 BJ (0.267) [1]	0.177 BJ (0.337) [1]	0.172 BJ (0.339) [1]
Arsenic	1.15 (0.274) [1]	1.50* (0.184) [1]	0.565 (0.259) [1]	0.873 (0.233) [1]
Barium	55.1 (0.0305) [1]	56.1 (0.0204) [1]	28.5 (0.0287) [1]	27.9 (0.0258) [1]
Beryllium	-0.133 BJ (0.0169) [1]	-0.106 BJ (0.0113) [1]	-0.0521 BJ (0.0160) [1]	-0.0737 BJ (0.0144) [1]
Cadmium	0.130 B (0.0338) [1]	0.366 (0.0227) [1]	0.181 (0.0319) [1]	0.0737 B (0.0287) [1]
Chromium	6.48 (0.0598) [1]	6.84 (0.0400) [1]	2.59 (0.0564) [1]	2.56 (0.0507) [1]
Copper	4.67 (0.147) [1]	7.68 (0.0982) [1]	6.16 (0.138) [1]	2.77 (0.124) [1]
Lead	3.04 (0.226) [1]	6.53 (0.151) [1]	6.81 (0.213) [1]	0.791 (0.191) [1]
Nickel	4.51 (0.0914) [1]	4.81 (0.0612) [1]	1.94 (0.0862) [1]	1.89 (0.0776) [1]
Selenium	-0.366 BJ (0.218) [1]	0.00604BJ (0.146) [1]	-0.342 BJ (0.205) [1]	0.0843 BJ (0.185) [1]
Silver	0.0305 J (0.0406) [1]	0.0423 (0.0272) [1]	0.0447 (0.0383) [1]	0.00287 J (0.0345) [1]
SW7471A – Mercury (mg/kg)				
Mercury	0.0128 (0.00455) [1]	0.0131 (0.00497) [1]	-0.00246 J (0.00700)[1]	0.00930 (0.00663) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* - Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-1 (Cont.) Fourth Quarter Analytical Results
Inorganic Constituents**

Sample ID	HOL20K-Q4-03C	HOL20K-Q4-04A	HOL20K-Q4-04B	HOL20K-Q4-04B
Date and Time Sampled	07-DEC-98 @ 1330	07-DEC-98 @ 1425	07-DEC-98 @ 1405	07-DEC-98 @ 1345
Sample Depth (ft)	0-0.2	0-1	0-2	0-0.2
PARAMETER				
SW6010A – Metals (mg/kg)				
Antimony	0.0155 BJ (0.249) [1]	0.277 BJ (0.406) [1]	0.0207 BJ (0.272) [1]	0.199 BJ (0.438) [1]
Arsenic	0.721 (0.171) [1]	0.679 (0.279) [1]	0.704 (0.187) [1]	1.33 (0.301) [1]
Barium	30.3 (0.0190) [1]	29.2 (0.0310) [1]	28.8 (0.0207) [1]	53.4 (0.0334) [1]
Beryllium	-0.0674 BJ (0.0105) [1]	-0.0689 BJ (0.0172) [1]	-0.0768 BJ (0.0115) [1]	-0.0941 BJ (0.0186) [1]
Cadmium	0.0983 B (0.0211) [1]	0.114 B (0.0344) [1]	0.0392 B (0.0231) [1]	0.165 (0.0372) [1]
Chromium	2.19 (0.0372) [1]	2.65 (0.0609) [1]	2.57 (0.0407) [1]	5.78 (0.0656) [1]
Copper	1.32 (0.0913) [1]	25.4* (0.149) [1]	2.40 (0.0999) [1]	5.64 (0.161) [1]
Lead	1.45 (0.140) [1]	15.0* (0.230) [1]	0.843 (0.154) [1]	3.49 (0.248) [1]
Nickel	1.16 (0.0569) [1]	1.86 (0.0930) [1]	2.13 (0.0622) [1]	4.38 (0.100) [1]
Selenium	-0.133 BJ (0.136) [1]	-0.0299 BJ (0.222) [1]	-0.164 BJ (0.148) [1]	-0.402 BJ (0.239) [1]
Silver	-0.0112 J (0.0253) [1]	-0.0356 J (0.0413) [1]	0.0161 J (0.0277) [1]	0.0334 J (0.0446) [1]
SW7471A – Mercury (mg/kg)				
Mercury	-0.00356 J (0.00507) [1]	0.00674 (0.00548) [1]	-0.00876 J (0.00624) [1]	0.00812 (0.00661)[1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* - Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-1 (Cont.) Fourth Quarter Analytical Results
Inorganic Constituents**

Sample ID	HOL20K-Q4-04C-11
Date and Time Sampled	07-DEC-98 @ 1345
Sample Depth (ft)	0-0.2
PARAMETER	
SW6010A – Metals (mg/kg)	
Antimony	-0.222 BJ (0.444) [1]
Arsenic	1.29 (0.305) [1]
Barium	56.0 (0.0338) [1]
Beryllium	-0.0890 BJ (0.0188) [1]
Cadmium	0.129 B (0.0376) [1]
Chromium	5.97 (0.0664) [1]
Copper	5.87 (0.163) [1]
Lead	3.77 (0.251) [1]
Nickel	4.59 (0.102) [1]
Selenium	0.202 BJ (0.242) [1]
Silver	0.0213 J (0.0451) [1]
SW7471A – Mercury (mg/kg)	
Mercury	-0.00980 J (0.00508) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* - Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-2 Fourth Quarter Analytical Results
Organic Constituents**

Sample ID	HOL20K-Q4-01A	HOL20K-Q4-01B	HOL20K-Q4-01C	HOL20K-Q4-02A
Date and Time Sampled	07-DEC-98 @ 1410	07-DEC-98 @ 1400	07-DEC-98 @ 1335	07-DEC-98 @ 1415
Sample Depth (ft)	0-1	0-2	0-0.2	0-1
PARAMETER				
Percent moisture	19.7 () [1]	24.1 () [1]	15.3 () [1]	22.7 () [1]
SW8330 – Explosives (ug/g)				
1,3,5-Trinitrobenzene	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]
1,3-Dinitrobenzene	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]
2,4,6-Trinitrotoluene	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
2,4-Dinitrotoluene	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]
2,6-Dinitrotoluene	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]
2-Nitrotoluene	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]
3-Nitrotoluene	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]
4-Nitrotoluene	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]
HMX	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]
Nitrobenzene	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]
RDX	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
TETRYL	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]
SW8332 – Nitroamine Explosives (ug/g)				
Nitroglycerin	ND (0.0151) [1]	ND (0.0151) [1]	ND (0.0151) [1]	ND (0.0151) [1]
PETN	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* – Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-2 (Cont.) Fourth Quarter Analytical Results
Organic Constituents**

Sample ID	HOL20K-Q4-02B	HOL20K-Q4-02C	HOL20K-Q4-03A	HOL20K-Q4-03B
Date and Time Sampled	07-DEC-98 @ 1355	07-DEC-98 @ 1340	07-DEC-98 @ 1420	07-DEC-98 @ 1350
Sample Depth (ft)	0-2	0-0.2	0-1	0-2
PARAMETER				
Percent moisture	23.6 () [1]	19.3 () [1]	21.7 () [1]	23.2 () [1]
SW8330 – Explosives (ug/g)				
1,3,5-Trinitrobenzene	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]
1,3-Dinitrobenzene	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]
2,4,6-Trinitrotoluene	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
2,4-Dinitrotoluene	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]
2,6-Dinitrotoluene	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]
2-Nitrotoluene	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]
3-Nitrotoluene	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]
4-Nitrotoluene	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]
HMX	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]
Nitrobenzene	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]
RDX	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
TETRYL	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]
SW8332 – Nitroamine Explosives (ug/g)				
Nitroglycerin	ND (0.0151) [1]	0.0430 J (0.0151) [1]	ND (0.0151) [1]	ND (0.0151) [1]
PETN	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* – Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-2 (Cont.) Fourth Quarter Analytical Results
Organic Constituents**

Sample ID	HOL20K-Q4-03C	HOL20K-Q4-04A	HOL20K-Q4-04B	HOL20K-Q4-04C
Date and Time Sampled	07-DEC-98 @ 1330	07-DEC-98 @ 1425	07-DEC-98 @ 1405	07-DEC-98 @ 1345
Sample Depth (ft)	0-0.2	0-1	0-2	0-0.2
PARAMETER				
Percent moisture	9.33 () [1]	23.6 () [1]	23.9 () [1]	21.6 () [1]
SW8330 – Explosives (ug/g)				
1,3,5-Trinitrobenzene	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]	ND (0.0970) [1]
1,3-Dinitrobenzene	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]	ND (0.0626) [1]
2,4,6-Trinitrotoluene	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
2,4-Dinitrotoluene	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]	ND (0.0721) [1]
2,6-Dinitrotoluene	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]	ND (0.130) [1]
2-Nitrotoluene	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]	ND (0.209) [1]
3-Nitrotoluene	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]	ND (0.253) [1]
4-Nitrotoluene	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]	ND (0.191) [1]
HMX	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]	ND (0.0830) [1]
Nitrobenzene	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]	ND (0.0584) [1]
RDX	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]	ND (0.133) [1]
TETRYL	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]	ND (0.145) [1]
SW8332 – Nitroamine Explosives (ug/g)				
Nitroglycerin	ND (0.0151) [1]	ND (0.0151) [1]	ND (0.0151) [1]	ND (0.0151) [1]
PETN	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]	ND (0.0230) [1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* – Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

**Table A-2 (Cont.) Fourth Quarter Analytical Results
Organic Constituents**

Sample ID	HOL20K-Q4-04C-11		
Date and Time Sampled	07 DEC-98 @ 1345		
Sample Depth (ft)	0-0.2		
PARAMETER			
Percent moisture	21.0	()	[1]
SW8330 – Explosives (ug/g)			
1,3,5-Trinitrobenzene	ND	(0.0970)	[1]
1,3-Dinitrobenzene	ND	(0.0626)	[1]
2,4,6-Trinitrotoluene	ND	(0.133)	[1]
2,4-Dinitrotoluene	ND	(0.0721)	[1]
2,6-Dinitrotoluene	ND	(0.130)	[1]
2-Nitrotoluene	ND	(0.209)	[1]
3-Nitrotoluene	ND	(0.253)	[1]
4-Nitrotoluene	ND	(0.191)	[1]
HMX	ND	(0.0830)	[1]
Nitrobenzene	ND	(0.0584)	[1]
RDX	ND	(0.133)	[1]
TETRYL	ND	(0.145)	[1]
SW8332 – Nitroamine Explosives (ug/g)			
Nitroglycerin	ND	(0.0151)	[1]
PETN	ND	(0.0230)	[1]

(Detection Limit)

[Dilution Factor]

B – Indicates that concentration is within 5 times the method blank concentration

J – Indicates that concentration is less than the specified detection limit

* – Indicates that concentration is greater than site-specific Upper Tolerance Limit (UTL)

APPENDIX B
Risk Evaluation Calculation Sheet

CALCULATION SHEET

PROJECT NUMBER

DATE

PROJECT

630258

04-13-99

20,000-Pound OD Unit

EOD Exposure Scenario

Noncarcinogenic

Carcinogenic

<u>Exposure Variables</u>	<u>Value</u>	<u>Symbol</u>
Hazard quotient	Calculated	
Cancer risk	Calculated	<i>HQ</i>
Constituent concentration (mg/kg)	Analyte-Specific	<i>TR</i>
Reference dose oral (mg/kg/d)	Analyte Specific	<i>C</i>
Slope factor (risk/mg/kg/d)	Analyte Specific	<i>CS</i>
Body weight, adult (kg)	70	<i>BW_a</i>
Averaging time noncarcinogens (d)	ED x 365	
Averaging time carcinogens (d)	25550	<i>AT_c</i>
Exposure frequency (d/y)	20	
Exposure duration, total (y)	5	<i>EF</i>
Ingestion rate of soil, adult (mg/d)	100	<i>ED</i>
Fraction of soil ingested from contaminated area (unitless)	0.5	<i>IR_s</i> ^a

APPENDIX C
Chain-of-Custody Forms

Chain of Custody Record

PROJECT			MS/MSD	NO. OF CONTAINERS	ANALYSES										REMARKS			
Holloway DUK Site					8330	8332	/ / / / / / / / / / / / / / / /											
SITE																		
OD Unit																		
PREPARED BY (Signature)																		
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME																
HLLDOK-04-01A	SOIL	12/798/1410		1														
HLLDOK-04-02A	SOIL	12/798/1415		1														
HLLDOK-04-03A	SOIL	12/798/1420		1														
HLLDOK-04-04A	SOIL	12/798/1425		1														
HLLDOK-04-05B	SOIL	12/798/1400		1														
HLLDOK-04-06B	SOIL	12/798/1355		1														
HLLDOK-04-07C	SOIL	12/798/1350		1														
HLLDOK-04-08B	SOIL	12/798/1405		1														
HLLDOK-04-09C	SOIL	12/798/1335		1														
HLLDOK-04-10C	SOIL	12/798/1340		1														
REMARKS												RELINQUISHED BY:	DATE	TIME				
Shipped Fed Ex 12/8/98													12/8	1730				
RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME							

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									



RADIAN INTERNATIONAL

A DAMES & MOORE GROUP COMPANY

Chain of Custody Record

PROJECT			MS/MSD	NO. OF CONTAINERS	ANALYSES										REMARKS		
Holloman JOK Site					8330	8332	/ / / / / / / / / / / / / / / /										
SITE																	
PREPARED BY (Signature)																	
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME															
HLLJOK-611-3C	Soil	120798/1330		1													
HLLJOK-611-04C	Soil	120798/1345		1													
HLLJOK-611-4C-11	Soil	120798/1345		1													
HLLJOK-611-4A-21	Water	120798/1445		1													
HLLJOK-611-4A-21	Water	120798/1445		1													
REMARKS												RELINQUISHED BY:		DATE	TIME		
Shipped FedEx 12/8/98												[Signature]		12/8/98	1730		
RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME			

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									



Chain of Custody Record

PROJECT			MS/MSD	NO. OF CONTAINERS	ANALYSES										REMARKS									
Holloman Dike Pond					6010A	7471A	D2216																	
SITE																								
PREPARED BY (Signature)																								
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME																						
HOLLOCK-G4-01A	SOIL	120798/1410	1																					
HOLLOCK-G4-02A	SOIL	120798/1415	1																					
HOLLOCK-G4-03A	SOIL	120798/1420	1																					
HOLLOCK-G4-04A	SOIL	120798/1425	1																					
HOLLOCK-G4-05A	SOIL	120798/1400	1																					
HOLLOCK-G4-06A	SOIL	120798/1355	1																					
HOLLOCK-G4-07A	SOIL	120798/1350	1																					
HOLLOCK-G4-08A	SOIL	120798/1405	1																					
HOLLOCK-G4-09A	SOIL	120798/1335	1																					
HOLLOCK-G4-10A	SOIL	120798/1310	1	✓	✓	✓																		
REMARKS												RELINQUISHED BY:	DATE	TIME										
SI [unclear] [unclear] 12/18/98												[Signature]	12/18/98	14:00										
RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME													

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									

Chain of Custody Record

PROJECT			MS/MSD	NO. OF CONTAINERS	ANALYSES	REMARKS				
Holloman 70K Panel										
SITE OD UNIT										
PREPARED BY (Signature) <i>[Signature]</i>										
FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME								
HOL 70K-11-40	SOIL	12/798/1330	1	↓						
HOL 70K-11-41	SOIL	12/798/1345	1	↓						
HOL 70K-11-42	Water	12/798/1445	1	↓		Processed w/ VPC ₂				
HOL 70K-11-43	SOIL	12/798/1345	1	↓	X					
REMARKS: SL and FA G 12/7/98						RELINQUISHED BY:	DATE	TIME		
RECEIVED BY:						DATE	TIME	RELINQUISHED BY:	DATE	TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									