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Revised Final

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

May 1999

49th FIGHTER WING

49 CES/CEV
Holloman Air Force Base,
New Mexico

Part III—Third Quarter 1998 Monitoring Report

20,000-Pound Open Detonation Unit
Background Study and Quarterly Monitoring Program

Revised Final

Prepared for:

Holloman Air Force Base
49 CES/CEV
550 Tabosa Avenue
Holloman AFB, New Mexico 99330

Prepared by:

Radian International
6400 Uptown Boulevard NE, Suite 250E
Albuquerque, New Mexico 87110

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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 third quarter of 1998, Holloman Air Force Base (HAFB) performed the third quarterly sampling event at the 20,000-Pound Open Detonation (OD) Unit in accordance with Attachment J of the operating permit. Twelve locations were sampled for metals and explosives. The analytical results were initially 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 third quarter 1998 sampling event.

1.0 Field Operations

Field sampling was conducted on 18 September 1998. The sampling was performed within 72 hours of the detonation event that occurred on 16 September 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 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 the detonation that had occurred on 16 September 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 third 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 within the expected limits of sampling and analytical error.

Table 1-1
Third Quarter Sample Locations

Stratum: A
Number of Samples: 4
Number of Potential Sampling Locations (n): 21
Scale Factor (n-1): 20

Sample Number	Random Number	Scaled Random Number[a]	Grid Node to Sample[b]
1	0.1349	2.70	A3
2	0.5478	10.96	A11
3	0.6177	12.35	A12
4	0.6903	13.81	A14

Stratum: B
Number of Samples: 4
Number of Potential Sampling Locations (n): 24
Scale Factor (n-1): 23

Sample Number	Random Number	Scaled Random Number[a]	Grid Node to Sample[b]
1	0.0941	2.16	B2
2	0.2783	6.40	B6
3	0.3414	7.85	B8
4	0.9507	21.87	B22

Stratum: C
Number of Samples: 4
Number of Potential Sampling Locations (n): 31
Scale Factor (n-1): 30

Sample Number	Random Number	Scaled Random Number[a]	Grid Node to Sample[b]
1	0.2108	6.32	C6
2	0.3132	9.40	C9
3	0.7254	21.76	C22
4	0.8124	24.37	C24

[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
	11	2
	12	3
	14	4
B	2	1
	6	2
	8	3
	22	4
C	6	1
	9	2
	22	3
	24	4

Table 1-3.
Wind Direction and Wind Speed During Days of Open Detonation Activities (direction/speed)[1]

Time	Date of Detonation 16 Nov 1998
1300	vrb/7[2]
1330	136/6
1400	202/1
1430	**292/5[3]**
1500	**256/11**
1530	**261/14**
1600	**243/10**

[1] Wind direction is the direction from which the wind is blowing, wind direction is in degrees, wind speed is in knots.
[2] "vrb" represents variable wind direction.
[3] Data in bold type indicate hours during which open detonation events occurred.

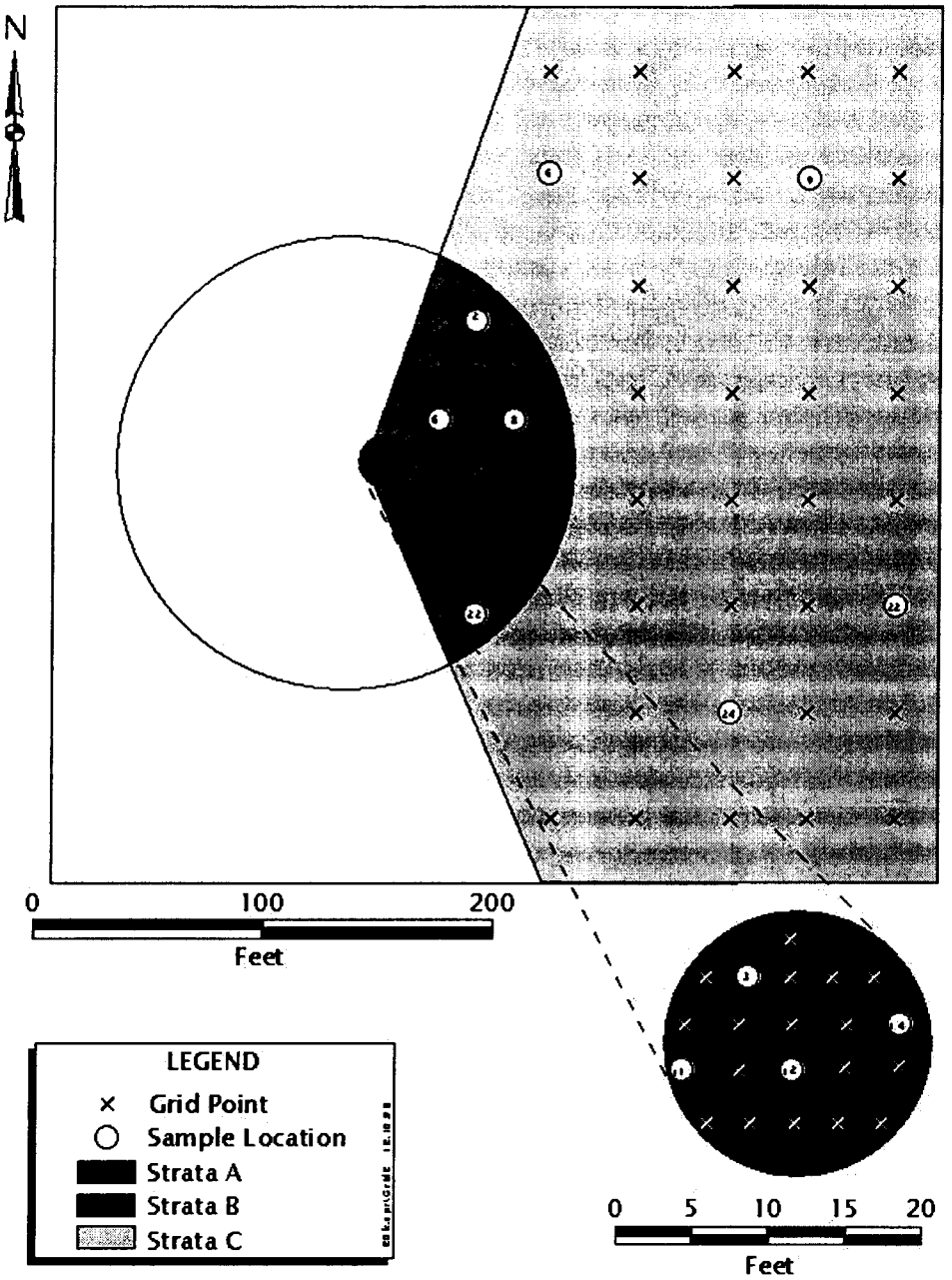

Figure 1-1. Grid Layout and Sample Locations

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

Only one organic constituent was detected at the site, 2,4-dinitrotoluene. 2,4-dinitrotoluene was detected in one sample within Strata B (Sample I.D. 03B). Because no background values exist for 2,4-dinitrotoluene, this was carried forward to the risk evaluation. The risk evaluation is described in Section 3.0 of this report.

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 third quarter 1998 sampling results that exceeded background UTLs are flagged in Appendix A of this report and were carried forward to the risk calculation.

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 Methodology

The 20,000-Pound OD Unit is located in an isolated area of the 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 1E-06. These are levels below which no adverse effects are anticipated. The levels calculated for the 20,000-Pound OD Unit are 2.17E-02 for the total hazard index and 1.81E-08 for the 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 third quarter 1998 monitoring data with the decision criteria indicates that treatment operations at the 20,000-Pound OD Unit are effective. It is recommended that monitoring continue for the next scheduled detonation event.

Table 3-1
Maximum Concentrations of Constituents Exceeding Background UTLs

Constituent	Maximum Detected Concentration (mg/kg)
Arsenic	2.41
Beryllium	0.663
Copper	10.4
Lead	8.54
Nickel	6.68

Notes:
mg/kg = milligrams per kilogram
UTL = Upper Tolerance Limit

Table 3-2
Site Specific Risk Evaluation

Constituent	Maximum Concentration (mg/kg)	Oral RfD (mg/kg/d)	Slope Factor (risk per mg/kg/d)	Hazard Quotient (mg/kg)	Cancer Risk
Arsenic	2.41	3.0E-04	1.50	3.14E-04	1.01E-08
Beryllium	0.663	5.0E-03	4.30	5.19E-06	7.97E-09
Copper	10.4	4.0E-02	NA	1.02E-05	NA
Lead	8.54	NA[a]	NA	2.14E-02[b]	NA
Nickel	6.68	2.00E-02	NA	1.31E-05	NA
2,4 Dinitrotoluene	6.40E-04	2.00E-03	NA	1.25E-08	NA
Total Hazard Quotient and Cancer Risk				**2.17E-02**	**1.81E-08**

[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

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 Third Quarter Analytical Results
Inorganic Constituents

Sample ID	HOL20K-Q3-01A				HOL20K-Q3-01B				HOL20K-Q3-01C				HOL20K-Q3-02A			
Date and Time Sampled	18-SEP-98 @ 1538				18-SEP-98 @ 1442				18-SEP-98 @ 1420				18-SEP-98 @ 1542			
Sample Depth (ft)	0-1				0-2				0-0.3				0-1			
PARAMETER																
SW6010 – Metals (mg/kg)																
Antimony	-0.367	J	(0.361)	[1]	-0.217	J	(0.279)	[1]	0.662		(0.233)	[1]	0.292	J	(0.325)	[1]
Arsenic	0.680		(0.248)	[1]	0.667		(0.191)	[1]	2.30	*	(0.160)	[1]	0.860		(0.223)	[1]
Barium	31.7		(0.0275)	[1]	34.5		(0.0213)	[1]	65.7		(0.0178)	[1]	34.8		(0.0248)	[1]
Beryllium	0.317	B	(0.0153)	[1]	0.254	B	(0.0118)	[1]	0.576	*B	(0.00987)	[1]	0.297	B	(0.0138)	[1]
Cadmium	0.0479	B	(0.0306)	[1]	0.0402	B	(0.0236)	[1]	0.278		(0.0197)	[1]	0.222		(0.0275)	[1]
Chromium	3.18		(0.0540)	[1]	2.73		(0.0417)	[1]	8.53		(0.0349)	[1]	4.21		(0.0486)	[1]
Copper	3.24		(0.132)	[1]	2.59		(0.102)	[1]	7.84		(0.0856)	[1]	6.84		(0.119)	[1]
Lead	1.67		(0.204)	[1]	2.43		(0.158)	[1]	7.27		(0.132)	[1]	2.68		(0.183)	[1]
Nickel	1.84		(0.0825)	[1]	2.05		(0.0638)	[1]	6.04		(0.0533)	[1]	2.20		(0.0743)	[1]
Selenium	-0.213	J	(0.197)	[1]	0.126	J	(0.152)	[1]	-0.000658	J	(0.127)	[1]	0.0514	J	(0.177)	[1]
Silver	0.0947	B	(0.0367)	[1]	-0.0165	BJ	(0.0284)	[1]	-0.0118	BJ	(0.0237)	[1]	-0.0688	BJ	(0.0330)	[1]
SW7471 – Mercury (mg/kg)																
Mercury	-0.00359	J	(0.00512)	[1]	-0.00602	J	(0.00686)	[1]	0.0141		(0.00423)	[1]	-0.00192	J	(0.00548)	[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.) Third Quarter Analytical Results
Inorganic Constituents

Sample ID	HOL20K-Q3-02B				HOL20K-Q3-02C				HOL20K-Q3-03A				HOL20K-Q3-03B			
Date and Time Sampled	18-SEP-98 @ 1447				18-SEP-98 @ 1452				18-SEP-98 @ 1547				18-SEP-98 @ 1452			
Sample Depth (ft)	0-2				0-0.3				0-1				0-2			
PARAMETER																
SW6010 – Metals (mg/kg)																
Antimony	-0.111	J	(0.317)	[1]	0.134	J	(0.307)	[1]	0.753		(0.337)	[1]	-0.181	J	(0.368)	[1]
Arsenic	0.609		(0.218)	[1]	2.41	*	(0.211)	[1]	1.06		(0.231)	[1]	0.489		(0.252)	[1]
Barium	31.5		(0.0242)	[1]	71.5		(0.0234)	[1]	35.7		(0.0257)	[1]	28.1		(0.0280)	[1]
Beryllium	0.283	B	(0.0135)	[1]	0.663	*	(0.0130)	[1]	0.319	B	(0.0143)	[1]	0.287	B	(0.0156)	[1]
Cadmium	0.0359	B	(0.0269)	[1]	0.150		(0.0260)	[1]	0.105		(0.0258)	[1]	0.0395	B	(0.0311)	[1]
Chromium	2.83		(0.0475)	[1]	9.90		(0.0460)	[1]	3.24		(0.0504)	[1]	2.27		(0.0550)	[1]
Copper	3.30		(0.117)	[1]	8.06		(0.113)	[1]	5.17		(0.124)	[1]	2.35		(0.135)	[1]
Lead	1.14		(0.179)	[1]	6.74		(0.173)	[1]	1.43		(0.190)	[1]	0.726		(0.208)	[1]
Nickel	2.04		(0.0726)	[1]	6.68	*	(0.0702)	[1]	1.99		(0.0770)	[1]	1.86		(0.0841)	[1]
Selenium	-0.0771	J	(0.173)	[1]	-0.308	J	(0.167)	[1]	-0.000950	J	(0.184)	[1]	-0.281	J	(0.200)	[1]
Silver	-0.0942	BJ	(0.0323)	[1]	0.0434	B	(0.0312)	[1]	-0.131	BJ	(0.0342)	[1]	-0.163	BJ	(0.0374)	[1]
SW7471 – Mercury (mg/kg)																
Mercury	-0.00599	J	(0.00569)	[1]	0.0127		(0.00601)	[1]	-0.00464	J	(0.00529)	[1]	-0.00598	J	(0.00568)	[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.) Third Quarter Analytical Results
Inorganic Constituents

Sample ID	HOL20K-Q3-03C				HOL20K-Q3-04A				HOL20K-Q3-04A-11				HOL20K-Q3-04B			
Date and Time Sampled	18-SEP-98 @ 1429				18-SEP-98 @ 1550				18-SEP-98 @ 1550				18-SEP-98 @ 1457			
Sample Depth (ft)	0-0.3				0-1				0-0.3				0-2			
PARAMETER																
SW6010 – Metals (mg/kg)																
Antimony	0.312		(0.299)	[1]	0.135		(0.297)	[1]	-0.562	J	(0.363)	[1]	-0.165	J	(0.399)	[1]
Arsenic	2.11	*	(0.205)	[1]	1.57		(0.204)	[1]	0.479		(0.249)	[1]	0.993		(0.274)	[1]
Barium	72.4		(0.0228)	[1]	28.9		(0.0227)	[1]	29.2		(0.0277)	[1]	28.8		(0.0304)	[1]
Beryllium	0.585	*B	(0.0127)	[1]	0.306	B	(0.0126)	[1]	0.334	B	(0.0154)	[1]	0.418	B	(0.0169)	[1]
Cadmium	0.311		(0.0253)	[1]	0.141		(0.0252)	[1]	-0.00308	BJ	(0.0308)	[1]	0.111		(0.0338)	[1]
Chromium	9.37		(0.0448)	[1]	2.90		(0.0445)	[1]	2.35		(0.0543)	[1]	2.63		(0.0598)	[1]
Copper	10.4	*	(0.110)	[1]	3.50		(0.109)	[1]	2.80		(0.133)	[1]	1.90		(0.147)	[1]
Lead	8.54	*	(0.169)	[1]	1.42		(0.168)	[1]	0.749		(0.205)	[1]	0.466		(0.226)	[1]
Nickel	6.24		(0.0684)	[1]	2.13		(0.0680)	[1]	1.62		(0.0830)	[1]	2.00		(0.0913)	[1]
Selenium	-0.0879	J	(0.163)	[1]	0.0453	J	(0.162)	[1]	0.189	J	(0.198)	[1]	0.0214	J	(0.218)	[1]
Silver	0.106	B	(0.0304)	[1]	0.0638	B	(0.0302)	[1]	0.0625	B	(0.0369)	[1]	0.124	B	(0.0406)	[1]
SW7471 – Mercury (mg/kg)																
Mercury	0.00692		(0.00493)	[1]	-0.00458	J	(0.00653)	[1]	-0.00260	J	(0.00494)	[1]	-0.00659	J	(0.00752)	[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.) Third Quarter Analytical Results
Inorganic Constituents

Sample ID	HOL20K-Q3-04C			
Date and Time Sampled	18-SEP-98 @ 1433			
Sample Depth (ft)	0-0.3			
PARAMETER				
SW6010 – Metals (mg/kg)				
Antimony	0.0574	J	(0.290)	[1]
Arsenic	1.12	*	(0.199)	[1]
Barium	48.2		(0.0221)	[1]
Beryllium	0.390	B	(0.0123)	[1]
Cadmium	0.177		(0.0246)	[1]
Chromium	5.64		(0.0435)	[1]
Copper	5.16		(0.107)	[1]
Lead	5.05		(0.164)	[1]
Nickel	3.67		(0.0664)	[1]
Selenium	-0.240	J	(0.158)	[1]
Silver	0.0148	BJ	(0.0295)	[1]
SW7471 – Mercury (mg/kg)				
Mercury	0.00175	J	(0.00499)	[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 Third Quarter Analytical Results
Organic Constituents

Sample ID	HOL20K-Q3-01A			HOL20K-Q3-01B			HOL20K-Q3-01C			HOL20K-Q3-02A		
Date and Time Sampled	18-SEP-98 @ 1538			18-SEP-98 @ 1442			18-SEP-98 @ 1420			18-SEP-98 @ 1542		
Sample Depth (ft)	0-1			0-2			0-0.3			0-1		
PARAMETER												
Percent moisture	22.7	( )	[1]	18.6	( )	[1]	10.1	( )	[1]	17.4	( )	[1]
SW8330 – Explosives (µg/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 (µg/g)												
Nitroglycerin	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]
PETN	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[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.) Third Quarter Analytical Results
Organic Constituents

Sample ID	HOL20K-Q3-02B			HOL20K-Q3-02C			HOL20K-Q3-03A			HOL20K-Q3-03B		
Date and Time Sampled	18-SEP-98 @ 1447			18-SEP-98 @ 1452			18-SEP-98 @ 1547			18-SEP-98 @ 1452		
Sample Depth (ft)	0-2			0-0.3			0-1			0-2		
PARAMETER												
Percent moisture	19.2	( )	[1]	10.6	( )	[1]	14.5	( )	[1]	20.4	( )	[1]
SW8330 – Explosives (µg/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]	0.610	(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 (µg/g)												
Nitroglycerin	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]
PETN	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[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.) Third Quarter Analytical Results
Organic Constituents

Sample ID	HOL20K-Q3-03C			HOL20K-Q3-04A			HOL20K-Q3-04A-11			HOL20K-Q3-04B		
Date and Time Sampled	18-SEP-98 @ 1429			18-SEP-98 @ 1550			18-SEP-98 @ 1550			18-SEP-98 @ 1457		
Sample Depth (ft)	0-0.3			0-1			0-0.3			0-2		
PARAMETER												
Percent moisture	9.65	( )	[1]	22.1	( )	[1]	18.7	( )	[1]	32.3	( )	[1]
SW8330 – Explosives (µg/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 (µg/g)												
Nitroglycerin	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]	ND	(0.0293)	[1]
PETN	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[1]	ND	(0.0232)	[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.) Third Quarter Analytical Results
Organic Constituents

Sample ID	HOL20K-Q3-04C		
Date and Time Sampled	18-SEP-98 @ 1433		
Sample Depth (ft)	0-0.3		
PARAMETER			
Percent moisture	13.5	( )	[1]
SW8330 – Explosives (µg/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 (µg/g)			
Nitroglycerin	ND	(0.0293)	[1]
PETN	ND	(0.0232)	[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

RADIAN INTERNATIONAL LLC

CALCULATION SHEET

PROJECT NUMBER	DATE	PROJECT
630258	12-1-98	20,000-Pound OD Unit

EOD Exposure Scenario

Noncarcinogenic

$$HQ\frac{mg}{kg} = \frac{C \cdot EF \cdot ED \cdot \frac{IRS_a}{10^6} \cdot FC}{RfD_o \cdot BW_a \cdot AT}$$

Carcinogenic

$$CR = \frac{C \cdot EF \cdot ED \cdot \frac{IRS_a}{10^6} \cdot FC \cdot CPS_o}{BW_a \cdot AT_c}$$

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

APPENDIX C
Chain-of-Custody Forms

9809485-48

RADIAN INTERNATIONAL LLC

Chain of Custody Record

PROJECT: Holloman 20k-Pound

SITE: OD Unit - 3rd Quarter

PREPARED BY (Signature): [signature]

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	MS/MSD	NO. OF CONTAINERS	SW 6010 A	SW 7471 A	D 2216	REMARKS
HOL20K-Q3-01A	Soil	9/18/98 1538		1	X	X	X	
" 02A		1542		1				
" 03A		1547		1				
" 04A		1550		1				
" 01B		1442		1				
" 02B		1447		1				
" 03B		1452		1				
" 04B		1457		1				
" 01C		1420		1				
" 02C		1424		1				

REMARKS: Placed in cooler w/ ice prior to shipment

RELINQUISHED BY:	DATE	TIME
[signature]	9/21/98	1700

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	LAB BILL #	OPENED BY	DATE	TIME	TEMPERATURE	SEAL #	CONDITION
[illegible]	9/21	[illegible]							

REMARKS: ADD 98-1765

9809485-4

RAD N INTERNATIONAL LLC

Chain of Custody Record

PROJECT: Holloman 20k Pond

SITE: OD unit - 3rd Quarter

PREPARED BY (Signature): [signature]

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	MS/MSD	NO. OF CONTAINERS	SW6010A	SW7471A	DZ2216	REMARKS
HOL20K-Q3-03C	Soil	9/18/98 1429		1	X	X		
" 04C	↓	1433		1	↓	↓	↓	
" 04A-11	↓	1550		1	↓	↓		
" 04A-21	EB	↓ 1605		1	↓	↓		HNO_3 Preserved

REMARKS

RELINQUISHED BY:	DATE	TIME
[signature]	9/21	1700

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
M. Gordon	9/22/98	1030							

REMARKS: ADD#98-1763

IEG-4/FH13-96-30337/coc.FH5

RADON INTERNATIONAL LLC

Chain of Custody Record

PROJECT: [illegible]

SITE: [illegible]

PREPARED BY (Signature): [illegible]

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	MS/MSD	NO. OF CONTAINERS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	REMARKS
[illegible]	S. [illegible]	9/17/97	[illegible]	16	X	X	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 07A	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 06A	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 01A	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 07B	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 02B	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 03B	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 01B	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 01C	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] 02C	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

REMARKS: [illegible]

RELINQUISHED BY:	DATE	TIME
[illegible]	1/21	1708

RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
[illegible]											

LAB USE ONLY

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

REMARKS: [illegible]

IEG-4VFH13-96-30337coc.FH5

RADON INTERNATIONAL LLC

Chain of Custody Record

PROJECT: [illegible] Zoo Pond

SITE: [illegible] Quarter 3

PREPARED BY (Signature): [illegible]

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	MS/MSD	NO. OF CONTAINERS	ANALYSES											REMARKS
[illegible]																
[illegible]																
[illegible]																
[illegible]																

REMARKS	RELINQUISHED BY:	DATE	TIME
	[illegible]	9/21	1700

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:

IEG-4\FH\3-96-30337coc.FH5