Dynamic Delineation, Quick Confirmation, and Through Tracking of Data at Hawthorne Army Depot Hawthorne, Nevada

Janel Duffy, P.E.

SECOR International Incorporated
1535 Hot Springs Road
Carson City, Nevada 89706
(775) 884-4561

Work Conducted in Association with:
Chung and Associates, Inc. & Geofon, Inc.

SECOR

Presentation Overview

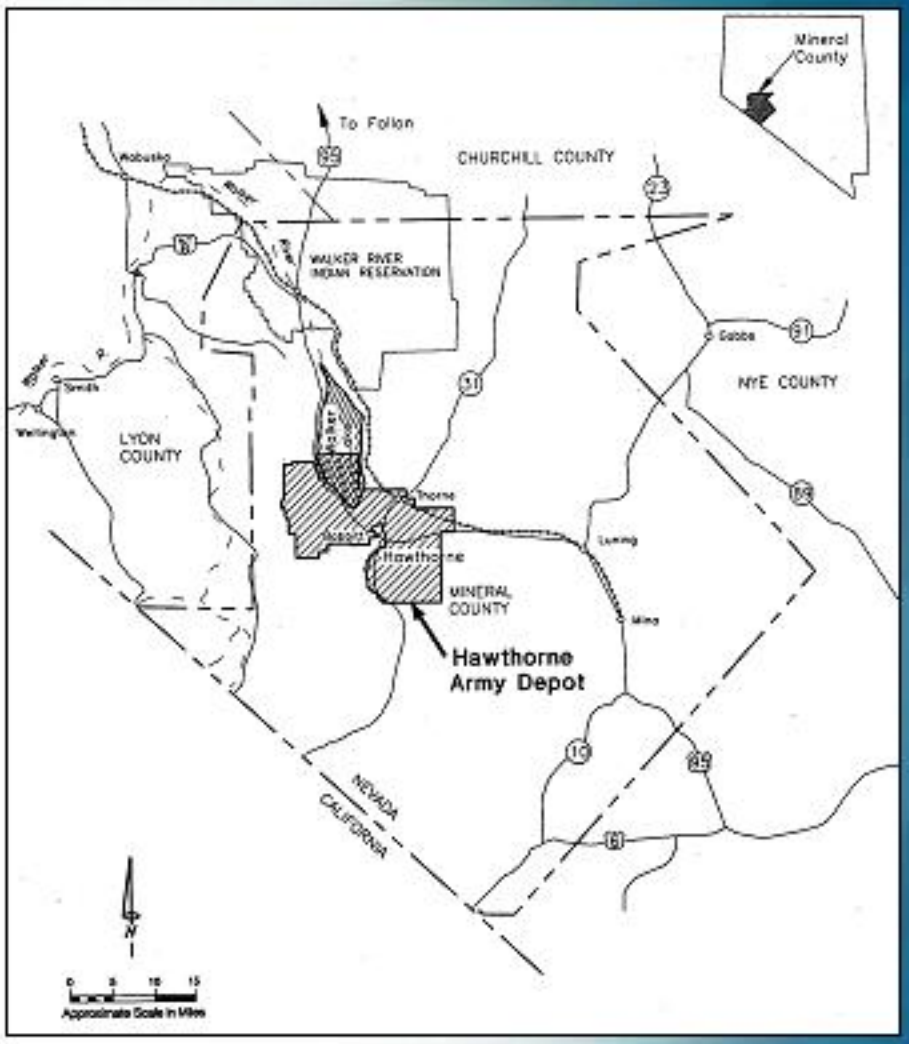
- Site Background
- Dynamic Immunoassay Field Screening
  - Pit Testing
  - Windrow Testing
- Comparison to Fixed Based Laboratory
- Project Tracking and Communications

SECOR

Site History

Hawthorne Army Depot

- Located in Central NV
- 225 square miles
- Munitions Depot with explosive-contaminated sites

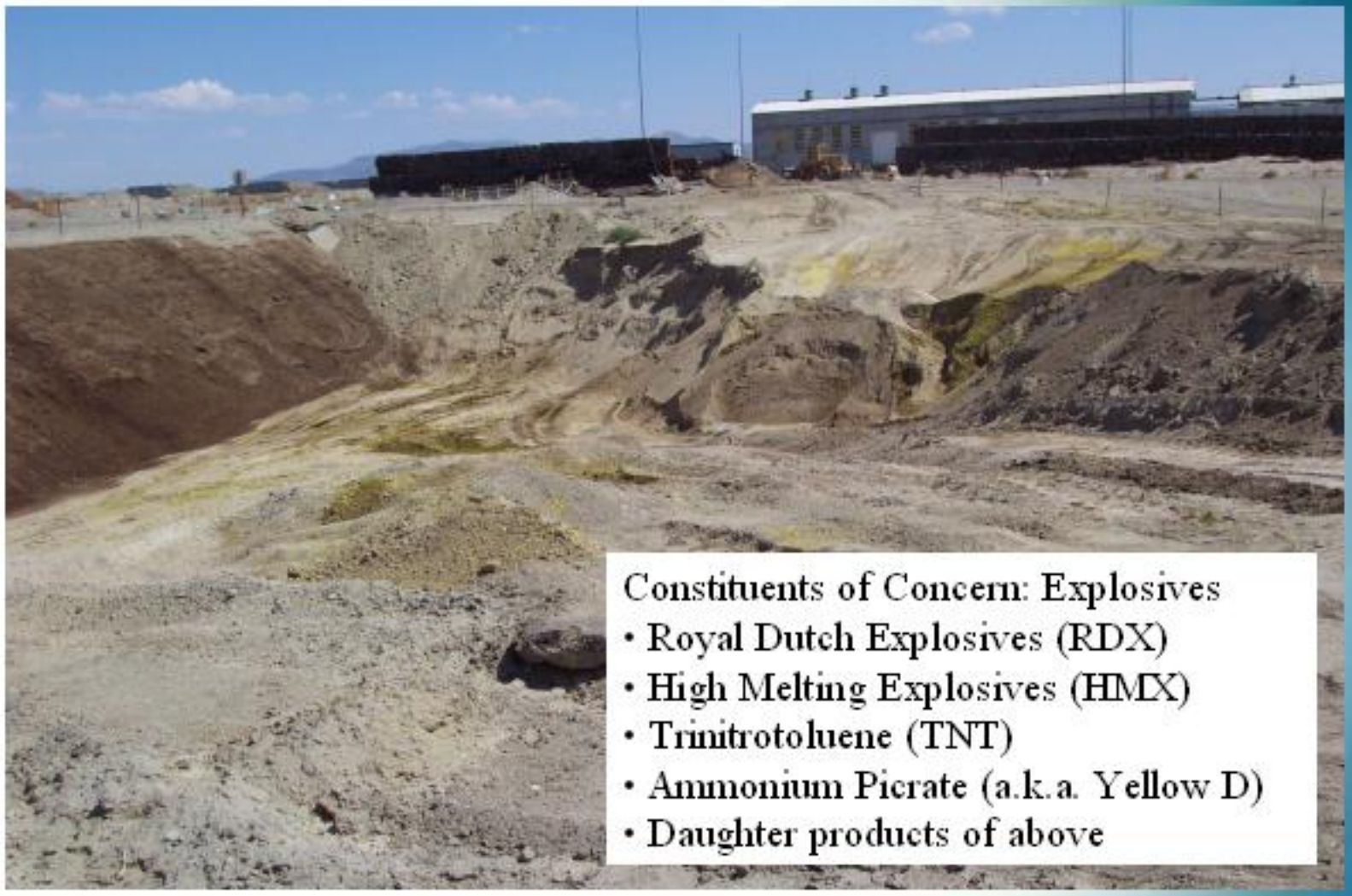


Source of Contamination

Explosive-laden wastewater used in process, sent down troughs

Source of Contamination

Waste water drained into "ponds", contaminating the soils



Constituents of Concern: Explosives

- Royal Dutch Explosives (RDX)
- High Melting Explosives (HMX)
- Trinitrotoluene (TNT)
- Ammonium Picrate (a.k.a. Yellow D)
- Daughter products of above

Treatment Methodology

Ex-Situ Bioremediation Employing Windrows

1) Excavate Soil/Place in Truck

- The SWMUs are not delineated
- Must use visual, immunoassay, then fixed based laboratory testing to confirm clean
- Dynamic process employing field screening

2) Add Amendments to Truck

Treatment Methodology

3) Place Load on Treatment Pad

4) Water & Turn with Composter

5) Turn, Water, Collect Moisture & Temp. Data Daily, Test with Immunoassay

6) Collect & Analyze Confirmation Samples for Fixed-Based Lab

Treatment Methodology

7) Collect and Analyze Final Pond Samples

8) Survey Ponds

9) Backfill Ponds with Compost

10) Clean Treatment Pad

Immunoassay Testing

- SDI EnSys Systems Specific for either TNT, RDX, or Ammonium Picrate
- Prefilters are Required for Windrow Samples
  - Filter out nitrates and organics to eliminate false positives
  - Prefilter steps vary by type of explosive
- ExSpray Testing for Troughs, Concrete, etc.

SECOR

Comparison to Fixed-Base

- In no case where immunoassay indicated a clean sample was an exceedence observed
- Below the cleanup level, immunoassay and fixed-based mimicked one another
- Turn around in <30 minutes versus up to 24 days
- Cost $15 - $30 + labor per sample, fixed-based laboratory analytical >$210

SECOR

Project Tracking

Components of Daily & Weekly Communication:

- Dailys – Typical, Formatted to Project QC/Safety Requirements
- Schedule – Typical, Weekly and Overall
- Tracking Form – Unique, Includes Self-Generating Schematics and All Data
- Electronic Submittal – Streamline Data Recall

SECOR

Tracking Form - Unique

- Contract is based on per yard
- Need to collect:
  - Soil Excavation Quantities;
  - Water Usage;
  - Amendment Usage;
  - Immunoassay Testing;
  - Analytical Testing;
  - Summary of All Data Including Location of Backfill; and
  - Windrow Build, Test and Backfill.

SECOR

Soil Excavation

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

K2

	A	B	C	D	E	F	G	H	I	J
1	B29 Daily Soil Excavation/Windrow									
2										
3	Total excavated		10660							
4	Date	total soil in cubic yards	Windrow No.	No. of Loads	Windrow No.	No. of Loads	Windrow No.	No. of Loads	Running total in CY	CORN? Type CY w/corn if yes (loads X 4)
13	5/5/2003	100	29	25					1964	100
14	5/6/2003	400	29	20	30	80			2364	
15	5/7/2003	448	30	11	31	90	32	11	2812	
16	5/8/2003	0							2812	
17	5/12/2003	0							2812	
18	5/13/2003	0							2812	
19	5/14/2003	408	32	89	33	13			3220	
20	5/15/2003	572	33	72	34	71			3792	
21	5/19/2003	208	34	20	35	32			4000	
22	5/20/2003	488	35	50	36	72			4488	
23	5/21/2003	404	36	11	37	90			4892	
24	5/22/2003	496	37	22	38	81	39	21	5388	
25	5/26/2003	0							5388	
26	5/27/2003	308	39	66	40	11			5696	
27	5/28/2003	0							5696	
28	5/29/2003	0							5696	
29	6/2/2003	0							5696	

Page 1

Schematic | T avg | dailys | Truck log2 | Amendment2 | Summary | Water | Immuno | WR Analyt | WR24

Ready NUM

Windrow Data - General

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

M10

	A	B	C	D	E	F	G	H
1		***Windrow Summary***	**24**			**Todays Date**	**5/10/2004**	
2		Complete?	Yes					
3		**Construction Record**						
4		Date begun	4/22/2003			Date completed	4/23/2003	
5		Days on the pad	377			Date activated	4/29/2003	
6		Length to date	500	feet		Total length	500	feet
7								
8		*Date*	4/22/2003	4/23/2003				
9		*Feet*	133	367				
10		*Bucket loads*	28	59				
11		*Truck loads*	28	59				
12		*Scale ticket count*	28	59				
13		*Soil volume*	112	236	0			
14								
15		**Volumes**						
16		# of Truckloads	87			# of Bucketloads soil	87	
17		Compost volume	1157.1	cubic yards		Soil volume	348	cubic yards
18								
19	Compost volume		1157.1	cubic yards				
20		Soil volume	348	cubic yards		Woodchips	231.42	cubic yards
21		Hay volume	231.42	cubic yards		Manure	231.42	cubic yards
22		Potato volume	115.71	cubic yards				
23								
24								
25		**Analytical Sampling**						
26		Date Sent	19-May					Clean? (yes or no)
27		Date Returned	24-Jul				Cell 1	yes
28		Percentage below PRGs	100%				Cell 2	yes
29		List any Exceedences					Cell 3	yes
30		by sample:					Cell 4	yes
31							Cell 5	yes
32								

Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24 / WR25 / WR26 / WR27 / WF

Ready NUM

Start Inbox - Mi... C:\Docum... Microsoft P... Microsoft ... 9:35 AM

Windrows – Temp/Moist Input

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

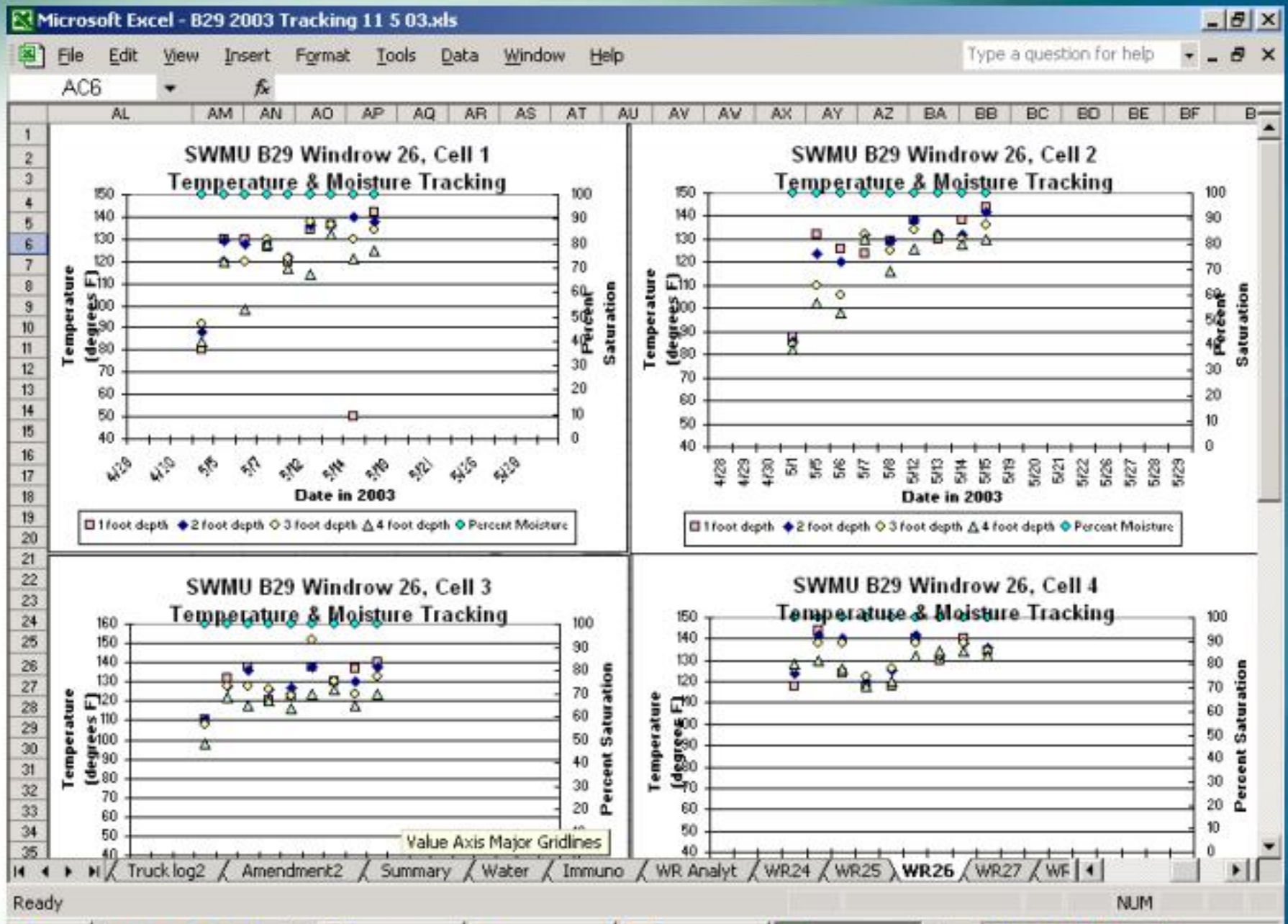
AC6

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
1	**Sampling records - B29 Windrow 26**		Enter a Monday Date Only																				
2		Date	4/28	4/29	4/30	5/1	5/5	5/6	5/7	5/8	5/12	5/13	5/14	5/15	5/19	5/20	5/21	5/22	5/26	5/27	5/28	5/29	
3		Total days	0	0	0	1	5	6	7	8	12	13	14	15	19	20	21	22	26	27	28	29	
4		Times turned			4		1	1			1		1										
5		Total times turned	0	0	4	4	5	6	6	6	7	7	8	8	8	8	8	8	8	8	8	8	
6	*Cell 1: 0 to 100 feet*									2430	2696	2618	2543	2693									
7		Time				7:35	832	730	735	755	724	850	821	756									
8		Temperature 1ft				80	130	130	126	120	134	136	50	142									
9		Temperature 2ft				88	129	128	130	122	136	136	140	138									
10		Temperature 3 ft				92	120	120	130	121	138	136	130	134									
11		Temperature 4ft				84	120	98	128	117	114	132	121	125									
12		% Saturation				100	100	100	100	100	100	100	100	100									
13	*Cell 2: 100 to 200 feet*																						
14		Time				7:33	825	725	738	755	721	844	830	750									
15		Temperature 1ft				88	132	126	124	129	138	130	138	144									
16		Temperature 2ft				86	124	120	132	129	138	132	132	142									
17		Temperature 3 ft				84	110	106	132	125	134	132	130	136									
18		Temperature 4ft				82	102	98	130	116	126	132	128	130									
19		% Saturation				100	100	100	100	100	100	100	100	100									
20	*Cell 3: 200 to 300 feet*																						
21		Time				7:30	815	723	741	745	717	842	840	746									
22		Temperature 1ft				110	132	138	120	122	138	130	137	140									
23		Temperature 2ft				110	128	136	126	127	138	130	130	138									
24		Temperature 3 ft				108	128	128	126	123	152	130	124	133									
25		Temperature 4ft				98	122	118	120	116	124	126	118	124									
26		% Saturation				100	100	100	100	100	100	100	100	100									
27	*Cell 4: 300 to 400 feet*																						
28		Time				7:28	810	720	744	742	715	836	845	741									
29		Temperature 1ft				118	144	124	118	118	140	130	140	134									
30		Temperature 2ft				124	142	140	120	125	142	132	138	136									
31		Temperature 3 ft				126	138	138	122	126	138	132	138	134									
32		Temperature 4ft				128	130	126	118	120	132	134	134	132									
33		% Saturation				100	100	100	100	100	100	100	100	100									
34	*Cell 5: 400 to 500 feet*																						
35		Time				7:24	758	718	747	736	712	832	853	736									

Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24 / WR25 / **WR26** / WR27 / WF

Page 2

Windrows – Chart Auto Generate



Water Usage

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

M19

Water Usage 2003

Total Number of Gallons: 1490000

Total Cost: $3,516.40

Green is a federal holiday

Date	4/21/2003	4/22/2003	4/23/2003	4/24/2003	4/28/2003	4/29/2003	4/30/2003	5/1/2003	5/5/2003	5/6/2003	5/7/2003	5/8/2003	5/12/2003	5/13/2003	5/14/2003	5/15/2003	5/19/2003	5/20/2003	5/21/2003
Total Truckloads	6	7	5	8	4	5	7	6	3	6	6	4	6	3	4	6	5	7	7
Total gallon used	24000	28000	20000	32000	16000	20000	28000	24000	12000	24000	24000	16000	24000	12000	16000	24000	20000	28000	28000
Total gallon on windrows	0	1000	3000	0	0	12000	17000	9000	3000	10000	16500	10500	12000	0	8000	10500	9000	18000	10000
WR 24 volume (gallons)		1000	1500			4000	2000			1500			1500		1000				
WR 25 volume (gallons)			1500			6000	3500			2500	1500		1500		1000				
WR 26 volume (gallons)						2000	5500	1500		1500			1500		1000				
WR 27 volume (gallons)							6000		1500		1500		1500		1000				
WR 28 volume (gallons)								7500	1500			1500	1500		1000				
WR 29 volume (gallons)										4500	3000	1500	1500		1000		1500		
WR 30 volume (gallons)											7500		1500		1000	1500			
WR 31 volume (gallons)											3000	7500	1500		1000	1500			
WR 32 volume (gallons)																7500			1000
WR 33 volume (gallons)																	7500	1500	1000
WR 34 volume (gallons)																		12000	2000
WR 35 volume (gallons)																		4500	4000
WR 36 volume (gallons)																			2000
WR 37 volume (gallons)																			
WR 38 volume (gallons)																			
WR 39 volume (gallons)																			
WR 40 volume (gallons)																			
WR 41 volume (gallons)																			

Schematic / T avg / dailys / Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24

Ready NUM

Page 1

Amendment Usage

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

M20

	A	B	C	D	E	F	G	H	I	J	K
1	**2003 Hawthorne Amendment Deliveries B29**								Today:	5/10/2004	
2	**Units in Cubic Yards**										
3		**Delivered**			**Used**				**Running Inventory**		
4	**Amendment**	**Hay**	**Manure**	**Corn**	**Soil**	**Hay**	**Manure**	**Corn**	**Hay**	**Manure**	**Corn**
5	**Total**	1500	1272	677	1952	1301.4	1196.58	650.016	199	75	27
6	**Percent**	NA	NA	NA	43.9%	29.2%	26.9%	14.6%	NA	NA	NA
7	In Stock	1500							1500		
8	9/22/2003		84	152.8	168	112	96	56	1388	-12	97
9	9/23/2003		168	134.8	284	189	162	95	1199	-6	137
10	9/24/2003		204	73.4	244	163	139	81	1036	59	129
11	9/25/2003		369		388	259	221	129	777	207	0
12	9/29/2003		321	156	148	99	99	49	679	429	107
13	9/30/2003		126	80	360	240	240	120	439	315	67
14	10/1/2003				200	133	133	67	305	182	0
15	10/2/2003			80	160	107	107	53	199	75	27
16	10/6/2003								199	75	27
17	10/7/2003								199	75	27
18	10/8/2003								199	75	27
19	10/9/2003								199	75	
20	10/13/2003								199	75	
21	10/14/2003								199	75	
22	10/15/2003								199	75	
23	10/16/2003								199	75	
24	10/20/2003								199	75	
25	10/21/2003								199	75	

Truck log2 | Amendment2 | Summary | Water | Immuno | WR Analyt | WR24 | WR25 | WR26 | WR27 | WF

Ready NUM

Page 1

Immunoassay Testing

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

Field Screening Calculations for B29 - 2003

Output concentrations in mg/kg

INPUT											OUTPUT			
Sample Number	Collection Date	Technician	Analysis Date	TNT ABS initial	DNT ABS initial	Picrate ABS initial	ABS TNT	ABS DNT	ABS RDX	ABS Picric Acid	TNT	DNT	RDX	Picrate
Pond E #1	6/12/2003	Knight	06/12/03	0.003			12.6				389.7	NA	NA	NA
Pond E #2	6/12/2003	Knight	06/12/03	0			1.25				38.7	NA	NA	NA
Pond E #3	6/12/2003	Knight	06/12/03	0.002			0.75				23.0	NA	NA	NA
Pond E #4	6/12/2003	Knight	06/12/03	0.004			2.78				85.4	NA	NA	NA
Pond E #5	6/12/2003	Knight	06/12/03	0.001			3.1				95.9	NA	NA	NA
Pond E #6	6/16/2003	Knight	06/16/03	0.001			3.88				119.8	NA	NA	NA
Pond E #7	6/16/2003	Knight	06/16/03	0.012			2.15				65.1	NA	NA	NA
Pond E #8	6/16/2003	Knight	06/16/03	0			0.1				3.1	NA	NA	NA
Pond E #9	6/16/2003	Knight	06/16/03	0.014			5.7				174.7	NA	NA	NA
Pond E #10	6/16/2003	Knight	06/16/03	0.001			2.83				87.3	NA	NA	NA
Pond E #11	6/16/2003	Knight	06/16/03	0.005			2.43				74.5	NA	NA	NA
Pond E #12	6/16/2003	Knight	06/16/03	0.001			3.6				111.3	NA	NA	NA
Pond D #1	6/18/2003	Knight	06/18/03	0			14.7				453.6	NA	NA	NA
Pond D #2	6/18/2003	Knight	06/18/03	0.004			20.3				627.2	NA	NA	NA
Pond D #3	6/18/2003	Knight	06/18/03	0.007			30.7				950.4	NA	NA	NA
Pond E #13	6/23/2003	Knight	06/23/03	0.006			1.45				44.1	NA	NA	NA
Pond E #14	6/23/2003	Knight	06/23/03	0.004			2.63				80.8	NA	NA	NA
Pond E #15	6/23/2003	Knight	06/23/03	0.01			2.1				63.8	NA	NA	NA
Pond E #16	6/23/2003	Knight	06/23/03	0.006			3.9				120.0	NA	NA	NA
Pond E #17	6/23/2003	Knight	06/23/03	0.011			3.2				97.7	NA	NA	NA

Schematic / T avg / dailys / Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24

Analytical Results

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

F199

Windrow Analytical Results

Windrow Number	Cell	Sample	RDX in mg/kg	Ammonium Picrate in mg/kg	TNT in mg/kg	Dup?	RDX exceed?	Ammonium Picrate exceed?	TNT exceed?
10	0.5	B29-WR10-050	4.47	NA	NA		no	NA	NA
10	1	B29-WR10-100	4.13	NA	NA		no	NA	NA
10	1.5	B29-WR10-150	9.64	NA	NA		no	NA	NA
10	2	B29-WR10-200	4.12	NA	NA		no	NA	NA
10	2.5	B29-WR10-250	3.43	NA	NA	Y	no	NA	NA
10	2.5	B29-WR-2-DUP-18		NA	NA			NA	NA
11	5	B29-WR11-350	0.03	NA	NA		no	NA	NA
12	1	B29-WR12-050	5.59	NA	NA		no	NA	NA
12	2	B29-WR12-150	5.01	NA	NA		no	NA	NA
24	1	B29-WR24-050	0.8 U	6.4 U	0.8 U		no	no	no
24	2	B29-WR24-150	0.01 U	0.64 U	0.08 U		no	no	no
24	3	B29-WR24-250	0.01 U	0.64 U	0.08 U	Y	no	no	no
24	4	B29-WR24-350	0.01 U	3.48 J	0.08 U		no	no	no
24	5	B29-WR24-450	0.02 U	0.363 J	0.08 UJ		no	no	no
25	0.5	B29-WR25-050	0.02 U	6.79	0.08 U		no	no	no
25	1	B29-WR25-100	0.8 U	6.4 U	0.8 U		no	no	no
25	1.5	B29-WR25-150	0.8 U	6.4 U	0.8 U		no	no	no
25	2	B29-WR25-200	0.8 U	6.4 U	0.8 U		no	no	no
25	2.5	B29-WR25-250	0.8 U	6.4 U	0.8 U		no	no	no
25	3	B29-WR25-300	0.8 U	6.4 U	0.8 U		no	no	no
25	3.5	B29-WR25-350	0.8 U	6.4 U	0.8 U		no	no	no
25	4	B29-WR25-400	0.8 U	6.4 U	0.8 U		no	no	no
25	4.5	B29-WR25-450	0.8 U	6.4 U	0.8 U		no	no	no

Schematic | T avg | dailys | Truck log2 | Amendment2 | Summary | Water | Immuno | WR Analyt | WR24

Ready NUM

Summary Output

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

P26

Summary B29 2003 Today: 5/10/2004

Plus-up No. 2 Soil to Excavate			Plus-up No. 3 Soil to Excavate		
Total Soil	2861	yd³	Total Soil	6522	yd³
Completed in 2002	675	yd³	Completed in 2003	8478	yd³
Completed in 2003	2186	yd³	Remaining		yd³
Remaining		yd³	Windrow cell begun	29	
			Started Mod 3 on 5/6/03		

	Total all rows	WR 10	WR 11	WR 12	WR 24	WR 25	WR 26	WR 27	WR 28	WR 29	WR 30	WR 31	WR 32	WR 33
Date begun	----				4/22/2003	4/23/2003	4/24/2003	4/28/2003	4/30/2003	5/1/2003	5/6/2003	5/7/2003	5/7/2003	5/14/2003
Date complete	----				4/23/2003	4/24/2003	4/28/2003	4/30/2003	5/1/2003	5/6/2003	5/7/2003	5/7/2003	5/14/2003	5/15/2003
Date Activated	----				4/29/2003	4/30/2003	4/30/2003	4/30/2003	5/1/2003	5/7/2003	5/7/2003	5/8/2003	5/15/2003	5/19/2003
Days Activated	----				377	376	376	376	375	369	369	368	361	357
Total windrow length to date in feet	**49388**				500	500	500	500	500	500	600	500	500	500
Total soil volume in cubic yards	**10664**				348	332	344	316	340	364	364	360	400	340
Total compost volume	**28222.6**				1157.1	1103.9	1143.8	1050.7	1130.5	1210.3	1210.3	1197	1330	1130.5
Total number turns	---				8	7	8	8	7	6	6	6	9	8
Analytical samples sent	---				5/19	5/19	5/19	5/21	5/21	5/21	5/21	5/21	6/5	6/5
Analytical results received	---				7/24	7/24	7/24	6/25	6/25	6/25			7/14	7/14
Percentage Clean	**66%**				100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Volume Clean	**7068**				348	332	344	316	340	364	364	360	400	340
Date removed from pad	---	5/8	5/8	5/8	7/28 & 29	7/28 & 29	7/28 & 29	7/29	7/29 & 30	7/30			7/24 &28 7/28	7/30 8/4
Taken to...	---	back in pit	back in pit	back in pit	B29 pit	B29 pit	B29 pit	B29 pit	B29 pit	B29 pit			Old bomb 200 cys	B29 pit

Page 1

Schematic / T avg / dailys / Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24

Ready NUM

Window Schematic Output

Microsoft Excel - B29 2003 Tracking 11 5 03.xls

File Edit View Insert Format Tools Data Window Help

P18

B29 Windrow Schematic - 2003

Displays if a cell has been built, sampled, or found to be clean.

WR	0-50 ft	51-100 ft	101-150 ft	151-200 ft	201-250 ft	251-300 ft	301-350 ft	351-400 ft	401-450 ft	451-500 ft	Soil total
24	Backfilled		Backfilled		Backfilled		Backfilled		Backfilled		348 yd³
										Days Active	377
25	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	Backfilled	332 yd³
										Days Active	376
26	Backfilled		Backfilled		Backfilled		Backfilled		Backfilled		344 yd³
										Days Active	376
27	Backfilled		Backfilled		Backfilled		Backfilled		Backfilled		316 yd³
										Days Active	376
28	Clean		Clean		Clean		Clean		Clean		340 yd³
											375
29	Sampled		Sampled		Sampled		Sampled		Sampled		364 yd³
										Days Active	369
30	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	Sampled	364 yd³
										Days Active	369
31	Sampled		Sampled		Sampled		Sampled		Sampled		360 yd³
										Days Active	368
32	Sampled		Sampled		Sampled		Sampled		Sampled		400 yd³
										Days Active	361
33	Built		Built		Built		Built		Built		340 yd³
										Days Active	357
34	Built	Built	Built	Built	Built	Built	Built	Built	Built	Built	364 yd³
										Days Active	356
35	Built		Built								328 yd³
										Days Active	355
36											332 yd³
										Days Active	354

Schematic / T avg / dailys / Truck log2 / Amendment2 / Summary / Water / Immuno / WR Analyt / WR24

Ready NUM

Start Inbox - Mi... C:\Docum... Microsoft P... Microsoft ... 10:15 AM

Conclusions

- Immunoassay Field Screening Effective Means to Dynamic Delineation
- Care Must be Taken When Choosing Immunoassay System
- The Development of Tracking System Saves Time, Increases Communication, and Eliminates Reporting Discrepancies

SECOR

QUESTIONS???