

Corrections and Clarifications

***Revised Alternative Feasibility Study
Groundwater Remedial Strategy
Badger Army Ammunition Plant
December 2011 Report***

Issued 2 February 2012

Page	Reads	Should Read
Page 11, 6 th Paragraph, 1 st Sentence	3,481	34,810
Page 16, 3 rd Paragraph, 1 st Sentence	The sentence should read: Based on investigation data presented in the <i>Draft Alternative Feasibility Study - Deterrent Burning Ground Waste Pits Subsurface Soil</i> (Stone & Webster, Inc., 2002) SpecPro calculated the amount of DNT-impacted soil remaining after capping or before soil removal in 1999/2000 at approximately 56,035 pounds.	
Page 25, 4 th Paragraph, 5 th and 6 th Sentences (respectively)	4,648 and 634	465 and 63
Page 29, 4 th Paragraph, 4 th Sentence	75.3	54
Page 31, 3 rd Paragraph, 4 th Sentence	24.5	25
Table 2	see Table 2 below	see Table 2R below
Table 8	see Table 8 below	see Table 8R below
Table 14	see Table 14 below	see Table 14R below
Table 15	see Table 15 below	see Table 15R below

Footnote: The original tables and revised tables are included with this submission.

VERIFIED
PETITION

EXHIBIT B

Table 2
DNT-Impacted Soil Contaminant Mass Estimate
Propellant Burning Ground and Deterrent Burning Ground Source Areas
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Source Location	Average Concentration (mg/Kg)	Interval Depth (ft bgs)	Interval Thickness (ft)	Length (ft)	Width (ft)	Total Volume (ft ³)	Mass Volume (lbs)
Propellant Burning Ground							
Waste Pit #1 (upper zone)	7,776	22 - 31	9	50	40	18,000	1,749
Waste Pit #1 (lower zone)	45.6	31 - 91	60	50	40	120,000	68
Waste Pit #2 (upper zone)	3,746	23 - 43	20	40	30	24,000	1,124
Waste Pit #2 (lower zone)	191	43 - 105	62	40	30	74,400	178
Waste Pit #3 (upper zone)	1,618	13 - 20	7	30	20	4,200	85
Waste Pit #3 (lower zone)	528	20 - 90	70	30	20	42,000	277
Total DNT Soil Contaminant Mass							3,481
Deterrent Burning Ground							
Waste Pit #1	1,950	10 - 30	20	70	35	49,000	1,194
Waste Pits #2 and #3	1,050	20 - 50	30	280	40	336,000	4,409
Total DNT Soil Contaminant Mass							5,603

cm - centimeters

cm³ - cubic centimeters

ft - feet

ft³ - cubic feet

lbs - pounds

mg/Kg - milligrams per kilogram

bgs - below ground surface

Deterrent Burning Ground estimate is based on data from 1991 to 1998.

Propellant Burning Ground estimate is based on data from 2005.

Soil bulk density = 125 lbs/ft³ = 0.002002 Kg/cm³

Mass volume = average concentration (mg/kg) x soil bulk density (kg/cm³) x 28,317 (cm³/ft³) x total volume (ft³) x 10E-6 (kg/mg) x 2.204586 (lb/kg)

Table 2R
DNT-Impacted Soil Contaminant Mass Estimate
Propellant Burning Ground and Deterrent Burning Ground Source Areas
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Source Location	Average Concentration (mg/Kg)	Interval Depth (ft bgs)	Interval Thickness (ft)	Length (ft)	Width (ft)	Total Volume (ft3)	Mass Volume (lbs)
Propellant Burning Ground							
Waste Pit #1 (upper zone)	7,776	22 - 31	9	50	40	18,000	17,493
Waste Pit #1 (lower zone)	45.6	31 - 91	60	50	40	120,000	684
Waste Pit #2 (upper zone)	3,746	23 - 43	20	40	30	24,000	11,236
Waste Pit #2 (lower zone)	191	43 - 105	62	40	30	74,400	1,776
Waste Pit #3 (upper zone)	1,618	13 - 20	7	30	20	4,200	849
Waste Pit #3 (lower zone)	528	20 - 90	70	30	20	42,000	2,772
Total DNT Soil Contaminant Mass							34,810
Deterrent Burning Ground							
Waste Pit #1	1,950	10 - 30	20	70	35	49,000	11,942
Waste Pits #2 and #3	1,050	20 - 50	30	280	40	336,000	44,093
Total DNT Soil Contaminant Mass							56,035

cm - centimeters

cm3 - cubic centimeters

ft - feet

ft3 - cubic feet

lbs - pounds

mg/Kg - milligrams per kilogram

bgs - below ground surface

Deterrent Burning Ground estimate is based on data from 1991 to 1998.

Propellant Burning Ground estimate is based on data from 2005.

Soil bulk density = 125 lbs/ft3 = 0.002002 Kg/cm3

Mass volume (lbs) = average concentration (mg/kg) x soil bulk density (kg/cm3) x 28,317 (cm3/ft3) x total volume (ft3) x (1 kg/10⁶ mg) x 2.204586 (lb/kg)

Table 8
Vertical Groundwater Gradient
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

	Well Pair	Well ID	Layer	Groundwater Elevation (ft msl)			Groundwater Vertical Gradient (ft/ft)			
				Mar-10	Sep-10	Mar-11	Mar-10	Sep-10	Mar-11	Average
Propellant Burning Ground	PBN-8910A	650	A	775.41	774.72	776.22				
	PBN-8910C	652	C	775.66	774.84	776.48	0.25	0.12	0.26	0.21
	PBN-8205A	622	A	774.30	773.56	775.03				
	PBN-8205B	623	B	774.38	773.73	775.12				
	PBN-8205C	624	C	774.42	773.69	775.15	0.12	0.13	0.12	0.12
	PBN-8501A	631	A	772.57	771.76	773.17				
	PBN-8901C	642	C	772.68	771.82	773.24				
	PBN-8901D	643	D	772.74	771.90	773.32	0.17	0.14	0.15	0.15
	PBN-9902A	688	A	764.29	764.78	765.58				
	PBN-9902B	689	B	764.31	764.78	765.55				
	PBN-9902C	690	C	764.26	764.97	765.51				
	PBN-9902D	691	D	764.36	764.75	765.52	0.07	-0.03	-0.06	-0.01
	PBN-9903A	692	A	763.03	763.65	764.21				
	PBN-9903B	693	B	763.45	764.09	764.64				
	PBN-9903C	694	C	763.52	764.14	764.70				
	PBN-9903D	695	D	763.49	764.13	764.70	0.46	0.48	0.49	0.48
	SWN-9103B	571	B	754.95	755.58	756.20				
	SWN-9103C	572	C	755.08	755.70	756.32				
	SWN-9103D	573	D	754.89	755.57	756.17				
	SWN-9103E	574	E	755.02	755.61	756.30	0.07	0.03	0.10	0.07
	PBN-9102B	562	B	743.36	743.95	744.41				
	PBN-9102C	563	C	743.50	744.11	744.60				
	PBM-9002D	982	D	743.73	744.37	744.86	0.37	0.42	0.45	0.41
	SWN-0501B	237	B	754.42	754.92	755.48				
SWN-0501C	238	C	754.40	754.90	755.34					
SWN-0501D	239	D	754.24	754.67	755.32					
SWN-0501E	240	E	754.04	754.38	755.27	-0.38	-0.54	-0.21	-0.38	
SWN-0503B	245	B	748.78	749.07	749.35					
SWN-0503C	246	C	748.74	749.04	749.38					
SWN-0503D	247	D	748.80	749.11	749.44					
SWN-0503E	248	E	752.07	750.71	749.53	3.29	1.64	0.18	1.70	
Deterrant Burning Ground	S1122	300	A	782.35	783.23	783.90				
	DBN-8201B	303	B	782.26	783.13	783.82				
	DBN-8201C	304	C	782.29	783.18	783.85	-0.06	-0.05	-0.05	-0.05
	DBN-9502A	318	A	782.19	783.22	783.85				
	DBN-9502B	319	B	781.87	782.90	783.56				
	DBN-9502C	320	C	781.94	782.97	783.63	-0.25	-0.25	-0.22	-0.24
	DBN-9501A	314	A	781.68	782.72	783.26				
	DBN-9501B	315	B	781.74	782.76	783.29				
	DBN-9501C	316	C	781.73	782.78	783.31				
	DBN-9501E	317	E	781.69	782.66	783.18	0.01	-0.06	-0.08	-0.04
	ELN-8203A	210	A	782.19	782.93	783.66				
	ELN-8203B	211	B	781.63	782.62	783.17				
	ELN-8203C	212	C	781.67	782.60	783.17	-0.52	-0.33	-0.49	-0.45
	ELM-9501	234	A	779.70	780.59	780.73				
	ELN-0801B	455	B	779.80	782.65	780.89				
	ELN-0801C	456	C	779.85	780.68	780.89				
	ELN-0801E	457	E	779.75	780.59	780.78	0.05	0.00	0.05	0.03
	ELN-1003A	467	A		779.50	779.43				
	ELN-1003B	468	B		778.90	779.45				
	ELN-1003C	469	C		779.03	779.59				
ELN-1003E	470	E		778.59	779.16		-0.91	-0.27	-0.59	

Table 8
Vertical Groundwater Gradient
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

	Well Pair	Well ID	Layer	Groundwater Elevation (ft msl)			Groundwater Vertical Gradient (ft/ft)			
				Mar-10	Sep-10	Mar-11	Mar-10	Sep-10	Mar-11	Average
Central Plume	RIN-1002A	492	A		776.92					
	RIN-1002C	493	C		776.84			-0.08		-0.08
	RIN-1005A	496	A		775.27					
	RIN-1005C	497	C		774.33			-0.94		-0.94
	SEN-0501A	580	A	764.96	765.51	765.50				
	SEN-0501B	581	B	765.03	765.56	765.58				
	SEN-0501D	582	D	765.29	765.83	765.83	0.33	0.32	0.33	0.33
	SEN-0503A	585	A	766.07	766.61	766.59				
	SEN-0503B	586	B	766.07	766.62	766.58				
	SEN-0503D	587	D	766.14	766.70	766.63	0.07	0.09	0.04	0.07

Layer designation

- A = shallow zone in sand and gravel aquifer
- B = intermediate zone in sand and gravel aquifer
- C = deep zone in sand and gravel aquifer
- D = bottom zone in sand and gravel aquifer
- E = top of bedrock aquifer

ft msl - Feet Mean Sea Level

R/R - Feet per Foot

Gradient determined between shallow and deep well for each well cluster

Table 8R
Vertical Groundwater Gradient
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

	Well Pair	Well ID	Layer	Screen Midpoint Elevation	Groundwater Elevation (ft msl)			Vertical Groundwater Gradient (ft/ft)			
					Mar-10	Sep-10	Mar-11	Mar-10	Sep-10	Mar-11	Average
Propellant Burning Ground	PBN-8910A	650	A	768.80	775.41	774.72	776.22				
	PBN-8910C	652	C	695.20	775.66	774.84	776.48	0.00340	0.00163	0.00353	0.00285
	PBN-8205A	622	A	768.30	774.30	773.56	775.03				
	PBN-8205B	623	B	752.63	774.38	773.73	775.12				
	PBN-8205C	624	C	743.30	774.42	773.69	775.15	0.00480	0.00520	0.00480	0.00493
	PBN-8501A	631	A	753.90	772.57	771.76	773.17				
	PBN-8901C	642	C	679.90	772.68	771.82	773.24				
	PBN-8901D	643	D	635.80	772.74	771.90	773.32	0.00144	0.00119	0.00127	0.00130
	PBN-9902A	688	A	736.11	764.29	764.78	765.58				
	PBN-9902B	689	B	699.91	764.31	764.78	765.55				
	PBN-9902C	690	C	643.66	764.26	764.97	765.51				
	PBN-9902D	691	D	589.50	764.36	764.75	765.52	0.00042	-0.00018	-0.00036	-0.00004
	PBN-9903A	692	A	736.68	763.03	763.65	764.21				
	PBN-9903B	693	B	715.50	763.45	764.09	764.64				
	PBN-9903C	694	C	664.49	763.52	764.14	764.70				
	PBN-9903D	695	D	619.60	763.49	764.13	764.70	0.00336	0.00350	0.00357	0.00348
	SWN-9103B	571	B	726.30	754.95	755.58	756.20				
	SWN-9103C	572	C	676.80	755.08	755.70	756.32				
	SWN-9103D	573	D	630.90	754.89	755.57	756.17				
	SWN-9103E	574	E	602.10	755.02	755.61	756.30	0.00056	0.00024	0.00081	0.00054
	PBN-9102B	562	B	709.00	743.36	743.95	744.41				
	PBN-9102C	563	C	663.60	743.50	744.11	744.60				
	PBN-9002D	982	D	619.20	743.73	744.37	744.86	0.00412	0.00468	0.00501	0.00460
	SWN-0501B	237	B	709.80	754.42	754.92	755.48				
	SWN-0501C	238	C	659.00	754.40	754.90	755.34				
	SWN-0501D	239	D	602.60	754.24	754.67	755.32				
	SWN-0501E	240	E	575.40	754.04	754.38	755.27	-0.00283	-0.00102	-0.00156	-0.00280
	SWN-0503B	245	B	699.50	748.78	749.07	749.35				
SWN-0503C	246	C	653.10	748.74	749.04	749.38					
SWN-0503D	247	D	613.00	748.80	749.11	749.44					
SWN-0503E	248	E	587.95	752.07	750.71	749.53	0.02949	0.01470	0.00161	0.01527	
S1122	300	A	770.69	782.35	783.23	783.90					
Deterrent Burning Ground	DBN-8201B	303	B	746.70	782.26	783.13	783.82				
	DBN-8201C	304	C	736.20	782.29	783.18	783.85	-0.00174	-0.00145	-0.00145	-0.00155
	DBN-9502A	318	A	774.10	782.19	783.22	783.85				
	DBN-9502B	319	B	722.05	781.87	782.90	783.56				
	DBN-9502C	320	C	667.15	781.91	782.97	783.63	-0.00231	-0.00234	-0.00206	-0.00224
	DBN-9501A	314	A	771.70	781.68	782.72	783.26				
	DBN-9501B	315	B	719.50	781.74	782.76	783.29				
	DBN-9501C	316	C	664.00	781.73	782.78	783.31				
	DBN-9501E	317	E	637.55	781.69	782.66	783.18	0.00007	-0.00045	-0.00060	-0.00052
	ELN-8203A	210	A	772.70	782.19	782.93	783.66				
	ELN-8203B	211	B	760.50	781.63	782.62	783.17				
	ELN-8203C	212	C	730.30	781.67	782.60	783.17	-0.02321	-0.01473	-0.02188	-0.01994
	ELM-9501	234	A	779.20	779.70	780.59	780.73				
	ELN-0801B	455	B	738.87	779.80	782.65	780.89				
	ELN-0801C	456	C	693.42	779.85	780.68	780.89				
	ELN-0801E	457	E	634.93	779.75	780.59	780.78	0.00035	0.00000	0.00035	0.00023
	ELN-1003A	467	A	776.19		779.50	779.43				
	ELN-1003B	468	B	704.74	no data	778.90	779.45				
ELN-1003C	469	C	641.64		779.03	779.59					
ELN-1003E	470	E	571.02		778.59	779.16		-0.00444	-0.00132	-0.00288	

Table 8R
Vertical Groundwater Gradient
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

	Well Pair	Well ID	Layer	Screen Midpoint Elevation	Groundwater Elevation (ft msl)			Vertical Groundwater Gradient (ft/ft)			
					Mar-10	Sep-10	Mar-11	Mar-10	Sep-10	Mar-11	Average
Central Plume	RIN-1002A	492	A	775.76	no data	776.92	no data				
	RIN-1002C	493	C	683.56		776.84					
	RIN-1005A	496	A	773.74	no data	775.27	no data				
	RIN-1005C	497	C	681.99		774.33					
	SEN-0501A	580	A	760.14	764.98	765.51	765.50				
	SEN-0501B	581	B	702.87	765.03	765.56	765.58				
	SEN-0501D	582	D	600.22	765.29	765.83	765.83	0.00206	0.00200	0.00206	0.00204
	SEN-0503A	585	A	761.63	766.07	766.61	766.59				
	SEN-0503B	586	B	704.39	766.07	766.62	766.58				
	SEN-0503D	587	D	601.31	766.14	766.70	766.63	0.00044	0.00056	0.00025	0.00042

Layer designation

- A = shallow zone in sand and gravel aquifer
- B = intermediate zone in sand and gravel aquifer
- C = deep zone in sand and gravel aquifer
- D = bottom zone in sand and gravel aquifer
- E = top of bedrock aquifer

ft msl - Feet Mean Sea Level

R/R - Feet per Foot

Gradient determined between shallow and deep well for each well cluster

Vertical Groundwater Gradient = (h2 - h1) / (z1 - z2)

h1 = shallow well groundwater elevation

h2 = deep well groundwater elevation

z1 = shallow well screen midpoint elevation

z2 = deep well screen midpoint elevation

Table 14
Groundwater Plume Contaminant Mass Estimate
Propellant Burning Ground
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Location	Plume Interval (µg/l)	Average Concentration (µg/l)	Interval Thickness (ft)	Length (ft)	Width (ft)	Porosity	Total Pore Space Volume (ft ³)	Conversion Factor (lbs/ft ³)	Mass Volume (lbs)
Carbon Tetrachloride									
On-site	>5.0	8.0	45	6,000	1,800	0.26	126,360,000	62.4	631
	0.5 to 5.0	1.5	45	7,200	3,000	0.26	252,720,000	62.4	237
Off-site	>25.0	60.0	60	6,000	750	0.26	70,200,000	62.4	2,628
	>5.0 to 25	8.0	75	8,400	1,125	0.26	184,275,000	62.4	920
	0.5 to 5.0	1.5	125	10,200	750	0.26	248,625,000	62.4	233
Carbon Tetrachloride Contaminant Mass									4,648
Dinitrotoluene									
On-site	>1.0	196	30	750	500	0.26	4,875,000	62.4	596.23
	>1.0	1.9	45	450	300	0.26	1,579,500	62.4	1.87
	>1.0	4.4	50	1,000	500	0.26	6,500,000	62.4	17.85
	0.05 - 1.0	0.15	45	7,200	400	0.26	33,696,000	62.4	3.15
	0.005 - 0.05	0.02	30	8,400	600	0.26	39,312,000	62.4	0.49
Off-site	0.05 - 1.0	0.05	70	6,000	2,000	0.26	218,400,000	62.4	6.81
	0.005 - 0.05	0.02	120	10,200	1,800	0.26	572,832,000	62.4	7.15
Total DNT Contaminant Mass									634

µg/l - micrograms per liter

ft - Feet

ft³ - Cubic Feet

lbs - Pounds

Total DNT values are based on the addition of the six DNT isomers.

Carbon tetrachloride and total DNT estimates are based on data from 2010.

Table 14 R
Groundwater Plume Contaminant Mass Estimate
Propellant Burning Ground
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Location	Plume Interval (µg/l)	Average Concentration (µg/l)	Interval Thickness (ft)	Length (ft)	Width (ft)	Porosity	Total Pore Space Volume (ft ³)	Conversion Factor (lbs/ft ³)	Mass Volume (lbs)
Carbon Tetrachloride									
On-site	>5.0	8.0	45	6,000	1,800	0.26	126,360,000	62.4	63
	0.5 to 5.0	1.5	45	7,200	3,000	0.26	252,720,000	62.4	24
Off-site	>25.0	60.0	60	6,000	750	0.26	70,200,000	62.4	263
	>5.0 to 25	8.0	75	8,400	1,125	0.26	184,275,000	62.4	92
	0.5 to 5.0	1.5	125	10,200	750	0.26	248,625,000	62.4	23
Carbon Tetrachloride Contaminant Mass									465
Dinitrotoluene									
On-site	>1.0	196	50	750	500	0.26	4,875,000	62.4	60
	>1.0	1.9	45	450	300	0.26	1,579,500	62.4	0
	>1.0	4.4	50	1,000	500	0.26	6,500,000	62.4	2
	0.05 - 1.0	0.15	45	7,200	400	0.26	33,696,000	62.4	0
	0.005 - 0.05	0.02	30	8,400	600	0.26	39,312,000	62.4	0
Off-site	0.05 - 1.0	0.05	70	6,000	2,000	0.26	218,400,000	62.4	1
	0.005 - 0.05	0.02	120	10,200	1,800	0.26	572,832,000	62.4	1
Total DNT Contaminant Mass									63

µg/l - micrograms per liter

ft - Feet

ft³ - Cubic Feet

lbs - Pounds

Total DNT values are based on the addition of the six DNT isomers.

Carbon tetrachloride and total DNT estimates are based on data from 2010.

Table 15
Dinitrotoluene Groundwater Plume Contaminant Mass Estimate
Deterrent Burning Ground and Central Plumes
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Location	Average Concentration (µg/l)	Elevation (ft above MSL)	Interval Thickness (ft)	Length (ft)	Width (ft)	Porosity	Total Pore Space Volume (ft ³)	Conversion Factor (lbs/ft ³)	Mass Volume (lbs)
Deterrent Burning Ground									
Hot Zone	4.09	735-780	45	900	800	0.26	8,424,000	62.4	21.50
Remainder	0.768	720-780	60	6,000	1,200	0.26	112,320,000	62.4	53.80
Total DNT Contaminant Mass									75.3
Central Plume									
Plume	0.042	660-760	100	18,000	2,000	0.26	936,000,000	62.4	24.5
Total DNT Contaminant Mass									24.5

µg/l - micrograms per liter

ft - Feet

ft³ - Cubic Feet

lbs - Pounds

Total DNT values are based on the addition of the six DNT isomers.

Deterrent Burning Ground estimate is based on data from 2010.

Central Plume estimate is based on data from 2008 to 2010.

MSL - mean sea level

Table 15 R
Dinitrotoluene Groundwater Plume Contaminant Mass Estimate
Deterrent Burning Ground and Central Plumes
Alternative Feasibility Study - Groundwater Remedial Strategy
Badger Army Ammunition Plant

Location	Average Concentration (µg/l)	Elevation (ft above MSL)	Interval Thickness (ft)	Length (ft)	Width (ft)	Porosity	Total Pore Space Volume (ft ³)	Conversion Factor (lbs/ft ³)	Mass Volume (lbs)
Deterrent Burning Ground									
Hot Zone	4.09	735-780	45	900	800	0.26	8,424,000	62.4	0
Remainder	0.768	720-780	60	6,000	1,200	0.26	112,320,000	62.4	54
Total DNT Contaminant Mass									54
Central Plume									
Plume	0.042	660-760	100	18,000	2,000	0.26	936,000,000	62.4	25
Total DNT Contaminant Mass									25

µg/l - micrograms per liter

ft - Feet

ft³ - Cubic Feet

lbs - Pounds

Total DNT values are based on the addition of the six DNT isomers.

Deterrent Burning Ground estimate is based on data from 2010.

Central Plume estimate is based on data from 2008 to 2010.

MSL - mean sea level