

APPENDIX G
EXCAVATION EVALUATION FOR DA 9

Memorandum

Date: February 19, 2016
To: The Companies
Copies To: Altamont Environmental, Inc.
From: Evan Cox, Todd Hagemeyer, and Leah MacKinnon, Geosyntec Consultants
Subject: Cost Estimate for Excavation and Off-Site Disposal of Drummed Waste and Impacted Soils from Disposal Area 9 (DA 9)

Geosyntec Consultants of NC PC (Geosyntec) has prepared this document to assist the companies responsible for the management of the Chemtronics Site (the Companies) with evaluating the potential cost of excavation and off-site disposal of waste and impacted soils at Disposal Area 9 (DA 9) at the Chemtronics Site in Swannanoa, North Carolina (the Site).

Capping and fencing of the disposal areas (DAs) is the selected remedy for waste and soil as defined in the 1988 Record of Decision (ROD) and 1989 ROD amendment^{1,2}. Following implementation of this remedy, the United States Environmental Protection Agency (EPA) has acknowledged that the caps are functioning as intended by the decision documents, ROD and ROD Amendment; i.e., the caps continue to function as designed and perform as expected to prevent direct exposure to, and limit rainfall infiltration through, the buried waste in the DAs³. However, the EPA requested additional information regarding excavation of DA 9 as part of the current Feasibility Study (FS) to evaluate if excavation should be considered as a process option for DA 9 waste and soil. Thus, this document has been prepared to support the FS evaluation process for the Site.

The evaluation presented in this memorandum supports eliminating this technology as a process option for DA 9 waste and soil for the following reasons: i) the area is already capped and suspected to contain materials that pose significant potential health and safety risk to workers

¹ EPA, 1988. Record of Decision, Chemtronics Site, Swannanoa, North Carolina. April, 1988.

² EPA, 1989. Amendment to the Enforcement Record of Decision Remedial Alternative Selection. Chemtronics Site, Inc., Swannanoa, Buncombe County, North Carolina. April, 1989.

³ EPA, 2012. Third Five-Year Review Report. Chemtronics Superfund Site, Swannanoa, Buncombe County, North Carolina, EPA ID NCD 095 459 392. September, 2012.

and the public if excavated; ii) as described above, the DAs have an EPA-approved capping remedy in place which is functioning as intended; and iii) excavation and on-site treatment are not cost effective compared to other safer and viable alternatives.

Understanding of Waste Contents/Conditions at DA 9

It is our understanding from available information^{4,5,6} that DA 9 was used for disposal of wastes generated from production of 3-quinuclidinyl benzilate (BZ) and ortho-chlorobenzylidene malononitrile (CS; tear gas). These wastes included: i) protective clothing, rags and other clean-up materials; ii) sump contents (settled residue) from the BZ operation at Building 113; and iii) waste or product grade CS and BZ. It is suspected that between 300 and 600 drums of waste may be buried at DA 9⁷. The *Work Plan for the Remedial Investigation / Feasibility Study* (Camp, Dresser & McKee, 1985) noted that drums were reported to be visible in the pit. The contents of the drums placed in DA 9 were reportedly treated with a kill solution prior to burial. The solid waste management unit (SWMU) Data Sheet for DA 9 reports that “The unit also received other wastes which were associated with manufacturing processes conducted at that time.”⁸ These wastes may have included chlorinated solvents^{4,5} such as trichloroethene (TCE) and 1,2-dichloroethane (1,2-DCA), which are present at elevated concentrations in groundwater immediately downgradient of DA 9. The disposal area was reported to have dimensions of 60 feet by 30 feet, with an approximate depth of 6 to 8 feet.

The SWMU Data Sheet for DA 9 reports the following maximum concentrations in soil samples collected in and around DA 9^{1,5} in the table on the next page. Although not specifically noted in the SWMU data sheet, a summary of previous investigations included in the SWMU document indicates that during the 1987 RI/FS⁹, soil was tested for “VOCS (volatile organic compounds), SVOCS (semi-volatile organic compounds), metals, pesticides/PCBs, explosives, total organic halide, total cyanide, CS (tear gas), and BZ. All were detected”. Available information from the

⁴ Altamont Environmental, Inc., 2010. RI/FS Work Plan Volume 2- Field Sampling and Analysis Plan. Chemtronics Site, Swannanoa, Buncombe County, North Carolina. January, 2010.

⁵ Camp, Dresser & McKee, Inc., 1985. Draft Work Plan for the Remedial Investigation/Feasibility Study, Chemtronics, Inc., Swannanoa, North Carolina, Remedial Investigation/Feasibility Study, May, 1985.

⁶ Camp, Dresser & McKee, Inc., 1985. Final Interim Report, Chemtronics, Inc., Swannanoa, North Carolina, Remedial Investigation/Feasibility Study, January, 1985.

⁷ Metcalf & Eddy, Inc., 1987. Remedial Investigation Report, Chemtronics, Inc., Swannanoa, North Carolina, April, 1987.

⁸ EPA, 1990. RCRA Facility Assessment Report, Jet Research Center, Inc. Swannanoa, North Carolina, July, 1990.

⁹ Serrine Environmental Consultants, 1987. Draft Feasibility Study Report, Chemtronics, Inc., Swannanoa, North Carolina, November, 1987.

SWMU Data Sheet states: "The units received waste or product-grade CS (tear gas) and BZ, both incapacitating agents. The drums were reportedly treated with a kill solution prior to burial."

<i>Constituent</i>	<i>Concentration (mg/kg)</i>
TCE	3.2
1,2-DCA	1.8
Methylene chloride	0.40
Tetrachloroethene (PCE)	0.021
Bis(2-ethylhexyl)phthalate	15.0
Poly chlorinated biphenols (PCBs; Arochlor)	5.0
Research Department Explosive (RDX)	220
Trinitrotoluene (TNT)	280
CS	370
Orthochlorobenzaldehyde	22
Total organic halides	260
Total cyanide	8.71

mg/kg – milligrams per kilogram

As indicated above, the contents of the drums placed in DA 9 were reportedly treated with a kill solution prior to burial. Because CS, BZ, and other constituents were detected in soil in the vicinity of DA 9, the efficacy of the kill solution and the integrity of the drums is unclear; thus it is uncertain whether excavation can proceed with complete confidence that active incapacitating agents will not be encountered during excavation and materials handling. Additionally, RDX and TNT were detected in soil samples collected in and around DA 9 during the RI, suggesting their potential presence in this area. The potential therefore exists for energetics to be present in the wastes. The potential presence of active incapacitating agents and energetics presents significant health and safety risks to Site workers and the public, which will dictate the pace and oversight of excavation and methods of off-site disposal. As such, both a Best Case and Worst Case cost estimate have been prepared to evaluate options for excavation and off-site disposal for DA 9. The Best Case assumes that the duration of the work will be shorter because CS, BZ and energetics are not encountered during the excavation and drum removal. The Worst Case assumes a longer drum removal period and much higher waste disposal costs because CS, BZ and energetics are encountered. For each case, similar Site preparation, oversight and supporting systems are assumed for the excavation period because the Site will need to be prepared and excavated assuming that CS, BZ and/or energetics may be encountered.

Additionally, based on the observation of energetics in the soil samples, both cases assume that personnel trained in addressing unexploded ordinance or munitions constituents (UXO/MC) will

be required to be on standby for the entire excavation period and that medical personnel be present during the drum removal period.

Best Case Estimate for Excavation and Off-Site Disposal of DA 9 Soil/Waste

The waste buried beneath the cap at DA 9, as well as impacted soil, would be excavated, removed and disposed off-site at a properly licensed facility. Conservatively, because very little is known about potential soil impacts beneath the cap, we have assumed that excavation of soil to the groundwater table will be required beneath the immediate footprint of the DA 9 area.

It is assumed that the BZ and CS wastes have been effectively de-activated and will not require health and safety precautions pertinent to BZ or CS (such as Level B or A Personal Protective Equipment [PPE]), as is required for the Worst Case estimate described in further detail below. However, because of the uncertainties associated with the waste, some precautions will be necessary during the excavation period.

The weather conditions in the area will play a role in the duration since precipitation may slow Site work and require maintenance on the access road to the Back Valley. For the purpose of this evaluation, we have assumed that road construction and other preparatory work will occur in the fall and all other work will occur during the following spring and early summer months. Delays due to weather are not included.

The following additional detailed assumptions have been made in preparing the cost estimate for the Best Case scenario.

- The contents of the drums likely contain deactivated BZ and CS wastes and solvents related to the manufacturing process.
- No UXO/MC or related manufacturing materials are encountered.
- The depth to groundwater in the area of DA 9 is approximately 20 feet and the drums are buried 6 feet below grade.
- The soil in the area will remain stable when excavated with a 1:1 side slope. This assumption is a key assumption when determining the size of the excavation and associated structures.
- The duration of the removal has been estimated at 30 working days based on an average drum removal of 20 drums per day. An additional 30 working days is included for excavation of the overlying soils and backfilling. We have not included overtime premiums for extended working hours.
- The drum removal crew includes two excavators, front-end loader, and one other vehicle, plus two laborers, two equipment operators, and a safety and sampling technician. We

have also included an independent safety and sampling technician to confirm the results on behalf of the Companies.

- An air monitoring team and a continuous air monitoring unit (i.e., MINICAM) will be present for the duration of the excavation to confirm that CS, BZ and explosives are not present.
- Drum removal will be conducted in Level D or C PPE. Level C PPE includes respirators, but not supplied air. This is based on: i) the assumed absence of BZ/CS in the breathing airspace; and ii) the potential for elevated concentrations of VOCs or other constituents in the breathing airspace. Thus PPE upgrade to Level C will be based on real-time air monitoring.
- While the Best Case scenario assumes that UXO/MC will not be present, some precautions for UXO/MC are included since energetics were measured in soil samples from the DA 9 area. Precautions include:
 - Specially trained personnel are included for the full excavation period in the cost estimate and it is assumed that members of the drum removal crew will be trained UXO/MC technicians.
 - A standby Emergency Medical Team with ambulance was included for the drum removal period.
- The test pits to confirm that impacted soil (i.e., above regulatory standards) has been removed will require approximately 2 days to complete.
- The laboratory analysis required for the characterization of waste and soil samples will be completed off-site.
- A temporary excavation protection structure has been included to protect the excavation from weather and to control potential fugitive air emissions from the area. The structure will be maintained under a slight vacuum pressure. While not expected to be used under the Best Case scenario, the structure will have the infrastructure for granular activated carbon (GAC) or thermal oxidation treatment of the collected air prior to discharge as a contingency measure. The structure will be sufficiently large to house the waste storage areas described above until the waste can be characterized and removed from Site.
- Upgrade of the current roadway to a construction road, suitable for heavy trucks and machinery, has been included for a distance of one mile. This is the approximate distance from the Front Valley to the DA 9 area.
- The existing synthetic cover will be disposed of on-site. The soil over the top of the drums will be removed and stockpiled on-site for re-use as clean fill, if appropriate. Additional clean fill will be required and has been assumed to be located within 1 mile of DA 9 for the purposes of this estimate. This fill will be characterized prior to use on-site.

- Costs for waste disposal are estimates based on experience by Geosyntec from other sites and unit rates provided from a disposal contractor. However, it should be noted that firm cost estimates would only be available based on sampling and analysis of the wastes.
- The following general classes of wastes have been assumed, as defined by the Resource Conservation and Recovery Act (RCRA) Subtitle C:
 - Soil – Non-hazardous, assuming that VOC concentrations fall below relevant thresholds and that CS, BZ, explosives and UXO are not present.
 - Waste drum contents – Characteristic hazardous waste based on the likelihood that the waste solvents are in high enough concentrations to trigger a Toxicity Characteristic Hazardous Waste criteria. The drums themselves will be characteristic hazardous solids.
 - Decontamination Materials (including GAC) – Impacted, non-hazardous wastes, disposed with soil.
- Three waste storage areas are required for the drum and waste removal activities:
 - Over-packed waste drums and drums of liquid waste from the excavated area.
 - Impacted soil to be stored until the waste characterization is complete.
 - Waste roll-off bins which will contain emptied drums and other miscellaneous waste.

The cost for these waste storage areas includes soil berms, a high density polyethylene (HDPE) liner, drainage and a sump for liquid collection and pumping.

- Water will be supplied for this activity by water truck and stored on-site in a frac-tank.
- The sanitary waste generated at the Site will be collected and periodically hauled off-site for disposal.
- It is assumed that the water generated by decontamination activities will be treatable on-site and discharged to the metropolitan sewer district (MSD).
- The Back Valley is currently supplied with electricity from a transformer located in the Front Valley. An allowance to either rent generators or bring electricity to the Back Valley has been included based on experience at other sites and pilot test work completed during the FS process.
- A decontamination trailer complete with two showers, heaters and exhaust fans is included. A Site trailer has also been included for the use of the project management team and clients.
- Surface runoff from precipitation will be diverted around the excavation using a barrier (i.e., berm, liner and drainage) uphill (i.e., north) of the excavation.
- Contractor mobilization, site-preparation, and performance bond costs have been included in the cost estimate as percentages of the construction sub-total, excluding waste disposal costs. The costs are higher than typical heavy construction projects, to account

for the complexity and potential risk associated with the waste. Unit cost estimates include standard contractor overhead and profit. Permit modifications are also included for waste generation.

- Due to the nature of the waste being removed, the work plan development and engineering task also includes the preparation of a detailed community relations program complete with community meetings. Coordination meetings with the EPA, the North Carolina Department of Environmental Quality (DEQ) and other regulatory bodies are also included in this cost.

Worst Case Estimate for Excavation and Off-Site Disposal of DA 9 Soil/Waste

The waste buried beneath the cap at DA 9, as well as impacted soil, would be excavated, removed and disposed off-site at a properly licensed facility. Conservatively, because very little is known about potential soil impacts beneath the cap, we have assumed that excavation of soils to the groundwater table will be required beneath the immediate footprint of DA 9.

It is assumed that BZ, CS and energetics are detected or observed during the excavation, which will significantly slow the work at the Site. Experience by Geosyntec suggests that worst case drum removal rates may be as low as 5 to 10 drums per day. Removal will proceed in Level B PPE. This alternative also assumes that MC and possibly UXO will be encountered, which will require specialized screening, segregation and disposal practices.

Similar to the Best Case, the weather conditions during the time the removal is completed will play a role in the project duration. For the purpose of this cost estimate, we have assumed that road and other preparatory work will occur in the fall and all other work will occur during the following spring and early summer months. Delays due to weather are not included.

The following additional detailed assumptions have been made in preparing the cost estimate for this alternative.

- The waste in the drums contains active BZ/CS wastes and energetics, as well as solvents related to the manufacturing process.
- The depth to groundwater in the area of DA 9 is approximately 20 feet and the drums are buried 6 feet below grade.
- The soil in the area will remain stable when excavated with a 1:1 side slope. This is a key assumption when determining the size of the excavation and associated structures.
- The duration of the removal has been estimated at 60 working days based on a drum removal of 10 drums per day. An additional 30 working days is included for excavation

of the overlying soils and backfilling. We have not included overtime premiums for extended working hours.

- The drum removal crew includes two excavators, front-end loader, and one other vehicle, plus two laborers, two equipment operators, and a safety and sampling technician. We have also included an independent safety and sampling technician for the duration of the excavation to confirm the results on behalf of the Companies.
- An air monitoring team and a continuous air monitoring unit (i.e., MINICAM) will be present for the duration of the excavation to confirm that CS, BZ and explosives are not present.
- The soil excavation crew includes all equipment plus two laborers and an equipment operator. Based on the lower risk associated with the soil compared with the buried waste drums, the soil excavation has been assumed to require a lower level of PPE (C or D).
- Based on the nature of the waste, the drum removal is assumed to require Level B PPE.
- Since UXO/MC may be encountered, specially trained personnel are included in the cost estimate and it is assumed that members of the drum removal crew will be trained UXO/MC technicians.
- A standby Emergency Medical Team with ambulance was included during removal of the drums.
- The test pits to confirm that impacted soil (i.e., above regulatory standards) has been removed will require approximately 5 days to complete.
- A mobile laboratory, complete with mass spectrometry, has been included to rapidly assess the nature of the waste and whether it contains active target compounds above remedial goals. This on-site laboratory will also be used to expedite analysis and characterization of the samples. Toxic characteristic leaching procedure analysis will be completed off-site.
- A temporary excavation protection structure has been included to protect the excavation from weather and to control fugitive air emissions from the area. The structure will be maintained under a slight vacuum pressure and collected air will be directed through a dual-train GAC or thermal oxidation treatment system prior to discharge to the natural environment. The structure will be sufficiently large to house the waste-disposal holding areas described above until the waste can be characterized and removed from Site.
- The upgrade of the current roadway to a construction road, suitable for heavy trucks and machinery, has been included for a distance of 1 mile. This is the approximate distance from the Front Valley to the DA 9 area.
- The existing synthetic cover will be removed for off-site disposal. The soil over the top of the drums will be removed and stockpiled on-site for re-use as clean fill, if appropriate.

Additional imported clean fill will be required to restore the excavation to the original ground surface elevation and would be characterized prior to use on-site. The imported fill has been assumed to be located within 1 mile of DA 9 for the purposes of this cost estimate.

- Costs for waste disposal are estimates based on unit rates provided by a disposal contractor. However, it should be noted that firm cost estimates would only be available based on sampling and analysis of the wastes.
- The following general classes of wastes have been used:
 - Soil –
 - 70 percent (%) of the excavated soil is assumed to be characteristic hazardous but would not have energetics, CS or BZ present.
 - 20% of the excavated soil is assumed to have concentrations of explosives or energetics that will require stabilization prior to off-site transport and disposal.
 - 10% of the excavated soil is assumed to be impacted with BZ, CS and energetics requiring soil mixing to reach concentrations that will allow for transportation (assumed to be a 10:1 ratio).
 - All mixed soil will be characteristic hazardous after mixing and would be incinerated.
 - Waste drum contents – It is assumed that 50% of the drums have leaked, such that only solids will remain. The drums and any solids within them will be characteristic hazardous solids. The remaining drums are assumed to be intact, and their contents are assumed to be characteristic hazardous, similar to the Best Case scenario.
 - Decontamination Materials (including GAC) – Characteristic hazardous wastes and will be disposed with soil.
- Three waste storage areas are required for the drum and waste removal activities:
 - A large waste storage area has been included for the drums of impacted decontamination wastewater, the over-packed waste drums from the pit, and drums of liquid waste.
 - A waste storage area has been included for the impacted soil to be stored until the waste characterization is complete.
 - A waste storage area has been included for the waste roll-off bins and will be located inside the excavation protection structure. The roll-off bins will contain emptied drums and other miscellaneous waste.

The cost for these waste storage areas includes soil berms, a HDPE liner, drainage and a sump for liquid collection and pumping.

- A potable water supply pipeline and lift station has been included in the cost estimate based on the observation by Altamont that the Back Valley groundwater treatment system is currently at the limit of the municipal water supply system. A temporary water storage tank (frac-tank) is included such that the lift station can pump water to the Site slowly over the course of the night and will be full for use during peak water consumption periods. The configuration of this system assumes that no 24/7 construction and/or operation at the Site will be required.
- The sanitary waste generated at the Site will be collected and periodically hauled off-site for disposal.
- It is assumed that a portion of the water generated by decontamination activities will be treatable on-site and discharged to MSD. The remainder will be collected in a wastewater storage frac-tank and transferred to drums for off-site disposal. We have assumed that a portion of the wastewater will be disposed as characteristic hazardous waste. This assumption would be confirmed during characterization of the decontamination water.
- The Back Valley is currently supplied with electricity from a transformer located in the Front Valley. An allowance to either rent generators or bring electricity to the Back Valley has been included based on experience at other sites.
- A decontamination trailer complete with two showers, heaters, and exhaust fans is included. A Site trailer has also been included for the use of the project management team and client.
- Surface runoff from precipitation will be diverted around the excavation using a barrier (i.e., berm, liner and drainage) uphill (i.e., north) of the excavation.
- Contractor mobilization, site-preparation, and performance bond costs have been included in the cost estimate as percentages of the construction sub-total, excluding the waste disposal costs. The costs are higher than typical heavy construction projects to account for the complexity and risk associated with the waste. Unit cost estimates include standard contractor overhead and profit.
- The engineering required for this alternative will be extensive to ensure that explosive hazards, and hazards associated with potentially active BZ/CS waste and the other DA 9 constituents are properly mitigated. Additionally, we anticipate that the regulatory reporting requirements will be high and project management controls will need to be extensive to ensure that all waste is properly tagged, tracked, sampled, stored, handled and disposed in accordance with all regulations. Permit modifications are also included for waste generation.
- Due to the nature of the waste being removed, the work plan development and engineering task also includes the preparation of a detailed community relations program

complete with community meetings. Coordination meetings with the EPA, DEQ, and other regulatory bodies are also included in this cost. These costs have been increased relative to the cost for the best case to account for the additional paperwork that would be necessary.

**Table 1: Cost Estimate for DA 9 Soil/Waste Excavation - Best Case Scenario
Chemtronics Site, Swannanoa, North Carolina**

	Item	Unit	Est. Qty.	Unit Price	Total Cost Estimate
1	Drum Removal Crew	Day	30	\$8,300	\$249,000
2	Air Monitoring Team	Day	60	\$2,000	\$120,000
3	H&S / Sampling Tech	Day	30	\$1,500	\$45,000
4	Standby Emergency Medical Team	Day	30	\$1,929	\$57,870
5	UXO/MC Supervisor	Day	60	\$1,400	\$84,000
6	Soil Loadout Crew	Day	35	\$5,000	\$175,000
7	Test Pit Crew	Day	2	\$5,000	\$10,000
8	MINICAM	Each	1	\$53,000	\$53,000
9	Clearing and Grubbing	Acre	1.4	\$7,500	\$10,500
10	Road Construction	SY	11700	\$16	\$182,988
11	Silt Fence	LF	1000	\$10	\$10,000
12	Sheetpile	LF	250	\$43	\$10,750
13	Excavation of Overburden	CY	1287	\$8	\$10,296
14	Excavation of Impacted Material	CY	1583	\$8	\$12,664
15	Transport and Stockpile Overburden	CY	1609	\$8	\$12,872
16	Transport, Place and Compact Overburden	CY	1609	\$12	\$19,308
17	Transport, Place and Compact Imported Fill	CY	1979	\$20	\$39,580
18	Vegetation Restoration	SF	61000	\$0.17	\$10,370
19	T&D Drums, Characteristic Hazardous, Solids	Ton	25	\$1,500	\$37,500
20	T&D Drums, Haz Liquids	Each	600	\$500	\$300,000
21	T&D Non-Haz Impacted Soils	Ton	4138	\$95	\$393,110
22	Sampling / Analysis - Characterization	Each	175	\$1,500	\$262,500
23	Sampling / Analysis - TCLP	Each	175	\$850	\$148,750
24	55-gal DOT Steel Drum	Each	100	\$50	\$5,000
25	95-gal Overpacks	Each	200	\$200	\$40,000
26	Waste Roll Off Bins	Each	15	\$1,300	\$19,500
27	Excavation Protection Structure	SF	24000	\$35	\$840,000
28	Rainwater Diversion Around Excavation Protection Structure	LS	1	\$30,000	\$30,000
29	Air Handling Equipment	LS	1	\$110,000	\$110,000
30	Dual Bed GAC Air System	LS	1	\$87,692	\$87,692
31	Waste Handling Area - Drums	SF	3000	\$3	\$9,000
32	Waste Handling Area - Roll Offs	SF	3300	\$3	\$9,900
33	Waste Handling Area - Impacted Soil	SF	10000	\$3	\$30,000
34	Water Supply by Water Truck	Weeks	10	\$3,500	\$35,000
35	Water Supply 20k-gal Storage Tank - frac tank	LS	1	\$5,000	\$5,000
36	Sanitary Waste	Each	1	\$5,000	\$5,000
37	Decon Water 20k-gal Storage Tank - frac tank	LS	1	\$5,000	\$5,000
38	Decon Water Treatment (on-site)	LS	1	\$25,000	\$25,000
39	Electrical Supply to DA 9 Area	LS	1	\$170,000	\$170,000
40	Site Trailer	Month	3	\$1,000	\$3,000
41	Decon Trailer	Month	2	\$2,000	\$4,000
42	Decon Area with Truck Wash	LS	1	\$20,000	\$20,000
43	Erosion Control	SY	300	\$5	\$1,500
44	Dewatering	Day	30	\$500	\$15,000
45	Surveying	Day	30	\$1,500	\$45,000
	Construction Sub-Total (CST) Includes Waste Disposal				\$3,769,650
	Waste Disposal Sub-Total				\$730,610
	Construction Sub-Total (CST) Not Including Waste Disposal				\$3,039,040
	Contractor Mobilization & Site Prep (10% of CST not incl. waste)		10%	\$3,039,040	\$303,904
	Performance Bond (2% of CST not incl. waste)		2%	\$3,039,040	\$60,781
	Miscellaneous Consumables (2% of CST not incl. waste)		2%	\$3,039,040	\$60,781
	Total Construction Cost (TCC)				\$4,195,116
	Total Construction Cost (TCC) Not Including Waste Disposal				\$3,464,506
	Work Plan Development & Engineering (4% of TCC not incl. waste)		4%	\$3,464,506	\$138,580
	Pre-Removal Tasks (2% of TCC not incl. waste)		2%	\$3,464,506	\$69,290
	Project Management (4% of TCC not incl. waste)		4%	\$3,464,506	\$138,580
	Oversight and Documentation (5% of TCC not incl. waste)		5%	\$3,464,506	\$173,225
	Reporting (3% of TCC not incl. waste)		3%	\$3,464,506	\$103,935
	Contingency (20%)		20%	\$4,818,727	\$963,745
	Total Capital Cost				\$5,782,500

Notes:

Assumptions for this estimate are outlined in the Geosyntec Memorandum entitled "Cost Estimate for Excavation and Off-Site Disposal of Drummed Waste and Impacted Soils for Disposal Area 9 (DA 9)" dated February 19, 2016

This cost table is not a standalone document and must be reviewed in conjunction with the above referenced memorandum.

Estimated unit prices include standard contractor overhead and profit

Costs are considered planning level -30%/+50%

H&S - health and safety

UXO/MC - unexploded ordinance / munitions constituent

MINICAM - continuous air monitoring unit

T&D - transport and disposal

TCLP - toxic characteristic leaching procedure

TCC - total construction cost

DOT - department of transportation

GAC - granular activated carbon

k-gal - thousand gallons

DA 9 - disposal area 9

Decon - decontamination

CST - construction sub-total

gal - gallon

SY - square yard

LF - linear feet

CY - cubic yard

LS - lump sum

LBS - pounds

**Table 2: Cost Estimate for DA 9 Soil/Waste Excavation - Worst Case Scenario
Chemtronics Site, Swannanoa, North Carolina**

	Item	Unit	Est. Qty.	Unit Price	Total Cost Estimate
1	Drum Removal Crew	Day	60	\$8,300	\$498,000
2	Air Monitoring Team	Day	90	\$2,000	\$180,000
3	H&S / Sampling Tech	Day	90	\$1,500	\$135,000
4	Standby Emergency Medical Team	Day	60	\$1,929	\$115,740
5	UXO/MC Supervisor	Day	90	\$1,400	\$126,000
6	Soil Loadout Crew	Day	90	\$5,000	\$450,000
7	Test Pit Crew	Day	5	\$5,000	\$25,000
8	MINICAM	Each	1	\$53,000	\$53,000
9	Mobile Lab	Day	60	\$4,116	\$246,960
10	Clearing and Grubbing	Acre	1.4	\$7,500	\$10,500
11	Road Construction	SY	11700	\$16	\$182,988
12	Silt Fence	LF	1000	\$10	\$10,000
13	Sheetpile	LF	250	\$43	\$10,750
14	Excavation of Overburden	CY	1492	\$8	\$11,933
15	Excavation of Impacted Material	CY	1379	\$8	\$11,033
16	Transport and Stockpile Overburden	CY	1865	\$8	\$14,916
17	Transport, Place and Compact Overburden	CY	1865	\$12	\$22,375
18	Transport, Place and Compact Imported Fill	CY	1724	\$20	\$34,479
19	Vegetation Restoration	SF	61000	\$0.17	\$10,370
20	Soil Mixing	CY	1724	\$300	\$517,188
21	Clean Fill for Stabilization	CY	1552	\$57	\$88,439
22	T&D Mixed Stabilized Soils with other agents	Ton	414	\$1,100	\$455,125
23	T&D Mixed Stabilized Soils with RDX 300 ppm, TNT 300 ppm	Ton	818	\$1,100	\$899,800
24	T&D Mixed Soils Characteristic Hazardous	Ton	2896	\$600	\$1,737,751
25	T&D Drums, Characteristic Hazardous, Solids	Ton	25	\$1,500	\$37,500
26	T&D Drums, Haz Liquids	Each	300	\$500	\$150,000
27	T&D Frac Tank, Liquids (Decon Waters)	Each	20	\$5,000	\$100,000
28	Sampling / Analysis - Characterization	Each	175	\$1,500	\$262,500
29	Sampling / Analysis - TCLP	Each	175	\$850	\$148,750
30	55-gal DOT Steel Drum	Each	100	\$50	\$5,000
31	95-gal Overpacks	Each	200	\$200	\$40,000
32	Waste Roll Off Bins	Each	15	\$1,300	\$19,500
33	Excavation Protection Structure	SF	24000	\$35	\$840,000
34	Rainwater Diversion Around Excavation Protection Structure	LS	1	\$30,000	\$30,000
35	Air Handling Equipment	LS	1	\$110,000	\$110,000
36	Dual Bed GAC Air System	LS	1	\$87,692	\$87,692
37	GAC for Air Treatment	LBS	3000	\$1.06	\$3,180
38	Waste Handling Area - Drums	SF	3000	\$3	\$9,000
39	Waste Handling Area - Roll Offs	SF	3300	\$3	\$9,900
40	Waste Handling Area - Impacted Soil	SF	10000	\$3	\$30,000
41	Water Supply	LF	1600	\$20	\$32,000
42	Water Supply Lift Station	Each	1	\$15,000	\$15,000
43	Water Supply 20k-gal Storage Tank - frac tank	LS	1	\$5,000	\$5,000
44	Sanitary Waste	Each	1	\$5,000	\$5,000
45	Decon Water 20k-gal Storage Tank - frac tank	LS	1	\$5,000	\$5,000
46	Decon Water Treatment (on-site)	LS	1	\$25,000	\$25,000
47	Electrical Supply to DA 9 Area	LS	1	\$170,000	\$170,000
48	Site Trailer	Month	3	\$1,000	\$3,000
49	Decon Trailer	Month	2	\$2,000	\$4,000
50	Decon Area with Truck Wash	LS	1	\$20,000	\$20,000
51	Erosion Control	SY	300	\$5	\$1,500
52	Dewatering	Day	150	\$500	\$75,000
53	Surveying	Day	75	\$1,500	\$112,500
	Construction Sub-Total (CST) Includes Waste Disposal				\$8,203,370
	Waste Disposal Sub-Total				\$3,985,803
	Construction Sub-Total (CST) Not Including Waste Disposal				\$4,217,567
	Contractor Mobilization & Site Prep (10% of CST not incl. waste)		10%	\$4,217,567	\$421,757
	Performance Bond (2% of CST not incl. waste)		2%	\$4,217,567	\$84,351
	Miscellaneous Consumables (2% of CST not incl. waste)		2%	\$4,217,567	\$84,351
	Total Construction Cost (TCC)				\$8,793,829
	Total Construction Cost (TCC) Not Including Waste Disposal				\$4,808,026
	Work Plan Development & Engineering (5% of TCC not incl. waste)		5%	\$4,808,026	\$240,401
	Pre-Removal Tasks (2% of TCC not incl. waste)		2%	\$4,808,026	\$96,161
	Project Management (3% of TCC not incl. waste)		3%	\$4,808,026	\$144,241
	Oversight and Documentation (5% of TCC not incl. waste)		5%	\$4,808,026	\$240,401
	Reporting (3% of TCC not incl. waste)		3%	\$4,808,026	\$144,241
	Contingency (20%)		20%	\$9,659,274	\$1,931,855
	Total Capital Cost				\$11,591,200

Notes:

Assumptions for this estimate are outlined in the Geosyntec Memorandum entitled "Cost Estimate for Excavation and Off-Site Disposal of Drummed Waste and Impacted Soils for Disposal Area 9 (DA 9)" dated February 19, 2016

This cost table is not a standalone document and must be reviewed in conjunction with the above referenced memorandum.

Estimated unit prices include standard contractor overhead and profit

Costs are considered planning level -30%/+50%

H&S - health and safety	DOT - department of transportation	gal - gallon
UXO/MC - unexploded ordinance / munitions constituent	GAC - granular activated carbon	SY - square yard
MINICAM - continuous air monitoring unit	k-gal - thousand gallons	LF - linear feet
T&D - transport and disposal	DA 9 - disposal area 9	CY - cubic yard
TCLP - toxic characteristic leaching procedure	Decon - decontamination	LS - lump sum
TCC - total construction cost	CST - construction sub-total	LBS - pounds
RDX - Research Department Explosive	ppm - part per million	TNT - trinitrotoluene