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APPROVAL OF THE CARBON TETRACHLORIDE EXPEDITED RESPONSE ACTION
(200-ZP-2) SOIL VAPOR EXTRACTION SYSTEM OPERATING PLAN FOR FY 2001

The Unit Managers for the Carbon Tetrachloride Expedited Response Action (200-ZP-2 Operable Unit) approve the attached FY 2001 Soil Vapor Extraction System Operating Plan.

A. C. Tortoso 3/22/01 D. A. Faulk 3-22-01

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FY 2001 SOIL VAPOR EXTRACTION SYSTEM OPERATING PLAN FOR THE CARBON
TETRACHLORIDE EXPEDITED RESPONSE ACTION
(200-ZP-2 OPERABLE UNIT)

Soil vapor extraction will be used at the 200-ZP-2 Operable Unit during FY 2001 to remove carbon tetrachloride from the vadose zone. The primary objectives for this remediation are protection of the groundwater and mass removal. Only the 14.2 m³/min soil vapor extraction (SVE) system will be operated. Two sites will be remediated using SVE: the 216-Z-9 (Z-9) site and the 216-Z-1A/Z-18/Z-12 (Z-1A) site. Specific on-line wells have been selected prior to start-up at each site based on vapor monitoring, previous concentration trends, and location. These site-specific plans are included in this operating plan for approval by the Unit Managers prior to implementation. Based on characterization data collected at on-line wells during operation, the mix of on-line wells may be reconfigured during operations to optimize removal. These adjustments to the mix of on-line wells will not be submitted to the Unit Managers for approval prior to implementation but will be reported at Unit Manager Meetings. Ongoing passive soil vapor extraction will be maintained at Z-1A wells.

Soil vapor monitoring will be conducted at vadose zone locations near the groundwater, the Plio-Pleistocene layer, and the ground surface at the Z-1A and Z-9 sites while they are not being actively remediated using SVE. The soil vapor monitoring plan for both sites from April 2001 through September 2001 is included with this operating plan for approval prior to implementation. Monitoring results will be reported at the Unit Manager Meetings. If carbon tetrachloride vapor concentrations increase such that the carbon tetrachloride contamination may impact human health or the environment (including groundwater), the Unit Managers will decide on the appropriate response to mitigate the problem (e.g., relocating the vapor extraction system to address the problem).

Two wells at the Z-9 site will be deepened during May and June 2001 to provide additional access to the vadose zone below the Plio-Pleistocene layer. The SVE system will be operated at the Z-1A site during this time to avoid interfering with the characterization sampling to be conducted during the well deepening.

The schedule for SVE operations and soil vapor monitoring is:

- | | |
|-----------------------------------|--|
| April 2001 through June 2001: | Operate the SVE system at the Z-1A site
Monitor soil vapor concentrations at the Z-9 site |
| July 2001 through September 2001: | Operate the SVE system at the Z-9 site
Monitor soil vapor concentrations at the Z-1A site |

SOIL VAPOR EXTRACTION OPERATING PLAN AT THE
216-Z-1A, 216-Z-18, AND 216-Z-12 SITE
April 2001 – June 2001

Twenty-three wells at the 216-Z-1A, 216-Z-18, and 216-Z-12 site (Z-1A site) are identified for potential soil vapor extraction (Table 1). All of these wells will be prepared for potential hook-up to the soil vapor extraction system in April-June 2001.

The March 2001 non-operational soil vapor monitoring was conducted on 3/20/01. On 3/21/01, the sampling tubes were removed from wells 299-W18-152, 299-W18-158L, 299-W18-167, 299-W18-249, and 299-W18-248. The current wellhead assemblies (configured for non-operational soil vapor monitoring) will not be disturbed until after 3/21/01, i.e., after the monitoring has been completed and the tubing removed.

Passive soil vapor extraction is being conducted at the following Z-1A wells with lower intervals open between the Plio-Pleistocene layer and groundwater: 299-W18-6L, 299-W18-7, 299-W18-10L, 299-W18-11L, 299-W18-12, 299-W18-246L, 299-W18-247L, 299-W18-252L (Table 2). Pressure and temperature monitoring is also being conducted at 299-W18-9, 299-W18-6U, 299-W18-247U, and 299-W18-252U. An additional objective during SVE operations at Z-1A in FY 2001 is to evaluate the effectiveness of the Plio-Pleistocene layer as a barrier to vertical air flow in this area. The evaluation will be based on comparison of the pressure responses above and below the Plio-Pleistocene layer to the vacuum applied by the SVE system above the Plio-Pleistocene layer.

For initial start-up operations at Z-1A, extraction will be implemented at six intervals in the Z-1A tile field: 299-W18-158L, 299-W18-165, 299-W18-166, 299-W18-167, 299-W18-168, and 299-W18-174 (Figure 1). During non-operational monitoring at Z-1A since October 1999, the highest carbon tetrachloride concentrations (maximum 248 ppmv) have been observed at wells in the tile field.

These six intervals will be characterized on the first day of operations. During continued operations, all on-line wells will be characterized each week and all off-line wells, if requested, will be characterized during the 2nd, 4th, 6th, 8th, 10th, and final weeks, according to the attached sampling and analysis plan (Table 3). As before, the mix of on-line wells will be periodically changed during operations, based on changing concentrations, extraction interval locations, and operating experience. In general, the initial extraction wells will be nearer the primary carbon tetrachloride source (Z-1A Tile Field) and wells added later will expand operations away from this source.

The ERC technical lead organizes and maintains spreadsheets of the characterization data on a desktop computer. The characterization data are included in the annual performance evaluation report.

SOIL VAPOR EXTRACTION OPERATING PLAN AT THE
216-Z-9 SITE
July 2001 – September 2001

Twenty-one wells at the 216-Z-9 site (Z-9 site) are identified for potential vapor extraction (Table 4). All of these wells will be prepared for potential hook-up to the soil vapor extraction system in July-September 2001.

Deepening of two existing soil vapor extraction wells, 299-W15-84 and 299-W15-95, will begin in May 2001. The sampling tube in well 299-W15-95 will be removed prior to that time. Soil vapor extraction operations will not begin at Z-9 until the well deepening activities have concluded in approximately mid-June 2001.

The last non-operational soil vapor monitoring at Z-9 prior to SVE restart will take place in mid to late June 2001. At that time, any sampling tubes will be removed from potential on-line wells. With the exception of the wells being deepened, the current wellhead assemblies (configured for non-operational soil vapor monitoring) will not be disturbed until the monitoring has been completed and the tubing removed.

Passive soil vapor extraction is being conducted at the following Z-1A wells with lower intervals open between the Plio-Pleistocene layer and groundwater: 299-W18-6L, 299-W18-7, 299-W18-10L, 299-W18-11L, 299-W18-12, 299-W18-246L, 299-W18-247L, 299-W18-252L (Table 2). Pressure and temperature monitoring is also being conducted at 299-W18-9, 299-W18-6U, 299-W18-247U, and 299-W18-252U.

The first task at Z-9 will be to conduct two 3-hour SVE tests, one at each of the two newly deepened wells, to observe initial carbon tetrachloride concentrations at these new extraction intervals (Table 4, initial wells labeled "1"). In addition, soil vapor samples collected using the SVE system will be compared to those collected using a sample pump during well deepening. During each test, only the one test well will be placed on-line to the SVE system. A minimum volume of air will be extracted initially to obtain a representative sample of the concentration adjacent to the well ("puffer test"). Soil vapor extraction will then be continued to determine the carbon tetrachloride concentration at progressive distances from the well. (Note: The term "puffer test" was coined by ERA project staff during the 1991 SVE pilot testing to describe collection of an initial, representative soil vapor sample using a minimal amount of vapor extraction to minimize potential redistribution of the soil vapor concentrations that might be produced by prolonged pumping [DOE-RL 1991, Appendix F.]

For initial full-scale start-up operations at Z-9, extraction will be implemented at four intervals: 299-W15-217, 299-W15-82, 299-W15-9U, and 299-W15-9L (Table 4, initial wells labeled "2") (Figure 1). During non-operational monitoring at Z-9 since July 1999, the highest carbon tetrachloride concentrations (maximum 442 ppmv) have been observed at well 299-W15-217. Start-up operations in FY98 and FY99 were also initiated using these four extraction intervals. Selecting the same set of initial wells will allow comparison of the rebound in FY98 after 9 months to that in FY99 after 6 months to that in FY01 after 24 months.

Based on past operating experience, it is anticipated that extraction will be continued on these four intervals for two to three weeks before additional wells are placed on-line. Preference will then be given to extended extraction from the new extraction intervals, 299-W15-84L and 299-W15-95L.

These four intervals will be characterized on the first day they are placed into operation. During continued operations, all on-line wells will be characterized each week and all off-line wells, if requested, will be characterized during the 2nd, 4th, 6th, 8th, 10th, and final weeks, according to the attached sampling and analysis plan (Table 3). As with Z-1A operations, the mix of on-line wells will be periodically changed during operations, based on changing concentrations, extraction interval locations, and operating experience. In general, the initial extraction wells will be nearer the carbon tetrachloride source (Z-9 Trench) and wells added later will expand operations away from this source.

The ERC technical lead organizes and maintains spreadsheets of the characterization data on a desktop computer. The characterization data are included in the annual performance evaluation report.

Reference:

DOE-RL, 1991, Expedited Response Action Proposal (EE/CA & EA) for 200 West Area Carbon Tetrachloride Plume, DOE/RL-91-32, Draft B.

VADOSE ZONE MONITORING PLAN FOR SOIL VAPOR EXTRACTION SITES
April 2001 – September 2001

Non-Operational Monitoring and Passive Soil Vapor Extraction Monitoring

This plan describes the non-operational monitoring and passive soil vapor extraction monitoring to be conducted during April through September 2001 for the 200 West Area Carbon Tetrachloride Expedited Response Action (200-ZP-2 Operable Unit). Non-operational monitoring will be conducted at the 216-Z-9 (Z-9) site during April through June 2001 while the soil vapor extraction (SVE) system is operating at the 216-Z-1A/Z-18/Z-12 (Z-1A) site. Non-operational monitoring will be conducted at the Z-1A site during July through September 2001 while the SVE system is operating at the Z-9 site. Passive soil vapor extraction monitoring will be conducted at the Z-1A site from April 2001 through September 2001.

Scope: Monitor carbon tetrachloride soil vapor concentrations at selected probes and wells during non-operation of the soil vapor extraction (SVE) system (Tables 5 and 6). At any particular time, all of the probes and some of the wells will be "non-operational," i.e., they will not be connected to the SVE system. Eight of the non-operational wells have a passive soil vapor extraction system installed at the wellhead.

Passive soil vapor extraction is a remediation technology that uses naturally induced pressure gradients between the subsurface and the surface to drive soil vapor to the surface. In general, falling atmospheric pressure causes subsurface vapor to move to the atmosphere through wells, while rising atmospheric pressure causes atmospheric air to move into the subsurface. The passive soil vapor extraction systems will be used to remove carbon tetrachloride from the vadose zone.

All of the passive extraction wells will vent through aboveground canisters containing Granular Activated Carbon (GAC). Each system also has an in-line, replaceable cartridge of GAC for sampling upstream of the canister of GAC. The GAC cartridges will be sampled and analyzed periodically to provide a passive, time-integrated measure of the amount of mass removed through the well. Three of the passive systems are also instrumented to measure and record the flow rate and carbon tetrachloride vapor concentration on an hourly basis; these data can be used to calculate an hourly estimate of the amount of mass removed (Table 7).

For monitoring the non-operational probes and wells, the components of this scope are:

- Collect soil vapor samples using the rebound study sampling method and sampling pump (Rohay 1997)
- Analyze soil vapor samples for carbon tetrachloride using B&K at field screening level QC-1 (BHI-QA-03)
- Evaluate concentration trends for ERC
- Report results to 200-ZP-2 Unit Managers
- Include results in annual reports

For monitoring the 8 passive soil vapor extraction system wells, the components of this scope are:

- Change out the used, in-line GAC sample cartridges and replace with clean GAC sample cartridges
- Sample the GAC and send the GAC samples to an off-site laboratory for analysis of carbon tetrachloride (Sampling Authorization Form B99-093)
- Download the dataloggers (4) and B&K instruments (3)
- Evaluate concentration trends for ERC
- Report results to 200-ZP-2 Unit Managers
- Include results in annual reports

Purpose and Objectives: The purpose of non-operational monitoring is to measure carbon tetrachloride concentrations in the vadose zone during the shutdown of the SVE system.

The objectives of monitoring the non-operational wells and probes are (1) to be cognizant of carbon tetrachloride concentrations and trends near the vadose-atmosphere and vadose-groundwater interfaces to ensure that non-operation of the SVE system is not negatively impacting atmosphere or groundwater; and (2) to be cognizant of carbon tetrachloride concentrations and trends near the lower permeability Plio-Pleistocene layer to provide an indication of concentrations that can be expected during restart of SVE operations and to support selection of on-line wells.

The objectives of monitoring the passive soil vapor extraction system wells, which are all open near the vadose-groundwater interface, are: (1) to protect groundwater by removing carbon tetrachloride from the vadose zone; (2) to be cognizant of the carbon tetrachloride concentrations and trends near the vadose-groundwater interface; and (3) to quantify the mass of carbon tetrachloride removed using this technology. The instrumented systems will be operated to provide a long-term record of passive extraction data, particularly contaminant concentrations in the extracted vapor and mass removal rates.

Duration: Non-operational monitoring and passive soil vapor extraction monitoring will be conducted from April 2001 through September 2001 during FY 2001. It is anticipated that non-operational and passive extraction monitoring will be continued in FY 2002.

Monitoring Frequency: Monitoring will be conducted monthly. It is assumed that (1) the ERC sampler(s)/geologist will spend approximately 2 days/month collecting and analyzing samples, shipping passive GAC samples to offsite laboratories, and downloading data; and (2) the ERC technical lead will spend approximately 1 day/month analyzing and reporting the results.

Monitoring Locations: Locations were selected to focus carbon tetrachloride monitoring near the vadose-atmosphere and vadose-groundwater interfaces and near the Plio-Pleistocene layer (Table 5). At the recommendation of the ERC technical lead, and with approval from the ERC task lead, these monitoring locations could be revised based on developing trends, accessibility, and/or recommendations of the sampler. The 200-ZP-2 Unit Managers will be advised of any changes to the monitoring locations. Monitoring locations are shown on Figures 2 and 3.

Note: During FY97, FY98, and FY99, carbon tetrachloride concentrations and trends were also monitored at shallow soil vapor probes (1.5 m deep). In light of the sporadic and low concentrations detected at these shallow soil vapor probes, shallow monitoring was not conducted during FY00 and will not be conducted during FY01.

Data Management: The field screening data obtained from non-operational wells and probes are entered into a controlled field logbook, which is maintained by ERC Document & Information Services. The ERC technical lead organizes and maintains spreadsheets of the field screening data on a desktop computer. The field screening data are included in the annual performance evaluation report.

The laboratory data obtained from the GAC samples on the 8 passive extraction wells are entered into HEIS. A hardcopy of the data and associated paperwork is maintained by ERC until transmitted to Hanford records holding. The data collected from the dataloggers and B&Ks are stored on ERC network drives that are backed up daily. The ERC technical lead organizes and maintains spreadsheets of all the passive extraction data on a desktop computer. The passive extraction data will be included in the annual performance evaluation report.

References:

BHI-QA-03, ERC Quality Assurance Program Plans, Procedure 5.2, Onsite Measurements Quality Assurance Program Plan

Rohay, V.J., 1997, Rebound Study Report for the Carbon Tetrachloride Soil Vapor Extraction Site, Fiscal Year 1997, BHI-01105, Rev. 0

Table 1. Wells Available for Soil Vapor Extraction System Operations at the 216-Z-1A/Z-18/Z-12 Site, April through June 2001

Potential On-Line Wells	Reason	Initial Wells
299-W18-89	Mass removal	
299-W18-93	Mass removal	
299-W18-94	Mass removal	
299-W18-96	Mass removal	
299-W18-97	Mass removal	
299-W18-98	Mass removal	
299-W18-99	Mass removal	
299-W18-152	Mass removal	
299-W18-153	Mass removal	
299-W18-157	Mass removal	
299-W18-158L	Mass removal	
299-W18-159	Mass removal	
299-W18-163L	Mass removal	
299-W18-165	Mass removal	1
299-W18-166	Mass removal	1
299-W18-167	Mass removal	
299-W18-168	Mass removal	1
299-W18-169	Mass removal	
299-W18-171L	Mass removal	
299-W18-174	Mass removal	1
299-W18-246U	Mass removal	
299-W18-248	Mass removal	
299-W18-249	Mass removal	

Table 2. Passive Soil Vapor Extraction Wells at the 216-Z-1A/Z-18/Z-12 Site, FY 2001

Passive Soil Vapor Extraction Wells	Reason
299-W18-6L	Groundwater Protection
299-W18-7	Groundwater Protection
299-W18-10L	Groundwater Protection
299-W18-11L	Groundwater Protection
299-W18-12	Groundwater Protection
299-W18-246L	Groundwater Protection
299-W18-247L	Groundwater Protection
299-W18-252L	Groundwater Protection
299-W18-9	Monitoring
299-W18-6U	Monitoring
299-W18-247U	Monitoring
299-W18-252U	Monitoring

Table 3. Sampling and Analysis Plan for Soil Vapor Extraction System Operations, April Through September 2001

When to Monitor	on-line wells	off-line wells	vacuum		flow	CCl4	CHCl3	CH2Cl2	MEK
			wellhead	system		carbon tetrachloride	chloroform	methylene chloride	MEK
first day of operations	X		X	X	X	X	X	X	X
beginning of 2nd week	X	X	X	X	X	X	X	X	X
beginning of 3rd week	X		X	X	X	X	X	X	X
beginning of 4th week	X	X	X	X	X	X	X	X	X
beginning of 5th week	X		X	X	X	X	X	X	X
beginning of 6th week	X	X	X	X	X	X	X	X	X
beginning of 7th week	X		X	X	X	X	X	X	X
beginning of 8th week	X	X	X	X	X	X	X	X	X
beginning of 9th week	X		X	X	X	X	X	X	X
beginning of 10th week	X	X	X	X	X	X	X	X	X
beginning of 11th week	X		X	X	X	X	X	X	X
beginning of 12th week	X		X	X	X	X	X	X	X
last day of operations	X	X	X	X	X	X	X	X	X
Fax copy of monitoring records to ERC Technical Lead (Virginia Rohay at 372-9447) by close of day following monitoring.									

Table 4. Wells Available for Soil Vapor Extraction System Operations at the 216-Z-9 Site, July through September 2001

Potential On-Line Wells	Reason	Initial Wells
299-W15-6U	Mass removal	
299-W15-6L	Groundwater Protection	
299-W15-9U	Mass removal	
299-W15-9L	Groundwater Protection	2
299-W15-82	Mass removal	2
299-W15-84U	Mass removal	2
299-W15-84L	Mass removal	1
299-W15-85	Mass removal	
299-W15-86	Mass removal	
299-W15-95U	Mass removal	
299-W15-95L	Mass removal	1
299-W15-216U	Mass removal	
299-W15-216L	Groundwater Protection	
299-W15-217	Mass removal	2
299-W15-218U	Mass removal	
299-W15-218L	Groundwater Protection	
299-W15-219U	Mass removal	
299-W15-219L	Groundwater Protection	
299-W15-220U	Mass removal	
299-W15-220L	Groundwater Protection	
299-W15-223	Mass removal	

Table 5a. Distribution of Selected Monitoring Locations During Soil Vapor Extraction System Operations at the 216-Z-1A/Z-18/Z-12 Site, April through June 2001

Target Zone	Number of Monitoring Locations		
	Z-1A	Z-9	Total
Near-surface (3-25 m below ground surface)	5	9	14
Plio-Pleistocene (25-45 m below ground surface)	0	8	8
Groundwater (50-65 m below ground surface)	8 ^a	3	11
Total	13	20	33

^a Eight available monitoring locations near the vadose/groundwater interface in the Z-1A area are being monitored as part of the passive soil vapor extraction system network. The passive network also includes an additional 12 wells and probes that are monitored only for pressures (Table 7).

Table 5b. Distribution of Selected Monitoring Locations During Soil Vapor Extraction System Operations at the 216-Z-9 Site, July through September 2001

Target Zone	Number of Monitoring Locations		
	Z-1A	Z-9	Total
Near-surface (3-25 m below ground surface)	9	3	12
Plio-Pleistocene (25-45 m below ground surface)	7	3	10
Groundwater (50-65 m below ground surface)	8 ^a	0	8
Total	24	6	30

^a Eight available monitoring locations near the vadose/groundwater interface in the Z-1A area are being monitored as part of the passive soil vapor extraction system network. The passive network also includes an additional 12 wells and probes that are monitored only for pressures (Table 7).

Table 6a. Non-Operational Wells and Probes Selected for Monitoring During Soil Vapor Extraction System Operations at the 216-Z-1A/Z-18/Z-12 Site, April through June 2001

Target Zone	Z-9	Depth (m)	Comment	Z-1A	Depth (m)	Comment
Near-surface	CPT-17 10 ft (blue)	3	southwest of Z-9	CPT-4A 25 ft (white)	8	north central in Z-1A/Z-18/Z-12 field
Near-surface	CPT-18 15 ft (white)	5	northwest of Z-9	CPT-13A 30 ft (blue)	10	southeast of Z-1A
Near-surface	CPT-16 25 ft (blue)	8	east of Z-9	CPT-7A 32 ft (yellow)	10	farfield northeast of Z-1A
Near-surface	CPT-27 33 ft (red)	10	southeast of Z-9	CPT-1A 35 ft (black)	11	west of Z-12
Near-surface	CPT-21A 45 ft (green)	14	south of Z-9	CPT-34 40 ft (green)	12	west of Z-18
Near-surface	299-W15-220 SST/52 ft (blue)	16	east of Z-9			
Near-surface	CPT-9A 60 ft (blue)	18	farfield north of Z-9			
Near-surface	299-W15-219 SST/70 ft (yellow)	21	northwest of Z-9			
Near-surface	CPT-18 75 ft (red)	23	near 299-W15-84U and 299-W15-95U			
Plio-Pleisto	299-W15-82	25	east side of Z-9			
Plio-Pleisto	CPT-21A 86 ft (red)	26	south of Z-9			
Plio-Pleisto	CPT-28 87 ft (red)	27	farfield south of Z-9			
Plio-Pleisto	299-W15-85	28	near 299-W15-84U and 299-W15-95U			
Plio-Pleisto	299-W15-217	35	southwest corner of Z-9			
Plio-Pleisto	CPT-24 118 ft (red)	36	north of Z-9			
Plio-Pleisto	299-W15-220 SST/118 ft (red)	36	east of Z-9			
Plio-Pleisto	299-W15-219 SST/130 ft (blue)	40	northwest of Z-9			
Gw	299-W15-219 SST/155 ft (red)	47	northwest of Z-9	299-W18-247L*	51	southeast of Z-18
Gw	299-W15-220 SST/185 ft (yellow)	56	east of Z-9	299-W18-246L*	52	west of Z-1A
Gw	299-W15-9L	57	11 m from 299-W15-32 extraction well	299-W18-252L*	53	middle of Z-1A/Z-18/Z-12 field
Gw				299-W18-10L*	55	east side of Z-18
Gw				299-W18-7*	57	east side of Z-1A
Gw				299-W18-6L*	60	west side of Z-1A
Gw				299-W18-11L*	60	Z-18
Gw				299-W18-12*	60	Z-18

* Passive soil vapor extraction wells (Table 7)

Note: Colors refer to the color coding on the soil vapor probe tubing.

Table 6b. Non-Operational Wells and Probes Selected for Monitoring During Soil Vapor Extraction System Operations at the 216-Z-9 Site, July through September 2001

Target Zone	Z-9	Depth (m)	Comment	Z-1A	Depth (m)	Comment
Near-surface	CPT-28 40 ft (green)	12	farfield south of Z-9	CPT-32 25 ft (green)	8	west of Z-1A
Near-surface	CPT-21A 45 ft (green)	14	south of Z-9	CPT-4A 25 ft (white)	8	north central in Z-1A/Z-18/Z-12 field
Near-surface	CPT-9A 60 ft (blue)	18	farfield north of Z-9	CPT-30 28 ft (green)	9	north of Z-18 (middle of Z-1A/Z-18/Z-12 field)
Near-surface				CPT-13A 30 ft (blue)	10	southeast of Z-1A
Near-surface				CPT-7A 32 ft (yellow)	10	farfield northeast of Z-1A
Near-surface				CPT-1A 35 ft (black)	11	west of Z-12
Near-surface				CPT-33 40 ft (green)	12	between Z-18 and Z-12
Near-surface				CPT-34 40 ft (green)	12	west of Z-18
Near-surface				CPT-32 70 ft (red)	21	west of Z-1A
Plio-Pleisto	CPT-21A 86 ft (red)	26	south of Z-9	CPT-4A 91 ft (red)	28	north central in Z-1A/Z-18/Z-12 field
Plio-Pleisto	CPT-28 87 ft (red)	27	farfield south of Z-9	CPT-1A 91 ft (red)	28	west of Z-12
Plio-Pleisto	CPT-9A 91 ft (red)	28	farfield north of Z-9	299-W18-152	34	northwest corner of Z-12
Plio-Pleisto				299-W18-158L	37	within Z-1A
Plio-Pleisto				299-W18-167	37	within Z-1A
Plio-Pleisto				299-W18-249	41	northeast corner of Z-18
Plio-Pleisto				299-W18-248	41	east side of Z-1A
Gw				299-W18-247L*	51	southeast of Z-18
Gw				299-W18-246L*	52	west of Z-1A
Gw				299-W18-252L*	53	middle of Z-1A/Z-18/Z-12 field
Gw				299-W18-10L*	55	east side of Z-18
Gw				299-W18-7*	57	east side of Z-1A
Gw				299-W18-6L*	60	west side of Z-1A
Gw				299-W18-11L*	60	Z-18
Gw				299-W18-12*	60	Z-18

* Passive soil vapor extraction wells (Table 7)

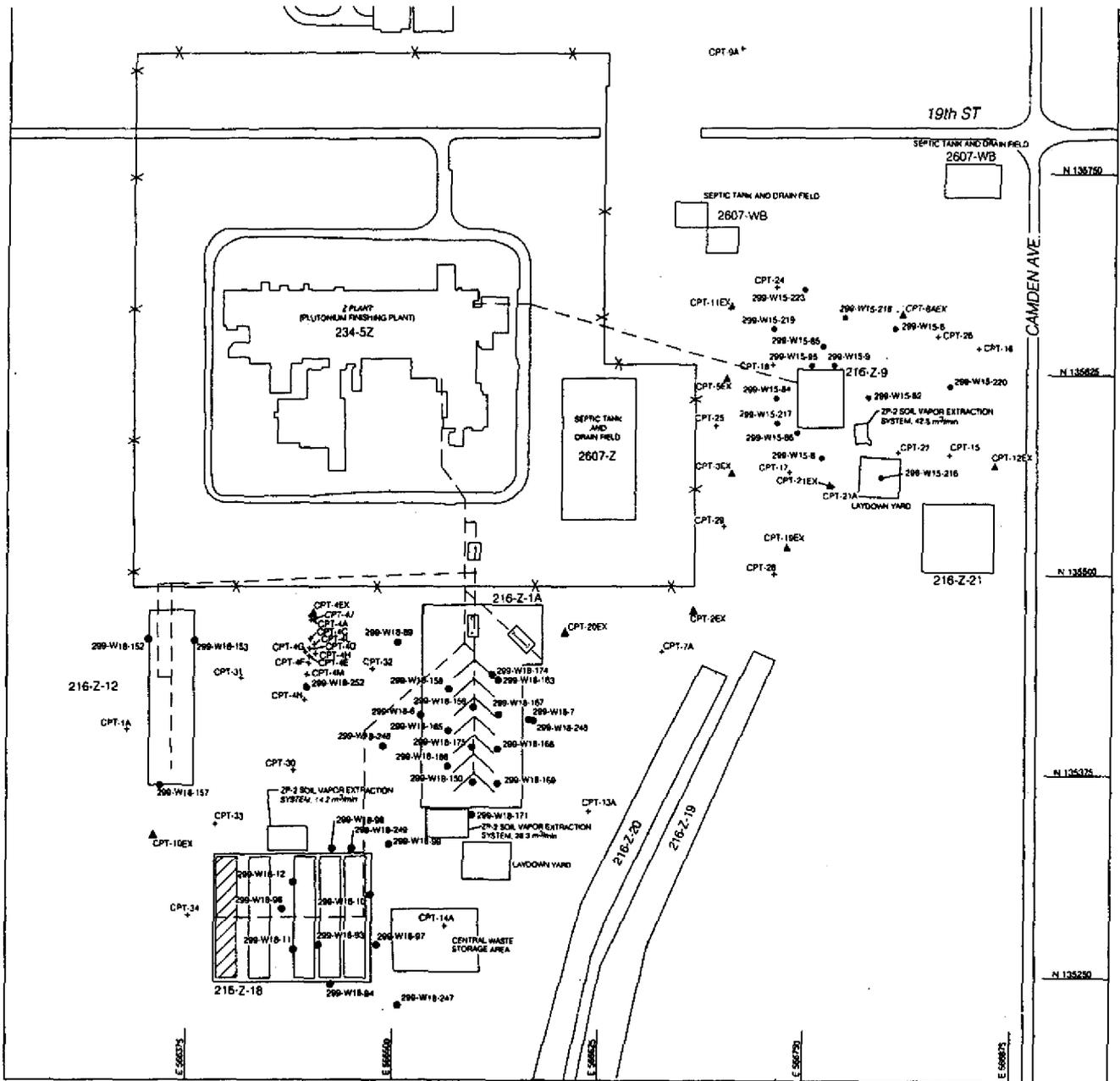
Note: Colors refer to the color coding on the soil vapor probe tubing.

Table 7. Passive Soil Vapor Extraction Well Network

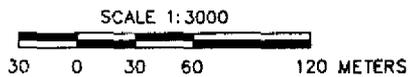
Well/Probe	Purpose	Instrumentation	Comment	Open Interval (m bgs)
		Parameter		
299-W18-7	Extraction	Carbon Tetrachloride (GAC)		51 – 62
299-W18-6U	Monitoring	Differential Pressure	Sealed well	29 – 38
299-W18-6L	Extraction	Differential Pressure	two 60-m lengths of sample tubing dropped in well	58 – 61
		Airflow		
		Temperatures at 3 m, 60 m below top of well		
		Carbon Tetrachloride (B&K)		
		Carbon Tetrachloride (GAC)		
299-W18-9	Monitoring	Differential pressure	Sealed well	55 – 64
		Temperatures at 3 m, 60 m below top of well		
299-W18-10L	Extraction	Carbon Tetrachloride (GAC)		45 – 64
299-W18-11L	Extraction	Carbon Tetrachloride (GAC)		55 – 65
299-W18-12	Extraction	Carbon Tetrachloride (GAC)		54 – 65
299-W18-246L	Extraction	Carbon Tetrachloride (GAC)		50 – 53
299-W18-247L	Extraction	Differential pressure	Well with long passive extraction record	49 – 52
		Airflow		
		Temperatures at 3 m, 60 m below top of well		
		Carbon Tetrachloride (B&K)		
		Carbon Tetrachloride (GAC)		
299-W18-247U	Monitoring	Differential pressure	Sealed well	36 – 39
299-W18-252L	Extraction	Differential pressure		50 – 56
		Airflow		
		Temperatures at 3 m, 60 m below top of well		
		Carbon Tetrachloride (B&K)		
		Carbon Tetrachloride (GAC)		
		Barometric pressure		
299-W18-252U	Monitoring	Differential pressure	Sealed well	34 – 41
299-W18-252/SST100 (red)	Monitoring	Differential pressure	Stainless steel tubes strapped to outside of casing	30
299-W18-252/SST145 (blue)	Monitoring	Differential pressure		44
299-W18-252/SST210 (yellow)	Monitoring	Differential pressure		64
CPT-4F/10 (black)	Monitoring	Differential pressure	Soil probes emplaced using cone penetrometer	3
CPT-4F/25 (white)	Monitoring	Differential pressure		8
CPT-4F/50 (blue)	Monitoring	Differential pressure		15
CPT-4F/75 (yellow)	Monitoring	Differential pressure		23
CPT-4F/109 (red)	Monitoring	Differential pressure		33

Note: Colors refer to the color coding on the soil vapor probe tubing.

Figure 1. Location of Extraction and Monitoring Wells and Probes at the 216-Z-1A/Z-18/Z-12 and 216-Z-9 Sites



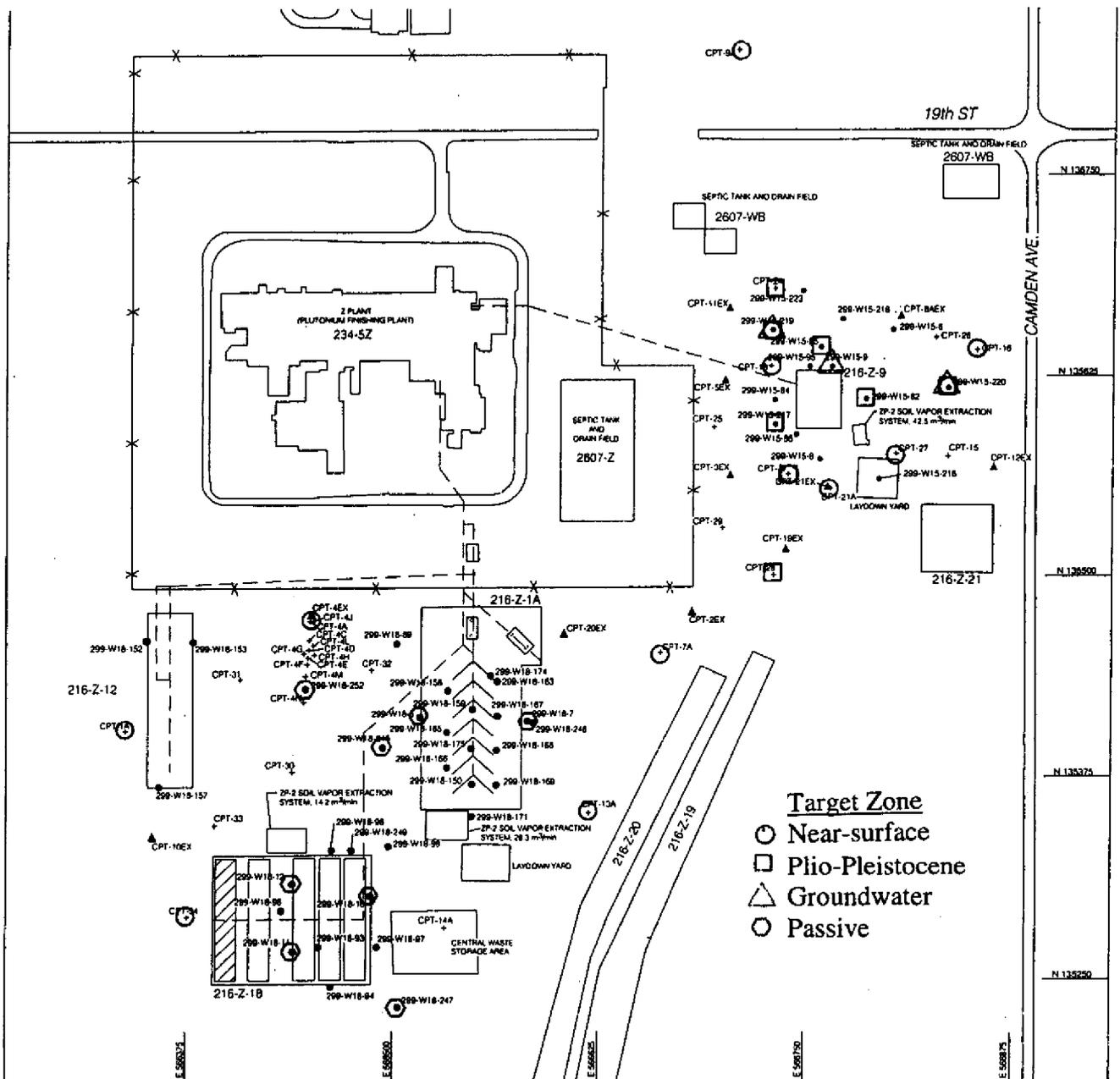
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LEGEND

- + CPT-32 CONE PENETROMETER DEEP SOIL VAPOR PROBE (> 2 m DEPTH) LOCATION AND NUMBER DESIGNATION
- ▲ CPT-4EX CONE PENETROMETER SOIL VAPOR EXTRACTION WELL LOCATION AND NUMBER DESIGNATION
- 299-W18-82 200-ZP-2 SOIL VAPOR EXTRACTION/MONITORING WELL LOCATION AND NUMBER DESIGNATION
- 216-Z-18 LIQUID WASTE DISPOSAL SITE

Figure 2. Location of Wells and Probes Selected for Non-Operational Monitoring and Passive Soil Vapor Extraction Monitoring, April through June 2001

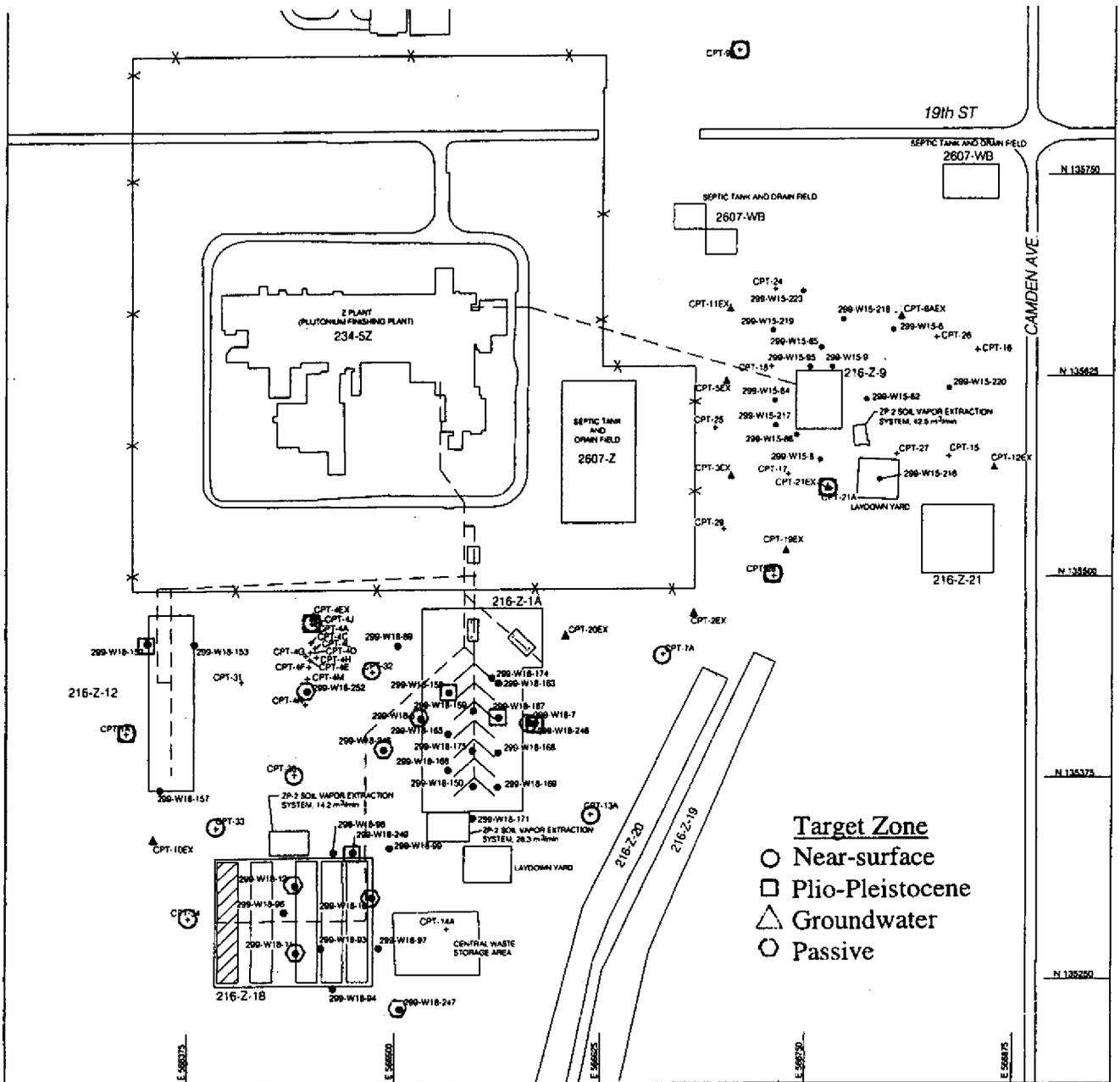


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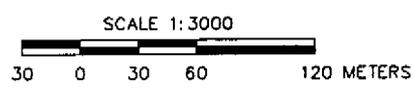
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- + CPT-33 CONE PENETROMETER DEEP SOIL VAPOR PROBE (>2 m DEPTH) LOCATION AND NUMBER DESIGNATION
- ▲ CPT-4EX CONE PENETROMETER SOIL VAPOR EXTRACTION WELL LOCATION AND NUMBER DESIGNATION
- 200-W18-82 200-ZP-2 SOIL VAPOR EXTRACTION/MONITORING WELL LOCATION AND NUMBER DESIGNATION
- 216-Z-18 LIQUID WASTE DISPOSAL SITE

Figure 3. Location of Wells and Probes Selected for Non-Operational Monitoring and Passive Soil Vapor Extraction Monitoring, July through September 2001



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LEGEND

- + CPT-33 CONE PENETROMETER DEEP SOIL VAPOR PROBE (>2 m DEPTH) LOCATION AND NUMBER DESIGNATION
- ▲ CPT-EX CONE PENETROMETER SOIL VAPOR EXTRACTION WELL LOCATION AND NUMBER DESIGNATION
- 200-W18-82 200-ZP-2 SOIL VAPOR EXTRACTION/MONITORING WELL LOCATION AND NUMBER DESIGNATION
- 216-Z-18 LIQUID WASTE DISPOSAL SITE