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Appendix A

Standard Operating Procedures

Standard Operating Procedure Number	Standard Operating Procedure Title	Revision Number	Revision Date	Annual Review Date
PWT-COS-302	XRF Sample Preparation	1	Nov-15	NA
PWT-COS-303	XRF Sample Analysis	1	Dec-15	NA
PWT-ENSE-402	Spatial Data Submittals	4	Oct-16	Oct-16
PWT-ENSE-406	Sample Handling	2	Mar-12	Oct-16
PWT-ENSE-413	Utility Clearance	2	Oct-16	Oct-16
PWT-ENSE-423	Investigation Derived Waste Management	2	Oct-16	Oct-16
PWT-ENSE-424	Personnel and Equipment Decontamination	3	Oct-16	Oct-16
PWT-COS-427	Surface and Shallow Sub-Surface Soil Sampling for Inorganics (Project Specific Procedure)	4	Mar-17	NA
PWT-ENSE-430	Indoor and Attic Dust Sampling	1	Dec-16	NA
Surveying Statement of Work	Request for Information for Surveying Services Colorado Smelter Site – Operable Unit 1 Pueblo, Colorado	0	Jul-15	NA

REVISION LOG		
Revision Number	**Description**	**Date**
0	Original SOP	September 2015
1	Editorial Changes	November 2015

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to prepare soil samples for chemical analysis during environmental investigations performed during the Remedial Investigation (RI) in the Community Properties Study Area (CPSA) of the Colorado Smelter Site. This SOP serves as a supplement to site-specific Health and Safety plans and the site-specific CPSA RI Quality Assurance Project Plan (QAPP). This SOP may be used in conjunction with other SOPs.

This SOP is intended to be used to prepare all RI soil samples for analysis by x-ray fluorescence (XRF). Subsamples of selected prepared samples will also be taken for analysis by fixed-laboratory methods for metals and bioavailability of metals. This SOP follows the standard template for SOPs produced by Pacific Western Technologies, Ltd. (PWT) for environmental support operations.

2.0 REQUIREMENTS

2.1 Key Words

X-ray fluorescence (XRF), sample preparation.

2.2 Quality Assurance / Quality Control (QA/QC)

Follow all QA/QC requirements as identified in the approved Quality Assurance Project Plan (QAPP), and associated SOPs.

2.3 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable task health and safety plans prepared by PWT subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3 Personnel Qualifications

Personnel preparing samples for the RI will have knowledge and experience in the subject matter and the goals of the RI. Personnel performing sample preparation activities are required to have completed the initial 24-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and work under the supervision of a 40-hour OSHA trained person. Supervisors of sample preparation activities are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in sample preparation activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

2.4 Definitions

1. <u>“Disaggregation”</u> is the process of breaking clumps of soil into free-flowing individual soil particles. It does not include the fracturing, crushing, pulverization, or comminution of individual soil particles. Clay particles are microscopic. Breaking up clay clumps or clods into the actual dust-sized clay particles usually requires some mechanization. This is discussed in detail in the section on disaggregation. Particles such as very small bits of solid stone or minerals, such as sand, are not crushed by the disaggregation techniques listed in this SOP.

3.0 MATERIALS AND EQUIPMENT

In order to prepare soil samples for XRF analysis and shipment for additional analysis by other methods the following equipment may be needed:

- Plastic storage bags (thick-walled, not to be used for analysis)
- Polypropylene bags of 1.2 mil thickness, (various sizes as necessary)
- Clear adhesive tape
- Sample labels
- Powder-free gloves
- Rolling pins
- Rubber mallets
- 10-mesh sieves
- 60-mesh sieves
- Sieve catch pans and lids
- Sieve shaker
- Drying ovens
- Drying trays sized for the drying ovens
- Aluminum foil
- Timers
- Analytical balances
- Calibration check weights
- Decontamination supplies and equipment (e.g., wash/rinse tubs, brushes, Alconox (or equivalent), plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, potable water, and deionized or distilled water, clean silica sand.

4.0 PROCEDURES

All samples will be initially weighed, then inspected. The samples will be oven-dried, and weighed again. Samples will be disaggregated before, during, and after drying. The dried samples will then be sieved and bagged for XRF analysis. The sections below describe these procedures in detail.

4.1 Initial Sample Weight

Tare the balance with an empty bag of the same type used to collect the sample. Measure and record the initial weight of the sample (which is expected to be between approximately 100 grams and 3 pounds depending on the type of sample collected). Balance calibration checks should be performed weekly following the procedures described in Section 4.7, "Balance Calibration Checks."

4.2 Sample Inspection

Each sample should be inspected for the presence of large rocks or other debris such as plastics, plant matter, or wood that should not be part of the soil sample. These materials should be removed from the sample prior to beginning sample processing, and retained in a separate bag for storage with the sample.

4.3 Drying

Each sample should be inspected for soil moisture prior to further processing. If any of the conditions noted below are observed, air drying or drying in an oven should be performed:

- Soil particles do not move relatively freely;
- The soil is visibly moist, as determined through observation of a slight color variation between the exposed surface of the sample and the rest of the sample.

If drying is necessary, perform the following steps to dry each sample:

1. Prior to drying, disaggregate the soil by hand (wear powder-free gloves) as much as possible. Disaggregation of clayey soils is easier when the soil is slightly damp, and may become difficult after the soil has dried, especially with oven drying.

2. Set the drying oven to a temperature of 100°C or lower.
3. Line a drying pan with aluminum foil, and spread the soils evenly over the foil. If the soil layer is too thick for air to reach the center of the sample, split the soil into two or more pans as needed.
4. Place the drying pan(s) in the oven for 5-20 minutes.
5. Remove the pan to inspect the soil, and disaggregate clumps by hand (gloved) when necessary and possible.
6. Repeat in 5- to 20- minute cycles as necessary.
7. After satisfactory dryness is achieved, as indicated by no color variation between the exposed surface of the sample and the rest of the sample weigh the dried soil on the aluminum foil and record the weight of the dried sample and aluminum foil in the appropriate column of the sample preparation form. Drying the samples is critical because even slightly damp soil will clog the screen openings rather than flowing through them.
8. Transfer the dried sample into the 10-mesh sieve of a sieve stack, then weigh the aluminum foil by itself and record the weight of the aluminum foil in the appropriate column of the sample preparation form.
9. Calculate the total weight of the dried sample by subtracting the recorded weight of the aluminum foil from the recorded weight of the dried sample and aluminum foil together, and then record the total weight of the dried sample in the appropriate column of the sample preparation form.

4.4 Disaggregation

Disaggregation will be conducted before, during, and after drying, if drying was necessary. During disaggregation, continue to remove any obvious stones larger than 2 mm, and retain these stones in a separate bag for storage with the sample (the same bag mentioned in Section 4.2 should be used). Disaggregation may be accomplished by several methods, and some methods may work better for certain soil types for others:

- <u>Hand-disaggregation:</u> This can be the fastest and easiest way to disaggregate small amounts of soft, semi-cohesive materials such as sandy and loamy soils. Repetitive motion injury and unseen sharp objects may be concerns during hand disaggregation, so care should be used.
    1. Hands must be gloved (powder-free) whenever handling soil directly.
    2. Hand disaggregation can also be accomplished by massaging through the plastic bag containing the soil.
    3. If there is a large amount of soil being processed in the bag, empty the bag contents into a pan for inspection to make sure no agglomerates were missed.
- <u>Rolling pin:</u> This option works well for soft soils able to be disaggregated by hand, but can be less tiring. Some soils may be rolled while still in the original plastic bag, but samples may still need to be emptied into a pan for inspection to make sure disaggregation was complete. If rolled in a pan, place a clean piece of thin plastic or butcher paper between the rolling pin and the sample to prevent contamination. The butcher paper may not be reused. Make sure the pan is either very shallow so that the handles are unobstructed, or is wide enough to easily accommodate the entire length of the rolling pin in motion (including handles and hands). Additional considerations:
    1. If larger stones, sticks, or anything sharp is present, remove them from the bag so they cannot interfere with the rolling pin or punch a hole in the bag (anything larger than 2 mm will eventually be removed during sieving).

2. This technique might not be effective for hard clay agglomerates which could be ejected from the work area from the pressure from the rolling pin.
3. If a rolling pin is used on soil that is outside of an enclosed bag, care must be used to avoid "popping" particles out of the sample. Lay sheets of butcher's paper or similar above and below the soil layer to be rolled. Fold, tuck or tape the edges so the material is completely enclosed and contained.

- Rubber mallet: Used to smash hard clods while soil is in the original heavy plastic bag or another enclosure, such as the butchers' paper described above.

Note that all techniques that disaggregate soil while it is in a plastic bag will create crinkles or dimples in the plastic. XRF readings through such a bag will present interference for the X-rays and result in poor data precision. Sample processing should be done in a heavy plastic bag to avoid tearing of the bag. However, even undamaged, thick-walled plastic bags should not be used for XRF analysis. Soil to be read by XRF must be in an undamaged thin-walled plastic bag that has been confirmed as free of interference (as described in the XRF Analysis SOP).

4.5 Sieving

Sieving will be conducted on all samples following disaggregation. Two sieve sizes will be used. The first is a coarse 10-mesh sieve which excludes material larger than 2 millimeters (mm) in diameter. This fraction will not be analyzed by XRF. The second is a 60-mesh sieve which excludes material larger than approximately 250 micrometers (µm) in diameter, which also will not be analyzed by XRF. The remaining material (smaller than 250-µm in diameter) is the fraction targeted for chemical analysis and project decision making. However, all three fractions will be weighed and stored.

1. Weigh the sample on the aluminum foil and record the weight on the sample preparation log.
2. Stack the sieves by placing the pan on the bottom, a 60-mesh sieve above the pan, and a 10-mesh sieve above the 60-mesh sieve.
3. Transfer the dried sample to the 10-mesh sieve, and fit a lid on the top of the 10-mesh sieve.
4. Weigh the aluminum foil (now without the soil) and record the foil weight. Calculate the total weight of soil and record on the sample preparation log.
5. Place one sieve stack on the sieve shaker, and set the sieve shaker to a 5-minute cycle. If the shaker is large enough, two set of sieves may be stacked together for simultaneous sieving.
6. Remove the sieves from the shaker.
7. Remove the bottom pan and pour the contents into the plastic bag to be used for XRF analysis (an appropriately sized polypropylene bag of 1.2 mil thickness, labeled with the sample ID and "fraction < 60-mesh"). Take care to ensure that the sample is transferred completely from the sieve to the storage bag.
8. Transfer the material retained by the 10-mesh sieve into the plastic bag containing material picked out of the sample by hand in previous steps (labeled with the sample ID and "fraction > 10-mesh"). Weigh and record the mass of this bag (using an empty bag of the same type for a tare weight).
9. Transfer the material retained by the 60-mesh sieve into a plastic bag (labeled with the sample ID and "10-mesh > fraction > 60-mesh". Weigh and record the mass of this bag (using an empty bag of the same type for a tare weight).
10. Weigh and record the mass of material passed through the 60-mesh sieve and into the bottom pan (using an empty bag of the same type for a tare weight).
11. Place the first two bags into a sample bag labeled with the sample ID and "overbag" for storage. The overbag storage bag will now contain any oversized material picked out of the

sample, as well as the two fractions of sample that did not pass through the 10-mesh and 60-mesh sieves.

12. Decontaminate the sieves before reusing them, following Section 4.7.

4.6 Final Sample Preparation

The soil fraction that passed through the 60-mesh sieve should now be in a polypropylene bag of 1.2 mil thickness of appropriate size for the amount of sample. The bag should be large enough for the soil inside to lay flat in a layer from 1 to 3 inches thick. The bag has a flap with a resealable sticky strip; however, <u>the sticky strip will not prevent leakage from the bag</u>. Clear adhesive tape (or equivalent) should be used to seal both sides of the flap. The tape should not be so wide that it interferes with the XRF readings. Tape may be necessary on the corners of bags to prevent pinhole leaks for certain bags. The bag should be placed in the corresponding overbag for storage before and after analysis.

The sample should now be transferred to the XRF analysis area.

4.7 Balance Calibration

On a weekly basis (or more frequently), the balances used for the project should be calibrated using 1-kilogram, 50-gram, or 1-gram calibration weights, as appropriate for the sample masses being measured. The following should be recorded:

1. Date.
2. Time.
3. Mass of the calibration weight.
4. Measured mass.

If the measured mass deviates from the measured mass by more than 1 percent, procedures described in the user manual for the balance should be followed to correct the deviation. If necessary, the balance manufacturer should be consulted. Any samples weighed since the last passing calibration should be re-weighed following successful corrective action.

4.7 Sieve Decontamination

The sieves should be decontaminated between each sample by brushing with appropriate gauge brushes as recommended by the manufacturer. After brushing, each sieve component should be wiped with a damp paper towel to remove any remaining dust. Each sieve should be examined following decontamination for damage; damaged sieves should be taken out of service and replaced.

5.0 DOCUMENTATION

Sample preparation procedures for each sample will be documented on the Sample Preparation Log. A Sample Preparation Log will be generated in Scribe with the sample IDs pre-populated. An example of how this documentation will look is included in Attachment A. Balance calibration checks will be documented on the Balance Calibration Log (Attachment B). Similar forms that capture the same information are acceptable.

ATTACHMENT A

Sample Preparation Log

EXAMPLE SAMPLE PREPARATION LOG

Property ID: ______________ Sample Preparation Log Staff Initials: ____________

Sample #	Pre Drying Mass (g)	Post drying mass (g)			Mass of Fraction > 10 mesh	Mass of Fraction between 10 and 60 mesh	Mass of fraction < 60 mesh
		Sample and Foil	Foil Only	Sample Only (calc)			
S0269-AP-0001-01							
S0269-AP-0106-01							
S0269-AP-0612-01							
S0269-AP-1218-01							
S0269-BY-0001-01							
S0269-BY-0106-01							
S0269-BY-0106-02							
S0269-BY-0106-03							
S0269-BY-0612-01							
S0269-BY-1218-01							
S0269-DZ-0001-01							
S0269-SY-0002-01							
S0269-SY-0206-01							
S0269-SY-0612-01							
S0269-SY-1218-01							

ATTACHMENT B
Balance Calibration Log

BALANCE CALIBRATION LOG

Balance Serial Number:	

Date	Time	Calibration Weight Used	Measured Mass	Accuracy	Corrective action necessary (yes/no)?	Initials	Comments

APPROVED: ______________________/s________________ ____________________
PWT Project Manager, Date

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Section Page No.

List of Attachments

REVISION LOG		
Revision Number	**Description**	**Date**
0	Original SOP	September 2015
1	Editorial corrections	December 2015

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used for X-ray fluorescence (XRF) sample analysis during environmental investigations performed during the Remedial Investigation (RI) in the Community Properties Study Area (CPSA) of the Colorado Smelter Site. This SOP serves as a supplement to site-specific Health and Safety plans and the site-specific CPSA RI Quality Assurance Project Plan (QAPP). This SOP may be used in conjunction with other SOPs.

This SOP is intended to be used to analyze all soil samples collected during the Colorado Smelter RI by XRF. This SOP follows the standard template for SOPs produced by Pacific Western Technologies, Ltd. (PWT) for environmental support operations.

2.0 REQUIREMENTS

2.1 Key Words

X-ray fluorescence (XRF), sample analysis.

2.2 Quality Assurance / Quality Control (QA/QC)

Follow all QA/QC requirements as identified in the approved QAPP, and associated SOPs.

2.3 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable task health and safety plans prepared by PWT subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3 Personnel Qualifications

Personnel analyzing samples for the RI will have knowledge and experience in the subject matter and the goals of the RI. Personnel performing soil sample analysis activities are required to have completed the initial 24-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and work under the supervision of a 40-hour OSHA trained person. Supervisors of soil sample analysis activities are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in soil sample analysis activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Training regarding x-ray safety is required in accordance with the HASP. Informal training on the procedures to be used will be performed during the RI by qualified project team staff.

2.4 Definitions

1. "Quality Control" (QC) refers to specific technical checks that allow a determination of whether the associated batch of products or services meets the specifications defined for that product or service. Analyzing samples of known composition (e.g., blanks and LCSs) is an important QC check on instrument performance. If an XRF performs well (i.e., gives results close to expected) on QC samples, then the assumption of equally good performance on unknown samples of a similar matrix may be justified.
2. "QC control chart" refers to a graphical representation of the acceptable limits for concentration results from an SRM of known concentration. The purpose of a control chart is monitoring the performance of an XRF before and after batches of samples are analyzed. Markings on a number

line (the y-axis) display the range of acceptable results. When an LCS is read, the result is plotted to show where it falls in relation to the acceptable limits which are derived from the mean and standard deviation of evaluation data. Results that fall outside of the limits indicate there is an analytical problem that needs to be resolved before sample results can be finalized and reported.

3. "XRF sample batch" refers to a group of samples bounded by LCS results. A sample batch must be bounded by in-control LCS results before the sample results for that batch can be reported. An LCS that is out-of-control at the start of a batch means that the batch cannot be analyzed until the performance problem has been resolved. An LCS that that is out-of-control at the end of a batch means that the batch cannot be reported until the problem is resolved, and the samples rerun.
4. "Standard Reference Material" (SRM) refers to a commercially prepared soil certified to have known (a mean plus/minus variability) concentrations for various elements or compounds.
5. "Lower confidence limit" (LCL) refers to a statistically calculated value that provides a specific level of confidence that the true mean for a sample with multiple measurements is above this value. If a 95% lower confidence limit is calculated, there is a 5% chance that the true mean actually lies below the LCL.
6. "Upper confidence limit" (UCL) refers to a statistically calculated value that provides a specific level of confidence that the true mean for a sample with multiple measurements is below this value. If a 95% upper confidence limit is calculated, there is a 5% chance that the true mean actually lies above the LCL.

3.0 MATERIALS AND EQUIPMENT

In order to analyze soil samples for XRF analysis and shipment for analysis by other methods the following equipment may be needed:

- Portable XRF analyzer
- Polypropylene bags of 1.2 mil thickness, (various sizes as necessary)
- Polypropylene bags of 1.2 mil thickness (for subsamples), approximately 2 inches by 2 inches
- Clear adhesive tape
- Sample labels
- Powder-free gloves
- Scoop or spatula
- SRMs for LCS checks.

4.0 PROCEDURES

Samples will be analyzed in a multi-step process. All samples will be initially inspected, then analyzed. Routine quality control procedures are to be conducted at the start of the day and periodically throughout the day. Corrective action may be required based on quality control results.

4.1 Sample Inspection

Each sample should be inspected to confirm the following:

1. The sample is in the correct type of plastic bag (polypropylene of 1.2 mil thickness). If the sample is double-bagged, remove the outer bag for analysis.
2. There are no crinkles or dimples in the bag walls that could interfere with the measurement.
3. The appearance of the soil particles should be identical on both sides of the bag. If one side appears different in color in or particle size, the following steps should be done to homogenize the soil in the bag:
    a. First, check that the bag is sealed properly. If it appears the bag may leak, use scotch tape to close the bag completely at the seam and in the corners as necessary.

   b. Suspend the bag by 2 corners and rotate the bag in the air through 360 degrees of rotation 5 times.

4. Repeat step 3 until the soil appears homogenous on both sides of the bag.

4.2 XRF Measurement for Full Samples

The following steps are used to analyze samples:

1. Start up the instrument using routine operating and QC procedures (see Section 4.4).
2. Lay the bag flat on the sample stand to take XRF readings. Make sure any taped areas of the sample bag are not in the area to be scanned by the XRF. Use the camera to check that no gaps are present in the portion of the sample to be scanned.
3. Take two readings on the first side of the bag (moving the sample between the two readings), and record each target element result and its instrument error in a spreadsheet. A minimum 30 second count time shall be used to perform each reading.
4. Flip the bag over.
5. Take two additional readings on the second side of the bag (moving the sample between the two readings). Again, record each target element result and its instrument error into the spreadsheet.
6. Check that the statistical confidence goals for the sample have been met:
   a. If the mean is lower than the decision limit for the metal being examined, compare the 95% upper confidence limit (95% UCL) of the mean to the decision limit. If the UCL is also below the decision limit, then no further analysis of the bag is necessary.
   b. If the mean is greater than the decision limit, compare the 95% lower confidence limit (95% LCL) of the mean to the decision limit. If the LCL is also above the decision limit, then no further analysis of the bag is necessary.
7. If further analysis is necessary as noted in steps 7a or 7b above, continue making additional measurements in pairs (one on each side of the bag) until one of the following occurs:
   a. The mean and UCL are both below the decision limit, or the mean and LCL are both above the decision limit.
   b. 10 measurements have been made, and the mean and UCL (or LCL) are still on opposite sides of the decision limit, but the RSD for the 10 measurements is below 25%. If this occurs, the data may be used without further reanalysis.
   c. 10 measurements have been made, and the mean and UCL (or LCL) are still on opposite sides of the decision limit, and the RSD for the 10 measurements is above 25%. If this occurs, remix the bag following Section 4.1.3, and reanalyze the sample following Section 4.2. See step 10 below for how to handle the results from the initial analysis.
8. If a second 10 measurements still does not provide a clear decision, the following steps may be taken to try to resolve the problem:
   a. Check whether the readings from the two sides of the bag demonstrate a consistent bias relative to each other. If a consistent bias is demonstrated and it appears that this bias may be introducing artificial variability, remix the bag by rotating it as described in Section 4.1.3. See step 10 below for how to handle the results from the initial analysis.
   b. If another sample from the same DU but a different depth interval for the same analyte provides a clear decision that that analyte is above the decision limit, then additional analysis is not required.
   c. If another sample from the same DU and the same depth interval (or a deeper interval) for a different target analyte provides a clear decision that that analyte is above the decision limit, then additional analysis is not required.

9. NOTE: If remixing of the bag is required to obtain data that meet the decision requirements as noted above, do not use the previous data.

4.3 Subsampling and XRF Analysis for Subsamples

Certain samples will be selected for comparability analysis by inductively-coupled plasma (ICP), geospeciation, and bioaccessiblity. These decisions will be made by the project team. In some cases, the project team may determine that a sample is a critical one, and a backup bag may be prepared for each specified comparability analysis. Each subsample should be prepared following the XRF sample preparation SOP, and analyzed following the procedures below:

1. Homogenize the soil in the bag, mixing thoroughly by hand. With the sample still in the storage bags (likely an analysis bag inside a thicker-walled plastic bag).
2. Reopen the outer sample bag, and open the inner sample bag by slitting the scotch tape along both sides. Open the flap.
3. Reach into the bag with a scoopula or similar implement.
4. Scoop out approximately half the mass of soil needed from a random location in the sample bag. For ICP/bioassay samples, this will be half of the target weight of 1 to 1.5 grams.
5. Place the soil into a small (2-inch by 2-inch) 1.2 mil thick polypropylene bag.
6. Carefully turn the large bag over, and scoop out the other half of the mass required into the subsample bag.
7. Check that sufficient soil is in the subsample bag to allow the XRF to shoot through a layer of soil at least 3 mm thick).
8. Weigh the bag, using an empty bag of the same type for a tare weight.
9. Analyze the small bag 4 times (twice on each side).
10. Check that the average of the readings on the subsample bag lies within the 2-sided 95% confidence interval for the large bag, or that the difference between the average of the subsample bag readings and average of the large bag readings is less than 10% of the large bag readings.
    a. If these conditions are not met, empty the small bag back into the large bag, and repeat steps 2 through 9. If the target cannot be met after 4 consecutive attempts, contact the project chemist for instructions on how to proceed.
    b. If these conditions are met, seal the flap of the small bag and tape to avoid leakage. Label the bag to allow association of the subsample bag and the measured concentration with the parent sample bag.

4.4 Routine Quality Control Procedures

The following quality control procedures will be performed during all sample analysis by XRF:

1. Initial control charting. Control charting will be conducted for each instrument, analyte, SRM, and scan time prior to the start of sample analysis. Follow the steps below to generate the initial control charts for the target analytes:
    a. Over a period of about 7 working days, generate at least 25 readings, and up to 50 readings, on each LCS, making 4 readings over the course of an 8-9 hour day, with an instrument restart between the third and fourth readings. If possible, use several different operators to collect data during this period.
    b. Prepare a control chart for each instrument, analyte, SRM, and scan time that will be used during the project. The chart should show a line for the mean value for the analyte, and lines at values for the mean plus and minus 2 standard deviations, and the mean plus and minus three standard deviations.

   c. Use the control chart to plot visually each LCS analyzed during the project. Assess the results following Section 4.4.4, below, and take corrective actions as necessary.

   d. Once an additional 25 to 50 LCS readings have been made, the new data may be incorporated into the control chart, or a new control chart generated. To assess ongoing instrument performance, statistical tests such as t-tests and F-tests may be conducted prior to incorporating the new data or substituting new data on the control chart; otherwise instrument drift may occur over the course of the project.

   e. It is important to note that the mean concentration measured by the XRF may vary from the concentration reported by the supplier of the SRM, even when uncertainty from precision is taken into account. This may occur because of bias in the XRF instrument relative to the techniques used by the manufacturer to establish the concentration of the SRM. This does not constitute a failure of the method; comparisons of XRF data with ICP data will be used to assess possible instrument bias, and if necessary, the XRF data may be adjusted for bias if this is supported by the data. Such adjustment is beyond the scope of this SOP, but any such processes will be documented in the remedial investigation report.

2. Interference checks. Each lot number of plastic bags should be checked for interference. Run LCS samples at both high and low concentrations with 7 to 10 readings. Conduct a t-test and an F-test to confirm that the bags do not interfere significantly with the results. Once a particular lot number has been cleared as free from interference, no other bags need to be checked from that lot.

3. Blank analysis. An instrument blank consists of silicon dioxide or sand in the same type of analysis bag as the samples. An instrument blank should be run at the start of every batch:

   a. Analyze the blank in the same manner as the samples (follow steps 4.2.2 through 4.2.10).

   b. If arsenic or lead is detected in the blank, the instrument should be considered to be out of control, and corrective actions identified in Section 4.5 should be taken.

4. LCS analysis. Before and after each batch of samples, LCS samples should be run to confirm that the instrument remains in control. The size of a batch is at the discretion of the analyst, but an LCS set should be run at least every 10 sample bags; if more replicate analysis is being performed for many samples, it may be better to run LCS sets more frequently. Early in the project it may be advisable to run the LCS sets at a higher frequency until it is established that the process is running smoothly.

   At least two and preferably three LCS samples should be run, with low, medium, and high concentrations of the target analytes. If the results for a specific instrument, target analyte, SRM, and scan time are outside of 2 standard deviations, the instrument may be out of control and corrective action is required - follow the actions identified in Section 4.5.2 or Section 4.5.3.

5. Instrument duplicate analysis. An instrument duplicate should be run once every day at startup samples to build an instrument history. To run an instrument duplicate, run the LCS sample twice consecutively to assess the instrument drift. Do not record the result for the instrument duplicate on the control chart. Instrument duplicates will be used for troubleshooting to assess whether electronic problems are occurring in the instrument. No specific corrective actions are required on the basis of the instrument duplicate; when electronic problems are suspected, another instrument duplicate may be analyzed and compared to previous instrument duplicate results as a diagnostic tool.

4.5 Troubleshooting and Corrective Actions

There are several possible causes of difficulties with XRF instruments:

1. Battery charge. Data may be affected before the instrument provides an indication that the batteries need to be recharged. This problem may be identified by downward trends on the control chart, and should be corrected by putting fresh batteries in the instrument. If possible, this should be done before an out-of-control situation occurs. The instrument should normally be operated on A/C power to prevent issues with battery charge, but if the instrument is used on battery power, the battery charge should be monitored.
2. Extreme ambient conditions. Extreme heat, cold, or humidity may all cause instrument problems. If these are the suspected cause, correct the conditions in the laboratory, and restart analysis.
3. Improper operator technique. The XRF should be mounted in a stand if possible for analysis, but vibration of the XRF during analysis may affect the instrument. If vibration is suspected, remove the source of vibration and repeat the analysis.
4. Torn XRF window membrane. A torn membrane may cause difficulties with internal temperature regulation. If the membrane is torn, replace it following the manufacturer's documentation. The instrument will need to be restarted after this service is conducted.
5. Jarring of the instrument strong enough to alter the alignment of the detector and/or internal optics, or electronic wear within the instrument. If either of these cases occurs, the XRF must be returned to the manufacturer for repair prior to further use.

Follow the instructions below for corrective actions based on specific causes:

1. <u>Detected target analyte in the blank.</u>
    a. Inspect the blank for possible problems such as wrinkles in the membrane, and correct if necessary.
    b. Repeat the blank analysis.
        i. If the repeat blank analysis shows no detections of target analytes, the instrument is in control, and sample analysis may begin.
        ii. If the repeat blank detects target analytes again, the instrument is out of control, and the cause must be investigated and corrected before sample analysis can begin.
2. <u>LCS reading outside 2 standard deviations but inside 3 standard deviations on the control chart for the specific instrument, SRM, analyte, and scan time.</u> The instrument should be considered to be in an uncertain state, and the following actions taken to either identify the instrument as in control or out of control.
    a. Do not analyze additional samples on the instrument until it is returned to in-control status.
    b. Immediately repeat the LCS analysis.
        i. If the repeat LCS reading falls within 2 standard deviations of the mean on the control chart, and there are no issues with the LCS results for any of the other analytes:
            1. The instrument is in control, and sample analysis may resume.
            2. All samples analyzed between the last passing LCS and the false alarm LCS may be reported without reanalysis.
            3. Record both the original and repeat LCS readings on the control chart.
        ii. If the repeat LCS also falls outside 2 standard deviations of the mean on the control chart for one or more analytes, examine the LCS cup for damage to the membrane.

1. If damage is noted, repair or replace the damaged LCS cup. Use another LCS cup, and repeat the LCS analysis. If it passes, the instrument remains in control, and sample analysis may resume. All samples analyzed between the last passing LCS and the false alarm LCS may be reported without reanalysis. Record both the original and repeat LCS readings on the control chart.
2. If damage is not noted, troubleshoot the instrument (check batteries, window membrane, vibration or jolting of the instrument during the reading, ambient temperature/humidity conditions, and operator error).
    a. If any obvious problems are found, correct them and rerun the LCS set.
        i. If the problem is corrected, the instrument is in control, and sample analysis may continue. All samples analyzed between the last passing LCS and the false alarm LCS may be reported without reanalysis. Record both the original and repeat LCS readings on the control chart.
    b. If no obvious problems are found, shut down the instrument and restart it with all usual startup procedures and QC.
        i. If the problem is corrected, return to an in-control state. The instrument is considered to have been out of control between the last passing LCS and the shutdown of the instrument. Reanalyze all samples run after the previous in-control LCS check.
        ii. If the problem is not corrected, the instrument remains out of control, and additional troubleshooting may be necessary. Steps may include shutting the instrument down and letting it equilibrate for 3-4 hours or overnight, consulting the instrument manufacturer or other XRF expert, and returning the instrument to the manufacturer for repairs and/or recalibration.

3. <u>LCS reading outside 3 standard deviations on a control chart for the specific instrument, SRM, analyte, and scan time.</u> The instrument should be considered to be in an uncertain state, and the following actions taken to either identify the instrument as in control or out of control.
    a. Do not analyze additional samples on the instrument until it is returned to in-control status.
    b. Inspect the LCS cup for damage as noted in Section 4.5.2.a.ii, and whether damage is noted or not, proceed as described in that section.

4. <u>Seven consecutive readings on the same side as the mean of the control chart.</u> The instrument is considered to be out of control, and the following actions should be taken to correct the situation:
    a. Remove the batteries for charging, and replace them with new or recharged batteries.
    b. Re-analyze all samples analyzed by the XRF since it went into out of control status, which means those samples between the sixth and seventh LCS that were on the same side of the mean (earlier samples do not need to be reanalyzed).

Log all nonconformances and corrective actions using the Nonconformance Log (Attachment B).

5.0 DOCUMENTATION

XRF readings for each sample will be documented on a Sample Analysis Log (Attachment A). XRF readings and sample masses for subsamples will be documented on a Subsample Preparation Log. Record all nonconformances and corrective actions using the Nonconformance Log (Attachment C). Similar electronic or paper forms that record the same information may be substituted.

ATTACHMENT A
Sample Analysis Log

SAMPLE ANALYSIS LOG

Instrument ID:	

ATTACHMENT B
Subsample Preparation Log

SUBSAMPLE PREPARATION LOG

Property ID:		Initials/Date of Preparer:	

Sample ID	Subsample ID	Original mass of fraction < 60-mesh (g)	Subsample Mass (g)	Arsenic Reading of Original Sample (mg/kg)	Arsenic Reading of Subsample (mg/kg)	Lead Reading of Original Sample (mg/kg)	Lead Reading of Subsample (mg/kg)	Pass/Fail

ATTACHMENT C

Nonconformance Log

NONCONFORMANCE LOG

Instrument ID:	

Date/Time	Maintenance Task or Problem Description	Corrective Actions Taken	Initials

PWT STANDARD OPERATING PROCEDURE

SURFACE and SHALLOW SUB-SURFACE SOIL SAMPLING for INORGANICS

APPROVED: /s/ 03/23/2017
PWT Project Manager, Date

TABLE OF CONTENTS

REVISION LOG

Revision Number	Description	Date
0	Original SOP	September 2015
1	Add sample collection for Mercury analysis; editorial changes	November 2015
2	Provide directions for Ecotox sampling for the OU1 RI Background Study	April 2016
3	Add collection of extra sample volume from 0-1 inch interval, and decontamination infomation	December 2016
4	Add collection of pea gravel from high use playground	March 2017

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to collect surface and shallow subsurface soil samples for chemical analysis during environmental investigations performed during the Remedial Investigation (RI) in the Community Properties Study Area (CPSA) of the Colorado Smelter Site. This SOP serves as a supplement to site-specific Health and Safety plans and the site-specific CPSA RI Quality Assurance Project Plan (QAPP). This SOP may be used in conjunction with other SOPs. This SOP is not appropriate for sampling to determine concentrations of organic compounds.

The SOP describes procedures for collection of five-point composite samples (i.e., composed of five equal sized aliquots collected in a star pattern or otherwise distributed approximately evenly within the area to be characterized), and incremental samples (i.e., composite samples composed of 30 equal sized aliquots collected on a grid; typically performed on decision units (DUs) over 5000 square feet or vacant properties, and in park areas to be characterized). Play areas and playgrounds are often covered with sand, pea gravel, or other distinct, imported material. In these areas, soil below the imported material will be sampled by removing the imported material and using the top of the native soil profile as the surface (0"). The imported material will be sampled separately as described in Section 4.5.

Typically, five-point composite samples will be collected from the surface interval (0-1") from each DU on the property. Five-point composite samples will be collected at multiple depths (0-1", 1-6", 6-12", and 12-18") from each DU on the property, exceptions to five-point composite sampling are discussed in Section 4.3. Unless otherwise specified by the QAPP, the term <u>"surface soil" refers to the top inch of soil following removal of surface vegetation and other debris from the sampling area. Samplers shall note the presence or absence of vegetative cover on the sampling sheets, and when vegetative cover is present, and the start of the depth interval will begin below the root structure of the plant material</u>. In support of the Background Study for the RI, a separate 5-point composite sample will be collected for the 0-6 inch soil horizon for Ecotox benchmark values in urban areas.

Shallow subsurface soil refers to the interval from 1" to 18" below the surface. Sample collection depths other than the ranges given above may be specified by the QAPP.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for surface soil sampling.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as specified in the approved project planning documents.

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable Task-Specific HASPs prepared by the PWT Team, or Subcontractors, and the associated Activity Hazard Analyses (AHAs).

A walkthrough shall be performed to identify any site specific hazards. Site specific hazards may include but are not limited to unidentified utilities such as underground propane lines, septic system drainfields, sprinkler systems, and owner placed electrical lines. Utility clearance will have been accomplished according to the PWT Utility Clearance SOP (PWT-ENSE-413). Other site specific hazards may include low tree limbs, uneven ground, unleashed animals, ponds, and miscellaneous equipment.

2.3. Personnel Qualifications

Personnel performing surface and shallow subsurface soil sampling activities are required to have completed the initial 24-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and work under the supervision of a 40-hour OSHA trained person. Supervisors of surface and shallow subsurface soil sampling activities are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in surface and shallow subsurface soil sampling activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Only qualified personnel will be allowed to perform these procedures. Required qualifications vary depending on the activity to be performed. If work is being performed by a subcontractor, the subcontractor's project manager will document personnel qualifications related to this procedure in the subcontractor's project QA files.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be necessary for surface and shallow subsurface soil sampling:

- Sample containers: Gallon-sized zip top bags, Quart sized zip top bags, and glass jars
- Leather work gloves
- Nitrile disposable gloves
- Bound field logbook
- Sampling site location map, which provides property address, project specific Property ID, and identifies any DUs to be sampled for Mercury or to be sampled incrementally
- Completed access agreement(s) (if owner and occupant are different, both must have completed an access agreement)
- 100-foot survey tape
- Measuring device such as small tape measure or calibrated instrument to identify sample depth increments
- Soil sample field data sheets (Attachment A)
- Approximate 4 foot by 6 foot plastic sheeting
- Surveying stakes or pin flags for marking of grid nodes and/or sampling locations

- Monitoring equipment and personal protective equipment (PPE) as outlined in the HASP.
- Decontamination equipment and supplies (e.g., high pressure sprayer/washer, wash/rinse tubs, brushes, Alconox (or equivalent), plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, and deionized or distilled water)
- Sharp cutting tool for removing turf layer, such as a curved knife
- Stainless steel scoops or spoons, knives, pick, and mixing bowls identified for each discrete depth interval to be sampled. Each bowl shall be clearly labeled with the sample depth interval.
- Decontaminated drive sampler device with spare stainless steel tips
- Slide hammer drive device
- Sample collection supplies (e.g., plastic re-closeable plastic bags or equivalent, waterproof markers, sample labels, chain of custody [COC] forms, cooler for sample storage, ice or ice substitute, clear plastic and strapping tape, custody seals, trash bags)
- Drums, 5-gallon buckets, or other approved containers for containing investigation derived waste (IDW) soil and water

Other materials and equipment may be needed based on field conditions.

4.0 PROCEDURES

After samplers have verified that they have all the necessary paperwork to enter the property, and they have completed a site walkthrough in accordance with the HASP, they will set up to sample.

Photograph the yard to document pre sampling conditions. Choose a safe location to set up the sample table during the site walkthrough. Lay out a tarp beneath the table and plastic sheeting over the table, and set up a three stage decontamination station in accordance with PWT-ENSE-424, Personnel and Equipment Decontamination. Set out sample containers, coolers, and bowls for combining the sample aliquots. Sample aliquots may be combined directly in the plastic sample bag, if desired.

4.1 Identification of Decision Units

In order to characterize the nature and extent of soil contamination at the property, each residential property sampled in the RI project will be divided in one or more discrete DUs. The specific DUs to be sampled at each property will be indentified in advance.

Generally, the homes have a drip line DU, which has been be defined as the exposed ground surface located immediately adjacent to the house out to a total width of 2 to 3 feet. At some homes with very narrow side yards (less than 5’ wide), the side yard will be considered part of the drip line DU. Front and back yards were the most common DUs identified at the DMA properties, and are expected to be common in the RI properties as well. Where a distinct play area or garden has been identified, it will be sampled as an independent DU.

Sampling sites specified for the RI project will be located by street address and property ID as listed on the property map and the access agreements.

Identification of DUs for the properties will be performed by the project team at a time between the property survey and the sample collection event. These decisions will be based on field observations of the property, and conversations with the occupants, when appropriate. DUs will be marked by the sampling crew on the property sketch. The sampling scheme described in the following sections should be methodically applied to each identified DU at each property.

4.2 Five-Point Composite Sample Collection

Five-point composite samples will be collected for the majority of surface and subsurface soil samples on this site. These samples are comprised of five sample cores collected at points spread around the yard area to be characterized.

The various yard components or DUs to be sampled will be identified on the property map and verified during the site walkthrough. The sample crew will identify approximate sample locations in pen on the property map, and will stake the locations in the yard using pin flags. This typically involves staking a 5 point pattern for the five sampling locations for a DU, but may involve a different layout if site specific factors make adjustment necessary (to avoid a yard feature like a concrete walkway, for example). Each composite surface soil sample will be collected as follows:

1. Use a pin flag to mark the approximate center of the DU, then place the remaining 4 pin flags in a cross or diamond pattern, or in another arrangement which generally covers the DU while avoiding features which would impede sampling (concrete walkways, etc).

2. Collecting a sample core. Leather work gloves are to be worn while using the sampling tool. Samples shall be collected by driving the slide hammer down to approximately 20 inches below ground surface with sharp blows, and then using the T-bar to twist the sampling tool out of the ground. Do not jerk the sample tool out of the ground, because the force can dislodge the sample. Carefully lay the sampling tool (which contains the first aliquot of each depth interval of the 5-point composite sample) on the table.

3. Remove leather work gloves and put on Nitrile gloves.

4. If the ground surface where the core was collected is generally bare of vegetation, measure 1” from the top of the sample, and then break, cut, or otherwise separate the recovered core at the 1” mark. If vegetative cover exists such that there is a substantial vegetative mat present, then measure the 1” from the base of the vegetative mat for the first sample core, and break, cut, or otherwise separate the recovered core at the 1” mark. The vegetative material shall be removed as a mat and lose soil particles removed by shaking inside the gallon-sized zip top plastic bag, discard vegetative material in the IDW bucket. Carefully transfer the soil aliquot into the sample bag labeled for the 0-1” interval. Repeat this process for the 1-6”, 6-12”, and 12-18” depth intervals. There will be some extra soil below the 18” mark. Discard this soil in the IDW bucket. During the Background Study, Ecotox samples from urban sample locations will be collected adjacent to a five point sample locations in urban DU’s. The sample will be a composite of a separate 0-6 inch increment and will be un-sieved.

5. Repeat steps 2 through 4 at the remaining four pin flagged locations.

6. For 5-point composite samples, additional sample volume is collected from the 0 to 1 inch interval in order to ensure that sufficient material is available for analysis. To collect this material, use a decontaminated trowel and the bag or container containing the 5 sample cores from the 0 to 1 inch interval. At each of the open holes from sample core collection, place the tip of the trowel against the open hole 1 inch below the ground surface (or one inch below the bottom of the vegetative mat in vegetated areas). Push the trowel forward approximately 1 inch, or to the mark on the trowel, and then lift carefully to minimize spillage. Transfer the soil to the sample baggie. Repeat this process at the remaining 4 holes for that DU, being sure to obtain approximately the same amount of sample material from each hole.

7. All sample cores for a given depth interval in a DU (five cores) are combined in a single sample bag.

8. After one five-point composite sample has been collected for each depth interval at the DU, it is sometimes necessary to repeat the process a second time to collect a sample for mercury analysis through an offsite laboratory. For collection of the mercury sample, soil cores should be collected approximately six inches away from each original pin flag. To prevent volatilization of mercury potentially present in the sample, sample cores should be exposed to air for the minimum amount of time necessary. Place sample aliquots in sample jars (rather than zip-top bags), and re-close the jars between aliquots. When all five aliquots are in the jar, mix using gloved hand or stainless steel spoon, then re-close the jar and place in a cooler on ice as soon as possible. Mercury samples will be sent to the CLP lab without further sample preparation. Typically, additional volume for mercury analysis will be collected for 5% of the total samples. The frequency of mercury sampling is specified in the project-specific QAPP.

9. After one five-point composite sample has been collected for each depth interval at the DU, it is sometimes necessary to repeat the process a second time for a replicate sample, and a third time for a triplicate sample. For collection of the replicate samples, soil cores should be collected approximately 1 foot up and to the right of each pin flag. For the triplicate sample, soil cores should be collected approximately 1 foot up and to the left of each pin flag. Typically, replicates will be collected for 5% of the total samples. The frequency of replicate sampling is specified in the project-specific QAPP.

10. It is not necessary to mix or homogenize the aliquots, because the soil will be processed at the field soils laboratory.

11. Complete all fields on the Soil Sample form (Attachment A). Label and handle the containers as specified in the PWT Sample Handling SOP (PWT-ENSE-406).

12. Decontaminate the sampling equipment in accordance with the PWT Personnel and Equipment Decontamination SOP (PWT-ENSE-424).

13. Repeat the five-point composite soil sampling procedure for all DUs identified on the property sketch, unless one or more DUs have been identified to receive 30-pt incremental composite sampling.

4.3 Incremental Sample Collection

Incremental samples consist of approximately 30 sample aliquots collected on a grid and composited for laboratory chemical analysis. In cases where the property in question is significantly large, a 30-pt incremental sample will be considered. For this project, incremental samples will be combined in a single container in the field and mixed/homogenized at the field soils laboratory in accordance with the XRF Sample Preparation SOP (PWT-COS-302).

Incremental surface soil samples will be collected as follows:

1. After the DUs have been identified and designated for 30-pt incremental sampling on the property sketch, label the incremental sample bag with the appropriate sample ID for the first DU to be sampled.

2. Starting at a random point near the corner of the DU, establish a grid pattern appropriate for the size of the DU that accommodates the spacing necessary in order to obtain 30 aliquots.

3. A sample core will be collected to a depth of 18 inches at each pin flag location. These locations correspond to the approximate bottom center of each grid square. If there is significant vegetation, be sure to sample a full 18 inches of soil below the vegetative mat.

4. Collecting a sample core. Leather work gloves are to be worn while using the sampling tool. Samples shall be collected by driving the slide hammer down to approximately 20 inches below ground surface with sharp blows, and then using the T-bar to twist the sampling tool out of the ground. Do not jerk the sample tool out of the ground, because the force can dislodge the sample. Carefully lay the sampling tool on the table. Because the sampling tool has a constant diameter core barrel, and samples from a given depth interval will be the same length, the sample aliquots obtained using the standard method will be of equal volume.

5. Remove leather work gloves and put on Nitrile gloves.

6. If the ground surface where the core was collected is generally bare of vegetation, measure 1” from the top of the sample, and then break, cut, or otherwise separate the recovered core at the 1” mark. If vegetative cover exists such that there is a substantial vegetative mat present, then measure the 1” from the base of the vegetative mat for the first sample core, and break, cut, or otherwise separate the recovered core at the 1” mark. The vegetative material shall be removed as a mat and lose soil particles removed by shaking inside the gallon-sized zip top plastic bag, discard vegetative material in the IDW bucket. Carefully transfer the soil aliquot into the sample bag labeled for the 0-1” interval. Repeat this process for the 1-6”, 6-12”, and 12-18” depth intervals. There will be some extra soil below the 18” mark. Discard this soil in the IDW bucket.

7. Repeat steps 4 through 6 at each of the 30 pin flag locations of the grid pattern.

8. After one incremental sample has been collected at the decision unit, it is sometimes necessary to repeat the process a second time for a replicate incremental sample, and a third time for a triplicate sample. For collection of the replicate sample, soil cores should be collected from the upper right hand corner of each imaginary grid square. For the triplicate sample, soil cores

should be collected from the upper left hand corner of each imaginary grid square. Typically, replicates will be collected for 5% of the total samples. The frequency of replicate incremental sample collection is specified in the project-specific QAPP.

9. It is not necessary to mix or homogenize the incremental samples, because the soil will be processed at the field soils laboratory.

10. Complete all fields on the Soil Sample form (Attachment A). Label and handle the containers as specified in the PWT Sample Handling SOP (PWT-ENSE-406).

11. Decontaminate the sampling equipment in accordance with the PWT Personnel and Equipment Decontamination SOP (PWT-ENSE-424).

12. Repeat the incremental sampling procedure for any other DUs identified to receive incremental sampling on the property sketch.

4.4 Increment Volume Considerations

In order to appropriately represent the area sampled, without over-representing or under-representing any particular portion of the DU, it is important that each individual aliquot (or increment) of a particular sample has the same volume/mass. It is not necessary that aliquots of different samples be the same size.

When the standard sample collection approach is used, the constant volume of the sample collection tool ensures each aliquot will have the same volume/mass.

4.5 Sampling Imported cover materials in play areas and playgrounds

If the play area/playground cover material is sand, then the typical sample collection procedure as described in Section 4.2 or 4.3 may be used to collect a sample of the cover material, and the underlying native soil will be sampled as described in Section 1.0. In order to appropriately characterize the pea gravel and other coarse materials which may be found covering native soil in play areas and playgrounds (such as was identified at Benedict Park) the following equipment and work instruction procedures may be used.

1. Using a clean (decontaminated) 5-gal bucket with a ¼-inch to 1/8-inch screen over the top, collect a 0-6 inch aliquot of pea gravel with a scoop from each 5-pt composite or 30-pt incremental sampling point. Number of aliquots in the sample (5 or 30) will be specified by the PWT Project Manager or by the Project QAPP.

2. Sieve the pea gravel and place the course fraction back into the play area. The goal is to gather about 100 grams or more of the fine dust which comes off the pea gravel without collecting the gravel itself.

3. At the completion of sampling in the playground transfer the fine material into a sample container.

4. Complete all fields on the Soil Sample form (Attachment A). Label and handle the container as specified in the PWT Sample Handling SOP (PWT-ENSE-406).

5. Decontaminate the sampling equipment in accordance with the PWT Personnel and Equipment Decontamination SOP (PWT-ENSE-424).

6. Repeat the pea gravel incremental sampling procedure for any other DUs identified with pea gravel.

5.0 DECONTAMINATION

Decontaminate soil sampling tools between each decision unit to be sampled using a three stage decontamination process as described in PWT-ENSE-424, Personnel and Equipment Decontamination. Buckets shall be labeled clearly to ensure they are only used for their assigned decontamination purposes and not used for IDW transfer, or other purposes. The washwater and tapwater rinse buckets may be used for up to four DUs at a single residence before being replaced. Buckets of fresh alconox washwater and tapwater for rinsing shall be used at each new residence to be sampled. Fresh decontamination water shall also be used after completing decontamination of four decision units at a single residence, and any time that the water becomes too turbid to see the bottom of the bucket.

6.0 DOCUMENTATION

Personnel collecting samples are responsible for documenting sampling activities in the field logbook and on the Surface Soil Sample Field Data Sheet (Attachment A). Discussions of sample documentation are provided in the PWT Sample Handling SOP and the Borehole Logging SOP.

ATTACHMENT A

Soil Sample Field Data Sheet

Page **1** of **3**

Inorganic Soil Sampling Field Form

Sample Information

Property ID Number: PC-__________ Date:__________ Start/End Time:_____/_____

Project: Colorado Smelter CPSA RI Sampler(s):________ Company:________

Sample Collection Method (circle one):

Liner? Y/N Drive Sampler Other:__________

Yard Hazards:______________________________

Sample Locations Recorded (circle one): GPS Property Map Other:__________

Sample Identification	Time	No. of Holes	QA/QC	Incremental Y/N	Comments

Sampler Name /Signature/Date (relinquish custody of listed samples):____________________

Field Lab Name /Signature/Date (accept custody of listed samples):____________________

Inorganic Soil Sampling Field Form

Property Information

Property Contact Phone Number:___________________ Property Identification Code: PC-______

Property Owner:____

Property Address: ____

Present during sampling? (Y/N):Owner:_______ Occupant:___________

Type of Roof:_________________________________ Condition:__________

Type of Siding:_________________________________ Condition:__________

Type of Trim (windows, doors, eves):_________________________________

Outbuildings? Type?_________________________________ Condition:__________

Porch/Other:_________________________________ Condition:__________

Gutters:_________________________________ Condition:__________

Sprinkler System present?:_________________________________ Location:__________

Sample Containers: 4 oz glass jar 8 oz glass jar Ziptop bagged Other:______________

Number of Sample Containers:________ Preservative: 4°C ± 2°C none Other:________

Analyses: TAL by 6020B (ICP-MS); antimony, arsenic, cadmium, copper, lead, zinc by 6200 (XRF)

Weather:____

Visitors:____

Comments/Observations:____

____

____

Samplers Name and Signature:____

Reviewer Name and Signature:____

A Yard Map will be used as page 3 of the field sampling form.

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Section Page No.

List of Attachments

Attachment A: U.S. EPA Region 8 GIS Deliverable Guidance

REVISION LOG		
Revision Number	**Description**	**Date**
1.1	Original SOP	September 2002
2.0	QA Review and Update	April 2012
3.0	QA Review and Update	October 2016

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013
2.0	Annual QA Review	September 2015

1.0 INTRODUCTION

This manual provides detailed instructions to allow contractors to submit spatial data to PWT in a format that can be used directly in PWT's software and filing structure. All contractors will be provided with this document before contract initiation. No contractor will be allowed to submit any spatial data developed without adhering to the rules described in this document, unless agreed to before contract initiation. In addition, the contractor must generate the projects in ESRI ArcView 8.X GIS.* and not ESRI ArcView 3.X GIS.* for submittal to PWT. Should the contactor generate the project in ESRI ArcView 3.X GIS.* then all functionality of an ESRI ArcView 8.X GIS.* project must be created such that labels, etc. are associated with the layers and not included merely as graphics.

The National Geospatial Data Policy (NGDP) establishes principles, responsibilities, and requirements for collecting and managing geospatial data used by the U.S. Environmental Protection Agency (EPA). Within EPA Region 8, GIS file delivery formats for all materials developed in support of CERCLA related site work are specified in the GIS Deliverable Guidance in A. All geospatial data that is collected, acquired, or managed in conjunction with an EPA project must comply with the requirements specified in these documents.

2.0 ARCVIEW 8 (ESRI ARCGIS) COMPATIBILITY

All data submitted must adhere to the requirements described below to allow it to be viewed and manipulated in ESRI ArcView 8.X GIS. ArcView 8 is a member of the ESRI ArcGIS family of software products that enables PWT to use GIS for field, office, database, and internet-based applications. By providing PWT with data already prepared for use in ArcView 8, the contractor will enable PWT personnel to maximize work efficiency and to more easily build new information by comparing and combining data from various submissions and contractors.

ArcView 8 consists of three separate, but integrated, applications: ArcCatalog, ArcMap and ArcToolbox. ArcCatalog is used to manage data in a Microsoft Windows Explorer-like environment. ArcCatalog functions include previewing and searching for data, generating and reviewing metadata, generating new files for data storage, and organizing folders. ArcMap is used to view, edit, analyze and map data. ArcToolbox includes 20+ tools for data conversion and management and permits batch processing.

3.0 SPATIAL DATA FORMAT

3.1 SHAPEFILE (*.shp, *.shx, *.dbf, *.prj)

All vector data sources (points, lines, or polygons) should be provided in ESRI shapefile format. ArcView 8 includes conversion tools in ArcCatalog and ArcToolbox that allow some other formats to be converted into shapefiles; however, to ensure maximum convertibility, it is best to generate new data directly as shapefiles using ArcMap edit function. A shapefile consists of at least three files by the same name in the same directory that have different file extensions:

- <shapefile name>.shp – Map features
- <shapefile name>.shx – Index file to associate map features with attributes

- <shapefile name>.dbf – Tabular, feature attribute information
- <shapefile name>.prj – Spatial reference (projection) information

3.2 DEFINING SPATIAL REFERENCE INFORMATION

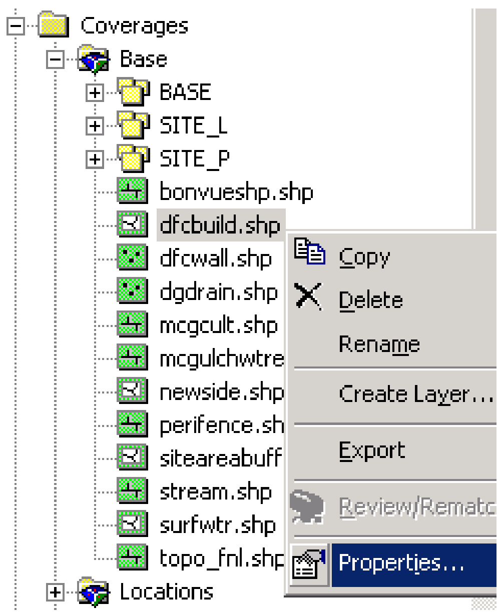
All data sources should use the State Plane Coordinate System with the following parameters:

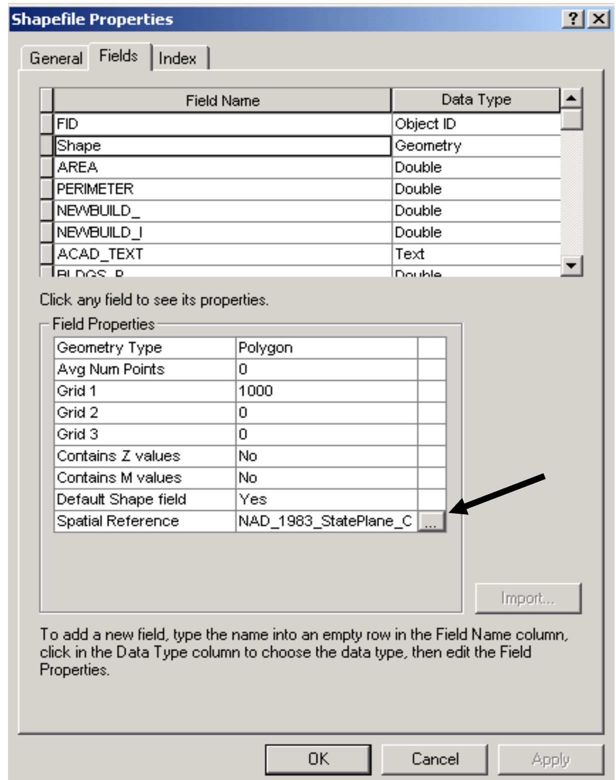
COORDINATE SYSTEM:	State Plane
ZONE:	State Specific [ex. Colorado Central (3476), (FIPSZONE : 502)]
DATUM:	NAD83
SPHEROID:	GRS80
UNITS:	Feet

Although older versions of ESRI ArcView software do not utilize the *.prj file associated with shapefiles, explicitly defining a shapefile's spatial reference information is imperative in ArcView 8. Without projection information, a shapefile added to ArcMap produces a warning message and may not work correctly in certain operations. There are two ways to define the projection of a shapefile in ArcView 8: 1) Using ArcCatalog (single shapefile), 2) Using ArcToolbox (multiple files).

3.2.1 Defining a Shapefile Projection Using ArcCatalog

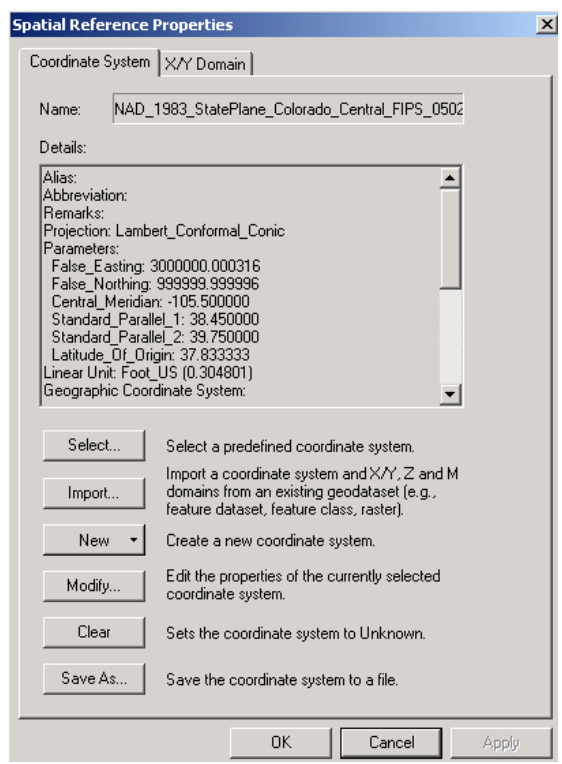
1. Right –click on the shapefile of interest in the ArcCatalog *Table of Contents* and choose *Properties* from the context menu to access the *Shapefile Properties* dialog.
2. In the *Fields* tab, choose the record selector left of the *Shape* name in the list of *Field Names*.
3. Select the ellipses following the *Spatial Reference* property in *Field Properties* to produce the *Spatial Reference* dialog.

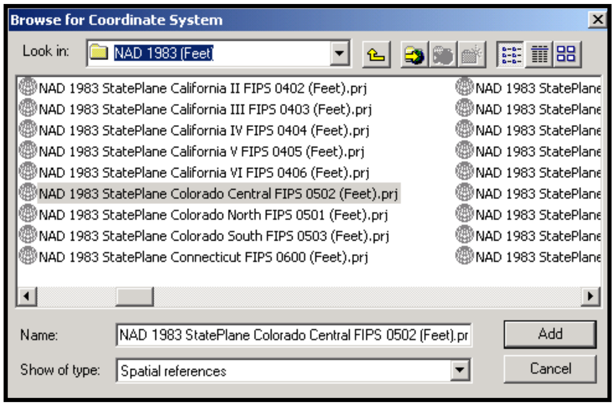


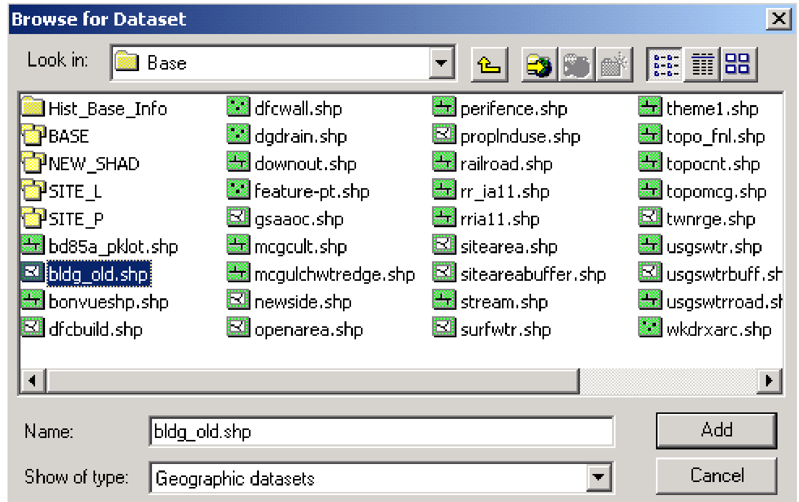


4. If no other spatial data source has yet had its projection defined, it will be necessary to choose the *Select*…option to select a predefined coordinate system (See 5a). If even one other data source has already had its projection defined that shares the same projection as the new data source to define, choose the *Import…* option (See 5b).

5a. Browse to the coordinate system definition, usually defined by a coordinate system, datum, units and location parameter (zone) that matches the coordinates the spatial data source is actually using. For DFC data, always make sure that you data is developed to allow it to be correctly defined with the *NAD 1983 State Plane Colorado Central GIPS 0502 (Feet).prj*.



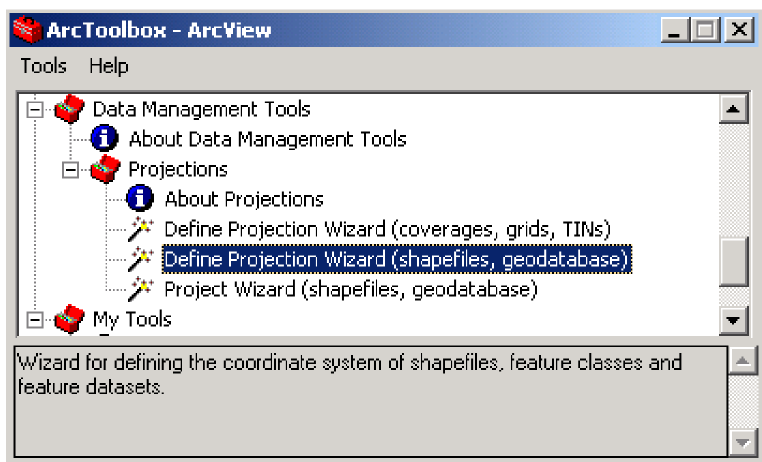




5b. Browse to the data source that has already had its projection defined to automatically assign the same one to the data source of interest.

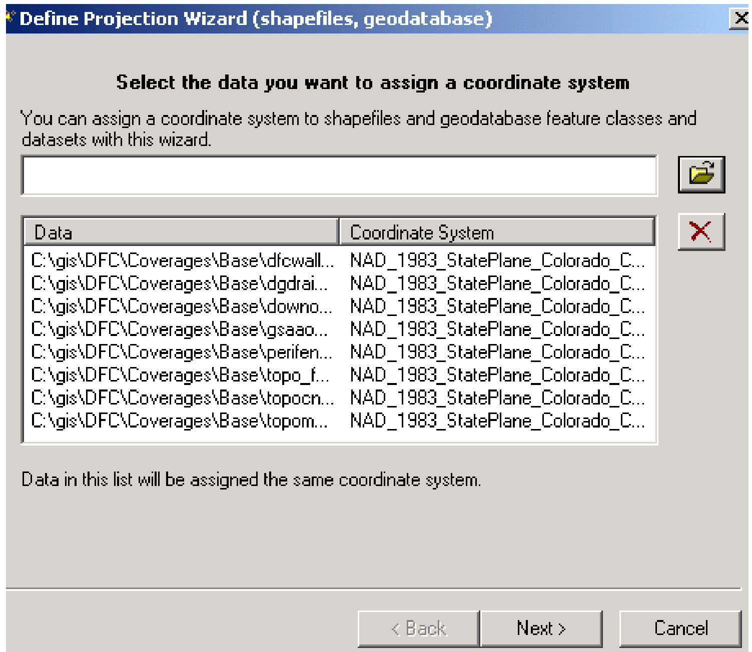
3.2.2 Defining a Shapefile Projection Using ArcToolbox

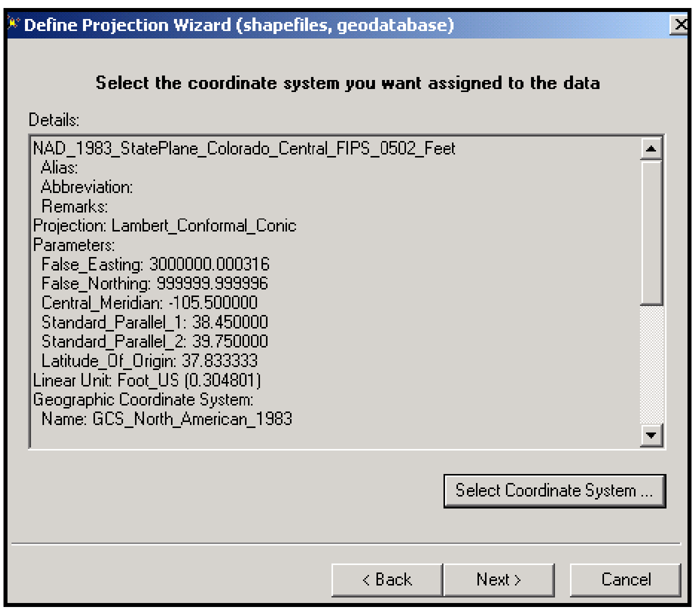
If more that one data source needs to have its spatial reference information defined, it is more efficient to use ArcToolbox to define the shared projection of multiple data sources at one time.

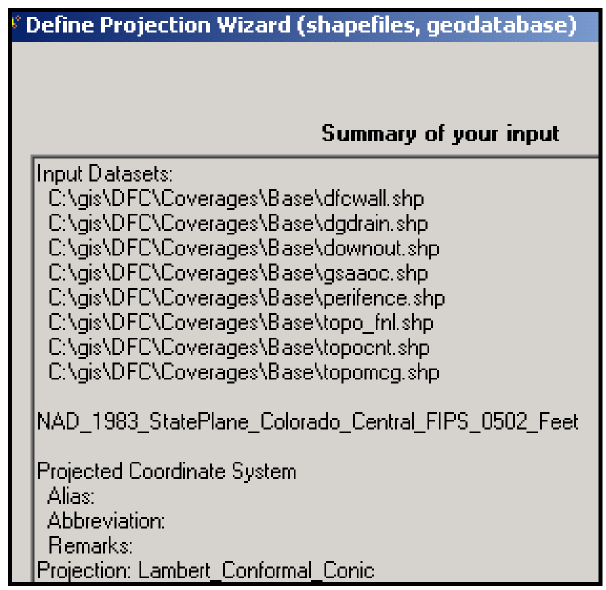


1. Choose the *Define Projection Wizard (shapefiles …)* option from the ArcToolbox *Data Management / Projections* tools.
2. Select all the data sources that share the same projection by browsing and holding down the <SHIFT> or <CTRL> keys to select multiple files.
3. Choose *Next*, then *Select Coordinate System* to launch the *Spatial References Properties* dialog.

4. As in the previous menu using ArcCatalog, choose *Select …* if the same projection has not been defined yet for any other data source, otherwise choose *Export* to export the projection information from the defined data source to all the other data sources in the projection list.
5. Choose *Next* to review the batch process information, then choose *Finish* to complete projection definition for all selected files.

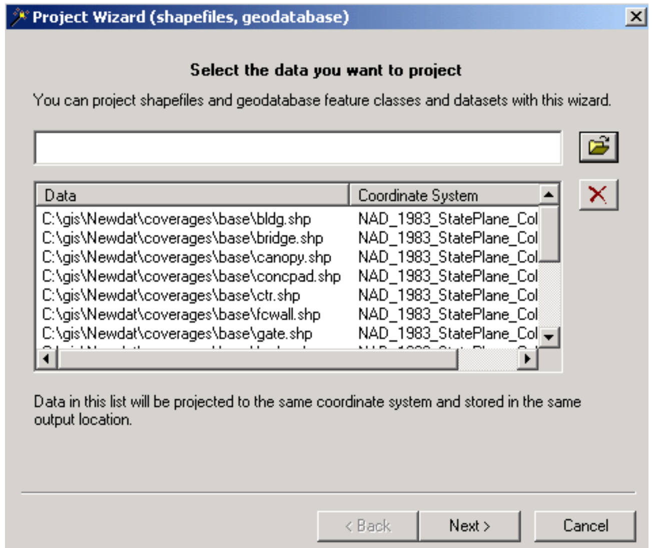


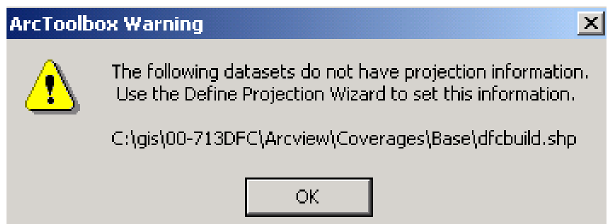




3.2.3 Reprojecting a Shapefile from One Spatial Reference System to Another

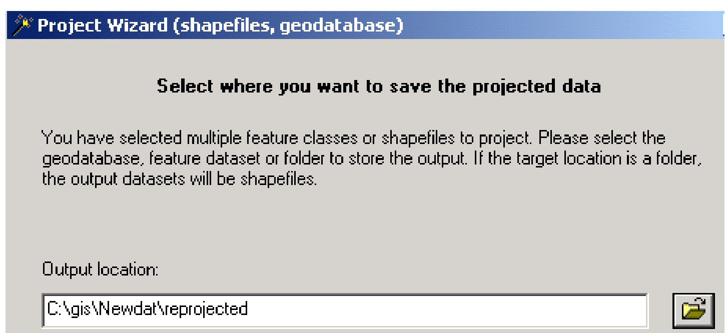
The two previous sections described methods to *define* the *existing* projection of a data source. However, in many cases data sources will not already be stored in the State Plane, Colorado Central, NAD83, feet coordinate system used at the Denver Federal Center. In such instances, it will be necessary to change the underlying projection of the data to make it consistent with these standards. To reproject data, use the *Project Wizard (shapefiles, geodatabase)* found in *Data Management Tools* in ArcToolbox.





1. Browse to the files that you wish to reproject. (Warning: The spatial reference system of all files to reproject must already have been defined using one of the projection definition methods described previously. A warning will display if any of the data sources you choose still needs to have its projection defined.)

2. Next, choose an output location to store the results. If you choose the same output location as your input location, all original files will be overwritten without a warning.

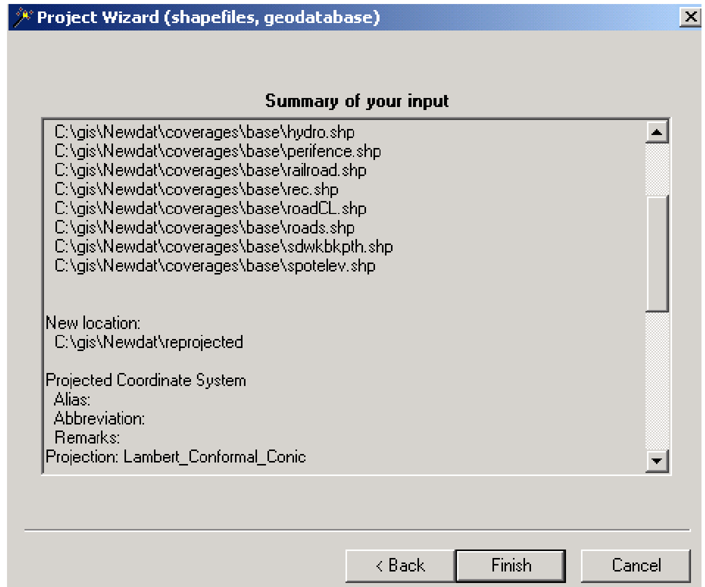


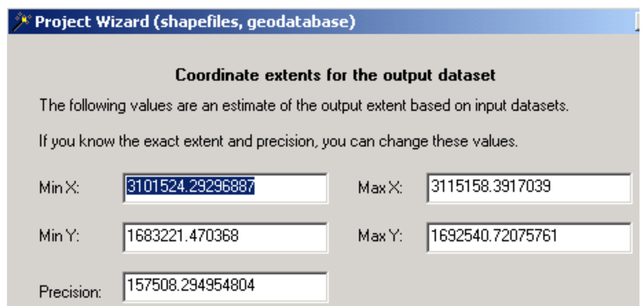
3. Choose the new coordinate system into which to project all data sources selected. In some instances, you will be asked to select a transformation to use to convert from one datum to another. Then, select all input files that are in the same projection, choose the *Set Transform* button and pick one

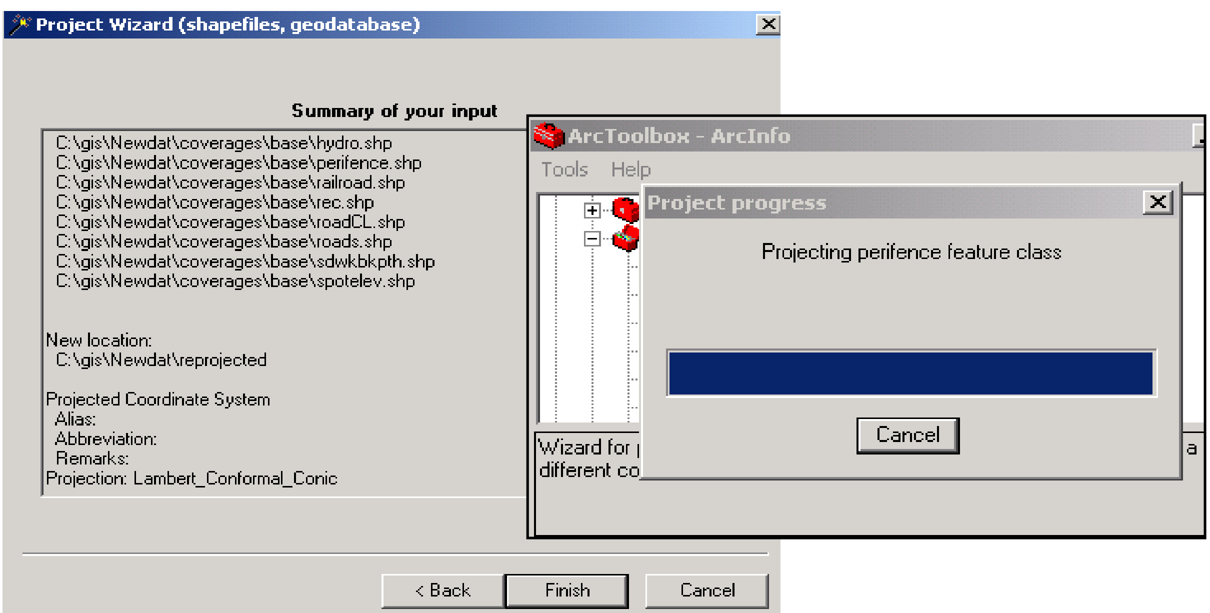
from the standard list.

4. If the exact extents of your data sources is known, the can be entered in the next frame of the project wizard. A desired precision can also be set at this point.

5. After reviewing a summary of the wizard input, choose *Finish* to regenerate all input into the new projection you defined.





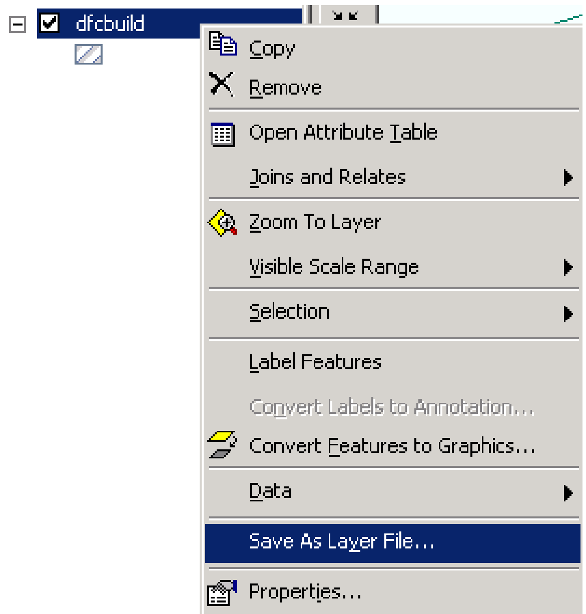


3.3 NON-VECTOR DATA

Image data should be provided in TIF file format (*.tif, *.tfw). A worldfile that provides spatial reference information (*.tfw) should accompany each TIFF file (*.tif). Digital elevation models or other grid-based data should be provided in ESRI ArcInfo GRID file format, which is stored in a named directory and always accompanied by an INFO directory at the same level in the directory structure.

3.4 SAVING A LAYER FILE REPRESENTATION (*.lyr) OF EACH DATA SOURCE

For every data source that is used as a layer in an ArcView map document, a layer file should be saved in the same location with the data source to preserve symbology, labeling, and other rendering properties. To save a layer file, choose each layer in turn in the *Table of Contents* in ArcMap, right click to expose the layer context menu, and choose *Save as Layer File*. Name the layer file the same name as its source if only one layer file will ever be needed (symbology and labeling will not need to be different for different uses). Otherwise call the new layer file the same name as its source file with a descriptor following the name such as roadscl14pt for 14 point labels on the center line roads layer.



4.0 FILE NAMING CONVENTIONS

File naming conventions need to be consistent to allow PWT staff to easily find related files for comparison, integration, or duplicate elimination. Each data source filename should include the date, (YYYY MM DD), a prefix labeling its general content, a more explicit descriptor, and finally a suffix that describes version or series information. Typically, do not include project area information in the filename, since this will be determined by the directory within which the data is stored.

4.1 PREFIX – CATEGORY

Include one of the following categorical prefixes to classify each data source. If a data source fits two categories or falls into a category not yet defined, the contractor should work with PWT personnel to create a new or combined class.

ast – above-ground storage tank

BD### – building number to proceed name of environmental samples collected within a building bh – borehole

blg – building

bnd – boundary

ctr – contours

ele – electrical system features

fnc – fence

gs - gas

gw – groundwater

IA##O – site identifier (such as IA14N), proceeds environmental sample names

ophoto – orthophoto

rd – road

rec – recreation

rr – railroad

sdwk – sidewalk

sol – soil

spot – point elevation

str – stream

sw – surface water

swr – sewer collection system features

stm – storm water collection system features

tel – telecommunication system features

ust – underground storage tank

utl – utility

veg – vegetation

wl - well

wall – wall

wtr – water distribution system features (e.g. domestic water line)

zon – zone

4.2 NAME – DESCRIPTION

Include an abbreviation for the name or identifier for data sources representing a single object, such as a stream (i.e. strMcGulch.shp). Typically do not include project area designators in the name, since the project directory in which the data source is stored will determine this. The exception is environmental samples, which should include a site or building designator prefix as described above and a date stamp suffix as described below.

4.3 SUFFIX – SERIES, VERSION, SOURCE

For periodically collected environmental sample data, a suffix should be added to distinguish one data source from another. For example, for quarterly samples, the year and quarter should be added as YYQ#, or 02Q1 for the first quarterly sample collected in 2002. For sporadically collected samples, a date stamp YYMM should be used, such as 0202 for samples collected in February 2002. For a sample type that will not to be sampled again, no date stamp is needed since it is already a unique data source.

Do not use words like new and old to describe versions. If existing data must be edited, then a dash followed by the edit date should be added to the name to indicate which version it is. Once all previous versions have been discarded, PWT personnel can decide how to reconcile any edits and drop the date suffix from the final version that results. Dates may be included at the beginning or end of filenames, based on project conventions, but should be in the format YYYY MM DD to allow files generated during different years to automatically sort in sequential order.

If it is necessary to distinguish a data source developed by an outside entity for public use from one developed for PWT, a suffix can be added to distinguish the source. For example, USGS could be added to a stream filename to indicate it is a US Geological Survey version of the stream, or LKWD could be appended to the name of files obtained from the City of Lakewood. However, if more than one or two files are going to be used from an outside source, it is better to place these data sources in their correct location in the directory structure in a subdirectory labeled with the name of the data provider.

5.0 DIRECTORY STRUCTURE

5.1 BASEWIDE DATA AND MAP DOCUMENTS

All data sources in shapefile format that cover the entire area of the installation or at least large portions of it or represent a single entity like a stream that traverses the installation should be stored in the ***Coverages*** directory. Within the *Coverages* directory, data sources should be placed in one of the following subdirectories based on their purpose:

- **Base –** base map layers like roads, buildings, etc
- **Locations –** environmental sampling data
- **IS-CS –** environmental site boundaries and area of concern polygons
- **Offsite –** areas adjacent to DFC but not within the boundaries of the compound
- **Utilities –**water, storm water, sewer, electrical, etc.

All map documents should be placed in the ***Projects*** directory. Since each ArcView 8 map document (*.mxd) file contains a single map, an abbreviation of the map title and page size should be used to describe it. For example, a basewide utilities map could be called wtrswrele36x24.mxd to indicate that it contains just water, sewer and electrical utilities (as opposed to all utilities) on a 36 inch wide by 24 inch tall map. If a map contains only site specific data, the title of the map should be prefixed with the site number (e.g. IA14N02Q1envchem17x11.mxd).

5.1.1 CAD and Image Files

All data sources stored in Computer-Aided Design (CAD) format should be places in the ***Cadfiles*** directory. Orthorectified photos should be placed in the ***Image/Airphoto*** directory. Pictures or photos of buildings should be placed in the ***Image/Bldg*** directory. Maps of project areas should be placed in the ***Image/Maps*** directory. Company logos and other types of images should be placed in the ***Image/Other*** directory. Cadfiles or image files that represent buildings should be named by their building number and an appropriate descriptive prefix (UTL – utility, Mod – modification, BH – borehole, etc.).

5.1.2 Project-specific Data

Project-specific data should be stored in a directory labeled with its IA or other location identifier within the Coverages directory described previously. Within each project directory, subdirectories should be established to organize all spatial data layers (coverages, cadfiles, etc.). To make it easier to load map documents, even project specific ArcView 8 map documents (*.mxd) should still be stored in the ***Projects*** subdirectory at the root level.

6.0 DATA DICTIONARY

A simple, but complete data dictionary must be submitted with each spatial data submittal that briefly describes each spatial data source included. The data dictionary should be submitted in an easy-to-read tabular or report format that includes the following headings:

<u>FILENAME</u> – if data files are submitted in more than one directory, include the full path

<u>DESCRIPTION</u> – provide a brief but clear description of content and use

<u>FORMAT</u> – list both the type of data (point, line, polygon, image, grid, drawing, etc.) and the file format along with its characteristic extension (e.g. shapefile - *.shp)

<u>DATE CREATED</u> – include the day, month and year the data was generated

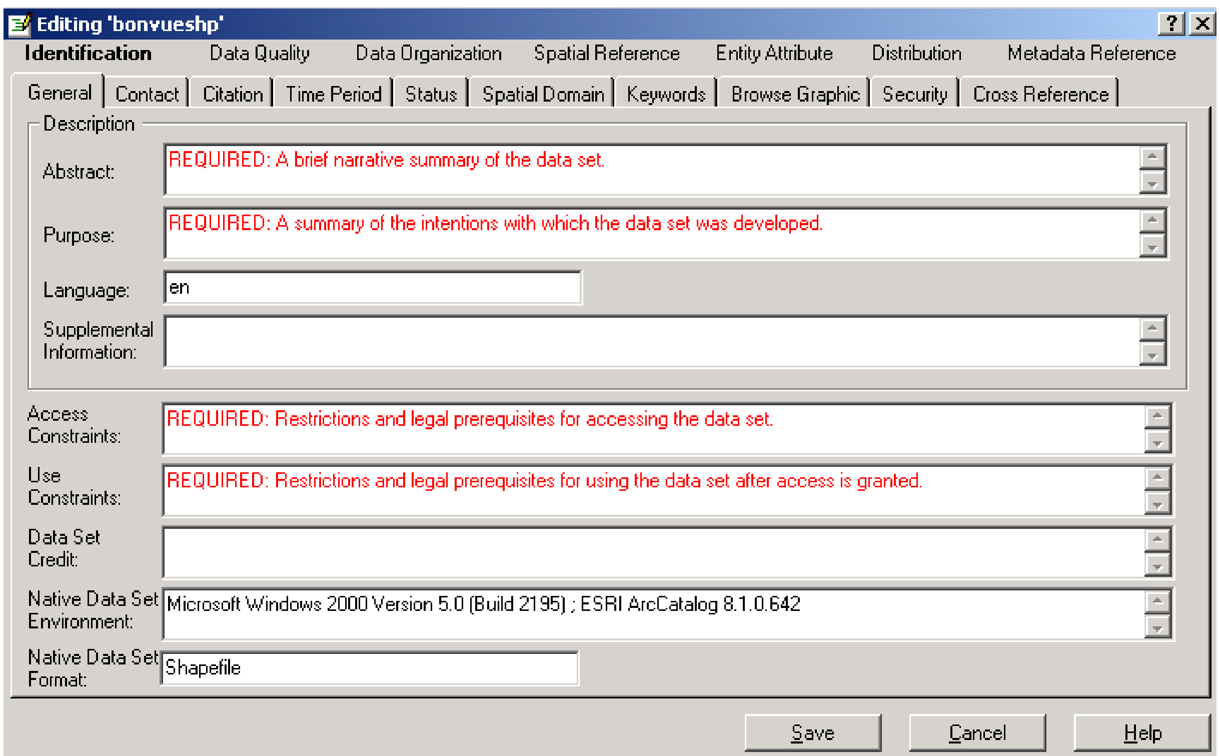
7.0 METADATA

7.1 ARCCATALOG-BASED XML FORMAT

Each spatial data source must be accompanied by an ArcView 8-based XML file that describes its content. This file can be automatically generated in part by choosing the data source name listed in the table of contents in ArcCatalog then selecting the *metadata* tab. To edit this metadata file to include other required information:

1. click on the metadata tab
2. choose the edit button

3. click on one of the 7 sections of Federal Geographic Data Committee (FGDC) metadata to begin modifying
4. click on the tab within the section that describes the type of information you wish to update
5. update information in each field (trying particularly hard to fill in all red lettered sections that include the word REQUIRED at the beginning of the text string)



NOTE: A metadata text file that includes standard sections such as access and use constraints is included on the CD that accompanies this document. This can be imported into the metadata using the *Import Metadata* button found on the metadata toolbar when the *Metadata* tab is active. Each contractor can add their contact information and other repetitive data then use the *Export Metadata* button to create a more complete, general purpose metadata file. Significant time can be saved by importing this descriptive information into the metadata for each data source before conducting further metadata edits. If this method is followed, it is possible that only the file's purpose and abstract and specific descriptive information about feature attributes associated with the map features will still need to be described.

7.2 SPATIAL REFERENCE INFORMATION MUST BE DEFINED

Once you define the spatial reference information of a data source using the ArcCatalog or ArcToolbox method described in an earlier section, ArcView 8 will automatically include this in the metadata. This is also true of all other information that ArcView 8 can determine from the data itself, such as extent, feature type and number of features, etc. To view all automatically recalculated metadata entries, review the *Spatial* tab of the *ESRI Stylesheet* for the data source of interest.

7.3 MINIMUM REQUIREMENTS

The following descriptive information is required for each spatial data source submitted. Including additional information is encouraged to enable the metadata to meet FGDC standards as well as possible. The three levels of the outline below relate to the ArcView 8 Metadata Editor dialog and indicate the menu, tab or button popup dialog, and finally the actual information field that must be completed shown in bold type.

- **Identification**
  - Description
    - **Abstract, Purpose**
  - **Access and Use Constraints**
  - Contact
    - **Person, Organization, Telephone, E-mail, Address**
  - Citation Information
    - **Title, Originator, Publication Date**
- **Spatial Reference** (automatically added once defined)
- Entity Attribute
  - Attribute
    - **Label, definition, units** (if applicable) for each user-defined attribute field
- Metadata Reference
  - Contact Information
    - **Person** (rest not necessary if it is the same as in the identification section)

8.0 MAP DOCUMENT

8.1 THE MAP DOCUMENT (*.mxd)

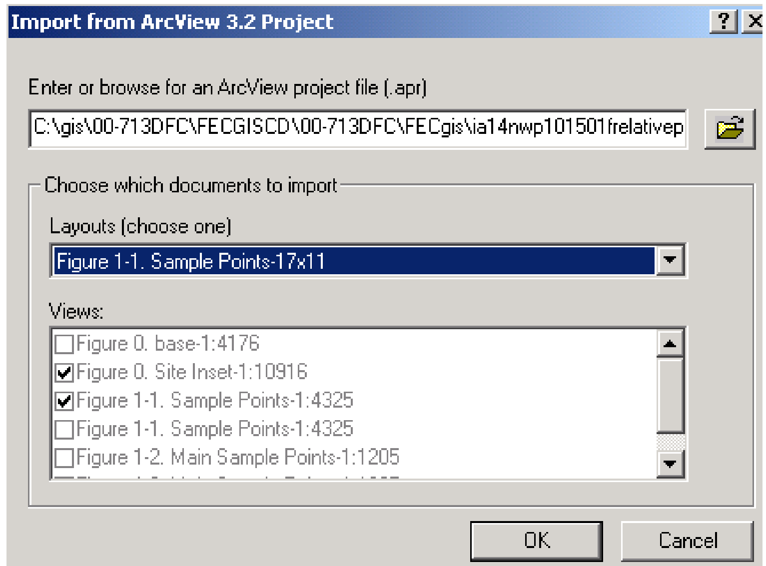
An ArcView ArcMap map document (*.mxd) will be generated for each map produced for a project. All map documents should be stored in a ***Projects*** directory, either at the root level of the directory structure for basewide projects, or within a subdirectory labeled with its project area (e.g. IA14N). Metadata should be generated for each map, but only needs to include the purpose, abstract, and complete contact information. Contact information should identify the person who actually designed the map as well as the project manager. The metadata should indicate if any symbols or map elements were used that are not found in the PWT map style and if a PWT-approved map template did NOT serve as the basis for the map. This will enable PWT personnel to add new symbols and map elements to the PWT style if necessary and review Layout View effectively to check for product consistency.

9.0 IMPORTING ARCVIEW 3.X PROJECTS INTO ARCVIEW 8

There are two methods for importing Layout and View documents from an ArcView 3.X project file (*.apr) into ArcView 8 map documents (*.mxd). Each map document is comprised of a single map (layout) containing one or more data frames – a data frame in ArcView 8.X is analogous to a View in ArcView 3.X. An ArcView 3.X project file often contains multiple layouts, so typically one *.apr is imported into several single-map map documents. If only the data and symbology is desired, instead of a final map presentation, the user can import selected Views instead of having Views selected for import automatically based on which Layout is to be imported. ArcView 3.X charts, tables, scripts and dialogs cannot be imported into ArcView 8. Tabular joins and links are also lost during the conversion. Therefore, any themes based on an Event Theme or relying on joins for symbology or labeling in ArcView 3.X will not appear correctly in ArcView 8. Sometimes it may be easier to open an ArcView 3.X and fix it to eliminate dependencies that ArcView 8 will not recognize before proceeding with the import process. Data source paths in the *.apr file to import should not be relative (start with a ./) or utilize a variable in the pathname, because only full paths to data sources will be read correctly by the Import tool. The first step to importing an ArcView 3.X project is to launch the *Import ArcView 3.X Project* option from the *File* menu in ArcMap. Browse to the ArcView 3.X project file (*.apr) file to be imported. Views and Layouts found in the project will appear in their respective lists as soon as an ArcView project file is selected.

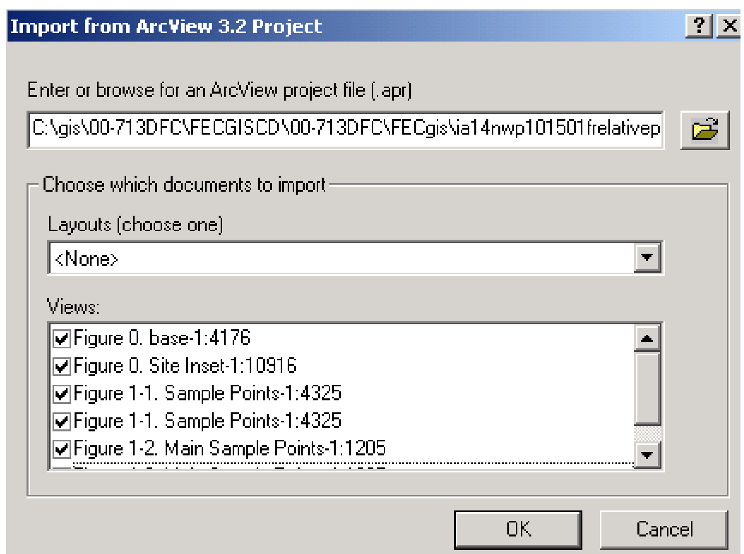
9.1 METHOD 1. IMPORTING BY LAYOUT

Choose a Layout from the list of all the Layouts found in the current ArcView project file to automatically import it and all of its associated Views into an ArcView 8 map document (*.mxd). After choosing a layout, the View Selector window will become grayed out and Views associated with the layout will automatically become check marked for import. Usually maps will not be converted perfectly, so review the *Correcting Import Errors* section below.



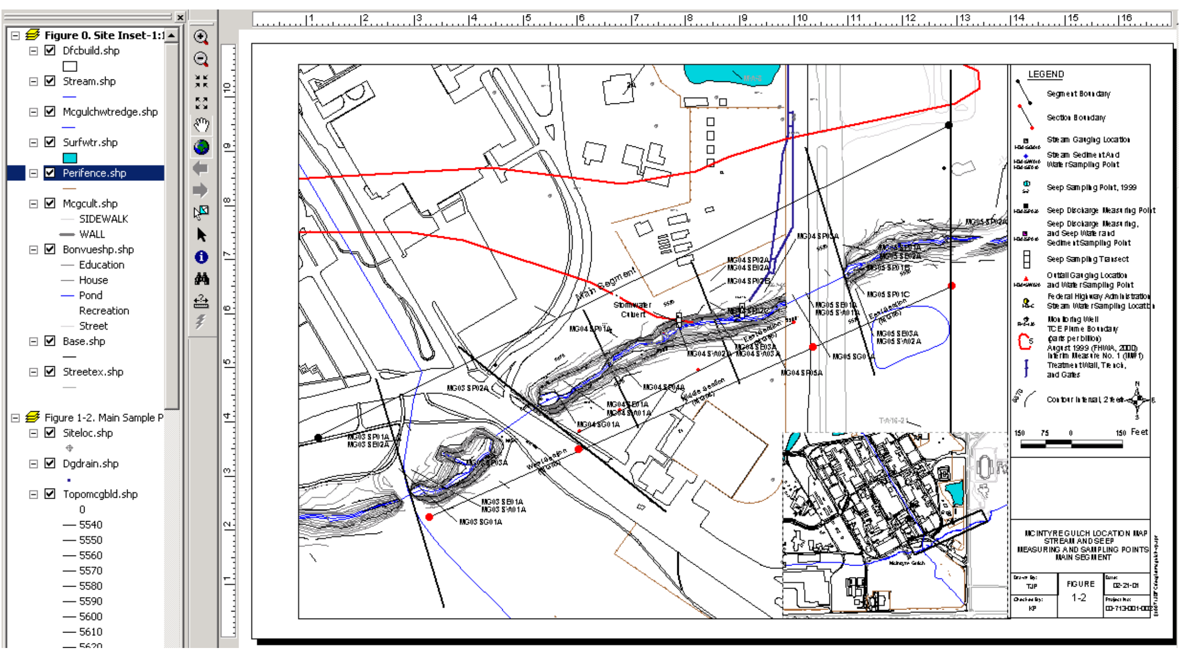
9.2 METHOD 2. IMPORTING SELECTED VIEWS

Since the approved ArcView 8 map templates may differ substantially from map layouts used in ArcView 3.2, in many cases it will be preferable to import Views by selecting the *None* option for *Layouts* to import. Then check mark the Views needed to construct a single map. Use one of the project-specific map templates to generate a new map using the *Change Layout* button on the *Layout* toolbar. After adding a template, adjust the text and map elements if necessary to match important features in the original ArcView 3.2 layout.



9.3 CORRECTING IMPORT ERRORS

After importing ArcView 3.X information in ArcView 8, it will be necessary to reestablish tabular joins and links and recreate event themes. The graphing tool accessed with the *Tools>Graphs>Create* option can be used to reconstruct any charts that had been present. Click on the *Source* tab in the *Table of Contents* and choose the *Add Data* button to import tabular data that had resided in an ArcView 3.X table document. Not all map elements translate correctly from ArcView 3.2 into ArcView 8. Therefore, it important to examine north arrows, scale bars, legends, etc. and replace them with ArcView 8 elements where conversion has not been effective. Sometimes text formats may need to be adjusted and neatlines reset, too. If the map resulting from an imported project is not consistent with approved PWT ArcView 8 map templates, map deliverables will NOT be accepted. Therefore, if a contractor's ArcView 3.2 layouts differ more than slightly from PWT ArcView 8 standards, it is better to import Views only and use an approved PWT map template to reconstruct the map.



ATTACHMENT A

U.S. EPA Region 8 GIS Deliverable Guidance

U.S. EPA Region 8
GIS Deliverable Guidance

Region 8 Ecosystems Protection and Remediation

Program Support

Data Systems Team

GIS

Version1.1

June 1, 2015

Document Revision History

Date	Author	Version	Description
1/6/2014	John Wieber	1.0	Final
6/1/2015	John Wieber	1.1	Final

Contacts

Name	Role/Org	Telephone	Email
John Wieber	GIS Lead	(303) 312-6118	Wieber.John@epa.gov

Contents

Purpose

The purpose of this document is to provide guidance to contractors, grantees, or others who provide GIS deliverables to EPA Region 8 programs, projects, or staff.

Scope

This document covers the types of GIS deliverables anticipated in Region 8 and how the Region would like to receive these deliverables. Additionally, data standards, formats, and best management practices are identified.

Responsibilities

The Region 8 GIS team is responsible for maintaining this document and providing it to those parties wishing to provide Region 8 with spatial data or products. It is the responsibility of those providing deliverables to the Region to adhere to the guidance provided in this document to the best of their abilities. The Region 8 GIS team relies on other EPA staff such as grant/contracting officers, RPMs, and inspectors to ensure data are getting submitted for long-term use at EPA.

Introduction

This document is intended to specify GIS file delivery formats for all geospatial materials developed in support of GIS related work within EPA Region 8. It is the intent of EPA Region 8 to acquire, catalog and manage all GIS files comprehensively across all projects to:

1) ensure future use and access to EPA,
2) provide an archive of work accomplished,
3) maintain and serve data that spatially represent features pertinent to on-going EPA efforts, and
4) provide a basis for future activities such as CERCLA Five Year Review.

GIS Formatted Data Files

All final version spatially enabled files acquired or developed to support mapping and/or spatial analysis by a contractor or grantee are considered property of the EPA and are required to be submitted to EPA. Delivery schedules are negotiable, but should be annual at a minimum. This includes but is not limited to all GIS, CAD, and image formatted files used to develop maps for any scoping or decision document developed for EPA, as well as any spatial file used to inform a decision on site management or development. Only final versions of each layer are required for delivery to EPA, and must be in an approved format as specified in this document. In addition, all electronic geospatial data, whether vector or raster, must be projection defined (have a projection defined and embedded in or associated with the data file), and in the case of CAD data must NOT be in page space or a custom site-specific projection. All CAD data must be in known real world coordinate space, ideally conforming to the projection specifications outlined below. Should tabular data be appropriate to connect location information with attribute information, then documentation specifying the primary and foreign keys is required. Should coordinate information be provided in tabular format it should contain at minimum the following fields:

ID – a unique identifier given to each feature
Latitude – the Y coordinate in decimal degrees, 6 significant digits
Longitude – the X coordinate in decimal degrees, 6 significant digits
Horizontal Datum – the datum of the coordinates.

Additionally all static maps that appear in an EPA document should be in an electronic Adobe PDF format with fonts embedded and at a resolution of 300 dots per inch (dpi) or greater. Finally, any dynamic maps used in final map production, such as ESRI ArcMap documents (.mxd), may also required for delivery to EPA with accompanying data in a stand-alone directory structure. Such documents are recommended to be provided as ESRI map packages (.mpk).

Projection Requirements

All GIS files submitted to EPA must have spatial reference information that describes the projection, datum, and where applicable the collection methods. The EPA requests that all vector data be submitted in geographic coordinate system, decimal degree units, and NAD83 datum, as is required under the EPA National Geospatial Data Policy, 2008. Raster data, such as aerial photographs may be submitted in their native projection, and maps should be in the appropriate projection/coordinate system for the area depicted. EPA Region 8 GIS staff will be happy to consult and advise on projection, coordinate, and datum details for submission to EPA.

Metadata Requirements

All GIS files developed for EPA are required by Executive Order 12906 to have associated metadata. EPA requires FGDC compliant metadata on all GIS files developed for site support. Region 8 also requires that all dynamic maps (ArcMap documents) have metadata completed. The Content Standard for Digital Geospatial Metadata can be found at www.fgdc.gov. Metadata, including information about the data's projection, can be developed using one of several built-in or add on tools within a GIS, and typically is associated with the geometry file as an XML file. EPA Region 8 GIS staff will be happy to consult and advise on development of required metadata.

Organizational Requirements

If the project is complex, a directory structure and readme text file in the upper level directory that describes the structure is required. Because EPA will be managing data across many projects, it is important to make your submittals as understandable as possible. A recommended directory structure is as follows:

<**Project_Name**>
|_ **Docs** (reports, SOPs, correspondence, and other such documents)
|_ **Maps** (MXDs and PDFs. Map names should use the project name as a prefix)
|_ **Rasters** (aerial photos, satellite imagery, logos, DEMs, and other raster type data)
|_ **Source** (original unmodified data that may have been acquired from external/internal sources)
|_ **Tables** (MS-Access databases, spreadsheets, delimited text files, or other such tabular data not stored in a geodatabase)
|_ **Vectors** (geodatabases, shape files, and other approved vector data formats)

File naming conventions should be logical, consistent, and contain no spaces or special characters. An underscore may be used in lieu of a space.

Delivery Requirements

EPA will accept data delivered on CD-Rom, DVD, or external hard drive, as well as direct electronic submission via email or FTP site. Other delivery methods may be allowed if those requirements present a significant burden or as technology changes.

EPA Acceptable Data Formats

The following file formats are considered acceptable and all maps and data must include an associated metadata document:

DATA
Vector - **projected to geographic, decimal degrees, NAD83**
File Geodatabase (.gdb) *Preferred Shape File (.shp, .shx, .dbf, .prj, .sbx, .sbn) Personal Geodatabase (.mdb) ESRI Map Package (.mpk)
Raster – **native projection acceptable**
TIFF image with world reference file or as a GeoTIFF (.tif, .tfw) JPEG image with world reference file (.jpg, .jpw) ERDAS Imagine image with pyramid file (.img, .rrd) MrSid image (.sid) ESRI Grid DEM
TINs – **appropriate projection/coordinate system for the area depicted**
ESRI TIN
CAD - **projected to geographic, decimal degrees, NAD83**
DXF layer separates (.dxf)
Tabular – **primary keys should be clearly identified/documented**
MS-Access database (.mdb) MS-Excel spreadsheet (.xlsx) Delimited text file (.txt, .csv)
MAPS
Static
Adobe PDF at 300 dpi or better with embedded fonts (.pdf)
Dynamic
ESRI Map Package (.mpk)

FGDC Compliant METADATA
XML (.xml)

PWT STANDARD OPERATING PROCEDURE

SAMPLE HANDLING

Procedure No. PWT-ENSE-406
Revision 2
Date effective: 03/01/12

APPROVED: ________________/s/____________________ ___________
PWT Project Manager Date

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1.0	Original SOP	July 2011
2.0	QA Review and Update	March 2012

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013
2.0	Annual QA Review	November 2014
2.0	Annual QA Review	September 2015
2.0	Annual QA Review	October 2016

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to handle environmental samples (such as: soil, groundwater, surface water, sediment, waste, and air samples) during environmental investigations. This SOP serves as a supplement to site-wide and investigation area specific workplans and the site-specific Quality Assurance Project Plan (QAPP) and may be used in conjunction with other SOPs.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for sample handling.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in approved project planning document(s).

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan, Job Safety Analyses (JSAs), any applicable Task-Specific Health and Safety Plans prepared by PWT Subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.3. Personnel Qualifications

Personnel performing sample handling activities will have knowledge and experience in the equipment and procedures used, or will work under the direct field supervision of knowledgeable and experienced personnel. Sample handling will be directed by a PWT field sample manager responsible for ensuring proper handling and shipment of samples. The field sample manager will be knowledgeable and experienced in handling and shipping of environmental samples.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for sample handling, packaging, and shipping:

- Monitoring equipment and personal protective equipment (PPE) as specified in the HASP.
- Appropriate clean sample containers as specified for each analytical method being tested. Sample containers will contain appropriate preservatives, according to method specifications. Sample containers will be provided by the analytical laboratory, unless otherwise specified in the QAPP.
- Decontamination equipment and supplies (e.g., wash/rinse tubs, brushes, Alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled water and/or deionized water).
- Sample handling supplies (e.g., recloseable plastic bags, waterproof markers and sample labels, cooler for sample storage, ice or ice substitute).
- Sample management supplies (e.g., soil sample field data sheets, chain-of-custody [COC] forms). An example COC form is included as Attachment A.
- Sample shipping supplies (shipping coolers, recloseable plastic bags, shipping labels, shipping forms [provided by shipping courier], bubble wrap, tape [e.g., clear tape, packing tape, and custody seal tape]).

Other materials and equipment may be needed based on field conditions.

4.0 PROCEDURES

4.1 Sample Identification

Samples collected during investigation activities will be identified using a pre-determined sample identification (ID) scheme described in the project or investigation –specific sampling plan.

Typically, sample ID numbers consist of two main components:

- The investigation location site identifier, which may include numbers, letters, or a combination of the two, and which corresponds to the investigation location at which the sample was collected.
- Sample-specific information, such as the sample collection method, sample depth interval, sample type and sequential sample number

4.2 Sample Labeling

Sample labels will be filled out to the extent possible before field sampling activities begin. However, the date, time, sample depth, and sampler's initials or signature will typically not be completed until the time of sample collection. Sample labels will be filled out using waterproof ink. At a minimum, each label will contain the following information:

- Company's name
- Project name/site location
- Sample ID
- Date and time of sample collection
- Method of preservation (if any) used
- Analyses required
- Sample matrix (e.g., soil, water)
- Sampler initials

4.3 Sample Handling

This section discusses proper sample containers, preservatives, and handling and shipping procedures.

4.3.1 Sample Containers

Unless otherwise specified in the QAPP, clean sample containers will be obtained from the subcontracted analytical laboratory performing the analyses. Extra containers will be ordered to account for the possibility of breakage during shipment or sample collection. To the extent possible, required preservatives will be prepared and placed in the bottles at the laboratory before shipment to the site. Project-specific sample containers will be identified in the site-specific QAPP.

4.3.2 Sample Preservation

Samples will be preserved in accordance with the site-specific QAPP. Chemical preservatives, if necessary, will be added to the sample containers by the laboratory (or vendor) before shipment to the field. Samples will be stored at appropriate temperatures as specified in the site-specific QAPP.

4.3.3 Sample Handling and Shipping

Sample containers will be packaged properly to prevent breakage of containers and leakage of contents. The following procedures will be followed during the packaging and shipping process:

1. Place sample containers in recloseable plastic bags.
2. If sample container is glass, wrap individual sample containers with bubble wrap.
3. Place sufficient amounts of bubble wrap in the bottom and sides of the shipping cooler to prevent movement of contents.
4. Add enough ice (in double bags) or ice substitute to the cooler to maintain proper preservation temperature in accordance with the QAPP.
5. Line the inside of the cooler with a plastic trash bag, place the samples and additional ice as necessary inside, and tie the bag shut.
6. Fill any void space in the cooler with packing material (e.g., bubble wrap) to prevent movement of sample containers.
7. Place the original COC form inside a recloseable plastic bag, and tape the bag to the inside of the cooler lid.
8. Close the cooler lid, and seal the cooler and the cooler drain spout with appropriate packaging tape.
9. Place two custody seals (tampering seals) on the cooler in separate areas over (across) the seal between the lid and the cooler base. Example custody seals are included as Attachment B.

A shipping bill should be completed for the shipper and taped to the top of the cooler using the envelope provided by the shipper. The following markings may also be placed on the top of the cooler:

- This end up
- Fragile
- Laboratory delivery address
- Sender's return address

A copy of the shipping bill will be retained by the field sample manager for attachment to the corresponding COC form. Samples will be hand delivered or shipped by express courier for delivery to the analytical laboratory.

The field sample manager or field team leader is responsible for verifying that samples collected by the field team(s) have been properly identified, preserved, and packaged, and for verifying the accuracy and completeness of sample labels, COC forms, and applicable sample field data sheets and logbook entries.

The following is a summary of steps to be performed by the field sample manager:

- Verify sample labels.
- Verify samples were collected and preserved in accordance with the site-specific FSP and QAPP.
- Check or complete the COC form, photocopy, and retain a copy for the project files.
- Pack samples in shipping containers and verify labels and shipping forms meet shipping requirements.
- Send original COC form to the laboratory.
- Retain a copy of the shipping bill and staple it to the corresponding COC copy.
- Send copies of sample field data sheets and photocopied pages of field logbooks to the project manager.

Close coordination will be maintained between the field sample manager and the analytical laboratory during sample collection and shipment. The laboratory will be instructed to report any handling or preservation issues immediately to the field sample manager (or other designated person) so that corrections can be made to field procedures, if necessary.

4.3.4 Sample Container Tampering

If, at any time after samples have been secured, custody seals on the cooler are identified as having been tampered with, the following procedures will be conducted to ensure that sample integrity has not been compromised:

- Check with personnel having access to sample coolers to assess the possibility of inadvertent breakage of custody seals.
- Inspect sample containers for signs of tampering, such as loose lids, foreign objects in containers, or broken or leaking containers.
- Review sample packaging and handling procedures.
- Document findings of the incident in the sample management logbook.

If it is determined that intentional tampering of samples has occurred, or it is believed that sample integrity has been compromised in any way, the Quality Assurance Officer and appropriate project managers will be notified.

4.3.5 Holding Times and Analyses

Samples will be shipped to the analytical laboratory for analysis as soon as practical following collection. At a minimum, samples will be shipped daily with the following exception. For small projects, samples may be collected over a period of several days at the discretion of the project managers, and then collectively shipped. No samples will be shipped on Friday for weekend delivery unless receipt and analysis procedures are pre-coordinated with the analytical laboratory. Allowable holding times for specific samples will be specified in the site-specific QAPP.

5.0 DOCUMENTATION

Documentation of sample handling is critical to project defensibility. The field sample manager will be responsible for ensuring all sample collection and handling documentation is complete and accurate.

5.1 <u>Sample Management Logbook</u>

The field sample manager will maintain a complete and accurate sample management logbook documenting sample handling procedures and observations. The logbook will be a permanently bound weatherproof field logbook with consecutively numbered pages. The field sample manager will also maintain a complete and accurate sample management file containing copies of all sample field data sheets, sampling crew logbooks, COC forms, shipping documentation, and written logs of correspondence or communications with the laboratory and other pertinent correspondence and communications. The sample management logbook will contain sufficiently detailed information to allow all significant sampling issues to be reconstructed without relying on the memory of sampling personnel.

The sample management logbook will contain daily entries for the following information:

- Project name

- Sampling activities performed that day
- Sampling crews and affiliations
- Sample location identifications
- List of samples collected, including sample IDs, collection time/date, media, analysis methods, and associated COC and shipping documentation.
- QA/QC samples collected and submitted for analysis
- Field observations
- Instrument calibration information
- Correspondence and communications
- Field sample manager's signature

Changes or deletions in the logbook will be lined out with a single strike mark, initialed and dated by the person making the change. Sufficient information should be recorded to allow the reason for the change to be reconstructed without relying on the memory of field personnel.

At the end of each day, the field sample manager will prepare copies of the sample management logbook, sample field data sheets, and field crew logbooks for the project manager. The field sample manager will coordinate with the project manager on the required frequency of transmittal of this information to the client. The client will expect this information to be available, accurate, and complete on a daily basis for possible inspection by the client, quality assurance personnel, the project manager or the regulatory agency.

5.2 Chain of Custody

Written documentation of the proper and secure handling of samples from the time samples are collected until laboratory data are issued is critical to project defensibility. The chain of custody of the physical sample and its corresponding documentation will be maintained throughout the handling of the sample. Sample custody applies to both the field and laboratory operations. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. An example COC form is provided as Attachment A. The COC form may consist of a triplicate, pressure-sensitive form or other form prepared by the contract laboratory, or the COC form may be electronically generated in the SCRIBE software. The COC form may vary depending on investigation activities. The investigation contractor will select an appropriate COC form subject to approval by the client.

A sample is under custody if it is in:

- The possession of the sampler/analyst.
- The view, after being in the possession, of the sampler/analyst.
- A sealed shipping container being carried by a designated commercial carrier.
- A designated secure area.

The sampling team will be responsible for initiating the original COC form and will sign and date the COC form when relinquishing sample custody to another person (e.g., the field sample manager) or to the analytical laboratory. The COC form and sample labels will be checked by the field sample manager to verify that samples are accounted for and in good condition, and that no errors were made.

The COC form will include the following information:

- COC number (unique, sequential number on the upper right corner of the form)
- Project name and number
- Sample ID number
- Sample preservatives
- Number of containers
- Sample collection date and time
- Sample matrix
- Requested analyses
- Signature and date blocks for personnel relinquishing or receiving sample custody
- Name and phone number of contractor contact person

Transfer of samples to the analytical laboratory may be via commercial carrier. The field sample manager will verify the proper packaging and shipment of samples. Prior to shipping, the field sample manager will officially transfer sample custody to the commercial carrier or analytical laboratory and secure the COC form inside the shipping container. Shipping containers transferred via commercial carrier will be sealed with strapping tape and with two custody seals. An example custody seal format is provided as Attachment B. Receipts of bills of lading from the carrier will be maintained as part of the custody record. Commercial carriers are not required to sign the COC form as long as the COC form is sealed inside the shipping container and the custody seals remain intact.

Upon receipt at the laboratory, the person receiving the samples will sign the COC form accepting transfer of custody to the laboratory. The laboratory will return a copy of the signed COC form to the designated investigation contractor personnel (i.e., project chemist, field sample manager, or project manager), and will retain a copy on file at the laboratory. The original COC form will remain with the samples until final disposition of the samples by the laboratory in accordance with the site-specific QAPP. After sample disposal, a copy of the original COC will be sent by the analytical laboratory to the investigation contractor.

ATTACHMENT A
EXAMPLE CHAIN OF CUSTODY FORM

	Chain of Custody/ Request for Analysis Record	CC#

Client

Project Number

Sampler Name(s)/Signature(s)

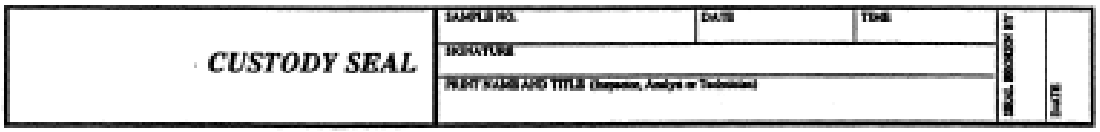
			Sample Data				Analyses Requested												Preservation	
Sample Number	Date	Time	Material Sampled: S = Soil; L = Liquid; G = Gas	Sample Type*	Container Type: G = Glass; P = Plastic; M = Metal	Number of Containers												Remarks or Sample Location	Iced	Specify Preservative Added and Final pH, If Known

Relinquished by (Signature): ①	Date	Time	Received by (Signature):	Relinquished by (Signature): ④	Date	Time	Shipped Via:
Relinquished by (Signature): ②	Date	Time	Received by (Signature):	Received for Laboratory by (Signature):	Date	Time	Shipping Ticket No:
Relinquished by (Signature): ③	Date	Time	Received by (Signature):	Name of Laboratory		Laboratory Control Number:	

*G = Grab; C = Composite; S = Split Spoon; ST = Shelby Tube; O = Other

White = Original (To Accompany Sample); Yellow = Main Office; Pink = Field Copy

ATTACHMENT B
EXAMPLE CUSTODY SEAL


CUSTODY SEAL

SAMPLE NO.	DATE	TIME
SIGNATURE		
PRINT NAME AND TITLE		

Custody Seal

APPROVED: /s/ ____________
PWT Project Manager Date

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REVISION LOG		
Revision Number	**Description**	**Date**
0.0	Original SOP	July 2011
1.0	QA Review and Update	March 2012
2.0	QA Review and Update	October 2016

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013
2.0	Annual QA Review	November 2014
2.0	Annual QA Review	September 2015

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides technical guidance and procedures for utility clearances at project sites. This SOP serves as a supplement to site-wide and investigation area specific workplans and the site-specific Quality Assurance Project Plan (QAPP) and is intended to be used in conjunction with other SOPs.

2.0 REQUIREMENTS

2.1 Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the approved project planning document(s).

2.2 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses, any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses.

3.0 RESPONSIBLE PERSONNEL

The project manager has the overall responsibility for implementing this SOP. The project manager will be responsible for assigning staff to implement this SOP and for ensuring that the procedures are followed by all personnel. The field team leader is responsible for ensuring that the appropriate utility clearances have been performed prior to any intrusive field activities. All utility clearances will comply with applicable portions of the Site-Specific HASP.

4.0 PROCEDURES

Locations selected for intrusive field activities (e.g. borehole drilling, surface or shallow subsurface soil sampling, trenching) will be cleared of utilities before field activities begin. Utilities may be located below ground or above ground. Before intrusive field activities can be performed each location will be cleared for the following utilities; natural gas, telecommunications, water and sewer, electrical, fiber optics and cable. At some locations additional utilities that may require clearance include petroleum service lines, irrigation lines, and building foundations.

Locations selected for intrusive work must be visually cleared for overhead utilities by the project manager or designee. This overhead utility check shall be recorded in the field logbook. Location of underground utilities will require additional steps, as described below.

It is the responsibility of the project manager to contact utility organizations directly for utility clearance at least one week in advance of scheduled intrusive work. Some utility companies guarantee that they will be present at the scheduled meet time. Other utility companies may call to reschedule at a different time or to reschedule the day of the scheduled utility meet. If possible, the utility clearance should be done 3 to 5 days prior to intrusive work to allow enough time for utilities companies to clear their lines. Because utility markings may be disturbed or fade, performing utility clearance more than 2 weeks in advance of field activities is not recommended. The utility companies will identify their utilities with spray paint on the ground and or pin flags. They also may leave a map or sketch at the location with their lines identified. In addition to the project manager (or designee), each subcontractor performing the actual intrusive work is required to provide a representative to attend the utility clearance, to pose any necessary questions. The subcontractors should request the same meet time that the PWT project manager has set up.

5.0 DOCUMENTATION

Underground and overhead utility clearance activities will be documented in the field logbook by the project manager, field team leader or rig geologist. The documentation will include the utility locator service sign-off, personnel present for the utility locate, the final project-site representative approval (if requested), and any current and historical maps used in locating utilities (or references to locations of maps for future reference).

PWT STANDARD OPERATING PROCEDURE

APPROVED: /s/ ____________
PWT Project Manager Date

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0.0	Original SOP No. GW.105	January 2012
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2.0	Annual QA Review	September 2015

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used for the handling, management, and disposal of investigation derived waste (IDW) encountered or generated during environmental field activities. This SOP serves as a supplement to the site-specific QAPP and other approved project planning documents, and is intended to be used in conjunction with other activity-specific SOPs. IDW management personnel are also referred to *Management of Investigation-Derived Wastes During Site Inspections* (EPA 1991), *Guide to Management of Investigation-Derived Wastes* (EPA 1992) and applicable state and federal requirements.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for IDW management.

2.1 Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the site-specific QAPP and other approved project planning document(s).

2.2 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses, any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses.

2.3 Personnel Qualifications

Personnel overseeing the handling and disposal of IDW will have IDW management knowledge and experience, or will work under the direct field supervision of knowledgeable and experienced personnel.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for IDW management:

- Personal protective equipment (PPE) as outlined in the HASP
- Decontamination equipment and supplies (e.g., wash/rinse tubs, brushes, alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags (minimum 0.85 mil), potable water, distilled water and/or deionized water)
- Department of Transportation (DOT)-rated 55-gallon drums or other approved containers for containing soil cuttings, decontamination water, and formation water
- Drum/bung wrench and drum funnel
- Heavy equipment forklift or vehicle with drum grappler
- Laboratory-supplied sample containers
- Photoionization detector (PID) or flame ionization detector (FID)
- Wood pallets

- Non-porous (e.g., stainless steel) shovels
- Hazardous Waste Labels
- Soil roll-off bins with liners and covers (if warranted)
- Polyethylene tank (if warranted)
- Waterproof and permanent marking pens

4.0 PROCEDURES

Environmental field activities may generate IDW that poses a risk to human health and the environment. It is anticipated that both non-liquid and liquid IDW will be generated or encountered during environmental field activities.

Non-liquid IDW may include:

- Drill cuttings from soil borings
- Sludges (from soil borings in the saturated zone and from development water)
- Excavated soil from trenches
- Construction debris (e.g., concrete and asphalt)
- Buried landfill materials (e.g., burned wood, desks, and metal objects)
- PPE
- Disposable investigation equipment (i.e., bailers, twine, discarded sample bottles, preservative containers, paper towels, aluminum foil)
- Empty drums

Liquid IDW may include:

- Well development water
- Purge water (from monitor wells)
- Well abandonment water
- Decontamination water

4.1 Non Liquid IDW

4.1.1 Soil IDW

- Soil cuttings generated during drilling and soil sampling will be placed into DOT-rated 55-gallon drums, or appropriately sized containers at the point of generation.
- Mixing of the cuttings from several borings or sampling locations is permissible in order to fill the drums. Consult with the PWT Project Manager to see if certain borings should or should not be combined. For example, borings from known areas of greater contamination might be mixed while

segregating cuttings from a boring installed in an upgradient area. The splitting of cuttings from one boring into several drums should generally be avoided.

- When drums are full, or daily activities are completed, the drum lids and rings will be fastened. Full drums will be transported to a designated IDW accumulation area on a regular basis to avoid accumulation of drums at investigation sites for extended periods of time. Alternative temporary IDW accumulation areas can be used as specified in the investigation-specific work plan.
- If large volumes of soil IDW will be generated, soil IDW may be transferred from the drums into roll-off bins (lined and covered) located within the designated IDW accumulation area.
- If only a small volume of soil IDW will be generated, DOT-rated 55-gallon drums can be used for the temporary storage of soil IDW pending analysis. Drums will be stored on pallets at the designated IDW accumulation area. Drums from individual sites will be segregated from each other as much as possible. The drums will be sealed and labeled with permanent markings (using paint pens or drum labels) with the following information:
    1. Source: the boring(s), well, or site identification number
    2. Matrix (e.g., soil, water)
    3. Sample interval (e.g., 0–20 ft or well screen depth) (multiple drums of development or purge water will be numbered consecutively as they are filled)
    4. Fill date
    5. Drum identification number
    6. Contractor
    7. The EPA or PWT designee point of contact with phone number
    8. "Contents Pending Analysis"

Soil IDW in drums will typically be characterized and disposed of based on the characterization of associated investigation sample results (if collected and analyzed).

If no associated investigation sample results exist, a composite soil sample will be collected from the soil IDW drums by collecting a drive or hand auger sample from each of the drums associated with a specific field activity. The sample material from all of the drums will be composited into a single sample that will be used to characterized and dispose of the soil IDW.

4.1.2 Excavated Soil from Trenches

Most trenching operations will generate substantial volumes of excavated soil.

Large volumes of excavated soil IDW will be placed directly into roll-off bins (lined and covered) at the excavation site. This procedure will minimize concerns resulting from stock piling the soil IDW, such as wind dispersion and contamination of the ground surface.

- Small volumes of excavated soil can be placed in drums at the excavation site. Drums will be labeled and stored as described in Section 4.1.1.
- Soil IDW in drums will be sampled (if warranted), characterized, and disposed of as described in Section 4.1.1 above.

Soil IDW placed on the ground surface prior to placement into drums or roll-off bins, must be placed on plastic sheeting covering the ground surface. The soil IDW must be transferred to drums or roll-off bins before completion of the days activities.

4.1.3 Construction Debris and Landfill Material

- Small pieces of construction debris or landfill materials may be placed in the soil IDW roll-off bins or drums. For example, small amounts of wood, concrete, rebar, and paper do not require segregation from the soil IDW.
- Large volumes of the materials listed above, and large objects, such as desks or large metal objects, will be segregated separately from the soil IDW.
  - If the associated soil IDW is characterized as nonhazardous, these materials can be disposed of as nonhazardous solid waste.
  - If the associated soil IDW is characterized as hazardous, potential surface contamination will be removed from the large objects with nonporous surfaces by brushing off, or using small amounts of water to scrub off, gross potential contamination. After decontamination, these objects can be disposed of as nonhazardous solid waste.
  - If the associated soil IDW is characterized as hazardous, large objects with porous surfaces may require disposal as hazardous waste. Consult the PWT Project Manager and the IDW disposal contractor.
- Containers that may contain or potentially contained controlled substances (e.g., paint cans, drums) will be segregated from the materials described above and placed in appropriately sized containers.
  - Consult the IDW disposal contractor for the appropriate disposal requirements for these materials.

4.1.4 PPE and Disposable Investigation Equipment

- PPE and disposable investigation equipment will be segregated separately and placed in dedicated heavy duty (minimum 0.85 mil) plastic bags or containers (e.g., drums).
- Potentially contaminated PPE or disposable investigation equipment will be decontaminated prior to placement in the plastic bags or containers, if warranted.
- Decontamination procedures consist of brushing off, or using small amounts of water to scrub off, gross potential contamination.
- PPE and disposable investigation equipment that have been decontaminated, if warranted, are considered refuse and do not require characterization prior to disposal as nonhazardous solid waste.

4.2 Liquid IDW

- Well development, purge, abandonment, and decontamination water will be contained in DOT-rated drums, or appropriately sized water-tight containers, at the point of generation. When drums are full, or daily activities are completed, the drum lids and rings will be fastened, and the drums will be transported to the designated temporary IDW accumulation area as described in Section 4.2 of Attachment B. Alternative temporary IDW accumulation areas can be used as specified in the site-specific QAPP.

- If large volumes of water will be generated, the water will be transferred into an appropriately sized polyethylene tank. The liquid IDW in the polyethylene tank will be characterized based on the analytical results of the well or wells sampled, or from a representative grab sample collected from the tank. The sample will be collected using a colliwasa, disposable point source bailer, or bomb sampler for discrete interval sampling within the polyethylene tank.
- After analytical data for the liquid IDW are obtained from the laboratory, the data will be directly compared to the hazardous waste concentrations presented in Table 1 in 40 CFR §261.24 (Attachment B). The liquid IDW will then be removed, and treated and disposed of by a certified hazardous waste contractor in accordance with the applicable waste characterization (Section 5.0).
- If only a small volume of water IDW will be generated, DOT-rated 55-gallon drums can be used for the temporary storage of water IDW pending analysis. Water IDW drums will be labeled and stored as described in Section 1.1.1, Soil IDW above.
- Water IDW in drums will be characterized and disposed of based on the characterization of associated investigation sample results (if collected and analyzed).
- If no associated investigation sample results exist, a composite water sample will be collected from each of the water IDW drums associated with a specific field activity. The sample will be used to characterize and dispose of the water IDW.
- The list of chemicals to be analyzed for is the same as the list for soil characterization (Attachment B).

5.0 DOCUMENTATION

Project staff are responsible for thoroughly documenting IDW handling and disposal activities. IDW personnel will be responsible for documenting the collection, transportation, labeling (if applicable), and staging or disposition of IDW. The documentation will be recorded with waterproof ink on a Waste Inventory Tracking Form (Attachment A) or in the sampler's field notebook with consecutively numbered pages. The information entered concerning IDW should include the following:

- Project Name
- PWT and subcontractor personnel
- Site location
- Type of activities
- Date waste generated
- Boring, well, or site number(s)
- Matrix
- Type of container(s) and identification number(s)
- Estimated volume
- Disposition of contents (roll-off/location, tank/location, temporary staging area)
- Waste characterization
- Comments (field evidence of contamination [e.g., PID reading, odors])

ATTACHMENT A

<u>Waste Inventory Tracking Form</u>

WASTE INVENTORY TRACKING FORM

Project Name: ____

PWT and Subcontractor Personnel:____

Site Location: ____

Type of Activities:____

Date Waste Generated	Borehole, Well, or Site #	Matrix	Type of Container (Plus ID#, if applicable)	Estimated Volume	Disposition of Contents	Waste Characterization	Comments (Field Evidence of Contamination [e.g., PID reading, odors])

Signature:____

ATTACHMENT B

<u>Maximum Concentration of Contaminants for the Toxicity Characteristic</u>

Maximum Concentration of Contaminants for the Toxicity Characteristic Leaching Procedure (TCLP)

EPA Hazardous Waste Number	Contaminant	TCLP Regulatory Level (mg/L)
D004	Arsenic	5.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100.0
D022	Chloroform	6.0
D007	Chromium	5.0
D023	o-Cresol	(1) 200.0
D024	m-Cresol	(1) 200.0
D025	p-Cresol	(1) 200.0
D026	Cresol	(1) 200.0
D016	2,4-D	10.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D012	Endrin	0.02
D031	Heptachlor (and its epoxide)	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D008	Lead	5.0
D013	Lindane	0.4
D009	Mercury	0.2
D014	Methoxychlor	10.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D010	Selenium	1.0
D011	Silver	5.0
D039	Tetrachloroethylene	0.7
D015	Toxaphene	0.5
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D017	2,4,5-TP (Silvex)	1.0
D043	Vinyl chloride	0.2

Notes:
(1)If o-, m-, and p- Cresol concentrations cannot be differentiated, the total cresol (DO26) concentration is used. The regulatory level of total cresol is 200 mg/L.
Source: 40 CFR 261.24 and WHWRR, Chapter 2, Section 3 (e)(ii).

PWT STANDARD OPERATING PROCEDURE

APPROVED: /s/ ____________
PWT Project Manager Date

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REVISION LOG		
Revision Number	**Description**	**Date**
1.0	Original SOP	July 2011
2.0	QA Review and Update	March 2012
3.0	QA Review and Update	October 2016

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
2.0	Annual QA Review	August 2013
2.0	Annual QA Review	September 2015

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to conduct decontamination of personnel and investigation equipment during environmental investigations. This SOP serves as a supplement to the site-specific Quality Assurance Project Plan (QAPP) and other approved project planning documents and may be used in conjunction with other SOPs.

2.0 REQUIREMENTS

The following sections identify the requirements for Quality Assurance / Quality Control (QA/QC), health and safety, and personnel qualifications for personnel and equipment decontamination.

2.1. Quality Assurance / Quality Control

Follow all QA/QC requirements identified for the project as identified in the QAPP and other approved project planning document(s).

2.2. Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses, any applicable Task-Specific HASPs prepared by PWT Subcontractors, and the associated Activity Hazard Analyses.

2.3. Personnel Qualifications

Personnel overseeing and performing decontamination activities will have knowledge and experience in the equipment and methods proposed, or will work under the direct field supervision of knowledgeable and experienced personnel. Personnel performing decontamination activities are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e)(3)(i), and must maintain a current training status by completing the appropriate annual 8-hour OSHA refresher courses. Personnel must also have read and signed the appropriate HASP(s). Prior to engaging in decontamination activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Only qualified personnel will be allowed to perform these procedures. Required qualifications vary depending on the activity to be performed. If work is being performed by a subcontractor, the subcontractor's project manager will document personnel qualifications related to this procedure in the subcontractor's project QA files.

3.0 MATERIALS AND EQUIPMENT

The following materials and equipment may be needed for personnel and equipment decontamination:

- Monitoring equipment and personal protective equipment (PPE) as outlined in the HASP.
- Decontamination equipment and supplies (e.g., wash/rinse tubs, nitrile disposable gloves, brushes, Alconox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled water and/or deionized water
- High pressure washer/steamer
- Four-foot long capped PVC casing for decontamination of submersible pumps

- Drums or other approved water-tight containers for containing decontamination sediment and fluids
- Materials necessary to construct an investigation site-specific decontamination facility, if required (e.g., heavy plastic sheeting, berming materials, sump pump, water tanks, roll-off bins)

4.0 PROCEDURES

This procedure describes the method for physically removing contaminants. It applies to chemical and radioactive decontamination of personnel and equipment used in field investigations. All equipment must be decontaminated before use at the project site, prior to sample collection, and before being removed from the project site. Decontamination of personnel, sampling equipment (e.g., soil sampling equipment and submersible pumps) and heavy equipment (e.g., hollow stem auger rigs, backhoes) is required to ensure the health and safety of personnel, reduce the potential for sample cross-contamination, and reduce the potential for contamination to enter or leave the project site on personnel or equipment.

4.1 Decontamination

4.1.1 Location of Decontamination Activities

Decontamination activities may take place either in the exclusion zone of the investigation site or at a decontamination facility designed to contain larger volumes of potentially contaminated fluids and materials, or at a combination of the two. Decontamination activities conducted in the exclusion zone will be limited to washing of personnel and small sampling equipment using wash tubs or wipes. Scraping of PPE and large equipment to remove adhered clumps of soil will also be performed in the exclusion zone.

Decontamination of heavy equipment or equipment requiring high-pressure washing will be performed at a decontamination facility designed to contain large volumes of washing fluids. The decontamination facility may consist of an investigation area-specific temporary facility constructed near the investigation site, or a decontamination facility central to the project site that may be used for multiple investigations. If a central decontamination facility is used, sufficient decontamination of equipment will be performed in the exclusion zone prior to moving to the central facility to reduce the potential for deposition of contaminated materials on roadways between the investigation area and decontamination facility.

Decontamination facilities will be constructed to limit the potential for contact of potentially contaminated materials (decontamination sediment and fluids) with environmental media (i.e., soil or water) in the decontamination area. This will be accomplished by performing decontamination activities in lined and bermed areas, and by containing decontamination sediment and fluids as they are generated.

4.1.2 Personnel Decontamination

The following steps will be used to perform personnel decontamination:

- Soil adhering to boots, apparel and equipment will be scraped off at the sampling or excavation site.
- Boots and outer apparel that will not be damaged by water will be washed with Alconox low-sudsing detergent and potable water and scrubbed with a bristle brush or similar utensil (if possible). Apparel will be rinsed with potable water.
- Coveralls removed (if used).
- Hard hat and other safety equipment removed and washed with Alconox and rinsed with potable water.

- Gloves and respirator (if used) removed.
- Personnel shall wash hands, face, and forearms before eating/drinking.
- Following decontamination, apparel will be placed in a clean area, on clean plastic sheeting to prevent contact with contaminated soil. If the apparel is not used immediately, the equipment will be stored in plastic sheeting or heavy duty trash bags.
- Disposable PPE will be handled in accordance with Section 4.1.1 of the PWT Investigation Derived Waste Management SOP.

4.1.3 Small Sampling Equipment Decontamination

Small sampling equipment consists of split spoons, sample bowls, scoops, hand augers, filtering devices, non-dedicated pumps, water level meters, and other such small equipment used in the exclusion zone or the immediate vicinity of the sample collection location. Small sampling equipment is designed to be decontaminated at the sampling location using small wash tubs. Decontamination of small sampling equipment does not require high-pressure washing or steam cleaning, or result in production of large volumes of decontamination sediment or fluids.

The following steps will be used to decontaminate small sampling equipment:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Soil adhering to equipment will be scraped off at the sampling site and containerized.
- Equipment that will not be damaged by water will be placed in a wash tub containing Alconox or equivalent detergent and potable water and scrubbed with a brush. Equipment will then be rinsed initially with potable tap water and then with distilled water.
- Equipment that cannot be submerged in water (e.g., air monitoring devices, electronic devices) will be carefully wiped clean using a sponge and detergent water or baby wipes.
- Wash and potable rinse water should be replaced frequently. Decontamination sediment and water will be handled as investigation derived waste (IDW) (see Section 4.1.6).
- Disposable sampling equipment will be handled in accordance with PWT's Investigation Derived Waste Management SOP.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting. If the equipment is not used immediately, the equipment will be covered or wrapped in plastic sheeting or trash bags.

4.1.4 Decontamination of Submersible Pumps

Submersible pumps used to conduct groundwater sampling will be decontaminated before being placed in the well. A decontaminated four-foot length of polyvinyl chloride (PVC) capped on one end will be utilized for this procedure. The following steps will be used to decontaminate submersible pumps:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Scrub the outside of the pump with a solution of Alconox or equivalent detergent and potable water and then rinse with potable water and distilled water.
- Fill the PVC tube with Alconox/potable water solution.

- Pump the solution through the submersible pump by lowering the intake tube of the pump to the bottom of the PVC tube. Be careful not to uncover the intake of the pump to prevent damage to the pump.
- Rinse the inside of the PVC tube with potable water to remove detergent and then fill the PVC tube with potable water.
- Pump the potable water through the pump. 5 to 10 gallons of potable water should be used, at a minimum.
- Repeat the rinse procedure with distilled water. 3 to 5 gallons of distilled or deionized water should be used, at a minimum.
- Decontamination sediment and water will be handled as IDW (see Section 4.1.6 below).

Following decontamination, the pump will be wrapped in plastic sheeting or trash bags and placed in a clean area.

4.1.5 Heavy Equipment Decontamination

Heavy equipment used within the exclusion zone and/or for intrusive activities (e.g., drill rigs and associated heavy drilling and sampling equipment, backhoes, sampling-related vehicles) will be decontaminated upon arrival at the project site, between investigation locations (i.e., between boreholes and test pits), and prior to leaving the project site. The following steps will be used to decontaminate heavy equipment:

- To reduce personal exposure, personnel will dress in suitable PPE in accordance with the HASP.
- Prior to use at the project site and between investigation locations (i.e., between boreholes, test pits), the portion of the equipment directly exposed to potential contamination (e.g., augers, drill rods, backhoe bucket) will be decontaminated by pressure washing the equipment at the decontamination facility.
- Drill rigs and vehicles will not require pressure washing between investigation locations unless they have become substantially dirty as a result of drilling or investigation activities.
- Prior to leaving the project site, all portions of the heavy equipment potentially exposed to contamination will be pressure washed using potable water at the decontamination facility. Special attention will be given to removing any soil or other site-related foreign materials on the equipment.
- Decontamination sediment and water will be handled as IDW as described in Section 4.1.6 below.

4.1.6 Decontamination Sediment and Fluids

Sediment and fluids from decontamination activities will be initially contained and stored in approved water-tight containers at the sampling site or decontamination facility. Each container will be labeled with its contents and the date using a paint pen, or permanent marker. As soon as practical, decontamination sediment and fluids will be transferred from the sampling site to a designated IDW management area. Handling of IDW is addressed by PWT's Investigation Derived Waste Management SOP.

4.2 Equipment Rinsate Sampling

Equipment rinsate blank samples may be collected to verify the effectiveness of the decontamination procedures. Equipment rinsate blank sampling is usually performed for small sampling equipment, rather than heavy equipment. The frequency of rinsate blank sample collection, as well as the analysis methods, will be specified in the site-specific QAPP. In general, the rinsate blank sample collection procedure will consist of rinsing decontaminated equipment with laboratory-grade deionized water and collecting the rinsate water in sample bottles provided by the analytical laboratory. Special attention will be given to rinsing the portions of the equipment exposed to environmental samples or potential contamination. Rinsate samples will be handled in the same manner as environmental and other QA/QC samples in accordance with PWT's Sample Handling SOP. Rinsate sample collection will be documented in the same manner as environmental and other QA/QC samples.

5.0 DECONTAMINATION DOCUMENTATION

Field personnel will be responsible for documenting proper sampling equipment and heavy equipment decontamination. The purpose of documentation is to demonstrate in the written field record that decontamination was performed in accordance with this SOP. Decontamination activities will be documented at least each day they are performed. The documentation will be recorded in a logbook or on appropriate project forms (i.e., boring log, sample field data sheets). The information recorded concerning decontamination will include:

- Date and times of decontamination
- Location of decontamination activities (i.e., sample site, central decontamination facility)
- Decontamination personnel and materials
- Decontamination steps/observations
- Other applicable information

PWT STANDARD OPERATING PROCEDURE

APPROVED: /s _______________ Date
PWT Program Manager,

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List of Attachments

REVISION LOG		
Revision Number	**Description**	**Date**
0	Original SOP	September 2015

ANNUAL REVIEW LOG		
Revision Reviewed	**Description**	**Date**
0	Annual QA Review	October 2016

APPROVED: ______________/s______________ ____________________
PWT Program Manager, Date

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used for collection of indoor dust samples for chemical analysis during environmental investigations. This procedure applies to collection of dust from a variety of indoor living space and attic surfaces, including level loop and plush pile carpets and bare floors (wood, tile, or other). Attic sample collection procedures vary slightly from collection of other indoor dust samples, and are discussed separately. This SOP serves as a supplement to site-specific Health and Safety plans and the project-specific Quality Assurance Project Plan (QAPP).

This SOP is intended to be used in conjunction with other SOPs produced by Pacific Western Technologies, Ltd. (PWT) for environmental support operations on contracts for the United States Environmental Protection Agency (USEPA).

2.0 REQUIREMENTS

The following sections identify the requirements for collection of indoor dust samples.

2.1 Key Words

Indoor Dust; Attic Dust; Dust Sampling; Residential Sampling.

2.2 Quality Assurance / Quality Control (QA/QC)

Follow all QA/QC requirements as identified in the approved project planning document(s) such as the project-specific QAPP and this SOP. Guidance documents referenced during SOP development are identified in Section 2.6.

2.3 Health and Safety

Follow health and safety requirements identified in the Site-Specific Health and Safety Plan (HASP), Job Safety Analyses (JSAs), any applicable task health and safety plans prepared by PWT subcontractors, and the associated Activity Hazard Analyses (AHAs).

2.4 Personnel Qualifications

Personnel planning to perform indoor or attic dust sampling activities will have knowledge and experience in the required equipment and methods, or will work under the direct supervision of knowledgeable and experienced personnel.

2.5 Definition

The dust sampling approach described in this SOP uses a High Volume Small Surface Sampler (HVS3). This specialized vacuum is designed to collect dust samples for chemical analysis, and is shown in Figure 1. Attic sampling will be completed using a specialized attic sampling attachment for the HVS3.

2.6 Guidance Documents and Reference SOPs

The following PWT SOPs should be used in conjunction with this Indoor and Attic Dust Sampling procedure:

- PWT-ENSE-402 Spatial Data Submittals
- PWT-ENSE-406 Sample Handling
- PWT-ENSE-423 Investigation Derived Waste Management

- PWT-ENSE-424 Personnel and Equipment Decontamination

In addition to the listed SOPs, this indoor dust sampling procedure is consistent with USEPA's Guidance for the Sampling and Analysis of Lead in Indoor Residential Dust for Use in the IEUBK Model (USEPA, 2008). The following supplemental information was also considered in development of PWT-ENSE-430, Indoor and Attic Dust Sampling.

- ASTM D5438-11: Standard Practice for Collection of Floor Dust for Chemical Analysis
- CS3-Inc.: High Volume Small Surface Sampler (HVS3) Operation Manual.

3.0 MATERIALS AND EQUIPMENT

This procedure is intended for use with the CS3 HVS3 unit. A schematic of the HVS3 is shown in Figure 1. The equipment consists of the following components:

- Nozzle – The edges and corners of the sampling nozzle are rounded and smooth. This prevents the nozzle from snagging on any carpeted material which may be encountered. Nozzle construction allows for sufficient suction to separate loose particles from the bare floor or carpeted surface and carry them to the cyclone. The nozzle is 12.5 centimeters (cm) long, and 1 cm wide, with a 13-millimeter (mm) flange which tapers to the nozzle tubing at an angle equal to or less than 30 degrees. This configuration allows the nozzle to perform with the appropriate velocities when operated correctly.
- Cyclone – The cyclone is constructed such that the air flow allows for separation of particles of 5-microns in diameter (or larger). The cyclone shall be made of aluminum or stainless steel. A spare cyclone should be kept on hand if possible.
- Catch Bottle – The catch bottle will be purchased from an appropriate environmental supply company, and shall meet the requirements of the analytical laboratory. Catch bottles must be transparent so that the operator can see the sample as it is collected. Bottles should be 250-mL low-density polyethylene (LDPE) or fluorinated ethylene propylene.
- Flow Control System – The flow control system allows for substantial volume adjustment. The suction source is capable of drawing 12 liters per second (L/s) through the system with no restrictions other than the connected nozzle, cyclone, and flow control system. A commercial vacuum cleaner may be modified for this purpose by the HVS3 manufacturer.
- Gaskets – Gaskets in joints will be made of an inert material appropriate to avoid sample contamination, and to prevent air leakage.
- Flow Measuring and Suction Gages – Magnehelic gages are used to measure the pressure drop at the nozzle and for control of the flow rate for the entire system.

Other equipment and materials necessary to perform the work described in the SOP include:

- Digital scale accurate to 0.1 grams, for weighing samples
- Stopwatch
- Two measuring tapes for sampling area layout, OR pre-cut, plastic templates for delineating sampling areas. Template size may vary, but a 2-foot by 2-foot or 3-foot by 3-foot template is recommended
- Masking tape (painter type masking tape is suggested, to allow for easy and damage free removal)

- Marking pens
- Nitrile gloves
- Safety glasses
- Manila envelope or file folder for leak check
- Thermometer
- Relative humidity meter
- Inclined manometer for instrument calibration
- Alconox (or equivalent) and brush for decontamination
- Squeeze bottle containing deionized water
- Squeeze bottle containing soap solution (Alconox or equivalent)
- Squeeze bottle containing reagent grade methanol
- Fine silica for blanks
- Kim-wipes
- Hand tools (screw driver, wrenches, etc)
- Extra sample catch bottles and caps
- Zip-top plastic bags
- Stainless steel tray or clean sheets of paper/foil
- Digital camera
- Sample labels
- Appropriate field forms and SOPs

Additional equipment for attic sampling includes:

- HVS3 Microvac Attic Sampling attachment
- Tyvek protective suit

4.0 PRIOR TO SAMPLING

4.1 Indoor Dust Sampling Methodology

This SOP describes the use of the HVS3 to collect indoor dust samples for chemical analysis. Surface dust particles are collected from the carpet or the bare floor by means of vacuum-induced suction. Particles enter the HVS3 through the sampling nozzle. The recommended pressure and flow rate are dependent on the type of surface being sampled, but must be sufficient to generate the velocity required to liberate the dust particles from carpeted and bare floor surfaces into the sampler air stream. The nozzle is designed to move across the floor with minimal resistance while still maintaining a seal to collect the sample.

Dust flows into the cyclone, which collects most particles larger than 5 microns in diameter. Sample collection utilizes centrifugal force. Larger (heavier) particles move to the outside wall of the cyclone and then slide down into the catch bottle (sample container) threaded onto the bottom of the cyclone. The sample container may then be capped and labeled for sample storage and shipment. Refer to PWT-ENSE-406, Sample Handling for details on sample labeling, storage, and shipment. Smaller particles remain in the air stream and flow out the exhaust tube. The cyclone collects an average of 99 percent of the surface dust picked up by the nozzle. Any dust that is not captured in the sample container moves through the fan and is retained in the vacuum cleaner bag. This material will not be sent for chemical analysis.

4.2 Equipment Calibration

The HVS3 sampling process does not require any internal calibrated flow devices. The cyclone is designed to create separation of particles at various flow rates throughout the range of operational flowrates the system can produce. As a result, there is not a requirement to regularly calibrate the HVS3. Pressure gages (Magnehelic gages) should be calibrated against a primary standard at the start of each day they will be used for sampling. Adjust the flow rate and the nozzle pressure drop to values that approximate those given in Section 6.2 of this SOP.

Pressure gages shall be calibrated against an inclined manometer or other primary standard. One means of checking a Magnehelic gage is to set a flow rate through the sampling system with a manometer, then switch to the Magnehelic gage. This process should be repeated at two different flow rates. If the difference in the readings is more than 3%, the gage is leaking, or is in need of repair or recalibration. The gage should be tagged "DO NOT USE" and taken out of service. Results of calibration should be recorded in the field logbook.

4.3 Leak Check

Prior to using the HVS3 to collect samples, a leak check shall be performed to verify that the equipment has been assembled correctly. The leak check shall be completed as follows:

- Place a thick manila envelope or a file folder underneath the nozzle to seal off the opening.
- Turn on the HVS3. The flow Magnehelic gage should read 0-0.02 inches of water to ensure the system is not leaking.
- If leakage is suspected, and the gage reads more than 0.02 inches of water, check all gaskets and check tightness of clamps, catch bottle, and material covering the nozzle opening.
- Once all connections have been verified, recheck the flow to the Magnehelic gage to make sure it reads less than 0-0.02 inches of water before beginning sampling.
- If the HVS3 is unable to pass the leak check after connections have been verified, tag the equipment "DO NOT USE" and contact the project manager for instructions.

4.4 Pre-Sampling Questionnaire and Pre-Test Survey

Owners and/or occupants as appropriate (hereafter referred to as "residents") of properties identified for indoor dust sampling will be contacted in advance to schedule a time for indoor sampling to occur. At the time that the sampling is scheduled, residents will be asked to maintain normal cleaning routines prior to sampling.

Upon arrival at the home for indoor sampling, a member of the field team will discuss the work to be completed with the residents. Through this discussion, the field sampler will identify appropriate sampling locations within the home, based on the information provided about how the space is used. The sampler will confirm the most frequently occupied areas of the home, the most frequently used doors to the outside, and whether any children sleep in the home (children's bedrooms will be sampled if available).

In order to better understand variables which are known to impact indoor dust, an Indoor Dust questionnaire (see Attachment 1) will be completed as part of dust sampling activities. One of the samplers will complete the questionnaire with the resident head-of-household if available, or with another resident of the house if necessary. Completion of the questionnaire is required prior to selection of sampling areas within the home. Some of the factors known to impact indoor dust include pets, occupation, smoking habits, age of residence, primary heating source, floor surface (carpet vs hard surfaces), cleaning equipment, cleaning habits, and resident hobbies.

4.5 Selection of Indoor Dust Sampling Locations

Sample collection locations are specified in the QAPP to include the main entryway (most frequently used entryway), the floor area of the most frequently occupied room (usually the kitchen or living room), and the floor of a child's bedroom (or any bedroom if there is not a child living in the home). A minimum of 3 and a maximum of 5 samples will be collected in each home.

The total floor area vacuumed to obtain dust for each sample will depend on the amount of dust present. The floor area sampled will be measured and recorded on the sampling form to allow calculation of the metals loading rate for each sample from the resulting analytical data. Sampling efforts at a location will continue until a minimum of 20 grams of sample is collected, or at least enough dust to completely cover the sample container. If the initially defined sampling area (or the template, if one is used) do not provide enough sample material, a second area immediately adjacent to the first should be defined, and sampled. The sampling form should indicate the total area sampled (the initial area which yielded an insufficient sample + the additional area, typically equal to the initial area times 2). If not enough dust is present in the individual room samples, samples from multiple living areas in the home may be composited. <u>However, attic samples (see below) will not be composited with discrete or composite samples from living areas under any circumstances</u>.

Attic dust sampling will be conducted only at those residences where the attic can be routinely accessed (e.g., by stairway, ladder/trap door, etc.) and is used by the resident for storage. One composite sample of attic dust will be collected in each home where the attic is accessible and used.

5.0 DOCUMENTATION

All forms required are provided as attachments to this SOP. Other documentation, such as information to be recorded in field log books, is described in this section of the SOP.

5.1 Sample Forms

The pre-sampling questionnaire must be completed prior to selection of sampling locations. The questionnaire may have some lines completed prior to samplers arriving at the house, if the information was obtained from the homeowner or resident over the telephone while scheduling sampling. This information should be verified on the day of sampling.

In addition to the Pre-Sampling Questionnaire, samplers will start an Indoor Dust Sample Information Form immediately prior to sampling. This form will be completed during sampling for each area sampled.

For all field documentation: All lines on the forms must be filled in. In cases where a given item may not apply, mark that space "N/A". Forms should be completed in accordance with PWT-ENSE-406.

5.1 Sample Identification

The sample identification scheme for indoor dust samples is presented in the project- specific QAPP, and a typical example is summarized here for sampler convenience.

The first part of the sample name is a letter designating the matrix sampled, D for indoor dust, followed by a unique four digit parcel code assigned by the PWT Team. The second part of the sample name identifies the feature sampled at the property. The final part of the sample name is a letter to designate other sample information, such as QC sample type.

For example, the sample name D1402-E-DUP refers to a dust sample collected from the main entryway at property 1402. The sample is a duplicate/replicate sample, as indicated by the trailing letters "DUP".

The features which might be sampled and the associated feature codes assigned are as follows:

For Dust:

E = main entryway

K = kitchen

L = living room

B = bedroom, if more than one bedroom is sampled, expand to B1, B2, etc.

C = residence living area composite sample (in case sufficient material could not be obtained for discrete samples)

A = attic

A unique CLP number will be assigned to each sample in addition to its sample identification as described above. Both identifications will be recorded on the sample label and the chain-of-custody.

6.0 FLOOR DUST SAMPLING PROCEDURE

Indoor Dust Sampling activities shall be conducted as follows.

6.1 Preparing the Sampling Area

The areas to be sampled will have been determined during completion of the Pre-Sampling Questionnaire. First, mark off the area to be sampled. This may be done by one of two methods. Regardless of which method is used, the sampled area should be at least 3 feet from any outside door, and the dimensions of the area will be recorded on the field form. When laying out the sampling area, it is important to leave enough space around the perimeter of the sampling area to allow for samplers to move and for operation of the HVS3 to the full extent of the sampled area.

A pre-made sampling template may be used or the area may be measured and taped with masking tape. If a pre-made sampling template is to be used, wipe the template with a clean laboratory tissue and place the template on the floor in the area to be sampled. Use masking tape to temporarily hold the template still during sampling.

To sample from a measured area, instead of a pre-made template, the procedure is as follows. Place two measuring tapes on the floor parallel to each other on either side of the main traffic path through the area. The tapes should be approximately 2 feet to 5 feet apart and be extended as far as the space will permit. Masking tape will be placed along the tape measures for a distance of approximately 3.5 feet for carpet or rugs, and as large as possible for bare floors, (this distance may be increased (space permitting) if sufficient sample volume cannot be collected in the initial area).

If a pre-made sampling template is used, distance marks will already be available. If a template is not used, begin at the same end of each piece of masking tape, and use a permanent marker to make a small mark every 3 inches and a larger mark every 12 inches along the tape. Individual sampling strips are determined by the size of the HVS3 nozzle, and are approximately 3 inches wide.

6.2 Adjusting the HVS3 Nozzle Suction and Flow Rate

Clean the wheels and nozzle tip of the HVS3 with a clean laboratory tissue before sampling. Place the HVS3 sampler in the lower left corner of the sampling area. Adjust the flow rate and pressure at the nozzle according to the surface to be sampled.

The pressure at the nozzle is a function of the flow rate and the distance between the surface and the nozzle. The nozzle position is regulated by the height control knob on the back of the HVS3 and the nozzle level adjustment knob on the front side of the nozzle. A butterfly valve located on the control tube downstream of the cyclone regulates the flow rate, which is measured by the pressure across the cyclone. Higher flow rates produce higher pressures. The nozzle position adjustment allows for the complete system to be regulated.

To use the HVS3 on hard surfaces or level loop carpet (typical commercial type carpeting), adjust the height of the nozzle until the bubble level is centered. If the HVS3 is close to the position required, but the bubble is not quite centered, use the nozzle level adjustment knob to fine tune the adjustment. Then, set the flow rate with the butterfly valve. To check the flow rate, tip the HVS3 unit forward and check the flow on the Magnehelic gage. The flow should read at least 5 cubic feet per minute (cfm).

Next, read the pressure across the nozzle. The pressure should be approximately 9 inches of water. If the pressure reading is not 9 inches, recheck the flow and/or check that the nozzle is still level and make adjustments accordingly.

To use the HVS3 unit on plush or shag carpet, read the pressure across the nozzle and set the pressure to approximately 9.5 inches on the nozzle gage. The pressure can be set by using the height adjustment knob and the level knob to keep the nozzle level. Next, set the flow rate with the butterfly valve for approximately 20 cfm, 8 inches of water. Then re-check the pressure across the nozzle. The pressure has likely increased due to the increased flow rate. Reset the pressure to 9.5 inches of water using the height adjustment knob. Then recheck the flow rate and reset it to 20 cfm, 8 inches of water. It may take multiple small adjustments to achieve the targeted flow rate of 20 cfm, 8 inches of water, and nozzle pressure of 9.5 to 10 inches of water.

Once the pressure and flow rate have been properly adjusted and verified, attach the sample container to the HVS3.

The manometer fluid should be replaced at least annually per manufacturer instructions.

6.3 Operating the HVS3 Unit

The HVS3 unit functions best when the handle is locked in the fixed position at a 45 degree angle. This is done using the level at the bottom of the handle. This will allow the HVS3 unit to move forward and backward in a smooth motion.

Starting at the bottom left corner of the sampling area, collect the sample by moving the nozzle forward in a straight line from one end of the sample area to the other at a speed of about 2 feet per second. When the first pass is complete, the unit is pulled directly backwards over the same strip of floor. This is repeated 4 times for each strip of the sampling area. For the next strip, the nozzle is angled slightly to the right to the adjacent section of floor and the HVS3 is moved forward and backward 4 times. This is repeated until all strips have been sampled, or there is enough sample in the catch bottle (sample container).

After sampling the floor area within the pre-made template or the pre-measured floor area, check the amount of dust in the catch bottle. At a minimum, there must be enough dust to completely cover the bottom of the sample container. If possible, 20 grams of dust should be collected. This quantity of dust is needed to allow for loss during sieving at the laboratory and to provide sufficient volume for laboratory duplicate, QA/QC, or re-analysis. Hair, carpet fibers, and other large objects should be excluded from consideration when visually evaluating how much dust has been collected.

If the sample volume is insufficient, sampling personnel will designate/mark another sample location immediately adjacent (if possible). If an adjacent area is not available to be sampled, then a similar high traffic area, frequent occupancy room, or bedroom should be selected to provide the additional sample volume.

The additional material will be collected using the same method, as described above. When a sufficient amount of dust has been collected, turn off the HVS3 unit. Remove the sample container and attach the screw on lid. Record the total dimensions of the sampled area on the Sample Information form. Weighing the dust sample will follow the procedure described in Section 10.

6.4 Cleaning the HVS3 Unit

The HVS3 unit will be decontaminated after collection of all dust samples at a residence (including both Living Space samples and the Attic sample). If the attic will not be sampled, follow this decontamination procedure after completion of indoor dust sampling at a residence and before beginning sampling at the next residence.

Rubber/nitrile gloves and safety glasses shall be worn while cleaning the HVS3 unit. With the sample container removed and safely stored, open the flow control valve to maximum flow, tip the sampler back so the nozzle is approximately 2 inches off the floor, and switch the vacuum on. Place a hand covered by a clean rubber glove on the bottom of the cyclone and alternate closing and opening the cyclone for 10 seconds to free any loose material adhering to the walls of the cyclone and tubing.

Remove the HVS3 unit to a well ventilated area free of dust (e.g. field truck or van, field office) for wet cleaning. Remove the cyclone and elbow at the top of the nozzle tubing from the sampling unit. Hold each section of the HVS3 over the methanol waste container and rinse with reagent grade methanol using a squeeze bottle. After rinsing, use Kim-wipes wetted with methanol and a brush to clean each section of the sampler. Then use Kim-wipes wetted with methanol to clean the gaskets and connections between each section of the tube. Use Kim-wipes wetted with methanol to clean the previously used cleaning brush.

Allow all equipment to air dry. The equipment must be completely dry before sampling again. The clean sections of the HVS3 unit can be placed in or on a clean container to air dry. Once the inside of the individual sections are dry, re-assemble the HVS3 unit. Conduct a leak test at the next sample location to ensure all clamps and gaskets have been assembled correctly.

An equipment blank will be collected every 20 decontaminations. Equipment blank sample collection will follow the procedure described in Section 9.

7.0 ATTIC DUST SAMPLING

Attic Dust Sampling activities shall be conducted in generally the same manner as living space dust samples. **Never composite Attic dust with Living Space dust.**

Attic dust will only be sampled in homes where the attic is used for storage and can be routinely accessed (by stairs, ladder/trapdoor, etc). If vermiculite or asbestos is identified in the attic, no sampling work will be conducted. Dust will be collected directly from exposed horizontal surfaces in the attic, such as rafter tops or flooring. The dust will be collected from an area of the attic not likely to have been disturbed over time (if possible). Attach the attic dust sampling attachment to the HVS3 unit. Complete a leak test at the nozzle, as described in Section 4.3. After a satisfactory leak check, attach a clean sample container.

The attic dust sampling procedure is as follows:

Sampled areas in the attic will be measured and areas will be calculated and recorded on the Sample Information Form. It is anticipated that space in attics will be limited, and it may be difficult to identify a suitable area for sampling. When space allows, areas to be sampled should be pre-measured and delineated with masking tape prior to sampling. Pre-made templates may be sized to fit in typical attic spaces and used to delineate sampling areas if space does not typically allow for pre-measuring custom sampling areas. It is also acceptable to measure the area after sampling is complete.

Once the space to be sampled has been identified and delineated with masking tape and/or the pre-made attic sampling template, sampling can proceed in accordance with the floor sampling procedure described in Section 6. Sampling should continue until adequate sample volume has been obtained, or until there are no more suitable locations to sample within the attic. Decontamination of the HVS3 and the HVS3 attic sampling extension will be completed as described in Section 6.4.

8.0 SAMPLE HANDLING

Samples will be preserved, stored, and handled in accordance with the project specific QAPP and PWT-ENSE-406, Sample Handling.

9.0 EQUIPMENT BLANKS

Equipment blanks or rinse blank samples will be collected after completing decontamination procedures as described in Section 6.4. For this project, equipment blanks shall be collected at the rate of one blank for every 10 decontaminations performed. Equipment blanks will be collected by vacuuming fine silica or powder through the collection device into a sample container. The material will then be submitted to the laboratory for the same analysis as the investigative samples. Laboratory grade methanol at least 99.5% purity will be used for decontamination; no source blank will be required.

10.0 SIDE BY SIDE REPLICATES

Replicate dust samples will be collected at a frequency of one per 20 dust samples collected. The replicate sample will be collected using the same procedure used for the investigative sample (as described in Section 6), from a floor area immediately adjacent to the investigative sample. Replicate samples will have the same identifier as investigative samples, with the addition of a trailing letter "D" to indicate it is a replicate/duplicate sample (as described in Section 4.1).

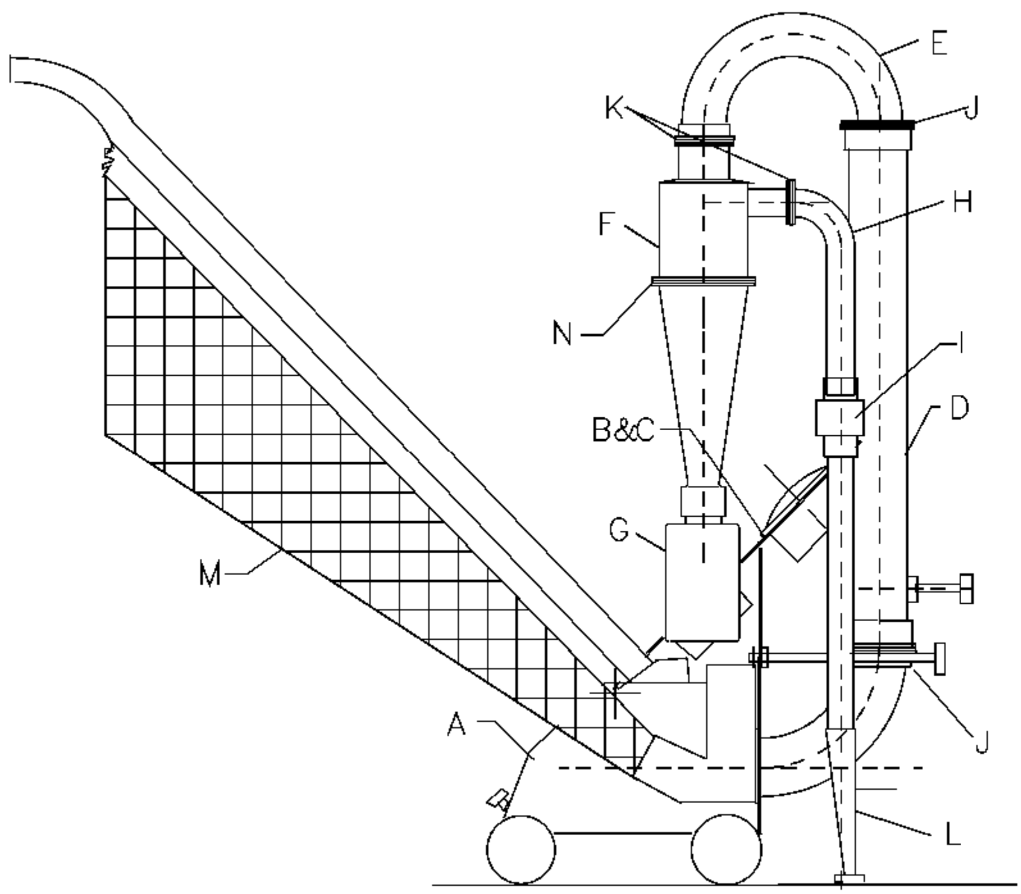
11.0 REFERENCES

ASTM-D5438-11, 2011. Standard Practice for Collection of Floor Dust for Chemical Analysis. American Society of Testing and Materials (ASTM) International. August.

CS3, Inc., 2001. High Volume Small Surface Sampler (HVS3) Operation Manual. Jack Hirsch.

US Environmental Protection Agency (USEPA), 2008. Guidance for Sampling and Analysis of Lead in Indoor Residential Dust for Use in the Integrated Exposure Uptake Biokenetic Model (IEUBK). Technical Review Workgroup for Metals and Asbestos, Lead Committee. OSWER 9285.7-81. December.

Figure 1 – High Volume Small Surface Sampler (HVS3) Schematic



* Refer to parts description Table on following page for identification of parts A through N

HVS3 Parts Description Table

Part #	Qty.	Description
A	1	Model 1020D Vacuum Platform
B	1	Mounting Plate with Magnehelic mount
C	2	Magnehelic gages, 0-15" & 0-10"
D	1	Control valve tube
E	1	U-Tube
F	1	3"diameter Aluminum Cyclone
G	1	P.E. or (F.E.P.) Catch Bottle
H	1	Cyclone Inlet Elbow
I	1	Tygon or (F.E.P) Flex Joint
J	2	2" clamps with gaskets
K	2	11/2” clamps with gaskets
L	1	Suction Nozzle with level
M	1	Vacuum Filter Bag
N	1	3" clamp with gasket

ATTACHMENT A
Field Forms

Indoor Dust Sampling Field Forms

Resident Questionnaire

Samplers:____ **Date:______________**

Property Code	PC-
Property Address	
Most frequently used entry	Front Door Back Door Side Door Other:___________
Most frequently occupied room	Living Room Kitchen Other:________________
Attic access method	No Access Stairs trapdoor w/ ladder trapdoor w/out ladder
Attic access frequency	1 time/wk 1 time/month 1-2 times/year Less than 1/year
Is the attic used for storage?	Yes / No
Is the attic used for living space? If Yes, Describe use	
Number of occupants (inc ages)	
Dwelling type (circle)	Single Family MultiFamily Mobile Home Other:__________
Year Built (inc dates for fences and outbuildings, if known)	
Name of Resident Interviewed	
Resident Occupation	
Own or Rent?	
Name of property owner	
Construction characteristics	Foundation type, etc
Remodel/Renovation history (project/date)	
When were interior walls/trip last painted?	
Years lived in home	
Years owned home	
List pets	
Where do pets sleep?	
Smoking habits	
Fireplace/wood stove use	
Primary heat source	
"Shoes off" policy in the house	
Vacuuming habits (typical and most recent)	
Type of vacuum	
Aware of attic dust entering house? (if yes, describe)	
Aware of holes where attic dust might enter house? (if yes, describe)	

Indoor Dust Sampling Field Forms

Sample Information

Property ID Number: PC-____________ Date:____________ Start/End Time:______/______

Project: Colorado Smelter CSSA RI Sampler(s):__________ Company:___________

Sample ID:			Sample Type:	Living Space	Attic	
Sample Location (room or entryway sampled)		Floor Type (carpet, wood, concrete, vinyl, tile, other)		Rug Type (Plush, level loop, flat, multilevel, shag or area rug)		Wall-to-wall carpet or Area Rug
Area Sampled (SqFt)	Sample Time	Weight Before (grams)	Weight After (grams)	Sample Weight (grams)	QA/QC QC (Sample ID or NA)	Vacuum Sampling Duration (sec)

Sample ID:			Sample Type:	Living Space	Attic	
Sample Location (room or entryway sampled)		Floor Type (carpet, wood, concrete, vinyl, tile, other)		Rug Type (Plush, level loop, flat, multilevel, shag or area rug)		Wall-to-wall carpet or Area Rug
Area Sampled (SqFt)	Sample Time	Weight Before (grams)	Weight After (grams)	Sample Weight (grams)	QA/QC QC (Sample ID or NA)	Vacuum Sampling Duration (sec)

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Sample ID:			Sample Type:	Living Space	Attic	
Sample Location (room or entryway sampled)		Floor Type (carpet, wood, concrete, vinyl, tile, other)		Rug Type (Plush, level loop, flat, multilevel, shag or area rug)		Wall-to-wall carpet or Area Rug
Area Sampled (SqFt)	Sample Time	Weight Before (grams)	Weight After (grams)	Sample Weight (grams)	QA/QC QC (Sample ID or NA)	Vacuum Sampling Duration (sec)

Indoor Dust Sampling Field Forms

Sampling Equipment Information

Property ID Number: PC-_____________ Date:_________

Sample Equipment: HVS3

Leak Check (Yes/No):________ 10-second cleaning after sampling (Yes/No):__________

Nozzle Flow Rate:___________ Nozzle Pressure Drop:________

Calibration Verification:

Magnehelic Reading:_________ inches water Manometer Reading:_________ inches water

Sample Equipment: HVS3 Connected to Attic Sampling Extension (NA if Attic not sampled)

Leak Check (Yes/No):________ 10-second cleaning after sampling (Yes/No):__________

Nozzle Flow Rate:___________ Nozzle Pressure Drop:________

Calibration Verification:

Magnehelic Reading:_________ inches water Manometer Reading:_________ inches water

Analyses: Total Metals by 6020B (ICP-MS) and Mercury by 7470 (CVAA)________________________

Visitors:____

Comments/Observations:____

____

____

____

____

Sampler Name and Signature:____

Reviewer Name and Signature:____

PACIFIC WESTERN TECHNOLOGIES, LTD. 3000 Youngfield Street, Suite 300, Wheat Ridge, CO 80215 • 303.274.5400 • FAX 303.274.6160

July 14, 2014

Subject: **Request for Information for Surveying Services**
Colorado Smelter Site – Operable Unit 1
Pueblo, Colorado

Pacific Western Technologies, Ltd (PWT) is interested in obtaining a quotation from your company for property (including property features) surveying services. The Subcontractor shall provide all labor, material, and equipment/tools needed to complete the scope of work described below.

Site History

The Colorado Smelter (also known and the Colorado Smelting Company and the Eiler's Smelter) was one of five smelters in Pueblo at the turn of the last century. This smelter processed silver–lead ore from the Monarch Pass area and operated from 1883 to 1908. There is one steel mill (Evraz/Rocky Mountain Steel/Colorado Fuel & Iron (CF&I)) located to the south that is still operating and that the state Resource Conservation and Recovery Act (RCRA) program is involved with.

Surveying Scope of Work

Assume 1200 properties will be inventoried. Each property will be drawn to scale within an accuracy of 10 percent and will neatly depict yard features such as:

- house
- front yard
- back yard
- side yards (as separate features)
- paved and unpaved driveways
- drip zones
- children's play areas
- buildings
- decks
- trees
- tree lines
- shrubs
- flower beds
- gardens
- play areas
- driveways
- sidewalks

For the following areas, a center point shall be established for each feature:

- house
- front yard
- back yard
- side yards (as separate features)
- unpaved driveways
- drip zones
- children's play areas
- unpaved alleyways
- flower beds
- gardens
- play areas
- driveway

Drip zone center points shall be established by selecting one corner of the house.

Provide calculated area values for each feature that has an established center point.

Deliverable

All point survey data shall be delivered in state plane coordinates in a Microsoft Excel table. In addition, a description of the points will be added. Survey data report shall also document the type of survey instrument used, survey tolerance, and evidence of survey controls points used to establish accuracy. Provide individual map quality figures showing each property including all labeled property features, surface area calculations, and established center points. Drawing accuracy and neatness are critical, and an example is provided in Figure 1.

For this quotation, assume that property utilities will not be included.

General Requirements
All work shall be conducted in full compliance with all applicable local, state, and federal laws, rules, and regulations, and in accordance with PWT's Site-Specific Health and Safety Plan. The Plan will be provided prior to the commencement of any work.

The tentative start date of this work is early September 2014; therefore, the quotation shall be submitted on or before July 25, 2014, and that you have the capacity to complete this work on a minimum 40 property per week schedule. Please submit your quotation completed and signed by an authorized representative of your company, via e-mail to me at taustin@pwt.com and to Steve Singer at ssinger@pwt.com. If you have any questions or comments regarding this request for information, please call me at (303) 274-5400 x34.

Sincerely,

Travis Austin
Pacific Western Technologies, Ltd.
3000 Youngfield Street, Suite 300
Wheat Ridge, CO. 80215
Ph: (303) 274-5400 ext.34
Fax: (303) 274-6160
www.pwt.com