WILLIAMS GAS PIPELINE - NORTHWEST PIPELINE CORPORATION
STANDARD OPERATING PROCEDURE
GRID-BASED SOIL SAMPLING PROTOCOL

1.0 METHODLOGY OVERVIEW

This standard operating procedure (SOP) specifies the rationale, methodology, and procedures for using a single fixed sampling grid for both pre-remedial investigation and for establishing the general extent of remedial excavation (if necessary). Some facilities where this SOP will be applied have been previously remediated. At those facilities the pre-remedial investigation sampling will include limited sub-surface sampling using the same sampling grid to assess the adequacy of the prior remediation. Performance sampling will typically be performed only from: (1) the bottom of a remedial excavation, but also using the same sampling grid established for the pre-excavation site surface and (2) from excavation sidewalls. The methodology for using the data resulting from grid-based sampling for remedial excavation purposes will be presented in the Standard Operating Procedures for Establishing Limits of Remedial Excavation to be provided to the Washington Department of Ecology (Ecology) with the site-specific Cleanup Action Plans (CAPs).

It should be acknowledged that this SOP may be modified on a site-specific basis in order to achieve the data quality objectives for this project. Site-specific modifications to this protocol, and the technical rationale for those modifications, are detailed in the Site Investigation Work Plans for individual facilities associated with the Northwest Pipeline Corporation's Capacity Replacement Project (CRP). The CRP facilities where the SOP will be applied include mostly meter stations (M/Ss) used to measure gas volumes and some compressor stations (C/Ss) used to compress gas in order to maintain system pressure.

2.0 DATA QUALITY OBJECTIVES

The Data Quality Objectives (DQOs) of the grid-based sampling protocol are to:

- Collect soil samples of sufficient quantity and quality for mercury analysis to assess the lateral distribution of impacts,
- Collect subsurface soil samples of sufficient quantity and quality for mercury analysis to assess the current vertical distribution of impacts at those facilities where soil remediation has previously been performed,
- Characterize the extent of impacts and attain data closure to an appropriate cleanup level,
- Identify target areas for remediation, and
- Defensibly verify attainment of an appropriate cleanup level following remediation.

It has been Williams Gas Pipeline's (Williams') experience that the grid-based sampling protocol presented below has the ability to attain the DQOs in the vast majority of cases. In the event that the grid-based sampling approach does not attain the DQOs, adjustments and modifications will be made on a site-specific basis.

3.0 TECHNICAL RATIONALE FOR GRID-BASED SAMPLING APPROACH

The grid pattern to be used is an equilateral triangular grid with a spacing of 10 feet between adjacent points. The technical basis for selecting an equilateral triangular grid pattern with a spacing of 10 feet between adjacent grid points includes:

- For identifying "hot spots," a triangular grid is efficient. It reduces the size of the identified area, compared to other grid patterns with the same number of samples covering the same area (Gilbert, R.O., *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, 1987).

- A sample location spacing of 10 feet yields a sampling density of at least one sample per 87 square feet. This sampling density is consistent with similar projects undertaken for remediation at natural gas pipeline facilities.

- A fixed-grid sampling scheme enables statistical calculation of the likelihood (or confidence) of detecting a given size of a "hot spot" that may remain after remediation. A grid spacing of 10 feet provides a 50% or greater confidence level for detecting a circular "hot spot" (if one exists) with a radius of about 3.5 feet or larger (*i.e.*, it is more likely than not that such an area would be detected). This grid spacing provides a 90% confidence level for detecting a circular "hot spot" with a radius of about 5 feet or larger.

- Regulatory guidance typically does not specify an "acceptable" sampling density (*e.g.,* number of samples for a discrete area). However, USEPA guidance related to characterization and verification sampling for PCBs (*Subparts N and O,* respectively, of 40 CFR 761) are exceptions. The conditions relevant to the sample design are similar for the Williams' M/S facilities and the PCB spill scenarios. Specifically, the origin of the contamination is defined and there is an expectation of some consistency to the spatial variability in concentrations.

Williams' experience at the CRP and similar M/S facilities indicates that the highest mercury levels in soils have been associated with either: (1) facility doorways and near the edges of concrete slabs at those facilities where the metering equipment is housed indoors and where slabs are present beneath metering equipment, or (2) as a point source immediately beneath metering equipment at locations where the equipment is underlain by a permeable surface. Williams' experience also indicates that detected concentrations will then decrease in a consistent fashion with increasing distance from a doorway, slab edge, or point source location. Given the surficial nature of the release, Williams has also found that mercury concentrations attenuate rapidly with depth and it is uncommon those impacts exceed 12 inches in depth.

Accordingly, as many of the M/S facilities in Washington have gravel/dirt floors, the grid pattern will be laid out using the likely source area at a particular site as an origin. Figure 1 presents a typical grid pattern for investigation of a point source over a permeable soil surface. For the facilities with concrete floors, the grid pattern will be laid out using the doorway as an origin as presented on Figure 2 (note: in the event more than one door is present at a given facility with a concrete floor, the grid will be installed at overlapping grids). All of the sampling locations on Figures 1 and 2 would be sampled from the 0 to 3-inch depth interval and an appropriate volume of soil would be retained. Soil sample collection procedures are detailed below in Section 3.4

3.1 Potential General Modifications to Grid-Based Sample Locations

As noted above, there is a consistent approach to establishing the locations of sampling points, which Williams has found to result in a detailed characterization of site impacts (if present). This SOP also notes that site-specific modifications may be required on a case-by-case basis. Since the general sampling approach may not have been based upon a site visit prior to developing the plan, the final selection of sampling points requires some degree of professional judgment.

In some instances, obstructions such as sidewalks and concrete pads may be coincident with locations targeted for sampling by the grid layout. In such instances, field personnel judgment will determine whether the sample location should be moved to the nearest available soil area or whether two separate samples, one from each side of the obstruction, should be collected. In general, two separate samples should be collected in instances where the obstruction substantially splits the area of interest.

In other instances, sub-surface high-pressure natural gas lines, piping appurtenances, and/or control lines and/or cables may be present and coincident with locations targeted for sampling by the grid layout. Sampling of these locations could pose a significant safety risk and, in these instances, field personnel judgment will determine where the sample location should be moved to the nearest available area that will not undermine the integrity of the facility infrastructure.

Facilities with potential source of release over an impervious surface (*e.g.,* concrete) will also be inspected for the presence of floor drains. If drains exist, the exterior outlet(s) will be located and a single sample will be collected at the outlet(s). Depending upon the results of this sample, additional sampling may be needed to characterize the extent of impacts.

3.2 Sample Naming Convention

A consistent sampling node numbering convention will be used in all phases of site work. The sample location immediately under the former source or outside a facility door (as applicable) will be used as the origin for the numbering system. Sample designations will reflect relative position from the origin. To avoid the use of positive and negative position increments, the origin point will be identified as node 1010. The first two digits indicate the sample "row," with rows farther from the origin having smaller or larger numbers as applicable. That is, the first two digits for sample identifiers in the rows "north" and "south" of the origin would be "11" and "09", respectively. Similarly, the second two digits indicate the sample "column" and, to an observer standing at the origin facing "north", the sample immediately on, or to the right of, the origin will be assigned 10; subsequent samples on the same row to the "east" will have increasing numbers and those to the "west" will have decreasing numbers. That is, the sample immediately to the "east" of the origin (i.e., 1010) would be numbered 1011 and the one immediately to the "west" of the origin would be numbered 1009. Figures 1 and 2 illustrate the node numbering convention.

Subsurface soil samples will carry the same sample designation as the shallow samples, but with a suffix identifying the depth in inches of the top of the sampled interval (*e.g.*, 1010-12 for a sample collected from the 12-inch depth in the location of surface soil sample 1010).

The sample may also carry a prefix that represents a site-specific identifier that is mnemonic to the site. For example, samples from the Mt. Vernon Metering Station may have the MVSS prefix. Therefore, a sample from the Mt. Vernon Metering Station, from sample node 1010 at a depth of 12 inches would have the sample name MVSS-1010-12.

It should be noted that the exact locations of sampling points at a particular site may be adjusted based upon site-specific considerations such as the extent of prior Interim Remedial Actions, the configuration of equipment, access to certain areas, and health and safety concerns. The rationale for modifications to this general SOP will be presented in the investigative reports for each specific site

3.3 Sample Selection for Analysis

Regardless of sample location, pre-remedial investigation sample collection and analysis would proceed in an iterative manner until the resulting data establish control of site data to potentially applicable cleanup levels appropriate for the particular site. Initially, all of the collected samples would be submitted to the selected analytical laboratory. A minimum subset of the collected samples, typically those nearest and surrounding the source areas (as indicated on Figures 1 and 2 as green dots) would be submitted for immediate analysis and the remaining samples would be archived for potential later analysis. Based upon a review of analytical results for the initial samples nearest the assumed source, additional "contingency" samples surrounding data points that exceed the potentially applicable cleanup level would be selected for follow-up analysis (the "contingency" sample locations are indicated on Figures 1 and 2 as blue dots). This approach would continue until the data fully characterize the limits of soil impacts or until the extent of collected samples has been exhausted. In the event data closure is not achieved with the analysis of the minimum and contingency samples, Williams may remobilize to the facility and collect additional soil samples by expanding the grid, using the same approach described above, until the lateral limits of soil impacts have been fully characterized.

As discussed with the Washington Department of Ecology (Ecology) the general conceptual model of site releases consists primarily of surface discharges of inorganic mercury and subsequent vertical migration. Foot traffic may have also contributed to migration, or mercury may have migrated to the edges of impervious surface (i.e., concrete slabs) and then entered soils. In all of these cases, it is reasonable to expect that concentrations will be highest near the surface and to rapidly attenuate with depth, consistent with Williams' observations and experience with similar facilities. At locations where foot traffic may have contributed to migration, mercury concentrations may be more diffuse, and accordingly have a shallower depth of impact.

For these reasons Williams will use the grid-based sampling approach to both characterize the lateral extent of impacts and to establish the final limits of the remedial excavation. This approach has been shown to be highly effective and if applied in a conservative manner, is fully protective of the environment, without resulting in duplicative laboratory analyses.

Given the mode of release and contaminant spread presented above, Williams will collect soil samples on the designated grid from the 0 to 3-inch depth interval as stated in this SOP. The pre-remedial investigation samples that are below the cleanup standard and define the general lateral extent of impacts will be used to guide (if necessary) subsequent remedial actions.

3.4 Sample Collection Procedures

New pre-cleaned two-ounce glass containers provided by the laboratory will be used for all sample collection. Each individual sample collected will be about 100 g of soil (for a sample of one-inch diameter collected to a three-inch depth). Gravel and soil particles greater than 3/8-inch in maximum diameter will be manually removed from the sample prior to placement in the sample container.

3.4.1 Surface Soil Samples

The following guidelines for soil sampling procedures are generic. All surface soil samples will be collected using disposable hand tools constructed of either plastic or stainless steel. The specific equipment to be used may vary depending on the surface conditions at a site. Some non-disposable equipment such as shovels and picks may be needed to expose the interval to be sampled, but actual samples will be collected using disposable equipment; any non-disposable equipment used to aid the sampling will be decontaminated between sample locations in accordance with the procedures in Section 4.2.1. Field personnel will wear disposable gloves when handling samples and gloves will be discarded after collection of each sample.

Ground cover (grass, roots, loose gravel) in the immediate area to be sampled will be stripped away prior to sampling. Samples will be collected to a depth of three inches and placed in a new pre-cleaned sample jar. All field-collected samples will be from discrete locations. Sample homogenization and, if performed, compositing will be performed by the analytical laboratory.

3.4.2 Subsurface Soil Samples

As described previously, some M/S facilities have previously undergone remedial actions and sub-surface sampling will be conducted at those grid nodes that are within the area of the prior remediation. The purpose of those samples will be to assess current soil impacts at the vertical limits of the prior remedial action. Sampling procedures for subsurface soil samples will be variable due to variations in access to designated sampling locations and variations in the density of soil materials at a particular site. Preferably, subsurface samples will be collected using a slide hammer-equipped probe with an acetate liner.

In areas where subsurface sampling locations are not readily accessible, or where soil density precludes the use of a probe, it is anticipated that a combination of manual methods will be used to remove overlying soils to access the sample interval. These manual methods may include posthole diggers, hand augers, picks, and/or shovels. Once the target sample depth has been attained (*i.e*., generally less than two feet below grade), a method similar to those described above in Section 3.4.1 will be used to acquire the actual sample. Preference will be made to collecting samples using disposable equipment. If it becomes necessary to collect samples using non-disposable equipment all such equipment will be decontaminated between uses in accordance with the procedures in Section 4.2.1.

In a limited number of cases it will be possible to collect subsurface samples with mechanical equipment such as direct-push technology (DPT; *e.g.,* stratoprobe) equipment or access the subsurface sample location for manual sampling as described above by first removing overlying soils with air knife/vacuum excavation equipment.

In the case of DPT sampling, standard DPT sampling methods will be used. The sample probe will be fitted with an acetate liner, and after the liner is retrieved from either the DPT or slide hammer-equipped probe and cut along it's length, the soil from the target depth interval (typically 3-inches in length) will be removed from the liner, placed in the sample jar, and handled in accordance with the applicable provisions of this SOP. All non-disposable probe equipment will be decontaminated consistent with the provisions of Section 4.2.1. It should be noted that no non-disposable equipment actually touches the samples.

Necessary deviations from this sampling approach will be fully documented in the investigation reports for each of the investigated sites.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Field Quality Assurance Procedures

4.1.1 *Field Documentation*

Sampling activities will be documented in a field logbook with consecutively numbered pages or on field forms designed to ensure consistent and complete data collection. Records will be recorded in non-erasable waterproof ink. If corrections are required, corrections will be made by crossing a single line through the error and entering the correct information. Corrections will be initialed and dated by the person making the correction. The logbook will contain sufficient detail to reconstruct the sampling event without reliance on the sampler's memory. The information recorded in the logbook will (as appropriate) include:

- Sample crew identification;
- Dates and times on-site;
- Weather conditions;
- Field observations;
- Location of sampling activity;
- Number and types of samples collected;
- Decontamination procedures;
- Variances from the Sampling Plan;

- Field equipment calibration;
- For each sample collected:
  - description of sampling point
  - sample identification number
  - date and time of sample collection
  - identification of personnel collecting sample
- A sketch of the excavation area and sampling locations, including dimensions and reference to a fixed landmark;
- References to oversize maps or other pertinent documentation that cannot be incorporated in the logbook;
- Identification of any photographs taken; and
- Signature of Field Team Manager.

Samples collected in the field will be identified with the following information written on the lid of the sample container with waterproof ink:

- Unique sample identification number (see Section 3.2); and
- Date and time of collection.

4.1.2 *Chain-of-Custody*

A Chain-of-Custody (COC) record will be maintained for all samples collected as part of this project. The COC provides an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through its analysis. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

4.1.2.1 Field Custody Procedures

- As few persons as possible will handle samples.
- Sample bottles will be obtained pre-cleaned from the laboratory or retail source. Coolers or boxes containing cleaned bottles will be sealed with a custody tape seal during transport to the field and while in storage prior to use.
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another responsible person or dispatched properly under chain-of-custody rules.
- The sample collector will record sample data in the field notebook or on the form.
- The site team leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

4.1.2.2 Chain of Custody Records

The COC record must be completed in duplicate (using self-duplicating forms where possible) by the field technician who has been designated by the project manager as responsible for sample shipment to the appropriate laboratory. At a minimum, the COC form will contain the following entries:

- Facility/client-specific information (e.g., project ID, facility address, client contact, billing, etc.);
- Unique sample identification number;
- Date and time of collection;
- Container number, type and, as applicable, preservative added;
- Sample type and analysis requested; and
- Name and signature of sampler.

In addition, if samples are (1) known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations), or (2) require compositing by the laboratory, the person completing the COC record should note these requirements in the "Remarks" section of the COC record.

4.1.2.3 Transfer of Custody and Shipment Procedures

- A COC record will accompany the coolers in which the samples are packed. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record.
- Samples will be dispatched to the laboratory for analysis with a separate COC record accompanying each shipment. The COC record will be suitably protected from getting wet (sealing in a Ziplock® or similar bag is recommended).
- Shipping containers will be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the COC record. The original record accompanies the shipment and the site team leader retains a copy.
- If sent by common carrier, a bill of lading will be used. Freight bills and bills of lading will be retained as part of the project's permanent documentation.

4.2.1 Equipment Decontamination

Non-disposable sampling equipment will be decontaminated between samples using the following or equivalent procedure:

- Wash thoroughly with a laboratory detergent (Alconox or equivalent) to remove any particulate matter and/or surface films,
- Rinse thoroughly with clean potable water,
- Rinse thoroughly with clean deionized water,
- Air dry, and

- Wrap decontaminated equipment in aluminum foil (shiny side out) for storage and transportation.

Sampling equipment with oily or other hard to remove materials may also require rinsing with pesticide-grade isopropanol prior to washing with the detergent solution. Use of isopropanol will typically be very limited due to the need to manage spent solvent as a hazardous waste.

4.3 Field Quality Assurance/Quality Control Samples

The following quality control samples will be collected.

- Field Blanks - Sampling equipment field blanks will be collected and analyzed to evaluate the effectiveness of decontamination of non-disposable sampling equipment. For samples collected with non-disposable equipment, one field blank will be collected for each ten soil samples, with a minimum of one per day of sampling. The field blank is obtained by placing clean sand in a decontaminated bowl and homogenizing with a decontaminated sampling tool. The sampling tool is then used to place the sand in an appropriate sample container. For samples collected with disposable sampling equipment, no field blank samples will be collected.

- Field Duplicates - Field duplicates will be collected to evaluate representativeness of field samples and laboratory performance. Field duplicates will be collected at a rate of one for every ten soil samples collected, with a minimum of one per day of sampling or one per facility/location. Duplicate samples will be collected by placing the sample in a disposable container, homogenizing the sample by thorough mixing, and placing the homogenized soil from the sampling container into two separate containers with unique sample identification numbers indiscernible to the laboratory (*i.e*., “blind” duplicate).

4.4 Health and Safety

Contractors implementing this sampling plan will prepare a Health and Safety Plan (HSP) for the sampling activities. At a minimum, the plan shall comply with the Williams’ *Minimum Requirements for Contractor Site Safety Plans*, and will be in accordance with the most recent Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), and National Institute of Occupational Safety and Health (NIOSH) regulations and guidelines [*e.g.,* 29 CFR 1910.120(b)(4)].

5.0 LABORATORY QUALITY ASSURANCE PROCEDURES

5.1 Analytical Methods

The analytical method for total mercury analysis for soils in this project is Method 7471A (USEPA SW-846, Test Methods for Evaluating Solid Waste).

5.2 Analytical Quality Control

Methods 7470A and 7471A contain method-specific Quality Control (QC) criteria that the laboratory must follow, such as calibration requirements and QC samples. Laboratories selected to perform analyses for this project shall submit their QA/QC plans and standard operating procedures to Williams; these procedures must meet or exceed the analytical method requirements.

5.3 Data Evaluation and Review

Williams or its representative will inspect the data packages for accuracy, precision, and completeness. Laboratory DQOs for mercury analysis are provided on the following table:

Minimum Required Quality Control Sample Frequency and Acceptance Criteria
EPA 7000A Method Series, Metals by Atomic Absorption

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration Curve	Linear Rev 1). Calib. Ref. Standard must be within 10% of true value	Must have calibration blank and at least 3 standards. Must calibrate each day.	Recalibrate
Initial Calibration Blank (ICB)	< detection limit	1 per batch	Recalibrate
Continuing Calibration Blank (CCB)	< detection limit	Every 20 samples	Recalibrate and reanalyze to last passing CCB
Method Blank	< detection limit, or < 5% of the regulatory limit, or < 5% of the sample result	Each digestion batch	Re-digest & reanalyze entire batch
Initial Calibration Verification (ICV)	+/- 10% of true value	1 per batch, independent source	Recalibrate
Continuing Calibration Verification (CCV)	+/-20% of true value	Every 10 samples and at the end of the batch	Recalibrate and reanalyze to last passing CCV
Lab Control Sample (LCS)	+/- 20% of true value	Each batch	Recalibrate, or if necessary re-digest
Matrix Spike	AA, GFAA: 75-125% recovery	Every 20 samples.	Case narrative if necessary
Matrix Spike Duplicate	75-125% recovery and 20% RPD	Every 20 samples	Case narrative if necessary
Serial Dilution	±10% of undiluted sample	One each analytical batch	Perform post digestion spike
Post Digestion Spike	85-115% recovery	If Serial Dilution fails	Use MSA for all samples in the batch associated with the sample

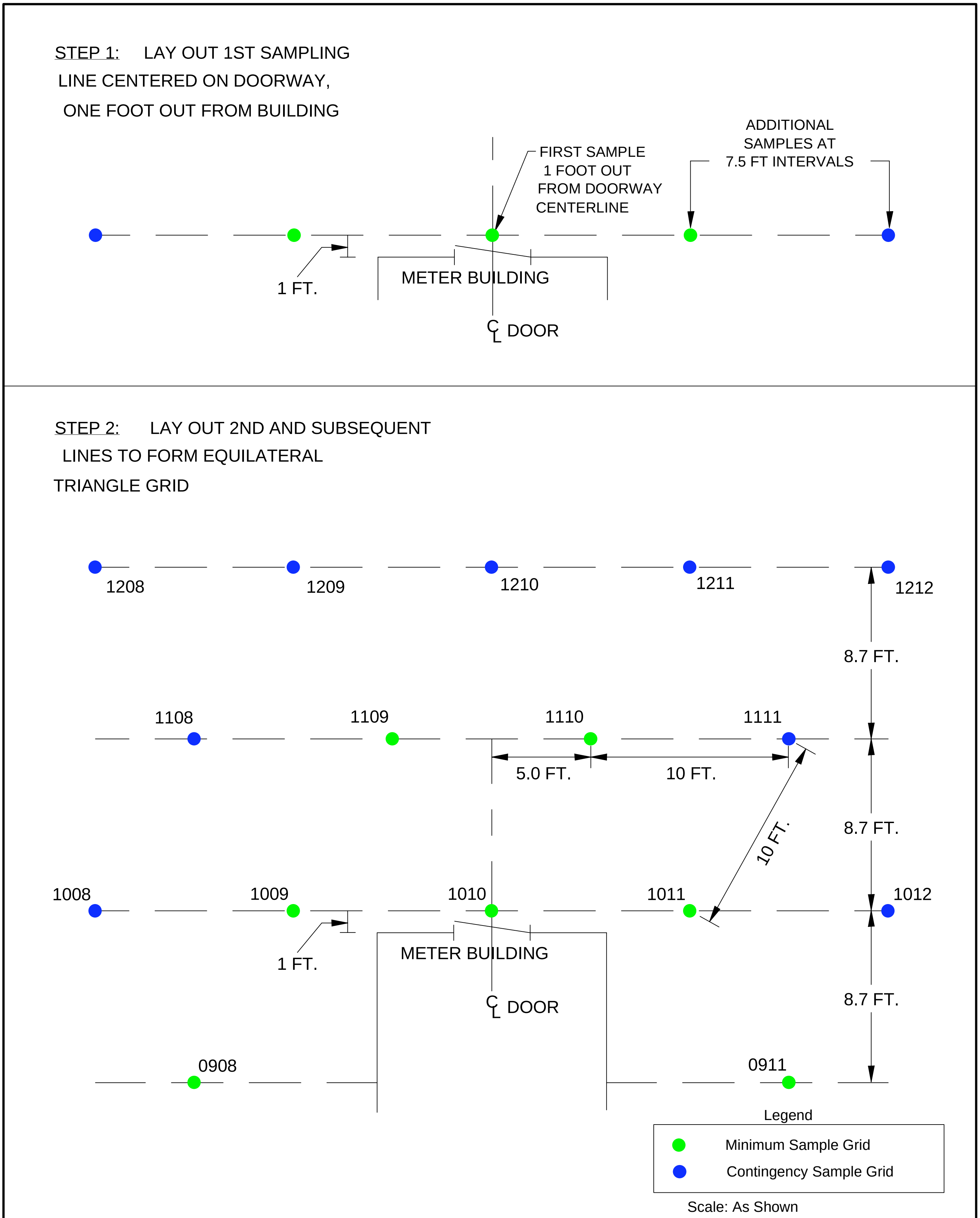
Source: SPL, Inc. Quality Assurance Manual, 10/22/00.

The stated laboratory DQOs are guidelines. Accuracy and precision are likely to be matrix-dependent and the DQOs noted above may not always be achievable. The data reviewer may and should use professional judgment in instances where these guidelines are not appropriate.

At Williams' option, some or all of the data may be subject to more rigorous data validation, including independent review of all laboratory measurements, data reduction, and reporting of analytical parameters.

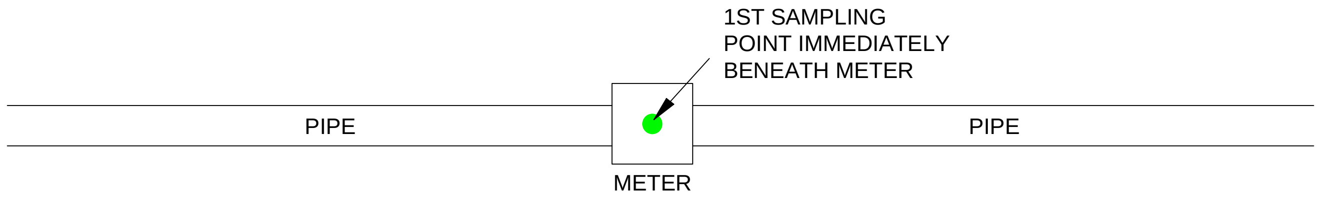
6.0 REFERENCES

- ENVIRON Corporation, *Remediation Sampling Plan for TGPL Metering and Regulating Facilities*, May 1995
- Gilbert, R.O., *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, 1987
- SPL, Inc. Quality Assurance Manual, 10/22/00.
- USEPA, 40 CFR 761, PCB "Mega-Amendment", revised 1998

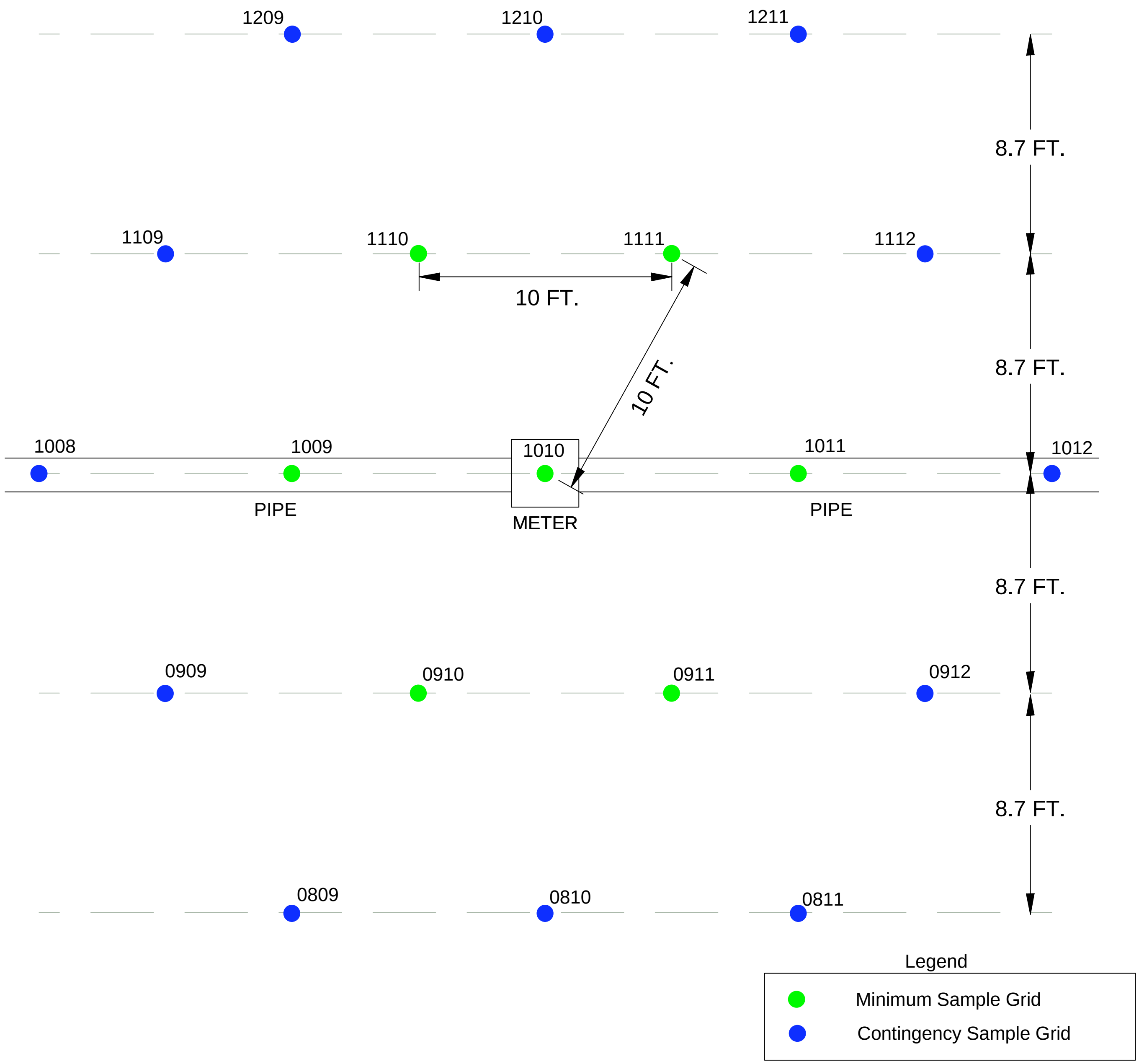


PORTNOY ENVIRONMENTAL / epi ENVIRONMENTAL PARTNERS INC	General Layout - Pre-Remedial Sampling Grid Williams Gas Pipeline - Transco	Figure 1
DRAWN BY: CFN REVISED BY: TJN — DATE: 6/29/01 REV. DATE: 2/28/05		PE PROJ. NO. 101062 EPI PROJ. NO. 47301.0

STEP 1: INSTALL 1ST SAMPLING POINT IMMEDIATELY BENEATH METER



STEP 2: LAY OUT SUBSEQUENT SAMPLING POINTS TO FORM EQUILATERAL TRIANGLE GRID



Scale: As Shown

PORTNOY ENVIRONMENTAL

epi ENVIRONMENTAL PARTNERS INC

DRAWN BY:	TLJ	DATE:	1/27/05
REV. BY:	TJN	REV. DATE:	2/28/05

General Layout - Pre-Remedial Sampling Grid
Williams Gas Pipeline - Transco

Figure 2