RENEWAL APPLICATION
APPENDIX N1

HYDROGEN AND METHANE MONITORING PLAN

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RENEWAL APPLICATION
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VOLATILE ORGANIC COMPOUND MONITORING PLAN

N1-1 Introduction

This Renewal Application Appendix describes the monitoring plan for hydrogen and methane generated in Underground Hazardous Waste Disposal Units (**HWDUs**) 3 through 7, also referred to as Panels 3 through 7.

Monitoring for hydrogen and methane in Panels 3 through 7 until final panel closure, unless an explosion-isolation wall is installed, may be an effective way to gather data to establish realistic gas generation rates. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance ~~(**QA**)~~ objectives (**QAOs**), and reporting activities.

N1-2 Parameters to be Analyzed and Monitoring Design

The Permittees will monitor for hydrogen and methane in filled Panels 3 through 7 until final panel closure, unless an explosion-isolation wall is installed. A "filled panel" is an Underground HWDU that will no longer receive waste for emplacement.

Monitoring of a filled panel will commence after installation of the following items in each filled panel:

- substantial barriers
- bulkheads
- five additional monitoring locations.

The substantial barriers serve to protect the waste from events such as ground movement or vehicle impacts. The substantial barrier will be constructed from available non-flammable materials such as mined salt (Figure N1-1).

The bulkheads (Figure N1-2) serves to block ventilation at the intake and exhaust of the filled panel and prevent personnel access. The bulkhead is constructed as a typical WIPP bulkhead with no access doors or panels. The bulkhead will consist of a steel member frame covered with galvanized sheet metal, and will not allow personnel access. Rubber conveyor belt will be used as a gasket to attach the steel frame to the salt, thereby providing an effective yet flexible blockage to ventilation air. Over time, it is possible that the bulkhead may be damaged by creep closure around it. If the damage is such as to indicate a possible loss of functionality, then the bulkhead will be repaired or an additional bulkhead will be constructed outside of the original one.

The existing volatile organic compound (**VOC**) monitoring lines as specified in Renewal Application Chapter N, Section N-3a(2), "Sampling Locations for Disposal Room VOC Monitoring", will be used for sample collection in each disposal room for Panels 3 through 7. The sample lines and their construction are shown in Figure N1-3. In addition to the existing

VOC monitoring lines, five more sampling locations will be used to monitor for hydrogen and methane. These additional locations include:

- the intake of room 1
- the waste side of the exhaust bulkhead,
- the accessible side of the exhaust bulkhead,
- the waste side of the intake bulkhead,
- the accessible side of the intake bulkhead.

These additional sampling locations (Figure N1-4) will use a single inlet sampling point placed near the back (roof) of the panel access drifts. This will maximize the sampling efficiency for these lighter compounds.

N1-3 Sampling Frequency

Sampling frequency will vary depending upon the levels of hydrogen and methane that are detected.

- If monitored concentrations are at or below Action Level 1 as specified in Table ~~IV.F.5.b~~N1-1, monitoring will be conducted monthly.

- If monitored concentrations exceed Action Level 1 as specified in Table ~~IV.F.5.b~~N1-1, monitoring will be conducted weekly in the affected filled panel.

N1-4 Sampling

Samples for hydrogen and methane will be collected using subatmospheric pressure grab sampling as described in Environmental Protection Agency (**EPA**) Compendium Method TO-15 (EPA, 1999). The TO-15 sampling method uses passivated stainless-steel sample canisters to collect integrated air samples at each sample location. Flow rates and sampling duration may be modified as necessary to meet data quality objectives.

Sample lines shall be purged prior to sample collection.

N1-5 Sampling Equipment

N1-5a SUMMA® Canisters

Stainless-steel canisters with passivated or equivalent interior surfaces will be used to collect and store gas samples for hydrogen and methane analyses collected as part of the monitoring processes. These canisters will be cleaned and certified prior to their use in a manner similar to that described by Compendium Method TO-15 (EPA, 1999). The vacuum of certified clean canisters will be verified upon initiation of a sample cycle. Sampling will be conducted using subatmospheric pressure grab sampling techniques as described in TO-15.

N1-5b Sample Tubing

Treated stainless steel tubing shall be used as a sample path and treatment shall prevent the inner walls from absorbing contaminants.

Any loss of the ability to purge a sample line will be evaluated. The criteria used for evaluation are shown in Figure N1-5.

The Permittees will first suspect that a line is not useable when it is purged prior to sampling. If the line cannot be purged, then it will not be used for sampling unless the line is a bulkhead line that can be easily replaced. Replacement of bulkhead lines will occur before the next scheduled sample. Non-bulkhead lines will be evaluated by first determining if adjacent sampling lines are working. If the answer is no, then the previous sample from the failed line will be examined. If the previous sample was between the first and second action levels, then the explosion-isolation wall will be installed since without the ability to monitor it is unknown whether the area is approaching the second action level or decreasing. If the previous sample was below the first action level then continued sampling is acceptable without the lost sample.

If an adjacent line is working, the prior concentrations measured in that line will be evaluated to determine if it is statistically similar to the prior measurements from the lost line. If the prior sampling results are statistically similar, the lines can be grouped. Statistical similarity will be determined using the Student's "t" test to evaluate differences.

The magnitude of *t* will be compared to the critical *t* value from SW-846, Table 9-2 (EPA, 1996), for this statistical test.

If the lost line can be grouped with an adjacent line, no further action is necessary because the unmonitored area is considered to be represented by the adjacent areas. If the lost sample line cannot be grouped with an adjacent line, the previous concentration measurement will be compared to the Action Levels. If the concentration is below Action Level 1, monitoring will continue. If the concentration is between Action Level 1 and Action Level 2, the explosion-isolation wall will be installed in the panel.

N1-6 Sample Management

Sample containers shall be sealed and uniquely marked at the time of collection of the sample. A Request-for-Analysis Form shall be completed to identify the sample canister number(s), sample type, and type of analysis requested.

N1-7 Analytical Procedures

The samples will be analyzed using gas chromatography equipped with the appropriate detector under an established ~~QA~~quality assurance (**QA**)/quality control (**QC**) program. Analysis of samples shall be performed by a laboratory that the Permittees select and approve through established QA processes.

N1-8 Data Evaluation and Notifications

Analytical data from sampling events will be evaluated to determine whether the sample concentrations of flammable gases exceed the Action Levels.

If any Action Level is exceeded, notification will be made to New Mexico Environment Department (NMED) and the notification posted to the Waste Isolation Pilot Plant (WIPP) web page and accessed through the email notification system within ~~7 (~~seven~~)~~ calendar days of obtaining validated analytical data.

If any sampling line loss occurs, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within ~~7 (~~seven~~)~~ calendar days of learning of a sampling line loss. After the evaluation of the impact of sampling line loss as shown in Figure N1-5, notification will be made to NMED and the notification posted to the WIPP web page and accessed through the email notification system within ~~7 (~~seven~~)~~ calendar days of completing the sampling line loss evaluation.

~~N1-9 List of~~ References

U.S. Environmental Protection Agency (EPA), 1996. SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. ~~3rd~~ Third Edition. Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1999. Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and Analyzed by Gas Chromatography/Mas Spectrometry, EPA 625/R-96/010b. Center for Environmental Research Information, Office of Research and Development, Cincinnati, OH, January 1999.

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TABLES

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TABLE N1-1
ACTION LEVELS FOR HYDROGEN AND METHANE MONITORING

Compound	Action Level 1	Action Level 2
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

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FIGURES

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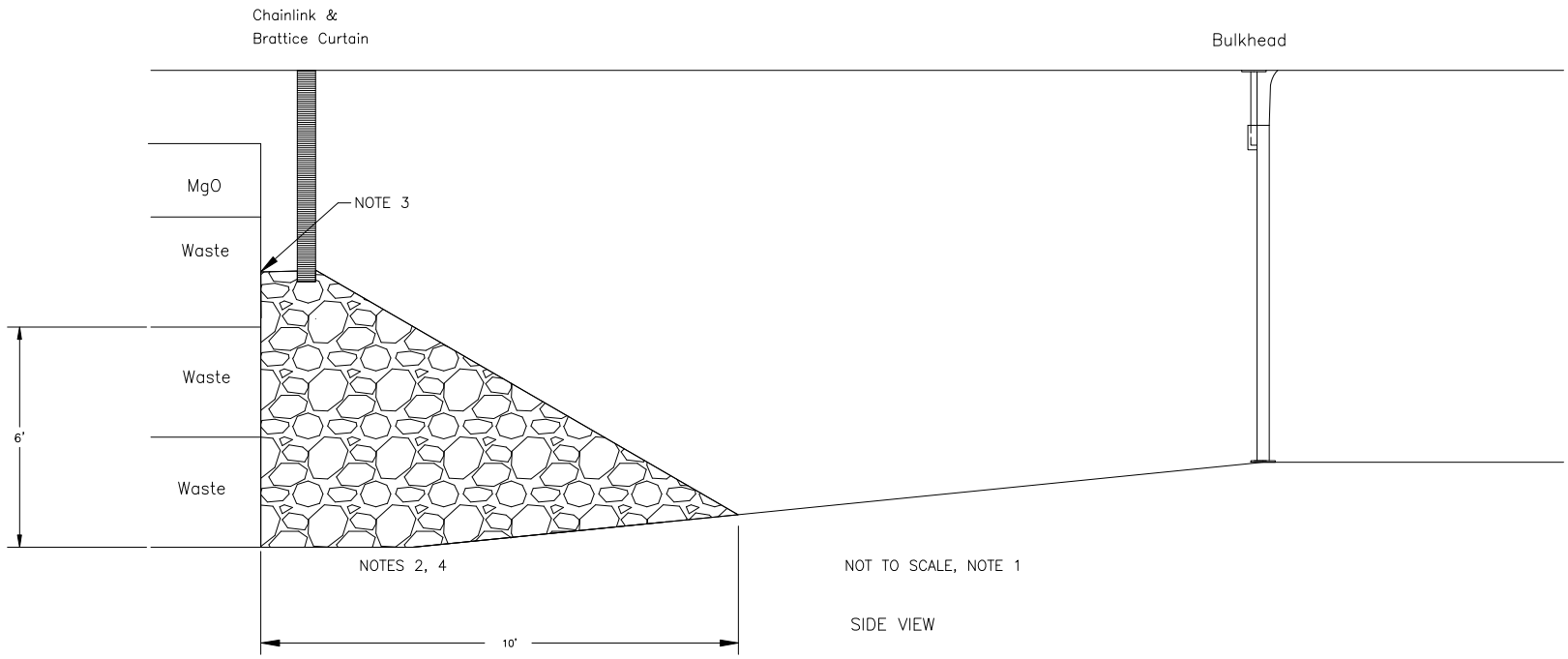


NOTES

1. CONFIGURATION AND PLACEMENT OF THE SUBSTANTIAL BARRIER AND THE BULKHEAD DICTATED BY AS-FOUND (FIELD) CONDITIONS, AS DESIGNATED BY THE COGNIZANT ENGINEER.

2. SUBSTANTIAL BARRIER MATERIAL WILL CONSIST OF RUN-OF-MINE SALT OR OTHER SUITABLE NON-FLAMMABLE MATERIAL AS DESIGNATED BY THE COGNIZANT ENGINEER.

3. SUBSTANTIAL BARRIER MATERIAL SHOULD BE AGAINST THE WASTE FACE. THE HEIGHT OF THE SUBSTANTIAL BARRIER NEAR THE WASTE WILL BE AT LEAST EQUAL TO THE HEIGHT OF THE BOTTOM OF THE TOP ROW OF WASTE.

4. DIMENSIONS INDICATED ARE MINIMUMS. THE HEIGHT OF THE SUBSTANTIAL BARRIER IS MEASURED AT THE WASTE FACE. THE LENGTH OF THE SUBSTANTIAL BARRIER IS MEASURED FROM THE BOTTOM OF THE WASTE FACE TO THE TOE OF THE SUBSTANTIAL BARRIER MATERIAL.

Figure N1-1
Typical Substantial Barrier and Bulkhead

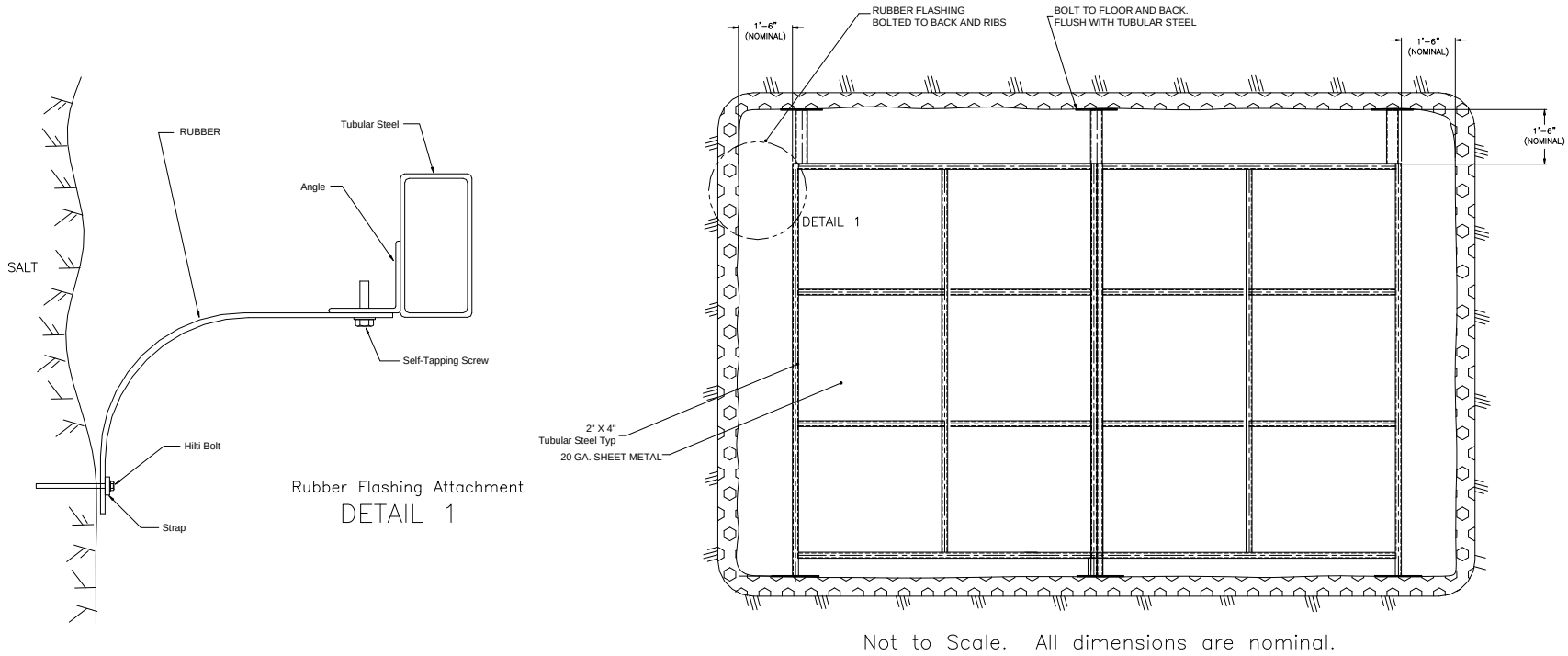
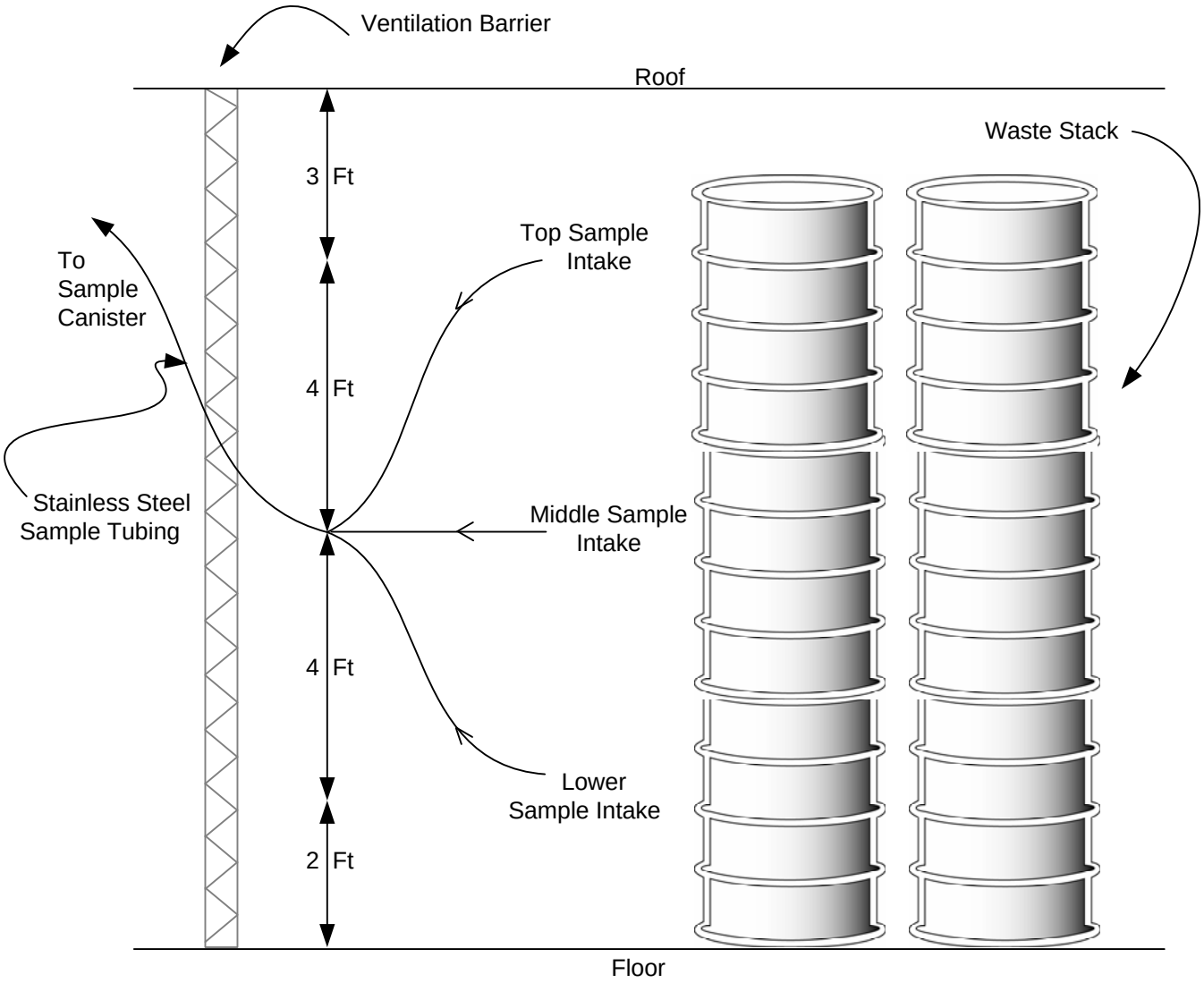


Figure N1-2
Typical Bulkhead



(not to scale, all measurements approximate)

Figure N1-3
Typical Hydrogen and Methane Monitoring System

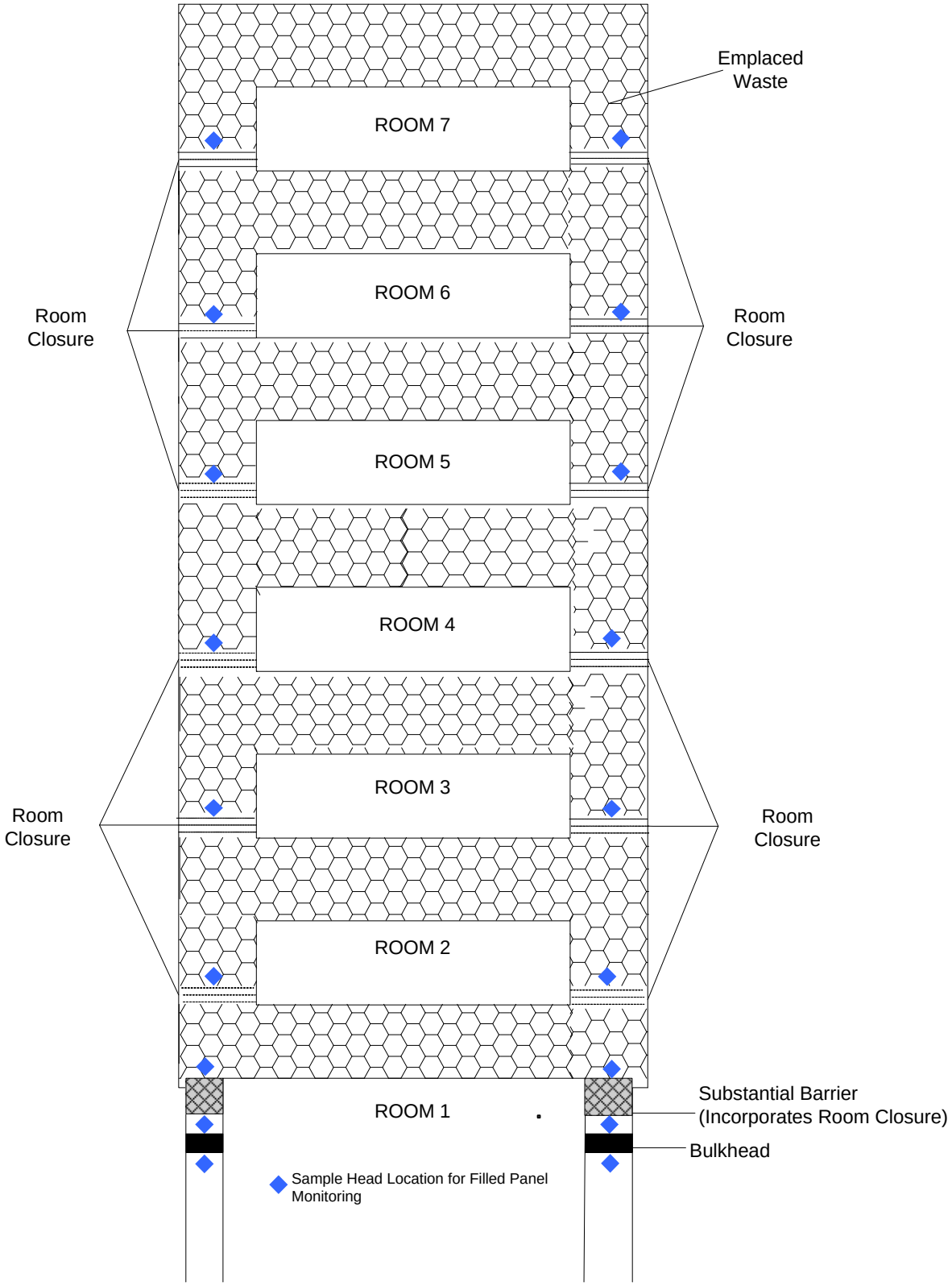
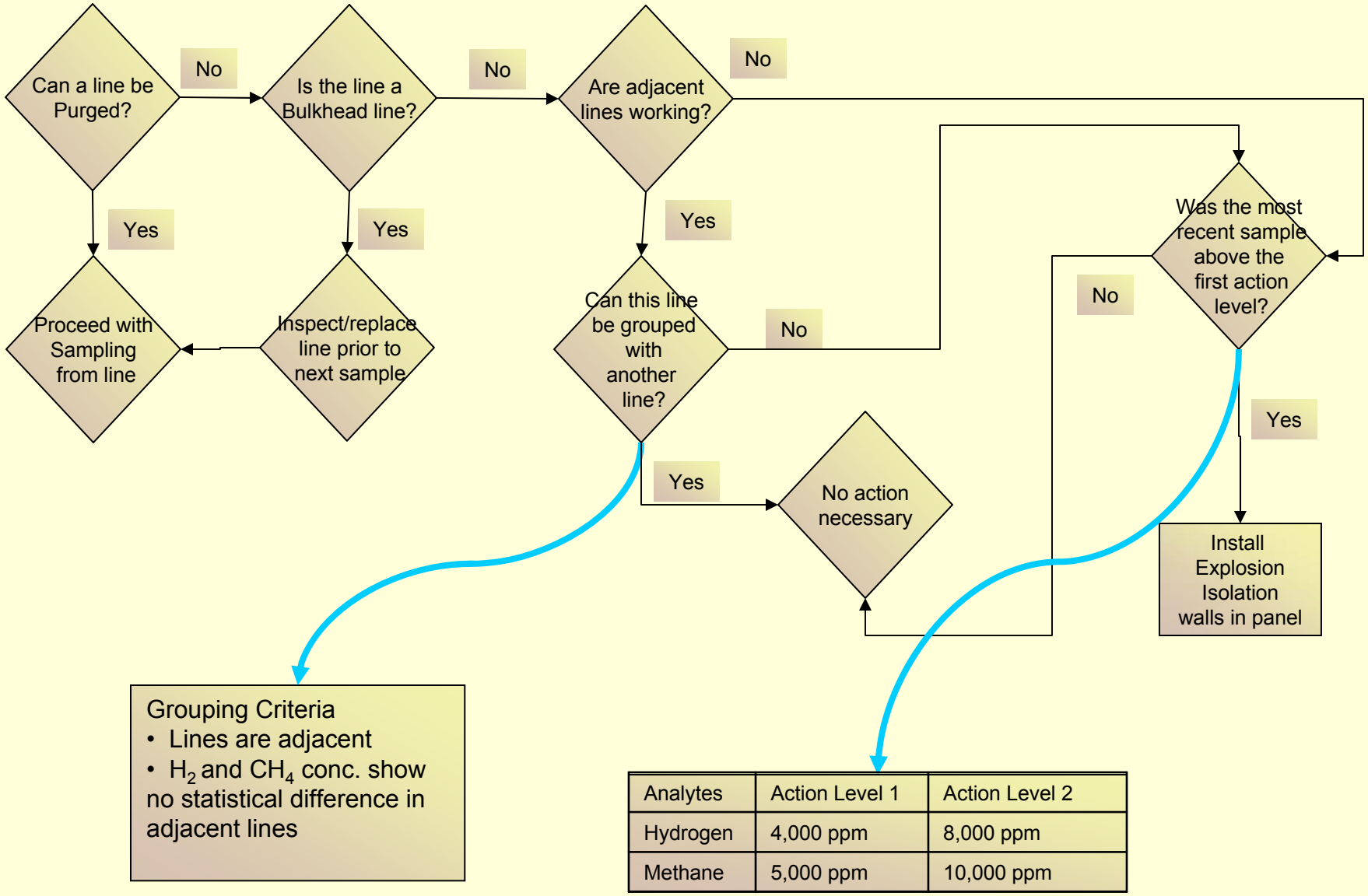


Figure N1-4
Typical Hydrogen and Methane Sampling Locations



Analytes	Action Level 1	Action Level 2
Hydrogen	4,000 ppm	8,000 ppm
Methane	5,000 ppm	10,000 ppm

Figure N1-5
Logic Diagram for Evaluating the Inability to Purge a Sample Line