

**ATTACHMENT ~~B~~ C1**

**WASTE CHARACTERIZATION SAMPLING METHODS**

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## ATTACHMENT ~~B~~ C1

### WASTE CHARACTERIZATION SAMPLING METHODS

#### Introduction

The ~~Permittees U.S. Department of Energy Carlsbad Field Office (DOE) Permittees~~ will require generator/storage sites (**sites**) to use the following methods, as applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at WIPP. These methods include requirements for headspace-gas sampling, sampling of homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this Attachment provides quality control, sample custody, and sample packing and shipping requirements.

#### BC1-1 Sampling of Debris Waste (Summary Category S5000)

Headspace gas sampling and analysis shall be used to resolve the assignment of Environmental Protection Agency (**EPA**) hazardous waste numbers to debris waste streams.

#### BC1-1a Method Requirements

~~The Permittees DOE The Permittees~~ shall require all headspace-gas sampling be performed in an appropriate radiation containment area on waste containers that are in compliance with the container equilibrium requirements (i.e., 72 hours at 18° C or higher).

For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination approved by ~~the Permittees the U.S. Department of Energy (DOE)~~, containers shall be randomly selected from waste streams designated as summary category S5000 (Debris waste) and shall be categorized under one of the sampling scenarios shown in Table ~~B~~ C1-5 and depicted in Figure ~~B~~ C1-1. If the container is categorized under Scenario 1, the applicable drum age criteria (**DAC**) from Table ~~B~~ C1-6 must be met prior to headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario 1 DAC from Table ~~B~~ C1-6 must be met prior to venting the container and then the applicable Scenario 2 DAC from Table ~~B~~ C1-7 must be met after venting the container. The DAC for Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table ~~B~~ C1-7 shall be determined using footnotes "a" and "b" in Table ~~B~~ C1-7. Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups listed in Table ~~B~~ C1-8. If a specific packaging configuration cannot be determined based on the data collected during packaging and/or repackaging (Attachment ~~B~~ C, Section ~~B~~ C-3d(1)), a conservative default Packaging Configuration Group of 3 for 55-gallon drums, 6 for Standard Waste Boxes (**SWBs**) and ten-drum overpacks (**TDOPs**), and 8 for 85-gallon and 100-gallon drums must be assigned, provided the drums do not contain pipe component packaging. If a container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, or SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of under any packaging configuration unless headspace gas sampling was performed before compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3 containers that contain rigid liner vent holes that are undocumented during packaging, repackaging, and/or venting (Section ~~B~~ C1-1a[4][ii]) shall be determined using the default conditions in footnote "b" in Table ~~B~~ C1-9. The

1 DAC for Scenario 3 containers that contain filters that are either undocumented or are other  
2 than those listed in Table ~~B.C~~1-9 shall be determined using footnote 'a' in Table ~~B.C~~1-9. Each of  
3 the Scenario 3 containers shall be sampled for headspace gas after waiting the DAC in Table ~~B.C~~  
4 ~~C~~1-9 based on its packaging configuration (note: Packaging Configuration Groups 4, 5, 6, 7,  
5 and 8 are not summary category group dependent, and 85-gallon drum, 100-gallon drum, SWB,  
6 and TDOP requirements apply when the 85-gallon drum, 100-gallon drum, SWB, or TDOP is  
7 used for the direct loading of waste).

#### 8 ~~B.C~~1-1a(1) General Requirements

9 The determination of packaging configuration consists of identifying the number of confinement  
10 layers and the identification of rigid poly liners when present. Generator/storage sites shall use  
11 either the default conditions specified in Tables ~~B.C~~1-7 through ~~B.C~~1-9 for retrievably stored  
12 waste or the data documented during packaging, repackaging, and/or venting (Section ~~B.C~~1-  
13 1a[4][iii]) for determining the appropriate DAC for each container from which a headspace gas  
14 sample is collected. These drum age criteria are to ensure that the container contents have  
15 reached 90 percent of steady state concentration within each layer of confinement (Lockheed,  
16 1995; BWXT, 2000). The following information must be reported in the headspace gas sampling  
17 documents for each container from which a headspace gas sample is collected:

- 18 • sampling scenario from Table ~~B.C~~1-5 and associated information from Tables ~~B.C~~1-6  
19 and/or Table ~~B.C~~1-7;
- 20 • the packaging configuration from Table ~~B.C~~1-8 and associated information from Table  
21 ~~B.C~~1-9, including the diameter of the rigid liner vent hole, the number of inner bags,  
22 the number of liner bags, the presence/absence of drum liner, and the filter hydrogen  
23 diffusivity,
- 24 • the permit-required equilibrium time,
- 25 • the drum age,
- 26 • for supercompacted waste, both
  - 27 – the absence of rigid liners in the compacted 55-gallon drums which have not been  
28 headspace gas sampled in accordance with this permit prior to compaction, and
  - 29 – the absence of layers of confinement must be documented in the WWIS if  
30 Packaging Configuration Group 7 is used.

31 For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed  
32 to be 0.3 inches unless a different size is documented during drum venting or repackaging. For  
33 all retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the  
34 most restrictive unless container-specific information clearly identifies a filter model and/or  
35 diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that  
36 have not been repackaged, acceptable knowledge shall not be used to justify any packaging  
37 configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-  
38 gallon drums, 6 for SWBs and TDOPs, and 8 for 85-gallon and 100-gallon drums). For  
39 information reporting purposes listed above, sites may report the default packaging  
40 configuration for retrievably stored waste without further ~~confirmation~~ verification.

1 All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly  
2 liners) shall be subject to innermost layer of containment sampling or shall be vented prior to  
3 initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario 1,  
4 the sampling device must form an airtight seal with the rigid poly liner to ensure that a  
5 representative sample is collected (using a sampling needle connected to the sampling head to  
6 pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies  
7 this requirement). The configuration of the containment area and remote-handling equipment at  
8 each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the  
9 analytes listed in Table B\_C3-2 of Permit Attachment B\_C3. If additional packaging  
10 configurations are identified, an appropriate Permit Modification will be submitted to incorporate  
11 the DAC using the methodology in BWXT (2000). Consistent with footnote "a" in Table B\_C1-8,  
12 any waste container selected for headspace gas sampling that cannot be assigned a packaging  
13 configuration specified in Table B\_C1-8 shall be assigned a conservative default packaging  
14 configuration..

15 Drum age criteria apply only to 55-gallon drums, 85-gallon drums, 100-gallon drums, standard  
16 waste boxes, and TDOPs. Drum age criteria for all other container types must be established  
17 through permit modification prior to performing headspace gas sampling..

18 ~~The Permittees DOE~~ The Permittees shall require site personnel to collect samples in SUMMA<sup>®</sup>  
19 or equivalent canisters using standard headspace-gas sampling methods that meet the general  
20 guidelines established by the EPA in the Compendium Method TO-14A or TO-15, Compendium  
21 of Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by  
22 using on-line integrated sampling/analysis systems. Samples will be directed to an analytical  
23 instrument instead of being collected in SUMMA<sup>®</sup> or equivalent canisters if a single-sample on-  
24 line integrated sampling/analysis system is used. If a multi-sample on-line integrated  
25 sampling/analysis system is used, samples will be directed to an integrated holding area that  
26 meets the cleaning requirements of Section B\_C1-1c(1). The leak proof and inert nature of the  
27 integrated holding area interior surface must be demonstrated and documented. Samples are  
28 not transported to another location when using on-line integrated sampling/analysis systems;  
29 therefore, the sample custody requirements of Section B\_C1-4 and B\_C1-5 do not apply. The  
30 same sampling manifold and sampling heads are used with on-line integrated sampling/analysis  
31 systems and all of the requirements associated with sampling manifolds and sampling heads  
32 must be met. However, when using an on-line integrated sampling/analysis system, the  
33 sampling batch and analytical batch quality control (**QC**) samples are combined as on-line batch  
34 QC samples as outlined in Section B\_C1-1b.

#### 35 BC1-1a(2) Manifold Headspace Gas Sampling

36 This headspace-gas sampling protocol employs a multiport manifold capable of collecting  
37 multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be  
38 used to collect samples in SUMMA<sup>®</sup> or equivalent canisters or as part of an on-line integrated  
39 sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to  
40 first use and as needed thereafter. The manifold and sample canisters will be evacuated to  
41 0.0039 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and  
42 evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet  
43 valve is opened. The manifold inlet valve will be attached to a changeable filter connected to  
44 either a side port needle sampling head capable of forming an airtight seal (for penetrating a  
45 filter or rigid poly liner when necessary), a drum punch sampling head capable of forming an  
46 airtight seal (capable of punching through the metal lid of a drum for sampling through the drum

1 lid), or a sampling head with an airtight fitting for sampling through a pipe overpack container  
2 filter vent hole. Refer to Section B.C1-1a(4) for descriptions of these sampling heads.

3 The manifold shall also be equipped with a purge assembly that allows applicable QC samples  
4 to be collected through all sampling components that may affect compliance with the quality  
5 assurance objectives (QAOs). ~~The Permittees DOE~~ The Permittees shall require the sites to  
6 demonstrate and document the effectiveness of the sampling equipment design in meeting the  
7 QAOs. Field blanks shall be samples of room air collected in the sampling area in the immediate  
8 vicinity of the waste container to be sampled. If using SUMMA<sup>®</sup> or equivalent canisters, field  
9 blanks shall be collected directly into the canister, without the use of the manifold.

10 The manifold, the associated sampling heads, and the headspace-gas sample volume  
11 requirements shall be designed to ensure that a representative sample is collected. The  
12 manifold internal volume must be calculated and documented in a field logbook dedicated to  
13 headspace-gas sample collection. The total volume of headspace gases collected during each  
14 sampling operation will be determined by adding the combined volume of the canisters attached  
15 to the manifold and the internal volume of the manifold. The sample volume should remain small  
16 in comparison to the volume of the waste container. When an estimate of the available  
17 headspace gas volume in the drum can be made, less than 10 percent of that volume should be  
18 withdrawn.

19 As illustrated in Figure B.C1-2, the sampling manifold must consist of a sample side and a  
20 standard side. The dotted line in Figure B.C1-2 indicates how the sample side shall be  
21 connected to the standard side for cleaning and collecting equipment blanks and field reference  
22 standards. The sample side of the sampling manifold shall consist of the following major  
23 components:

- 24 • An applicable sampling head that forms a leak-tight connection with the headspace  
25 sampling manifold.
- 26 • A flexible hose that allows movement of the sampling head from the purge assembly  
27 (standard side) to the waste container.
- 28 • A pressure sensor(s) that must be pneumatically connected to the manifold. This  
29 manifold pressure sensor(s) must be able to measure absolute pressure in the range  
30 from 0.002 in. (0.05 mm) Hg to 39.3 in. (1,000 mm) Hg. Resolution for the manifold  
31 pressure sensors must be  $\pm 0.0004$  in. (0.01 mm) Hg at 0.002 in. (0.05 mm) of Hg. The  
32 manifold pressure sensor(s) must have an operating range from approximately 59°F  
33 (15°C) to 104°F (40°C).
- 34 • Available ports for attaching sample canisters. If using canister-based sampling  
35 methods, a sufficient number of ports shall be available to allow simultaneous  
36 collection of headspace-gas samples and duplicates for VOC analyses. If using an on-  
37 line integrated sampling/analysis system, only one port is necessary for the collection  
38 of comparison samples. Ports not occupied with sample canisters during cleaning or  
39 headspace-gas sampling activities require a plug to prevent ambient air from entering  
40 the system. In place of using plugs, sites may choose to install valves that can be  
41 closed to prevent intrusion of ambient air into the manifold. Ports shall have VCR<sup>®</sup>

1 fittings for connection to the sample canister(s) to prevent degradation of the fittings on  
2 the canisters and manifold.

- 3 • Sample canisters, as illustrated in Figure ~~B C~~ 1-3, are leak-free, stainless steel  
4 pressure vessels, with a chromium-nickel oxide (**Cr-NiO**) SUMMA<sup>®</sup>-passivated interior  
5 surface, bellows valve, and a pressure/vacuum gauge. Equivalent designs, such as  
6 Silco Steel canisters, may be used so long as the leak proof and inert nature of the  
7 canister interior surface is demonstrated and documented. All sample canisters must  
8 have VCR<sup>®</sup> fittings for connection to sampling and analytical equipment. The  
9 pressure/vacuum gauge must be mounted on each manifold. The canister must be  
10 helium-leak tested to  $1.5 \times 10^{-7}$  standard cubic centimeters per second (cc/s), have all  
11 stainless steel construction, and be capable of tolerating temperatures to 125°C. The  
12 gauge range shall be capable of operating in the leak test range as well as the sample  
13 collection range.
- 14 • A dry vacuum pump with the ability to reduce the pressure in the manifold to 0.05 mm  
15 Hg. A vacuum pump that requires oil may be used, but precautions must be taken to  
16 prevent diffusion of oil vapors back to the manifold. Precautions may include the use of  
17 a molecular sieve and a cryogenic trap in series between the headspace sampling  
18 ports and the pump.
- 19 • A minimum distance, based upon the design of the manifold system, between the tip of  
20 the needle and the valve that isolates the pump from the manifold in order to minimize  
21 the dead volume in the manifold.
- 22 • If real-time equipment blanks are not available, the manifold must be equipped with an  
23 organic vapor analyzer (**OVA**) that is capable of detecting all analytes listed in Table ~~B~~  
24 ~~C~~ 3-2 of Permit Attachment ~~B C~~ 3. The OVA shall be capable of measuring total VOC  
25 concentrations below the lowest headspace gas PRQL. Detection of 1,1,2-trichloro-  
26 1,2,2-trifluoroethane may not be possible if a photoionization detector is used. The  
27 OVA measurement shall be ~~confirmed~~ verified by the collection of equipment blanks at  
28 the frequency specified in Section ~~B C~~ 1-1 to check for manifold cleanliness.

29 The standard side must consist of the following major elements:

- 30 • A cylinder of compressed zero air, helium, argon, or nitrogen gas that is hydrocarbon  
31 and carbon dioxide (**CO<sub>2</sub>**)-free (only hydrocarbon and CO<sub>2</sub>-free gases required for  
32 Fourier Transform Infrared System [**FTIRS**]) to clean the manifold between samples  
33 and to provide gas for the collection of equipment blanks or on-line blanks. These  
34 high-purity gases shall be certified by the manufacturer to contain less than one ppm  
35 total VOCs. The gases must be metered into the standard side of the manifold using  
36 devices that are corrosion proof and that do not allow for the introduction of manifold  
37 gas into the purge gas cylinders or generator. Alternatively, a zero air or nitrogen  
38 generator may be used, provided a sample of the zero air or nitrogen is collected and  
39 demonstrated to contain less than one ppm total VOCs. Zero air or nitrogen from a  
40 generator shall be humidified (except for use with FTIRS).
- 41 • Cylinders of field-reference standard gases or on-line control sample gases. These  
42 cylinders provide gases for evaluating the accuracy of the headspace-gas sampling

1 process. Each cylinder of field-reference gas or on-line control sample gas shall have  
2 a flow-regulating device. The field-reference standard gases or on-line control sample  
3 gas shall be certified by the manufacturer to contain analytes from Table B\_C3-2 of  
4 Permit Attachment B\_C3 at known concentrations.

- 5 • If using an analytical method other than FTIRS a humidifier filled with American  
6 Society for Testing and Materials (**ASTM**) Type I or II water, connected, and opened to  
7 the standard side of the manifold between the compressed gas cylinders and the  
8 purge assembly shall be used. Dry gases flowing to the purge assembly will pick up  
9 moisture from the humidifier. Moisture is added to the dry gases to condition the  
10 equipment blanks and field-reference standards and to assist with system cleaning  
11 between headspace-gas sample collection. If using FTIRS for analysis, the sample  
12 and sampling system shall be kept dry.

13 NOTE: Caution should be exercised to isolate the humidifier during the evacuation of  
14 the system to prevent flooding the manifold. In lieu of the humidifier, the compressed  
15 gas cylinders (e.g., zero air and field-reference standard gas) may contain water vapor  
16 in the concentration range of 1,000 to 10,000 parts per million by volume (**ppmv**).

- 17 • A purge assembly that allows the sampling head (sample side) to be connected to the  
18 standard side of the manifold. The ability to make this connection is required to  
19 transfer gases from the compressed gas cylinders to the canisters or on-line analytical  
20 instrument. This connection is also required for system cleaning.
- 21 • A flow-indicating device or a pressure regulator that is connected to the purge  
22 assembly to monitor the flow rate of gases through the purge assembly. The flow rate  
23 or pressure through the purge assembly shall be monitored to assure that excess flow  
24 exists during cleaning activities and during QC sample collection. Maintaining excess  
25 flow will prevent ambient air from contaminating the QC samples and allow samples of  
26 gas from the compressed gas cylinders to be collected near ambient pressure.

27 In addition to a manifold consisting of a sample side and a standard side, the area in which the  
28 manifold is operated shall contain sensors for measuring ambient pressure and ambient  
29 temperature, as follows:

- 30 • The ambient-pressure sensor must have a sufficient measurement range for the  
31 ambient barometric pressures expected at the sampling location. It must be kept in the  
32 sampling area during sampling operations. Its resolution shall be 0.039 in. (1.0 mm)  
33 Hg or less, and calibration performed by the manufacturer shall be based on National  
34 Institute of Standards and Technology (**NIST**), or equivalent, standards.
- 35 • The temperature sensor shall have a sufficient measurement range for the ambient  
36 temperatures expected at the sampling location. The measurement range of the  
37 temperature sensor must be from 18°C to 50°C. The temperature sensor calibration  
38 shall be traceable to NIST, or equivalent, standards.

### 39 BC1-1a(3) Direct Canister Headspace Gas Sampling

40 This headspace-gas sampling protocol employs a canister-sampling system to collect  
41 headspace-gas samples for analysis and QC purposes without the use of the manifold

described above. Rather than attaching sampling heads to a manifold, in this method the sampling heads are attached directly to an evacuated sample canister as shown in Figure-B.C1-4.

Canisters shall be evacuated to 0.0039 in. (0.10 mm) Hg prior to use and attached to a changeable filter connected to the appropriate sampling head. The sampling head(s) must be capable of either punching through the metal lid of the drums (and/or the rigid poly liner when necessary) while maintaining an airtight seal when sampling through the drum lid, penetrating a filter or the septum in the orifice of the self-tapping screw, or maintaining an airtight seal for sampling through a pipe overpack container filter vent hole to obtain the drum headspace samples. Field duplicates must be collected at the same time, in the same manner, and using the same type of sampling apparatus as used for headspace-gas sample collection. Field blanks shall be samples of room air collected in the immediate vicinity of the waste-drum sampling area prior to removal of the drum lid. Equipment blanks and field-reference standards must be collected using a purge assembly equivalent to the standard side of the manifold described above. These samples shall be collected from the needle tip through the same components (e.g., needle and filter) that the headspace-gas samples pass through.

The sample canisters, associated sampling heads, and the headspace-sample volume requirements ensure that a representative sample is collected. When an estimate of the available headspace-gas volume of the waste container can be made, less than 10 percent of that volume should be withdrawn. A determination of the sampling head internal volume shall be made and documented. The total volume of headspace gases collected during each headspace gas sampling operation can be determined by adding the volume of the sample canister(s) attached to the sampling head to the internal volume of the sampling head. Every effort shall be made to minimize the internal volume of sampling heads.

Each sample canister used with the direct canister method shall have a pressure/vacuum gauge capable of indicating leaks and sample collection volumes. Canister gauges are intended to be gross leak-detection devices not vacuum-certification devices. If a canister pressure/vacuum gauge indicates an unexpected pressure change, determination of whether the change is a result of ambient temperature and pressure differences or a canister leak shall be made. This gauge shall be helium-leak tested to  $1.5 \times 10^{-7}$  standard cc/s, have all stainless steel construction, and be capable of tolerating temperatures to 125°C.

The SUMMA<sup>®</sup> or equivalent sample canisters as specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) shall be used when sampling each drum. These heads shall form a leak-tight connection with the canister and allow sampling through the drum-lid filter, through the drum lid itself and/or rigid poly liner when necessary (by use of a punch or self-tapping screw), using an airtight fitting to collect the sample through the filter vent hole of a pipe overpack container, or using a hollow side port needle. Figure-B.C1-4 illustrates the direct canister-sampling equipment.

**BC1-1a(4) Sampling Heads**

A sample of the headspace gas directly under the container lid, pipe overpack filter vent hole, or rigid poly liner shall be collected. Several methods have been developed for collecting a representative sample: sampling through the filter, sampling through the drum lid by drum punching, sampling through a pipe overpack container filter vent hole, and sampling through the rigid poly liner. The chosen sampling method shall preserve the integrity of the drum to contain

1 radionuclides (e.g., replace the damaged filter, replace set screw in filter housing, seal the  
2 punched drum lid).

3 BC1-1a(4)(i) Sampling Through the Filter

4 To sample the drum-headspace gas through the drum's filter, a side-port needle (e.g., a hollow  
5 needle sealed at the tip with a small opening on its side close to the tip) shall be pressed  
6 through the filter and into the headspace beneath the drum lid. This permits the gas to be drawn  
7 into the manifold or directly into the canister(s). To assure that the sample collected is  
8 representative, all of the general method requirements, sampling apparatus requirements, and  
9 QC requirements described in this section shall be met in addition to the following requirements  
10 that are pertinent to drum headspace-gas sampling through the filter:

- 11 • The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum  
12 headspace. A representative sample cannot be collected from the drum headspace  
13 until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a  
14 sample may be collected from inside the 90-mil rigid poly liner. If the sample is  
15 collected by removing the drum lid, the sampling device shall form an airtight seal with  
16 the rigid poly liner to prevent the intrusion of outside air into the sample (using a  
17 sampling needle connected to the sampling head to pierce the rigid poly liner satisfies  
18 this requirement). If headspace-gas samples are collected from the drum headspace  
19 prior to venting the 90-mil rigid poly liner, the sample is not acceptable and a  
20 nonconformance report shall be prepared, submitted, and resolved. Nonconformance  
21 procedures are outlined in Permit Attachment BC3.
- 22 • For sample collection, the drum's filter shall be sealed to prevent outside air from  
23 entering the drum and diluting and/or contaminating the sample.

24 The sampling head for collecting drum headspace by penetrating the filter shall consist of a  
25 side-port needle, a filter to prevent particles from contaminating the gas sample, and an adapter  
26 to connect the side-port needle to the filter. To prevent cross contamination, the sampling head  
27 shall be cleaned or replaced after sample collection, after field-reference standard collection,  
28 and after field-blank collection. The following requirements shall also be met:

- 29 • The housing of the filter shall allow insertion of the sampling needle through the filter  
30 element or a sampling port with septum that bypasses the filter element into the drum  
31 headspace.
- 32 • The side-port needle shall be used to reduce the potential for plugging.
- 33 • The purge assembly shall be modified for compatibility with the side-port needle.

34 BC1-1a(4)(ii) Sampling Through the Drum Lid By Drum Lid Punching

35 Sampling through the drum lid at the time of drum punching or thereafter may be performed as  
36 an alternative to sampling through the drum's filter if an airtight seal can be maintained. To  
37 sample the drum headspace-gas through the drum lid at the time of drum punching or  
38 thereafter, the lid shall be breached using an appropriate punch. The punch shall form an  
39 airtight seal between the drum lid and the manifold or direct canister sampling equipment. To  
40 assure that the sample collected is representative, all of the general method requirements,

1 sampling apparatus requirements, and QC requirements specified in EPA's Compendium  
2 Method TO-14A or TO-15 (EPA 1999) as appropriate, shall be met in addition to the following  
3 requirements:

- 4 • The seal between the drum lid and sampling head shall be designed to minimize  
5 intrusion of ambient air.
- 6 • All components of the sampling system that come into contact with sample gases shall  
7 be purged with humidified zero air, nitrogen, or helium prior to sample collection.
- 8 • Equipment blanks and field reference standards shall be collected through all the  
9 components of the punch that contact the headspace-gas sample.
- 10 • Pressure shall be applied to the punch until the drum lid has been breached.
- 11 • Provisions shall be made to relieve excessive drum pressure increases during drum-  
12 punch operations; potential pressure increases may occur during sealing of the drum  
13 punch to the drum lid.
- 14 • The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum  
15 headspace. A representative sample cannot be collected from the drum headspace  
16 until the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a  
17 sample may be collected from inside the 90-mil rigid poly liner. If headspace-gas  
18 samples are collected from the drum headspace prior to venting the 90-mil rigid poly  
19 liner, the sample is not acceptable and a nonconformance report shall be prepared,  
20 submitted, and resolved. Nonconformance procedures are outlined in Permit  
21 Attachment B.C3.
- 22 • During sampling, the drum's filter, if present, shall be sealed to prevent outside air from  
23 entering the drum.
- 24 • While sampling through the drum lid using manifold sampling, a flow-indicating device  
25 or pressure regulator to verify flow of gases shall be pneumatically connected to the  
26 drum punch and operated in the same manner as the flow-indicating device described  
27 above in Section B.C1-1a(2).
- 28 • Equipment shall be used to adequately secure the drum-punch sampling system to the  
29 drum lid.
- 30 • If the headspace gas sample is not taken at the time of drum punching, the presence  
31 and diameter of the rigid liner vent hole shall be documented during the punching  
32 operation for use in determining an appropriate Scenario 2 DAC.

33 BC1-1a(4)(iii) Sampling Through a Pipe Overpack Container Filter Vent Hole

34 Sampling through an existing filter vent hole in a pipe overpack container (**POC**) may be  
35 performed as an alternative to sampling through the POC's filter if an airtight seal can be  
36 maintained. To sample the container headspace-gas through a POC filter vent hole, an  
37 appropriate airtight seal shall be used. The sampling apparatus shall form an airtight seal

1 between the POC surface and the manifold or direct canister sampling equipment. To assure  
2 that the sample collected is representative, all of the general method, sampling apparatus, and  
3 QC requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as  
4 appropriate, shall be met in addition to the following requirements:

- 5 • The seal between the POC surface and sampling apparatus shall be designed to  
6 minimize intrusion of ambient air.
- 7 • The filter shall be replaced as quickly as is practicable with the airtight sampling  
8 apparatus to ensure that a representative sample can be taken. Sites must provide  
9 documentation demonstrating that the time between removing the filter and installing  
10 the airtight sampling device has been established by testing to assure a representative  
11 sample.
- 12 • All components of the sampling system that come into contact with sample gases shall  
13 be cleaned according to requirements for direct canister sampling or manifold  
14 sampling, whichever is appropriate, prior to sample collection.
- 15 • Equipment blanks and field reference standards shall be collected through all the  
16 components of the sampling system that contact the headspace-gas sample.
- 17 • During sampling, openings in the POC shall be sealed to prevent outside air from  
18 entering the container.
- 19 • A flow-indicating device shall be connected to sampling system and operated  
20 according to the direct canister or manifold sampling requirements, as appropriate.

#### 21 BC1-1b Quality Control

22 For manifold and direct canister sampling systems, field QC samples shall be collected on a per  
23 sampling batch basis. A sampling batch is a suite of samples collected consecutively using the  
24 same sampling equipment within a specific time period. A sampling batch can be up to 20  
25 samples (excluding QC samples), all of which shall be collected within 14 days of the first  
26 sample in the batch. For on-line integrated sampling/analysis systems, QC samples shall be  
27 collected and analyzed on a per on-line batch basis. Holding temperatures and container  
28 requirements for gas sample containers are provided in Table-BC1-1. An on-line batch is the  
29 number of headspace-gas samples collected within a 12-hour period using the same on-line  
30 integrated analysis system. The analytical batch requirements are specified by the analytical  
31 method being used in the on-line system. Table-BC1-2 provides a summary of field QC sample  
32 collection requirements. Table-BC1-3 provides a summary of QC sample acceptance criteria.

33 For on-line integrated sampling analysis systems, the on-line batch QC samples serve as  
34 combined sampling batch/analytical batch QC samples as follows:

- 35 • The on-line blank replaces the equipment blank and laboratory blank
- 36 • The on-line control sample replaces the field reference standard and laboratory control  
37 sample

- The on-line duplicate replaces the field duplicate and laboratory duplicate

The acceptance criteria for on-line batch QC samples are the same as for the sampling batch and analytical batch QC samples they replace. Acceptance criteria are shown in Table ~~B~~ C1-3. A separate field blank shall still be collected and analyzed for each on-line batch. However, if the results of a field blank collected through the sampling manifold meets the acceptance criterion, a separate on-line blank need not be collected and analyzed.

~~The Permittees DOE-The Permittees~~ shall require the site project manager to monitor and document field QC sample results and fill out a nonconformance report if acceptance or frequency criteria are not met. ~~The Permittees DOE-The Permittees~~ shall require the site project manager to ensure appropriate corrective action is taken if acceptance criteria are not met.

#### BC1-1b(1) Field Blanks

Field blanks shall be collected to evaluate background levels of program-required analytes. Field blanks shall be collected prior to sample collection, and at a frequency of one per sampling batch. ~~The Permittees DOE-The Permittees~~ shall require the site project manager to use the field blank data to assess impacts of ambient contamination, if any, on the sample results. Field blank results determined by gas chromatography/mass spectrometry and gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the method detection limit (**MDL**) listed in Table ~~B~~ C3-2 in Permit Attachment ~~B~~ C3. Field blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table ~~B~~ C3-2. A nonconformance report shall be initiated and resolved if the final reported QC sample results do not meet the acceptance criteria.

#### BC1-1b(2) Equipment Blanks

Equipment blanks shall be collected to assess cleanliness prior to first use after cleaning of all sampling equipment. On-line blanks will be used to assess equipment cleanliness as well as analytical contamination. After the initial cleanliness check, equipment blanks collected through the manifold shall be collected at a frequency of one per sampling batch for VOC analysis or one per day, whichever is more frequent. If the direct canister method is used, field blanks may be used in lieu of equipment blanks. ~~The Permittees DOE-The Permittees~~ shall require the site project manager to use the equipment blank data to assess impacts of potentially contaminated sampling equipment on the sample results. Equipment blank results determined by gas chromatography/mass spectrometry or gas chromatography/flame ionization detection shall be acceptable if the concentration of each VOC analyte is less than or equal to three times the MDL listed in Table ~~B~~ C3-2 in Permit Attachment ~~B~~ C3. Equipment blank results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less than the program required quantitation limit listed in Table ~~B~~ C3-2.

#### BC1-1b(3) Field Reference Standards

Field reference standards shall be used to assess the accuracy with which the sampling equipment collects VOC samples into SUMMA<sup>®</sup> or equivalent canisters prior to first use of the sampling equipment. The on-line control sample will be used to assess the accuracy with which the sampling equipment collects VOC samples as well as an indicator of analytical accuracy for the on-line sampling system. Field reference standards shall contain a minimum of six of the

1 | analytes listed in Table ~~B C~~3-2 in Permit Attachment ~~B C~~3 at concentrations within a range of 10  
2 | to 100 ppmv and greater than the MDL for each compound. Field reference standards shall  
3 | have a known valid relationship to a nationally recognized standard (e.g., NIST), if available. If  
4 | NIST traceable standards are not available and commercial gases are used, a Certificate of  
5 | Analysis from the manufacturer documenting traceability is required. Commercial stock gases  
6 | shall not be used beyond their manufacturer-specified shelf life. After the initial accuracy check,  
7 | field reference standards collected through the manifold shall be collected at a frequency of one  
8 | per sampling batch and submitted as blind samples to the analytical laboratory. For the direct  
9 | canister method, field reference standard collection may be discontinued if the field reference  
10 | standard results demonstrate the QAO for accuracy specified in ~~Appendix Attachment B C~~3.  
11 | Field reference standard results shall be acceptable if the accuracy for each tested compound  
12 | has a recovery of 70 to 130 percent.

#### 13 | ~~BC~~1-1b(4) Field Duplicates

14 | Field duplicate samples shall be collected sequentially and in accordance with Table ~~B C~~1-1 to  
15 | assess the precision with which the sampling procedure can collect samples into SUMMA<sup>®</sup> or  
16 | equivalent canisters. Field duplicates will also serve as a measure of analytical precision for the  
17 | on-line sampling system. Field duplicate results shall be acceptable if the relative percent  
18 | difference is less than or equal to 25 for each tested compound found in concentrations greater  
19 | than the PRQL in both duplicates.

#### 20 | ~~BC~~1-1c Equipment Testing, Inspection and Maintenance

21 | All sampling equipment components that come into contact with headspace sample  
22 | gases shall be constructed of relatively inert materials such as stainless steel or  
23 | Teflon<sup>®</sup>. A passivated interior surface on the stainless steel components is  
24 | recommended.

25 | To minimize the potential for cross contamination of samples, the headspace sampling manifold  
26 | and sample canisters shall be properly cleaned and leak-checked prior to each headspace-gas  
27 | sampling event. Procedures used for cleaning and preparing the manifold and sample canisters  
28 | shall be equivalent to those provided in EPA's Compendium Method TO-14A or TO-15 (EPA  
29 | 1999). Cleaning requirements are presented below.

#### 30 | ~~BC~~1-1c(1) Headspace-Gas Sample Canister Cleaning

31 | SUMMA<sup>®</sup> or equivalent canisters used in these methods shall be subjected to a rigorous  
32 | cleaning and certification procedures prior to use in the collection of any samples. Guidance for  
33 | the development of this procedure has been derived from Method TO-14A or TO-15 (EPA  
34 | 1999). Specific detailed instructions shall be provided in laboratory standard operating  
35 | procedures (**SOPs**) for the cleaning and certification of canisters.

36 | Canisters shall be cleaned and certified on an equipment cleaning batch basis. An equipment  
37 | cleaning batch is any number of canisters cleaned together at one time using the same cleaning  
38 | method. A cleaning system, capable of processing multiple canisters at a time, composed of an  
39 | oven (optional) and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap  
40 | backed by an oil sealed pump shall be used to clean SUMMA<sup>®</sup> or equivalent canisters. Prior to  
41 | cleaning, a positive or negative pressure leak test shall be performed on all canisters. The  
42 | duration of the leak test must be greater than or equal to the time it takes to collect a sample,

1 but no greater than 24 hours. For a leak test, a canister passes if the pressure does not change  
2 by a rate greater than  $\pm 2$  psig per 24 hours. Any canister that fails shall be checked for leaks,  
3 repaired, and reprocessed. One canister per equipment cleaning batch shall be filled with humid  
4 zero air or humid high purity nitrogen and analyzed for VOCs. The equipment cleaning batch of  
5 canisters shall be considered clean if there are no VOCs above three times the MDLs listed in  
6 Table B\_C3-2 of Permit Attachment B\_C3. After the canisters have been certified for leak-  
7 tightness and found to be free of background contamination, they shall be evacuated to 0.0039  
8 in. (0.10 mm) Hg or less for storage prior to shipment. ~~The Permittees~~ DOE-The Permittees  
9 shall require the laboratory responsible for canister cleaning and certification to maintain  
10 canister certification documentation and initiate the canister tags as described in Permit  
11 Attachment B\_C3.

12 BC1-1c(2) Sampling Equipment Initial Cleaning and Leak Check

13 The surfaces of all headspace-gas sampling equipment components that will come into contact  
14 with headspace gas shall be thoroughly inspected and cleaned prior to assembly. The manifold  
15 and associated sampling heads shall be purged with humidified zero air, nitrogen, or helium,  
16 and leak checked after assembly. This cleaning shall be repeated if the manifold and/or  
17 associated sampling heads are contaminated to the extent that the routine system cleaning is  
18 inadequate.

19 BC1-1c(3) Sampling Equipment Routine Cleaning and Leak Check

20 The manifold and associated sampling heads which are reused shall be cleaned and checked  
21 for leaks in accordance with the cleaning and leak check procedures described in EPA's  
22 Compendium Method TO-14A or TO-15 (EPA 1999). The procedures shall be conducted after  
23 headspace gas and field duplicate collection; after field blank collection, after field blanks are  
24 collected through the manifold; and after the additional cleaning required for field reference  
25 standard collection has been completed. The protocol for routine manifold cleaning and leak  
26 check requires that sample canisters be attached to the canister ports, or that the ports be  
27 capped or closed by valves, and requires that the sampling head be attached to the purge  
28 assembly.

29 VOCs shall be removed from the internal surfaces of the headspace sampling manifold to levels  
30 that are less than or equal to three times the MDLs of the analytes listed in Table B\_C3-2 of  
31 Permit Attachment B\_C3, as determined by analysis of an equipment blank or through use of an  
32 OVA. It is recommended that the headspace sampling manifold be heated to 150° Centigrade  
33 and periodically evacuated and flushed with humidified zero air, nitrogen, or helium. When not in  
34 use, the manifold shall be demonstrated clean before storage with a positive pressure of high  
35 purity gas (i.e., zero air, nitrogen, or helium) in both the standard and sample sides.

36 Sampling shall be suspended and corrective actions shall be taken when the analysis of an  
37 equipment blank indicates that the VOC limits have been exceeded or if a leak test fails. ~~The~~  
38 Permittees DOE-The Permittees shall require the site project manager to ensure that corrective  
39 action has been taken prior to resumption of sampling.

40 BC1-1c(4) Manifold Cleaning After Field Reference Standard Collection

41 The sampling system shall be specially cleaned after a field reference standard has been  
42 collected, because the field reference standard gases contaminate the standard side of the

1 headspace sampling manifold when they are regulated through the purge assembly. This  
2 cleaning requires the installation of a gas-tight connector in place of the sampling head,  
3 between the flexible hose and the purge assembly. This configuration allows both the sample  
4 and standard sides of the sampling system to be flushed (evacuated and pressurized) with  
5 humidified zero air, nitrogen, or helium which, combined with heating the pneumatic lines,  
6 should sweep and adequately clean the system's internal surfaces. After this protocol has been  
7 completed and prior to collecting another sample, the routine system cleaning and leak check  
8 (see previous section) shall also be performed.

9 BC1-1c(5) Sampling Head Cleaning

10 To prevent cross contamination, the needle, airtight fitting or airtight seal, adapters, and filter of  
11 the sampling heads shall be cleaned in accordance with the cleaning procedures described in  
12 EPA's Compendium Method TO-14A or TO-15 (EPA 1999). After sample collection, a sampling  
13 head shall be disposed of or cleaned in accordance with EPA's Compendium Method TO-14A  
14 or TO-15 (EPA1999), prior to reuse. As a further QC measure, the needle, airtight fitting or  
15 airtight seal, and filter, after cleaning, should be purged with zero air, nitrogen, or helium and  
16 capped for storage to prevent sample contamination by VOCs potentially present in ambient air.

17 BC1-1d Equipment Calibration and Frequency

18 The manifold pressure sensor shall be certified prior to initial use, then annually, using NIST  
19 traceable, or equivalent, standards. If necessary, the pressure indicated by the pressure  
20 sensor(s) shall be temperature compensated. The ambient air temperature sensor, if present,  
21 shall be certified prior to initial use, then annually, to NIST traceable, or equivalent, temperature  
22 standards.

23 The OVA shall be calibrated once per day, prior to first use, or as necessary according to the  
24 manufacturer's specifications. Calibration gases shall be certified to contain known analytes  
25 from Table B\_C3-2 of Permit Attachment B\_C3 at known concentrations. The balance of the  
26 OVA calibration gas shall be consistent with the manifold purge gas when the OVA is used (i.e.,  
27 zero air, nitrogen, or helium).

28 BC1-2 Sampling of Homogeneous Solids and Soil/Gravel (Summary Categories S3000/S4000)

29 For those waste streams without an AK Sufficiency Determination approved by ~~the Permittees~~  
30 DOE, randomly selected containers of homogeneous solid and/or soil/gravel waste streams  
31 (S3000/S4000) shall be sampled and analyzed to resolve the assignment of EPA hazardous  
32 waste numbers. For example, analytical results may be useful to resolve uncertainty regarding  
33 hazardous constituents used in a process that generated the waste stream when the hazardous  
34 constituents are not documented in the acceptable knowledge information for the waste.

35 BC1-2a Method Requirements

36 The methods used to collect samples of transuranic (**TRU**) mixed waste, classified as  
37 homogeneous solids and soil/gravel from waste containers, shall be such that the samples are  
38 representative of the waste from which they were taken. To minimize the quantity of  
39 investigation-derived waste, laboratories conducting the analytical work may require no more  
40 sample than is required for the analysis, based on the analytical methods. However, a sufficient  
41 number of samples shall be collected to adequately represent waste being sampled. For those

1 waste streams defined as Summary Category Groups S3000 or S4000 in Attachment B\_C,  
2 debris that may also be present within these wastes need not be sampled.

3 Samples of retrievably stored waste containers will be collected using appropriate coring  
4 equipment or other EPA approved methods to collect a representative sample. Newly generated  
5 wastes that are sampled from a process as it is generated may be sampled using EPA  
6 approved methods, including scoops and ladles, that are capable of collecting a representative  
7 sample. All sampling and core sampling will comply with the QC requirements specified in B  
8 C1-2b.

9 BC1-2a(1) Core Collection

10 Coring tools shall be used to collect cores of homogeneous solids and soil/gravel from waste  
11 containers, when possible, in a manner that minimizes disturbance to the core. A rotational  
12 coring tool (i.e., a tool that is rotated longitudinally), similar to a drill bit, to cut, lift the waste  
13 cuttings, and collect a core from the bore hole, shall be used to collect sample cores from waste  
14 containers. For homogeneous solids and soil/gravel that are relatively soft, non-rotational coring  
15 tools may be used in lieu of a rotational coring tool.

16 To provide a basis for describing the requirements for core collection, diagrams of a rotational  
17 coring tool (i.e., a light weight auger) and a non-rotational coring tool (i.e., a thin-walled sampler)  
18 are provided in Figures B\_C1-5 and B\_C1-6, respectively.

19 The following requirements apply to the use of coring tools:

- 20 • Each coring tool shall contain a removable tube (liner) that is constructed of fairly rigid  
21 material unlikely to affect the composition and/or concentrations of target analytes in  
22 the sample core. Materials that are acceptable for use for coring device sleeves are  
23 polycarbonate, teflon, or glass for most samples, and stainless steel or brass if  
24 samples are not to be analyzed for metals. ~~The Permittees DOE The Permittees~~ shall  
25 require site quality assurance project plans (QAPjPs) to document that analytes of  
26 concern are not present in liner material. ~~The Permittees DOE The Permittees~~ shall  
27 also require sites to document that the materials are unlikely to affect sample results  
28 through the collection and analysis of an equipment blank prior to first use as specified  
29 in the 'Equipment Blanks' section of this appendix. Liner outer diameter is  
30 recommended to be no more than 2 in. and no less than one in. Liner wall thickness is  
31 recommended to be no greater than 1/16 in. Before use, the liner shall be cleaned in  
32 accordance the requirements in Section B\_C1-2b. The liner shall fit flush with the inner  
33 wall of the coring tool and shall be of sufficient length to hold a core that is  
34 representative of the waste along the entire depth of the waste. The depth of the waste  
35 is calculated as the distance from the top of the sludge to the bottom of the drum  
36 (based on the thickness of the liner and the rim at the bottom of the drum). The liner  
37 material shall have sufficient transparency to allow visual examination of the core after  
38 sampling. If sub-sampling is not conducted immediately after core collection and liner  
39 extrusion, then end caps constructed of material unlikely to affect the composition  
40 and/or concentrations of target analytes in the core (e.g., Teflon®) shall be placed over  
41 the ends of the liner. End caps shall fit tightly to the ends of the liner. ~~The Permittees~~  
42 ~~DOE The Permittees~~ shall require site specific QAPjPs to indicate the acceptable  
43 materials for core liners and end caps.

- 1 • A spring retainer, similar to that illustrated in Figures ~~B\_C~~1-5 and ~~B\_C~~1-6, shall be used  
2 with each coring tool when the physical properties of the waste are such that the waste  
3 may fall out of the coring tool's liner during sampling activities. The spring retainer shall  
4 be constructed of relatively inert material (e.g., stainless steel or Teflon<sup>®</sup>) and its inner  
5 diameter shall not be less than the inner diameter of the liner. Before use, spring  
6 retainers shall be cleaned in accordance with the requirements in Section ~~B\_C~~1-2b.
- 7 • Coring tools may have an air-lock mechanism that opens to allow air inside the liners  
8 to escape as the tool is pressed into the waste (e.g., ball check valve). If used, this air-  
9 lock mechanism shall also close when the core is removed from the waste container.
- 10 • After disassembling the coring tool, a device (extruder) to forcefully extrude the liner  
11 from the coring tool shall be used if the liner does not slide freely. All surfaces of the  
12 extruder that may come into contact with the core shall be cleaned in accordance with  
13 the requirements in Section ~~B\_C~~1-2(b) prior to use.
- 14 • Coring tools shall be of sufficient length to hold the liner and shall be constructed to  
15 allow placement of the liner leading edge as close as possible to the coring tools  
16 leading edge.
- 17 • All surfaces of the coring tool that have the potential to contact the sample core or  
18 sample media shall be cleaned in accordance with the requirements in Section ~~B\_C~~1-  
19 2(b) prior to use.
- 20 • The leading edge of the coring tools may be sharpened and tapered to a diameter  
21 equivalent to, or slightly smaller than, the inner diameter of the liner to reduce the drag  
22 of the homogeneous solids and soil/gravel against the internal surfaces of the liner,  
23 thereby enhancing sample recovery.
- 24 • Rotational coring tools shall have a mechanism to minimize the rotation of the liner  
25 inside the coring tool during coring activities, thereby minimizing physical disturbance  
26 to the core.
- 27 • Rotational coring shall be conducted in a manner that minimizes transfer of frictional  
28 heat to the core, thereby minimizing potential loss of VOCs.
- 29 • Non-rotational coring tools shall be designed such that the tool's kerf width is  
30 minimized. Kerf width is defined as one-half of the difference between the outer  
31 diameter of the tool and the inner diameter of the tool's inlet.

#### 32 ~~BC~~1-2a(2) Sample Collection

33 Sampling of cores shall be conducted in accordance with the following requirements:

- 34 • Sampling shall be conducted as soon as possible after core collection. If a substantial  
35 delay (i.e., more than 60 minutes) is expected between core collection and sampling,  
36 the core shall remain in the liner and the liner shall be capped at each end. If the liner  
37 containing the core is not extruded from the coring tool and capped, then two  
38 alternatives are permissible: 1) the liner shall be left in the coring tool and the coring

1 tool shall be capped at each end, or 2) the coring tool shall remain in the waste  
2 container with the air-lock mechanism attached.

- 3 • Samples of homogeneous solids and soil/gravel for VOC analyses shall be collected  
4 prior to extruding the core from the liner. These samples may be collected by collecting  
5 a single sample from the representative subsection of the core, or three sub-samples  
6 may be collected from the vertical core to form a single 15-gram composite sample.  
7 Smaller sample sizes may be used if method PRQL requirements are met for all  
8 analytes. The sampling locations shall be randomly selected. If a single sample is  
9 used, the representative subsection is chosen by randomly selecting a location along  
10 the portion of the core (i.e. core length). If the three sub-sample method is used, the  
11 sampling locations shall be randomly selected within three equal-length subsections of  
12 the core along the long axis of the liner and access to the waste shall be gained by  
13 making a perpendicular cut through the liner and the core. ~~The Permittees DOE~~ The  
14 Permittees shall require sites to develop documented procedures to select, and record  
15 the selection, of random sampling locations. True random sampling involves the  
16 proper use of random numbers for identifying sampling locations. The procedures  
17 used to select the random sampling locations will be subject to review as part of  
18 annual audits by ~~the Permittees DOE~~. A sampling device such as the metal coring  
19 cylinder described in EPA's SW-846 Manual (1996), or equivalent, shall be  
20 immediately used to collect the sample once the core has been exposed to air.  
21 Immediately after sample collection, the sample shall be extruded into 40-ml volatile  
22 organics analysis (VOA) vials (or other containers specified in appropriate SW-846  
23 methods), the top rim of the vial visually inspected and wiped clean of any waste  
24 residue, and the vial cap secured. Sample handling requirements are outlined in Table  
25 B\_C1-4. Additional guidance for this type of sampling can be found in SW-846 (EPA  
26 1996).

- 27 • Samples of the homogeneous solids and soil/gravel for semi-volatile organic  
28 compound and metals analyses shall be collected. These samples may be collected  
29 from the same sub-sample locations and in the same manner as the sample collected  
30 for VOC analysis, or they may be collected by splitting or compositing the  
31 representative subsection of the core. The representative subsection is chosen by  
32 randomly selecting a location along the portion of the core (i.e. core length). ~~The~~  
33 ~~Permittees DOE~~ The Permittees shall require sites to develop documented procedures  
34 to select, and record the selection, of random sampling locations. True random  
35 sampling involves the proper use of random numbers for identifying sampling  
36 locations. The procedures used to select the random sampling locations will be subject  
37 to review as part of annual audits by ~~the Permittees DOE~~. Guidance for splitting and  
38 compositing solid materials can be found in SW-846 (EPA 1996). All surfaces of the  
39 sampling tools that have the potential to come into contact with the sample shall be  
40 constructed of materials unlikely to affect the composition or concentrations of target  
41 analytes in the waste (e.g., Teflon<sup>®</sup>). In addition, all surfaces that have the potential to  
42 come into contact with core sample media shall either be disposed or decontaminated  
43 according to the procedures found in Section B\_C1-2(b). Sample sizes and handling  
44 requirements are outlined in Table B\_C1-4.

45 Newly generated waste samples may be collected using methods other than coring, as  
46 discussed in Section B\_C1-2a. Newly generated wastes samples will be collected as soon as

1 possible after sampling, but the spatial and temporal homogeneity of the waste stream dictate  
2 whether a representative grab sample or composite sample shall be collected. As part of the  
3 site audit, ~~the Permittees~~ DOE shall assess waste sampling to ensure collection of  
4 representative samples.

#### 5 BC1-2b Quality Control

6 QC requirements for sampling of homogeneous solids and soil/gravel include collecting co-  
7 located samples from cores or other sample types to determine precision; equipment blanks to  
8 verify cleanliness of the sampling and coring tools and sampling equipment; and analysis of  
9 reagent blanks to ensure reagents, such as deionized or high pressure liquid chromatography  
10 (**HPLC**) water, are of sufficient quality. Coring and sampling of homogeneous solids and  
11 soil/gravel shall comply, at minimum, with the following QC requirements.

#### 12 BC1-2b(1) Co-located Samples

13 In accordance with the requirement to collect field duplicates required by the EPA methods  
14 found in SW-846 (EPA 1996), samples shall be collected to determine the combined precision  
15 of the coring and sampling procedures. The co-located core methodology is a duplicate sample  
16 collection methodology intended to collect samples from a second core placed at approximately  
17 the same location within the drum when samples are collected by coring. Waste may not be  
18 amenable to coring in some instances. In this case, a co-located sample may be collected from  
19 a sample (e.g. scoop) collected from approximately the same location in the waste stream. A  
20 sample from each co-located core or waste sample collected by other means shall be collected  
21 side by side as close as feasible to one another, handled in the same manner, visually  
22 inspected through the transparent liner (if cored), and sampled in the same manner at the same  
23 randomly selected sample location(s). If the visual examination detects inconsistencies such as  
24 color, texture, or waste type in the waste at the sample location, another sampling location may  
25 be randomly selected, or the samples may be invalidated and co-located samples or cores may  
26 again be collected. Co-located samples, from either core or other sample type, shall be  
27 collected at a frequency of one per sampling batch or once per week, whichever is more  
28 frequent. A sampling batch is a suite of homogeneous solids and soil/gravel samples collected  
29 consecutively using the same sampling equipment within a specific time period. A sampling  
30 batch can be up to 20 samples (excluding field QC samples), all of which shall be collected  
31 within 14 days of the first sample in the batch.

#### 32 BC1-2b(2) Equipment Blanks

33 In accordance with SW-846 (EPA 1996), equipment blanks shall be collected from fully  
34 assembled sampling and coring tools (i.e., at least those portions of the sampling equipment  
35 that contact the sample) prior to first use after cleaning at a frequency of one per equipment  
36 cleaning batch. An equipment cleaning batch is the number of sampling equipment items  
37 cleaned together at one time using the same cleaning method. The equipment blank shall be  
38 collected from the fully assembled sampling or coring tool, in the area where the sampling or  
39 coring tools are cleaned, prior to covering with protective wrapping and storage. The equipment  
40 blank shall be collected by pouring clean water (e.g., deionized water, HPLC water) down the  
41 inside of the assembled sampling or coring tool. The water shall be collected in a clean sample  
42 container placed at the leading edge of the sampling or coring tool and analyzed for the  
43 analytes listed in Tables B C3-4, B C3-6, and B C3-8 of Permit Attachment B C3. The results of  
44 the equipment blank will be considered acceptable if the analysis indicates no analyte at a

1 concentration greater than three times the MDLs listed in Tables B\_C3-4 and B\_C3-6 or in the  
2 Program Required Detection Limits (PRDL) in Table B\_C3-8 of Permit Attachment B\_C3. If  
3 analytes are detected at concentrations greater than three times the MDLs (or PRDLs for  
4 metals), then the associated equipment cleaning batch of sampling or coring tools shall be  
5 cleaned again and another equipment blank collected. Equipment from an equipment cleaning  
6 batch may not be used until analytical results have been received verifying an adequately low  
7 level of contamination in the equipment blank.

8 Equipment blanks for coring tools shall be collected from liners that are cleaned separately from  
9 the coring tools. These equipment blanks shall be collected at a frequency of one per equipment  
10 cleaning batch. The equipment blanks shall be collected by randomly selecting a liner from the  
11 equipment cleaning batch, pouring clean water (e.g., deionized water or HPLC water) across its  
12 internal surface, collecting the water in a clean sample container, and analyzing the water for  
13 the analytes listed in Tables B\_C3-4, B\_C3-6, and the PRDLs in Table B\_C3-8 of Permit  
14 Attachment B\_C3. The results of the equipment blank analysis will be considered acceptable if  
15 the results indicate no analyte at a concentration greater than three times the MDLs listed in  
16 Tables B\_C3-4, B\_C3-6, or B\_C3-8 of Permit Attachment B\_C3. If analytes are detected at  
17 concentrations greater than three times the MDLs (or PRDLs for metals), then the associated  
18 equipment cleaning batch of liners shall be cleaned again and another equipment blank  
19 collected. Equipment from an equipment cleaning batch may not be used until analytical results  
20 have been received verifying an adequately low level of contamination in the equipment blank.

21 Sampling equipment (e.g., bowls, spoons, chisel, VOC sub-sampler) shall also be cleaned.  
22 Equipment blanks shall be collected for the sampling equipment at a frequency of one per  
23 equipment cleaning batch. After the sampling equipment has been cleaned, one item from the  
24 equipment cleaning batch is randomly selected, water (e.g., deionized water, HPLC water) is  
25 passed over its surface, collected in a clean container, and analyzed for the analytes listed in  
26 Tables B\_C3-4, B\_C3-6, and B\_C3-8 of Permit Attachment B\_C3. The results of the equipment  
27 blank will be considered acceptable if the results indicate no analyte present at a concentration  
28 greater than three times the MDLs listed in Tables B\_C3-4 and B\_C3-6 and in the PRDLs in B\_C3-8  
29 of Permit Attachment B\_C3. If analytes are detected at concentrations greater than three  
30 times the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of  
31 sampling equipment shall be cleaned again and another equipment blank collected. Equipment  
32 from an equipment cleaning batch may not be used until analytical results have been received  
33 verifying an adequately low level of contamination in the equipment blank. The above  
34 equipment blanks may be performed on a purchased batch basis for sampling equipment  
35 purchased sterile and sealed in protective packaging. Equipment blanks need not be performed  
36 for equipment purchased in sealed protective packaging accompanied by a certificate certifying  
37 cleanliness.

38 The results of equipment blanks shall be traceable to the items in the equipment cleaning batch  
39 that the equipment blank represents. All sampling items should be identified, and the associated  
40 equipment cleaning batch should be documented. The method of documenting the connection  
41 between equipment and equipment cleaning batches shall be documented. Equipment blank  
42 results for the coring tools, liners, and sampling equipment shall be reviewed prior to use. A  
43 sufficient quantity of these items should be maintained in storage to prevent disruption of  
44 sampling operations.

1 | ~~The Permittees~~ **DOE-The Permittees** may require a site to use certified clean disposable  
2 | sampling equipment and discard liners and sampling tools after one use. In this instance,  
3 | cleaning and equipment blank collection is not required.

4 | BC1-2b(3) Coring Tool and Sampling Equipment Cleaning

5 | Coring tools and sampling equipment shall be cleaned in accordance with the following  
6 | requirements:

- 7 | • All surfaces of coring tools and sampling equipment that will come into contact with the  
8 | samples shall be clean prior to use. All sampling equipment shall be cleaned in the  
9 | same manner. Immediately following cleaning, coring tools and sampling equipment  
10 | shall be assembled and sealed inside clean protective wrapping.
- 11 | • Each reusable sampling or coring tool shall have a unique identification number. Each  
12 | number shall be referenced to the waste container on which it was used. This  
13 | information shall be recorded in the field records. One sampling or coring tool from  
14 | each equipment cleaning batch shall be tested for cleanliness in accordance with the  
15 | requirements specified above. The identification number of the sampling or coring tool  
16 | from which the equipment blank was collected shall be recorded in the field records.  
17 | The results of the equipment blank analysis for the equipment cleaning batch in which  
18 | each sampling or coring tool was cleaned shall be submitted to the sampling facility  
19 | with the identification numbers of all sampling or coring tools in the equipment cleaning  
20 | batch. If analytes are detected at concentrations greater than three times the MDLs (or  
21 | PRDLs for metals), then the associated equipment cleaning batch of sampling  
22 | equipment shall be cleaned again and another equipment blank collected. Equipment  
23 | from an equipment cleaning batch may not be used until analytical results have been  
24 | received verifying an adequately low level of contamination in the equipment blank.
- 25 | • Sample containers shall be cleaned in accordance with SW-846 (EPA 1996).

26 | BC1-2c Equipment Testing, Inspection and Maintenance

27 | Prior to initiation of sampling or coring activities, sampling and coring tools shall be tested in  
28 | accordance with manufacturer specifications to ensure operation within the manufacturer's  
29 | tolerance limits. Other specifications specific to the sampling operations (e.g., operation of  
30 | containment structure and safety systems) should also be tested and verified as operating  
31 | properly prior to initiating coring activities. Coring tools shall be assembled, including liners, and  
32 | tested. Air-lock mechanisms and rotation mechanisms shall be inspected for free movement of  
33 | critical parts. Sampling and coring tools found to be malfunctioning shall be repaired or replaced  
34 | prior to use.

35 | Coring tools and sample collection equipment shall be maintained in accordance with  
36 | manufacturer's specifications. Clean sampling and coring tools and sampling equipment shall  
37 | be sealed inside clean protective wrapping and maintained in a clean storage area prior to use.  
38 | Sampling equipment shall be properly maintained to avoid contamination. A sufficient supply of  
39 | spare parts should be maintained to prevent delays in sampling activities due to equipment  
40 | down time. Records of equipment maintenance and repair shall be maintained in the field  
41 | records in accordance with site SOPs.

1 Inspection of sampling equipment and work areas shall include the following:

- 2 • Sample collection equipment in the immediate area of sample collection shall be  
3 inspected daily for cleanliness. Visible contamination on any equipment (e.g., waste on  
4 floor of sampling area, hydraulic fluid from hoses) that has the potential to contaminate  
5 a waste core or waste sample shall be thoroughly cleaned upon its discovery.
- 6 • The waste coring and sampling work areas shall be maintained in clean condition to  
7 minimize the potential for cross contamination between waste (including cores) and  
8 samples.
- 9 • Expendable equipment (e.g., plastic sheeting, plastic gloves) shall be visually  
10 inspected for cleanliness prior to use and properly discarded after each sample.
- 11 • Prior to removal of the protective wrapping from a coring tool designated for use, the  
12 condition of the protective wrapping shall be visually assessed. Coring tools with torn  
13 protective wrapping should be returned for cleaning. Coring tools visibly contaminated  
14 after the protective wrapping has been removed shall not be used and shall be  
15 returned for cleaning or properly discarded.
- 16 • Sampling equipment shall be visually inspected prior to use. All sampling equipment  
17 that comes into contact with waste samples shall be stored in protective wrapping until  
18 use. Prior to removal of the protective wrapping from sampling equipment, the  
19 condition of the protective wrapping shall be visually assessed. Sampling equipment  
20 with torn protective wrapping should be discarded or returned for cleaning. Sampling  
21 equipment visibly contaminated after the protective wrapping has been removed shall  
22 not be used and shall be returned for cleaning or properly discarded.
- 23 • Cleaned sampling and coring equipment will be physically segregated from all  
24 equipment that has been used for a sampling event and has not been decontaminated.

25 BC1-2d Equipment Calibration and Frequency

26 The scale used for weighing sub-samples shall be calibrated as necessary to maintain its  
27 operation within manufacturer's specification, and after repairs and routine maintenance.  
28 Weights used for calibration shall be traceable to a nationally recognized standard. Calibration  
29 records shall be maintained in the field records.

30 BC1-3 Radiography

31 Radiography has been developed by ~~the Permittees DOE the Permittees~~ specifically to aid in  
32 the examination and identification of containerized waste. ~~The Permittees DOE The Permittees~~  
33 shall require that sites describe all activities required to achieve the radiography objectives in  
34 site QAPjPs and SOPs. These SOPs should include instructions specific to the radiography  
35 system(s) used at the site. For example, to detect liquids, some systems require the container to  
36 be rotated back and forth while other systems require the container to be tilted.

37 A radiography system (e.g., real time radiography, digital radiography/computed tomography)  
38 normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation  
39 protection, a waste container handling system, an audio/video recording system, and an

1 operator control and data acquisition station. Although these six components are required, it is  
2 expected there will be some variation within a given component between sites. The radiography  
3 system shall have controls or an equivalent process which allow the operator to control image  
4 quality. On some radiography systems, it should be possible to vary the voltage, typically  
5 between 150 to 400 kilovolts (kV), to provide an optimum degree of penetration through the  
6 waste. For example, high-density material should be examined with the X-ray device set on the  
7 maximum voltage. This ensures maximum penetration through the waste container. Low-density  
8 material should be examined at lower voltage settings to improve contrast and image definition.  
9 The imaging system typically utilizes either a fluorescent screen and a low-light television  
10 camera or x-ray detectors to generate the image.

11 To perform radiography, the waste container is scanned while the operator views the television  
12 screen. A video and audio recording is made of the waste container scan and is maintained as a  
13 non-permanent record. A radiography data form is also used to document the Waste Matrix  
14 Code to ensure that the waste container contains no ignitable, corrosive, or reactive waste by  
15 documenting the absence of liquids in excess of TSDf-WAC limits or compressed gases, and  
16 verify that the physical form of the waste is consistent with the waste stream description  
17 documented on the WSPF. Containers whose contents prevent full examination of the  
18 remaining contents shall be subject to visual examination unless the site certifies that visual  
19 examination would provide no additional relevant information for that container based on the  
20 acceptable knowledge information for the waste stream. Such certification shall be documented  
21 in the generator/storage site's record.

22 For containers which contain classified shapes and undergo radiography, the radiography video  
23 and audio recording will be considered classified. The radiography data forms will not contain  
24 classified information.

25 The radiography system involves qualitative and semiquantitative evaluations of visual displays.  
26 Operator training and experience are the most important considerations for ensuring quality  
27 controls in regard to the operation of the radiography system and for interpretation and  
28 disposition of radiography results. Only trained personnel shall be allowed to operate  
29 radiography equipment.

30 Standardized training requirements for radiography operators shall be based upon existing  
31 industry standard training requirements.

32 | ~~The Permittees DOE-The Permittees~~ shall require each site to develop a training program that  
33 provides radiography operators with both formal and on-the-job (OJT) training. Radiography  
34 operators shall be instructed in the specific waste generating practices, typical packaging  
35 configurations, and associated waste material parameters expected to be found in each Waste  
36 Matrix Code at the site. The OJT and apprenticeship shall be conducted by an experienced,  
37 qualified radiography operator prior to qualification of the training candidate. The training  
38 programs will be site-specific due to differences in equipment, waste configurations, and the  
39 level of waste characterization efforts. For example, certain sites use digital radiography  
40 equipment, which is more sensitive than real-time radiography equipment. In addition, the  
41 particular physical forms and packaging configurations at each site will vary; therefore,  
42 radiography operators shall be trained on the types of waste that are generated, stored, and/or  
43 characterized at that particular site.

1 Although ~~the Permittees DOE the Permittees~~ shall require each site to develop its own training  
2 program, all of the radiography QC requirements specified in this WAP shall be incorporated  
3 into the training programs and radiography operations. In this way data quality and  
4 comparability will not be affected.

5 Radiography training programs will be the subject of the ~~Permittees' DOE~~ Audit and  
6 Surveillance Program (Permit Attachment-B\_C6).

7 A-One or more training drum containers with items (including prohibited items) common to the  
8 waste streams to be characterized and internal containers of various sizes shall be scanned  
9 biannually semiannually by each operator. The audio and video media shall then be reviewed  
10 by a supervisor to ensure that operators' interpretations remain consistent and accurate.  
11 Imaging system characteristics shall be verified on a routine basis.

12 Independent replicate scans and replicate observations of the video output of the radiography  
13 process shall be performed under uniform conditions and procedures. Independent replicate  
14 scans shall be performed on one waste container per day or once per testing batch, whichever  
15 is less frequent, by a qualified radiography operator that was not involved in the original scan of  
16 the waste container. Independent observations of one scan (not the replicate scan) shall also be  
17 made once per day or once per testing batch, whichever is less frequent, by a qualified  
18 radiography operator ~~other than the individual who performed the first examination that was not~~  
19 involved in the original scan of the waste container. A testing batch is a suite of waste  
20 containers undergoing radiography using the same testing equipment. A testing batch can be up  
21 to 20 waste containers without regard to waste matrix.

22 Oversight functions include periodic audio/video tape media reviews of accepted waste  
23 containers and shall be performed by qualified radiography operators personnel other than the  
24 operator who dispositioned that were not involved in the original scans of the waste containers.  
25 The results of this independent verification shall be available to the radiography operators who  
26 performed the original scans. ~~The Permittees DOE The Permittees~~ shall require the site project  
27 manager to be responsible for monitoring the quality of the radiography data and calling for  
28 corrective action, when necessary.

#### 29 BC1-4 Visual Examination

30 The waste container contents may be verified directly by visual examination (**VE**) of the waste  
31 container contents. Visual examination may be performed by physically examining the contents  
32 of waste containers to verify the Waste Matrix Code and to verify that the container is properly  
33 included in the appropriate waste stream. Visual examination shall be conducted on a waste  
34 container to identify and describe all waste items, packaging materials, and waste material  
35 parameters in the waste container. Visual examination activities shall be documented on  
36 video/audio media, or by using a second operator to provide additional verification by reviewing  
37 the contents of the waste container to ensure correct reporting. When VE is performed using a  
38 second operator, each operator performing the VE shall observe for themselves the waste being  
39 placed in the waste container or the contents within the examined waste container when waste  
40 is not removed. The results of all VE shall be documented on VE data forms, which are used to  
41 document the Waste Matrix Code, ensure that the waste container contains no ignitable,  
42 corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC  
43 limits or compressed gases, and verify that the physical form of the waste is consistent with the  
44 waste stream description documented on the WSPF in the AK Summary.

1 Visual examination recorded on video/audio media shall meet the following minimum  
2 requirements:

- 3 • The video/audio media shall record the waste packaging event for the container such  
4 that all waste items placed into the container are recorded in sufficient detail and shall  
5 contain an inventory of waste items in sufficient detail that another trained VE operator  
6 can identify the associated waste material parameters.
- 7 • The video/audio media shall capture the waste container identification number.
- 8 • The personnel loading the waste container shall be identified on the video/audio media  
9 or on packaging records traceable to the loading of the waste container.
- 10 • The date of loading of the waste container will be recorded on the video/audio media  
11 or on packaging records traceable to the loading of the waste container.

12 Visual examination performed using two generator site personnel shall meet the following  
13 minimum requirements:

- 14 • At least two generator site personnel who witnessed the packaging of the waste shall  
15 approve the data forms or packaging records attesting to the contents of the waste  
16 container.
- 17 • The data forms or packaging records shall contain an inventory of waste items in  
18 sufficient detail that another trained VE operator can identify the associated waste  
19 material parameters.
- 20 • The waste container identification number shall be recorded on the data forms or  
21 packaging records.

22 Visual examination video/audio media of containers which contain classified shapes shall be  
23 considered classified information. Visual examination data forms or packaging records will not  
24 contain classified information.

25 Waste container packaging records may be used to meet the VE data quality objectives (**DQOs**)  
26 (Permit Attachment **B\_C**, Section **B\_C**-4a(1)). These records must meet the minimum  
27 requirements listed above for either VE recorded on video/audio media or VE performed by two  
28 generator/storage site personnel, and shall be reviewed by operators trained and qualified to the  
29 requirements listed below. The operators will prepare data forms based on the visual  
30 examination records. Visual examination batch data reports will be prepared, reviewed, and  
31 approved as described in Permit Attachment **B\_C**, Section **B\_C**-4, and Permit Attachment **B\_C**3.

32 Standardized training for VE shall be developed. Visual examination operators shall be  
33 instructed in the specific waste generating processes, typical packaging configurations, and  
34 waste material parameters expected to be found in each Waste Matrix Code at the site. The  
35 training shall be site specific to include the various waste configurations generated/stored at the  
36 site. For example, the particular physical forms and packaging configurations at each site will  
37 vary so operators shall be trained to examine the types of waste that are generated, stored,  
38 and/or characterized at that particular site. Training will include the following regardless of  
39 Summary Category Group:

1       • Identifying and describing the contents of a waste container by examining all items in  
2       waste containers of previously packaged waste

3       • Identifying when VE cannot be used to meet the DQOs

4       Visual examination personnel shall be requalified once every two years.

5       Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste  
6       generating processes that have taken place at that site and also be familiar with all of the types  
7       of waste being characterized at that site. The VE expert shall be responsible for the overall  
8       direction and implementation of the VE at that facility. ~~The Permittees DOE-The Permittees~~ shall  
9       require site QAPjPs to specify the selection, qualification, and training requirements of the VE  
10      expert.

11      BC1-5 Custody of Samples

12      Chain-of-Custody on field samples (including field QC samples) will be initiated immediately  
13      after sample collection or preparation. Sample custody will be maintained by ensuring that  
14      samples are custody sealed during shipment to the laboratory. After samples are accepted by  
15      the analytical laboratory, custody is maintained by assuring the samples are in the possession  
16      of an authorized individual, in that individual's view, in a sealed or locked container controlled by  
17      that individual, or in a secure controlled access location. Sample custody will be maintained until  
18      the sample is released by the site project manager or until the sample is expended. ~~The~~  
19      ~~Permittees DOE-The Permittees~~ shall require that site QAPjPs or site-specific procedures  
20      include a copy of the sample chain-of-custody form and instructions for completing sample  
21      chain-of-custody forms in a legally defensible manner. This form will include provisions for each  
22      of the following:

23      • Signature of individual initiating custody control, along with the date and time.

24      • Documentation of sample numbers for each sample under custody. Sample numbers  
25      will be referenced to a specific sampling event description that will identify the  
26      sampler(s) through signature, the date and time of sample collection, type/number  
27      containers for each sample, sample matrix, preservatives (if applicable), requested  
28      methods of analysis, place/address of sample collection and the waste container  
29      number.

30      • For off-site shipping, method of shipping transfer, responsible shipping organization or  
31      corporation, and associated air bill or lading number.

32      • Signatures of custodians relinquishing and receiving custody, along with date and time  
33      of the transfer.

34      • Description of final sample container disposition, along with signature of individual  
35      removing sample container from custody.

36      • Comment section.

37      • Documentation of discrepancies, breakage or tampering.

1 All samples and sampling equipment will be identified with unique identification numbers.  
2 Sampling Coring tools and equipment will be identified with unique equipment numbers to  
3 ensure that all sampling equipment, coring tools, and sampling canisters are traceable to  
4 equipment cleaning batches.

5 All samples will be uniquely identified to ensure the integrity of the sample and can be used to  
6 identify the generator/storage site and date of collection. Sample tags or labels will be affixed to  
7 all samples and will identify at a minimum:

- 8 • Sample ID number
- 9 • Sampler initials and organization
- 10 • Ambient temperature and pressure (for gas samples only)
- 11 • Sample description
- 12 • Requested analyses
- 13 • Data and time of collection
- 14 • QC designation (if applicable)

#### 15 BC1-6 Sample Packing and Shipping

16 In the event that the analytical facilities are not at the generator/storage site, the samples shall  
17 be packaged and shipped to an off-site laboratory. Sample containers shall be packed to  
18 prevent any damage to the sampling container and maintain the preservation temperature, if  
19 necessary. Department of Transportation (**DOT**) regulations shall be adhered to for shipment of  
20 the package.

21 When preparing SUMMA<sup>®</sup> or equivalent canisters for shipment, special care shall be taken with  
22 the pressure gauge and the associated connections. Metal boxes which have separate  
23 compartments, or cardboard boxes with foam inserts are standard shipping containers. The  
24 chosen shipping container shall meet selected DOT regulations. If temperatures shall be  
25 maintained, an adequate number of cold packs necessary to maintain the preservation  
26 temperature shall be added to the package.

27 Glass jars are wrapped in bubble wrap or another type of protection. The wrapped jar should be  
28 placed in a plastic bag inside of the shipping container, so that if the jar breaks, the inside of the  
29 shipping container and the other samples will not be contaminated. The plastic bag will enable  
30 the receiving analytical lab to prevent contamination of their shipping and receiving area. Plastic  
31 jars do not present a problem for shipping purposes. All shipping containers will contain  
32 appropriate blank samples to detect any VOC cross-contamination. A DOT approved cooler, or  
33 similar package may be used as the shipping container. If temperatures must be maintained, an  
34 adequate number of cold packs necessary to maintain the preservation temperature shall be  
35 added to the package. If fill material is needed, compatibility between the samples and the fill  
36 should be evaluated prior to use.

37 All sample containers should be affixed with signed tamper-proof seals or devices so that it is  
38 apparent if the sample integrity has been compromised and that the identity of the seal or  
39 device is traceable to the individual who affixed the seal. A seal should also be placed on the  
40 outside of the shipping container for the same reason. Sample custody documentation shall be  
41 placed inside the sealed or locked shipping container, with the current custodian signing to  
42 release custody. Transfer of custody is completed when the receiving custodian opens the

1 shipping container and signs the custody documentation. The shipping documentation will serve  
2 to track the physical transfer of samples between the two custodians.

3 A Uniform Hazardous Waste Manifest is not required, since samples are exempted from the  
4 definition of hazardous waste under RCRA. All other shipping documentation specified in the  
5 site specific SOP for sample shipment (i.e., bill of lading, site-specific shipping documentation)  
6 is required.

7 BC1-7 List of References

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14 M.J. Connolly, et. al.

15 U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for Determination  
16 of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/10b, January 1999).

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18 "Laboratory Manual Physical/Chemical Methods, SW-846, 3rd ed., U.S. EPA, OSW and ER,  
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## TABLES

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**Table ~~B~~ C1-1**  
**Gas Sample Requirements**

<b>Parameter</b>	<b>Container<sup>a</sup></b>	<b>Minimum Drum Headspace Sample Volume<sup>b</sup></b>	<b>Holding Temperatures</b>
VOCs	SUMMA <sup>®</sup> Canister	250 ml	0-40 °C

<sup>a</sup> Alternately, canisters that meet QAOs may be used.

<sup>b</sup> Alternatively, if available headspace is limited, a single 100 ml sample may be collected for determination of VOCs.

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**Table B.C1-2  
 Summary of Drum Field QC Headspace Sample Frequencies**

QC Samples	Manifold	Direct Canister	On-Line Systems
Field blanks <sup>a</sup>	1 per sampling batch <sup>d</sup>	1 per sampling batch <sup>d</sup>	1 per on-line batch <sup>f</sup>
Equipment blanks <sup>b</sup>	1 per sampling batch <sup>d</sup>	once <sup>e</sup>	1 per on-line batch <sup>f</sup>
Field reference standards <sup>c</sup>	1 per sampling batch <sup>d</sup>	once <sup>e</sup>	1 per on-line batch <sup>f</sup>
Field duplicates	1 per sampling batch <sup>d</sup>	1 per sampling batch <sup>d</sup>	1 per on-line batch <sup>f</sup>

- <sup>a</sup> Analysis of field blanks for VOCs (Table B.C3-2 of Appendix Attachment B.C3), only, is required. For on-line integrated sampling/analysis systems, if field blank results meet the acceptance criterion, a separate on-line blank is not required.
- <sup>b</sup> One equipment blank or on-line sample shall be collected, analyzed for VOCs (Table B.C3-2), and demonstrated clean prior to first use of the headspace gas sampling equipment with each of the sampling heads, then at the specified frequency, for VOCs only thereafter. Daily, prior to work, the sampling manifold, if in use, shall be verified clean using an OVA.
- <sup>c</sup> One field reference standard or on-line control sample shall be collected, analyzed, and demonstrated to meet the QAOs specified in Permit Attachment B.C3 prior to first use, then at the specified frequency thereafter.
- <sup>d</sup> A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be collected within 14 days of the first sample in the batch.
- <sup>e</sup> One equipment blank and field reference standard shall be collected after equipment purchase, cleaning, and assembly.
- <sup>f</sup> An on-line batch is the number of samples collected within a 12-hour period using the same on-line integrated sampling/analysis system. The analytical batch requirements are specified by the analytical method being used in the on-line system.

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**Table-B\_C1-3**  
**Summary of Sampling Quality Control Sample Acceptance Criteria**

<b>QC Sample</b>	<b>Acceptance Criteria</b>	<b>Corrective Action<sup>a</sup></b>
Field blanks	VOC amounts $\leq 3 \times$ MDLs in Table-B_C3-2 for GC/MS and GC/FID; $<$ PRQLs in Table-B_C3-2 for FTIRS	Nonconformance if any VOC amount $> 3 \times$ MDLs in Table-B_C3-2 for GC/MS and GC/FID; $\geq$ PRQLs in Table-B_C3-2 for FTIRS
Equipment blanks	VOC amounts $\leq 3 \times$ MDLs in Table-B_C3-2 of for GC/MS and GC/FID; $<$ PRQLs in Table-B_C3-2 for FTIRS	Nonconformance if any analyte amount $> 3 \times$ MDLs in Table-B_C3-2 for GC/MS and GC/FID; $\geq$ PRQLs in Table-B_C3-2 for FTIRS
Field reference standards or on-line control sample	70 - 130 %R	Nonconformance if %R $< 70$ or $> 130$
Field duplicates or on-line duplicate	RPD $\leq 25$	Nonconformance if RPD $> 25$

<sup>a</sup> Corrective action is only required if the final reported QC sample results do not meet the acceptance criteria.

MDL = Method detection limit

%R = Percent recovery

RPD = Relative percent difference

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**Table-B C1-4**  
**Sample Handling Requirements for Homogeneous Solids and Soil/Gravel**

Parameter	Suggested Quantity <sup>a</sup>	Required Preservative	Suggested Container	Maximum Holding Time <sup>b</sup>
VOCs	15 grams	Cool to 4°C	Glass Vial <sup>c</sup>	14 Days Prep/ 40 Days Analyze <sup>d</sup>
SVOCs	50 grams	Cool to 4°C	Glass Jar <sup>e</sup>	14 Days Prep/ 40 Days Analyze <sup>d</sup>
Metals	10 grams	Cool to 4°C	Plastic Jar <sup>f</sup>	180 Days <sup>g</sup>

<sup>a</sup> Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.

<sup>b</sup> Holding time begins at sample collection (holding times are consistent with SW-846 requirements).

<sup>c</sup> 40-ml VOA vial or other appropriate containers shall have an airtight cap.

<sup>d</sup> 40-day holding time allowable only for methanol extract - 14-day holding time for non-extracted VOCs.

<sup>e</sup> Appropriate containers should be used and should have Teflon<sup>®</sup> lined caps.

<sup>f</sup> Polyethylene or polypropylene preferred, glass jar is allowable.

<sup>g</sup> Holding time for mercury analysis is 28 days.

Note: Preservation requirements in the most recent version of SW-846 may be used if appropriate.

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**Table ~~B~~ C1-5**  
**Headspace Gas Drum Age Criteria Sampling Scenarios**

Scenario	Description
1	A. Unvented 55-gallon drums without rigid poly liners are sampled through the drum lid at the time of venting. B1. Unvented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. B2. Vented 55-gallon drums with unvented rigid poly liners are sampled through the rigid poly liner at the time of venting or prior to venting. C. Unvented 55-gallon drums with vented rigid poly liners are sampled through the drum lid at the time of venting.
2	55-gallon drums that have met the criteria for Scenario 1 and then are vented, but not sampled at the time of venting. <sup>a</sup>
3	Containers (i.e., 55-gallon drums, 85-gallon drums, 100-gallon drums, SWBs, TDOPs, and pipe components) that are initially packaged in a vented condition and sampled in the container headspace and containers that are not sampled under Scenario 1 or 2.

<sup>a</sup> Containers that have not met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. This requires the additional information required of each container in Scenario 3 (i.e., determination of packaging configuration), and such containers can only be sampled after meeting the appropriate Scenario 3 DAC.

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**Table BC1-6**  
**Scenario 1 Drum Age Criteria (in days) Matrix**

<b>Summary Category Group</b>	<b>DAC (Days)</b>
S5000	53

Note: Containers that are sampled using the Scenario 1 DAC do not require information on the packaging configuration because the Scenario 1 DAC are based on a bounding packaging configuration. In addition, information on the rigid liner vent hole presence and diameter do not apply to containers that are sampled using the Scenario 1 DAC because they are unvented prior to sampling.

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**Table B.C1-7  
 Scenario 2 Drum Age Criteria (in days) Matrix**

	Summary Category Group S5000			
Filter H <sub>2</sub> Diffusivity <sup>a</sup>	Rigid Liner Vent Hole Diameter (in) <sup>b</sup>			
(mol/s/mod fraction)	0.30	0.375	0.75	1.0
1.9 × 10 <sup>-6</sup>	29	22	13	12
3.7 × 10 <sup>-6</sup>	25	20	12	11
3.7 × 10 <sup>-5</sup>	7	6	6	4

<sup>a</sup> The documented filter H<sub>2</sub> diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H<sub>2</sub> diffusivity (e.g., a container with a filter H<sub>2</sub> diffusivity of 4.2 × 10<sup>-6</sup> must use a DAC for a filter with a 3.7 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity). If a filter H<sub>2</sub> diffusivity for a container is undocumented or unknown or is less than 1.9 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity, a filter of known H<sub>2</sub> diffusivity that is greater than or equal to 1.9 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity must be installed prior to initiation of the relevant DAC period.

<sup>b</sup> The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging (Attachment-B.C, Section-B.C-3d(1)), repackaging (Attachment-B.C, Section B.C-3d(1)), and/or venting (Section-B.C1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

Note: Containers that are sampled using the Scenario 2 DAC do not require information on the packaging configuration because the Scenario 2 DAC are based on a bounding packaging configuration.

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**Table B.C1-8**  
**Scenario 3 Packaging Configuration Groups**

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 1, 55-gal drums <sup>a</sup>	<ul style="list-style-type: none"> <li>• No layers of confinement, filtered inner lid <sup>b</sup></li> <li>• No inner bags, no liner bags (bounding case)</li> </ul>
Packaging Configuration Group 2, 55-gal drums <sup>a</sup>	<ul style="list-style-type: none"> <li>• 1 inner bag</li> <li>• 1 filtered inner bag</li> <li>• 1 liner bag</li> <li>• 1 filtered liner bag</li> <li>• 1 inner bag, 1 liner bag</li> <li>• 1 filtered inner bag, 1 filtered liner bag</li> <li>• 2 inner bags</li> <li>• 2 filtered inner bags</li> <li>• 2 inner bags, 1 liner bag</li> <li>• 2 filtered inner bags, 1 filtered liner bag</li> <li>• 3 inner bags</li> <li>• 3 filtered inner bags</li> <li>• 3 filtered inner bags, 1 filtered liner bag</li> <li>• 3 inner bags, 1 liner bag (bounding case)</li> </ul>
Packaging Configuration Group 3, 55-gal drums <sup>a</sup>	<ul style="list-style-type: none"> <li>• 2 liner bags</li> <li>• 2 filtered liner bags</li> <li>• 1 inner bag, 2 liner bags</li> <li>• 1 filtered inner bag, 2 filtered liner bags</li> <li>• 2 inner bags, 2 liner bags</li> <li>• 2 filtered inner bags, 2 filtered liner bags</li> <li>• 3 filtered inner bags, 2 filtered liner bags</li> <li>• 4 inner bags</li> <li>• 3 inner bags, 2 liner bags</li> <li>• 4 inner bags, 2 liner bags (bounding case)</li> </ul>
Packaging Configuration Group 4, pipe components	<ul style="list-style-type: none"> <li>• No layers of confinement inside a pipe component</li> <li>• 1 filtered inner bag, 1 filtered metal can inside a pipe component</li> <li>• 2 inner bags inside a pipe component</li> <li>• 2 filtered inner bags inside a pipe component</li> <li>• 2 filtered inner bags, 1 filtered metal can inside a pipe component</li> <li>• 2 inner bags, 1 filtered metal can inside a pipe component (bounding case)</li> </ul>
Packaging Configuration Group 5, Standard Waste Box or Ten-Drum Overpack <sup>a</sup>	<ul style="list-style-type: none"> <li>• No layers of confinement</li> <li>• 1 SWB liner bag (bounding case)</li> </ul>
Packaging Configuration Group 6, Standard Waste Box or Ten-Drum Overpack <sup>a</sup>	<ul style="list-style-type: none"> <li>• any combination of inner and/or liner bags that is less than or equal to 6</li> <li>• 5 inner bags, 1 SWB liner bag (bounding case)</li> </ul>

Packaging Configuration Group	Covered S5000 Packaging Configuration Groups
Packaging Configuration Group 7, 85-gal. drums and 100-gal. drums <sup>a</sup>	<ul style="list-style-type: none"> <li>No inner bags, no liner bags, no rigid liner, filtered inner lid (bounding case)<sup>b</sup></li> <li>No inner bags, no liner bags, no rigid liner</li> </ul>
Packaging Configuration Group 8, 85-gal. drums and 100-gal. drums <sup>a</sup>	<ul style="list-style-type: none"> <li>4 inner bags and 2 liner bags, no rigid liner, filtered inner lid (bounding case)<sup>b</sup></li> </ul>

<sup>a</sup> If a specific Packaging Configuration Groups cannot be determined based on the data collected during packaging and/or repackaging, a conservative default Packaging Configuration Group of 3 for 55-gallon drums, 6 for SWBs and TDOPs, and 8 for 85-gallon and 100-gallon drums must be assigned provided the drums do not contain pipe component packaging. If pipe components are present as packaging in the drums, the pipe components must be sampled following the requirements for Packaging Configuration Group 4.

<sup>b</sup> A “filtered inner lid” is the inner lid on a double lid drum that contains a filter.

Definitions:

Liner Bags: One or more optional plastic bags that are used to control radiological contamination. Liner bags for drums have a thickness of approximately 11 mils. Liner bags are typically similar in size to the container. SWB liner bags have a thickness of approximately 14 mils. TDOPs use SWB liner bags.

Inner Bags: One or more optional plastic bags that are used to control radiological contamination. Inner bags have a thickness of approximately 5 mils and are typically smaller than liner bags.

1 | **Table B.C1-9**  
 2 | **Scenario 3 Drum Age Criteria (In Days) Matrix for S5000 Waste by Packaging Configuration Group**

<b>Packaging Configuration Group 1</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a</sup> (mol/s/mol fraction)</b>	<b>Rigid Liner Vent Hole Diameter<sup>b</sup></b>				<b>No Liner Lid</b>	<b>No Liner</b>
	<b>0.3-inch Diameter Hole</b>	<b>0.375-inch Diameter Hole</b>	<b>0.75-inch Diameter Hole</b>	<b>1-inch Diameter Hole</b>		
1.9 × 10 <sup>-6</sup>	131	95	37	24	4	4
3.7 × 10 <sup>-6</sup>	111	85	36	24	4	4
3.7 × 10 <sup>-5</sup>	28	28	23	19	4	4
<b>Packaging Configuration Group 2</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a</sup> (mol/s/mol fraction)</b>	<b>Rigid Liner Vent Hole Diameter<sup>b</sup></b>				<b>No Liner Lid</b>	<b>No Liner</b>
	<b>0.3-inch Diameter Hole</b>	<b>0.375-inch Diameter Hole</b>	<b>0.75-inch Diameter Hole</b>	<b>1-inch Diameter Hole</b>		
1.9 × 10 <sup>-6</sup>	175	138	75	60	30	11
3.7 × 10 <sup>-6</sup>	152	126	73	59	30	11
3.7 × 10 <sup>-5</sup>	58	57	52	47	28	8
<b>Packaging Configuration Group 3</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a</sup> (mol/s/mol fraction)</b>	<b>Rigid Liner Vent Hole Diameter<sup>b</sup></b>				<b>No Liner Lid</b>	<b>No Liner</b>
	<b>0.3-inch Diameter Hole</b>	<b>0.375-inch Diameter Hole</b>	<b>0.75-inch Diameter Hole</b>	<b>1-inch Diameter Hole</b>		
1.9 × 10 <sup>-6</sup>	199	161	96	80	46	16
3.7 × 10 <sup>-6</sup>	175	148	93	79	46	16
3.7 × 10 <sup>-5</sup>	72	72	67	62	42	10
<b>Packaging Configuration Group 4</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a</sup> (mol/s/mol fraction)</b>	<b>Headspace Sample Taken Inside Pipe Component</b>					
> 1.9 × 10 <sup>-6</sup>	152					
<b>Packaging Configuration Group 5</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a, c</sup> (mol/s/mol fraction)</b>	<b>Headspace Sample Taken Inside SWB/TDOP</b>					
> 7.4 × 10 <sup>-6</sup> (SWB)	15					
3.33 × 10 <sup>-5</sup> (TDOP)	15					
<b>Packaging Configuration Group 6</b>						
<b>Filter H<sub>2</sub> Diffusivity<sup>a, c</sup> (mol/s/mol fraction)</b>	<b>Headspace Sample Taken Inside SWB/TDOP</b>					
> 7.4 × 10 <sup>-6</sup> (SWB)	56					
3.33 × 10 <sup>-5</sup> (TDOP)	56					

Packaging Configuration Group 7 <sup>d</sup>			
Filter H <sub>2</sub> Diffusivity <sup>a</sup> (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H <sub>2</sub> Diffusivity (mol/s/mol fraction) <sup>a</sup>		
	7.4 × 10 <sup>-6</sup>	1.85 × 10 <sup>-5</sup>	9.25 × 10 <sup>-5</sup> <sup>e</sup>
3.7 × 10 <sup>-6</sup>	13	7	2
7.4 × 10 <sup>-6</sup>	10	6	2
1.85 × 10 <sup>-5</sup>	6	4	2
Packaging Configuration Group 8			
Filter H <sub>2</sub> Diffusivity <sup>a</sup> (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H <sub>2</sub> Diffusivity (mol/s/mol fraction)		
	7.4 × 10 <sup>-6</sup>		
3.7 × 10 <sup>-6</sup>	21		

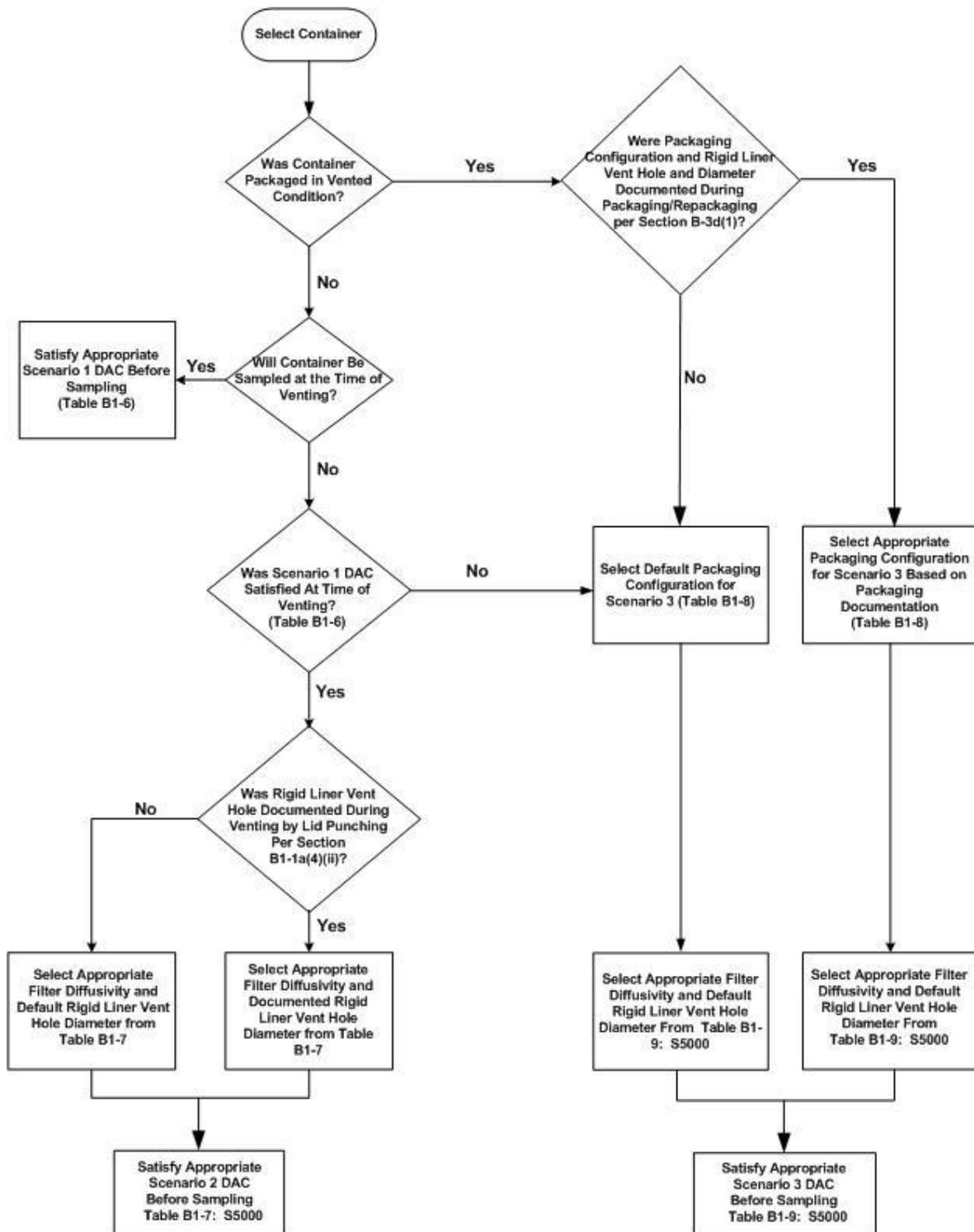
- <sup>a</sup> The documented filter H<sub>2</sub> diffusivity must be greater than or equal to the listed value to use the DAC for the listed filter H<sub>2</sub> diffusivity (e.g., a container with a filter H<sub>2</sub> diffusivity of 4.2 × 10<sup>-6</sup> must use a DAC for a filter with a 3.7 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity). If a filter H<sub>2</sub> diffusivity for a container is undocumented or unknown or is less than 1.9 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity, a filter of known H<sub>2</sub> diffusivity that is greater than or equal to 1.9 × 10<sup>-6</sup> filter H<sub>2</sub> diffusivity must be installed prior to initiation of the relevant DAC period.
- <sup>b</sup> The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for the listed rigid liner vent hole diameter (e.g., a container with a rigid liner vent hole of 0.5 in. must use a DAC for a rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during packaging, repackaging, and/or venting (Section B.C1-1a[64][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.
- <sup>c</sup> The filter H<sub>2</sub> diffusivity for SWBs or TDOPs is the sum of the diffusivities for all of the filters on the container because SWBs and TDOPs have more than 1 filter.
- <sup>d</sup> Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also applicable. Packaging Configuration Group 7 DAC values apply to drums with up to two lids.
- <sup>e</sup> While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements specified in Section B.C1-1a (i.e., 72 hours at 18°C or higher). The equilibrium requirement for headspace gas sampling shall be met separately.

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## FIGURES

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**Figure B\_C1-1**  
**Headspace Gas Drum Age Criteria Sampling Scenario Selection Process**

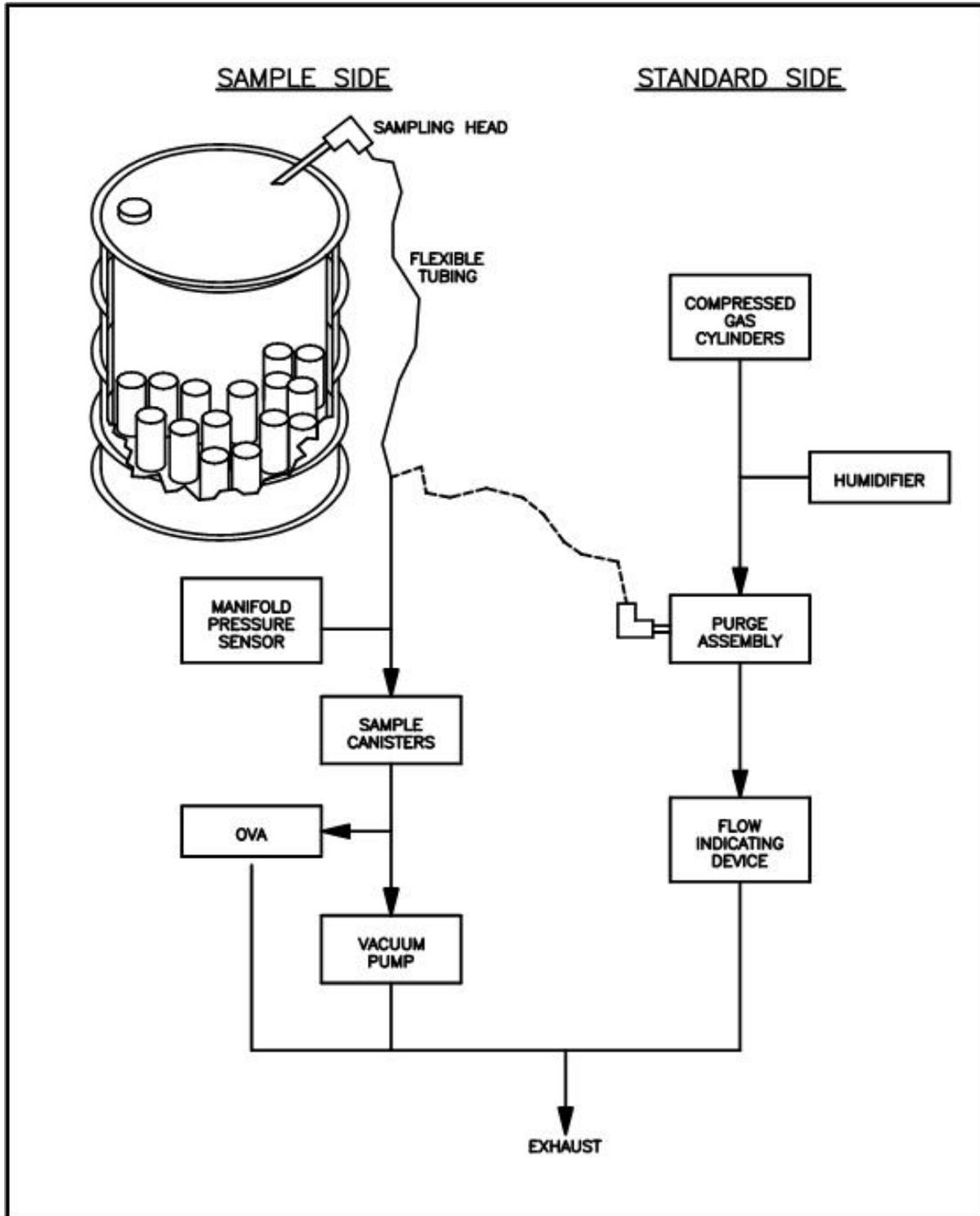


Figure **B\_C1-2**  
Headspace Sampling Manifold

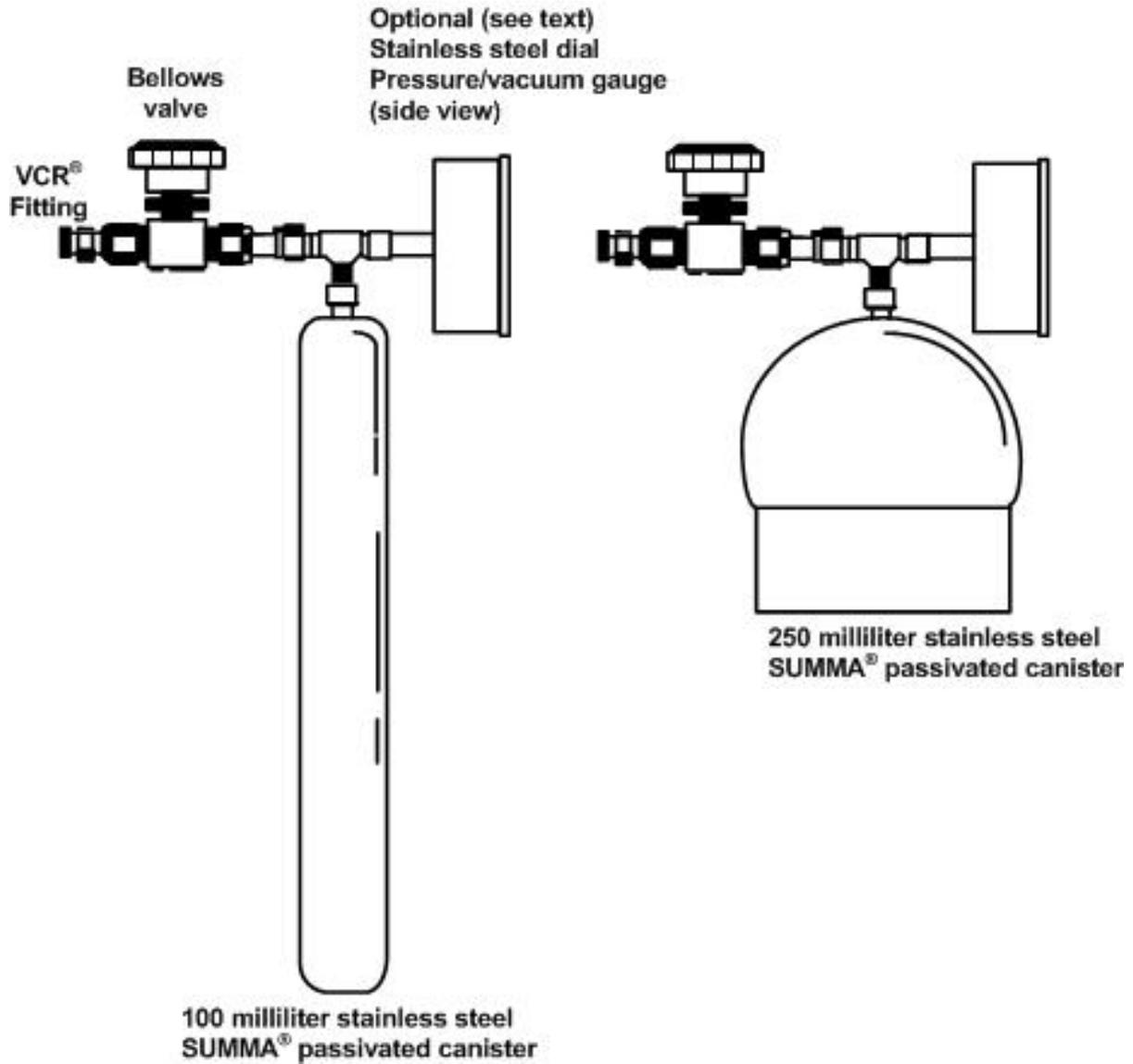


Figure **B\_C1-3**  
SUMMA<sup>®</sup> Canister Components Configuration (Not to Scale)

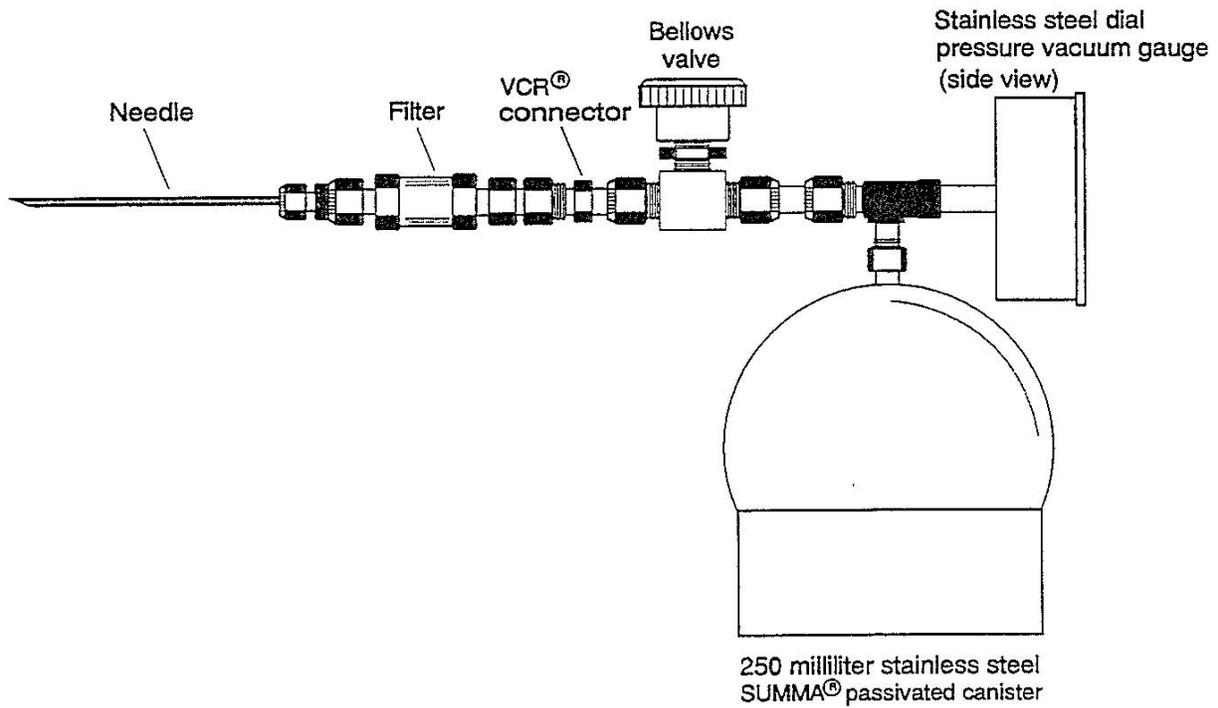
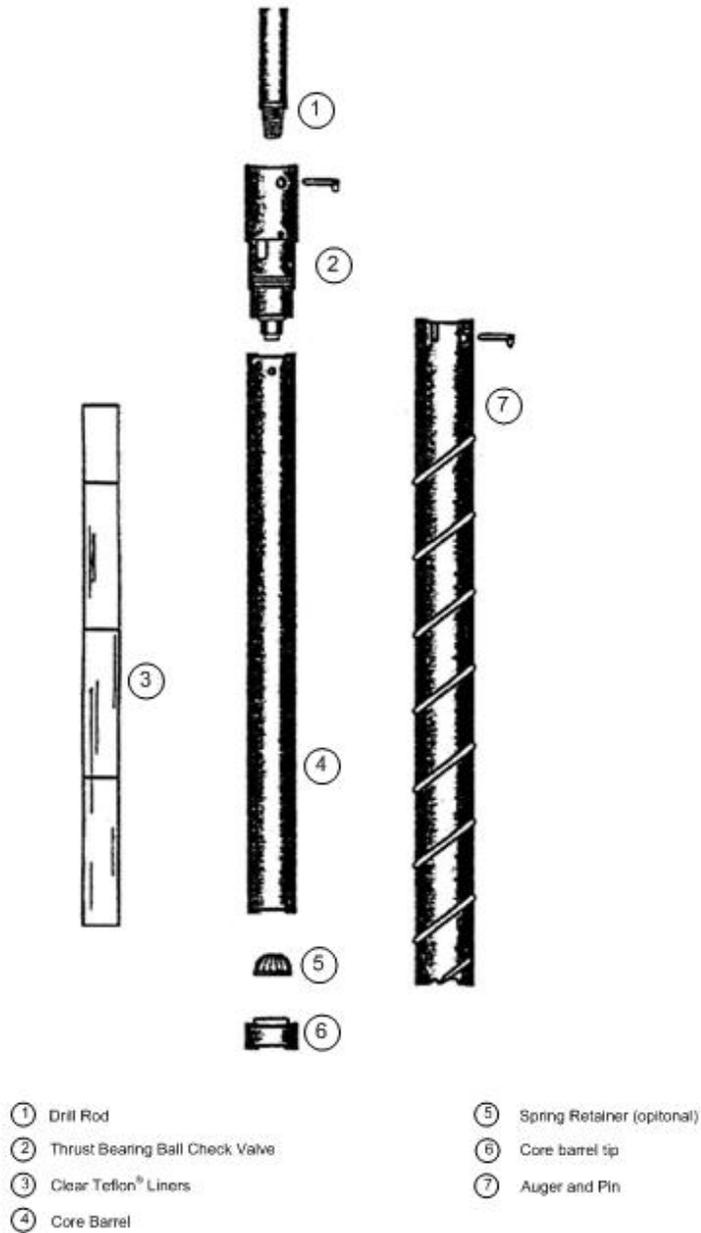
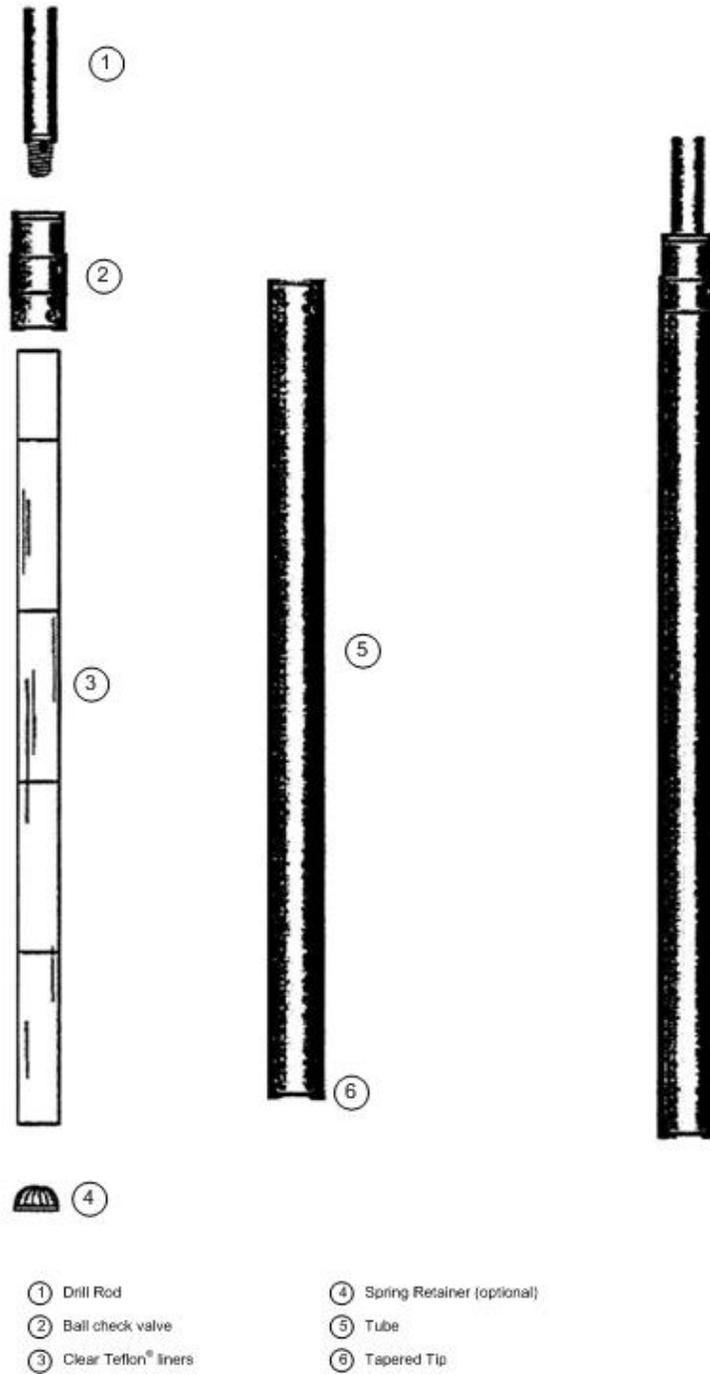


Figure **B\_C1-4**  
Schematic Diagram of Direct Canister with the Poly Bag Sampling Head



**Figure B C1-5**  
**Rotational Coring Tool (Light Weight Auger)**



**Figure-B\_C1-6**  
**Non-Rotational Coring Tool (Thin Walled Sampler)**

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