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APPENDIX B1

2

WASTE CHARACTERIZATION SAMPLING METHODS

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WASTE CHARACTERIZATION SAMPLING METHODS

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1 **APPENDIX B1**

2 **WASTE CHARACTERIZATION SAMPLING METHODS**

3 Introduction

4 The Permittees will require generator/storage sites (**sites**) to use the following methods, as
5 applicable, for characterization of TRU mixed waste which is managed, stored, or disposed at
6 WIPP. These methods include requirements for headspace-gas sampling, sampling of
7 homogeneous solids and soil/gravel, and radiography or visual examination. Additionally, this
8 Attachment provides quality control, sample custody, and sample packing and shipping
9 requirements.

10 B1-1 Sampling of Debris Waste (Summary Category S5000)

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

13 B1-1a Method Requirements

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

17 For those waste streams without an acceptable knowledge (**AK**) Sufficiency Determination
18 approved by the Permittees, containers shall be randomly selected from waste streams designated
19 as summary category S5000 (Debris waste) and shall be categorized under one of the sampling
20 scenarios shown in Table B1-5 and depicted in Figure B1-1. If the container is categorized under
21 Scenario 1, the applicable drum age criteria (**DAC**) from Table B1-6 must be met prior to
22 headspace gas sampling. If the container is categorized under Scenario 2, the applicable Scenario
23 1 DAC from Table B1-6 must be met prior to venting the container and then the applicable
24 Scenario 2 DAC from Table B1-7 must be met after venting the container. The DAC for
25 Scenario 2 containers that contain filters or rigid liner vent holes other than those listed in Table
26 B1-7 shall be determined using footnotes “a” and “b” in Table B1-7. Containers that have not
27 met the Scenario 1 DAC at the time of venting must be categorized under Scenario 3. Containers
28 categorized under Scenario 3 must be placed into one of the Packaging Configuration Groups
29 listed in Table B1-8. If a specific packaging configuration cannot be determined based on the
30 data collected during packaging and/or repackaging (Attachment B, Section B-3d(1)), a
31 conservative default Packaging Configuration Group of 3 for 55-gallon drums, 6 for Standard
32 Waste Boxes (**SWBs**) and ten-drum overpacks (**TDOPs**), and 8 for 85-gallon and 100-gallon
33 drums must be assigned, provided the drums do not contain pipe component packaging. If a
34 container is designated as Packaging Configuration Group 4 (i.e., a pipe component), the
35 headspace gas sample must be taken from the pipe component headspace. Drums, TDOPs, or
36 SWBs that contain compacted 55-gallon drums containing a rigid liner may not be disposed of
37 under any packaging configuration unless headspace gas sampling was performed before

1 compaction in accordance with this waste analysis plan (**WAP**). The DAC for Scenario 3
2 containers that contain rigid liner vent holes that are undocumented during packaging,
3 repackaging, and/or venting (Section B1-1a[4][ii]) shall be determined using the default
4 conditions in footnote “b” in Table B1-9. The DAC for Scenario 3 containers that contain filters
5 that are either undocumented or are other than those listed in Table B1-9 shall be determined
6 using footnote ‘a’ in Table B1-9. Each of the Scenario 3 containers shall be sampled for
7 headspace gas after waiting the DAC in Table B1-9 based on its packaging configuration (note:
8 Packaging Configuration Groups 4, 5, 6, 7, and 8 are not summary category group dependent,
9 and 85-gallon drum, 100-gallon drum, SWB, and TDOP requirements apply when the 85-gallon
10 drum, 100-gallon drum, SWB, or TDOP is used for the direct loading of waste).

11 B1-1a(1) General Requirements

12 The determination of packaging configuration consists of identifying the number of confinement
13 layers and the identification of rigid poly liners when present. Generator/storage sites shall use
14 either the default conditions specified in Tables B1-7 through B1-9 for retrievably stored waste
15 or the data documented during packaging, repackaging, and/or venting (Section B1-1a[4][ii]) for
16 determining the appropriate DAC for each container from which a headspace gas sample is
17 collected. These drum age criteria are to ensure that the container contents have reached 90
18 percent of steady state concentration within each layer of confinement (Lockheed, 1995; BWXT,
19 2000). The following information must be reported in the headspace gas sampling documents for
20 each container from which a headspace gas sample is collected:

- 21 • sampling scenario from Table B1-5 and associated information from Tables B1-6 and/or
22 Table B1-7;
- 23 • the packaging configuration from Table B1-8 and associated information from Table B1-
24 9, including the diameter of the rigid liner vent hole, the number of inner bags, the
25 number of liner bags, the presence/absence of drum liner, and the filter hydrogen
26 diffusivity,
- 27 • the permit-required equilibrium time,
- 28 • the drum age,
- 29 • for supercompacted waste, both
 - 30 • the absence of rigid liners in the compacted 55-gallon drums which have not been
 - 31 headspace gas sampled in accordance with this permit prior to compaction, and
 - 32 • the absence of layers of confinement must be documented in the WWIS if Packaging
 - 33 Configuration Group 7 is used.

34 For all retrievably stored waste containers, the rigid liner vent hole diameter must be assumed to
35 be 0.3 inches unless a different size is documented during drum venting or repackaging. For all
36 retrievably stored waste containers, the filter hydrogen diffusivity must be assumed to be the
37 most restrictive unless container-specific information clearly identifies a filter model and/or
38 diffusivity characteristic that is less restrictive. For all retrievably stored waste containers that
39 have not been repackaged, acceptable knowledge shall not be used to justify any packaging
40 configuration less conservative than the default (i.e., Packaging Configuration Group 3 for 55-

1 gallon drums, 6 for SWBs and TDOPs, and 8 for 85-gallon and 100-gallon drums). For
2 information reporting purposes listed above, sites may report the default packaging configuration
3 for retrievably stored waste without further confirmation.

4 All waste containers with unvented rigid containers greater than 4 liters (exclusive of rigid poly
5 liners) shall be subject to innermost layer of containment sampling or shall be vented prior to
6 initiating drum age and equilibrium criteria. When sampling the rigid poly liner under Scenario
7 1, the sampling device must form an airtight seal with the rigid poly liner to ensure that a
8 representative sample is collected (using a sampling needle connected to the sampling head to
9 pierce the rigid poly liner, and that allows for the collection of a representative sample, satisfies
10 this requirement). The configuration of the containment area and remote-handling equipment at
11 each sampling facility are expected to differ. Headspace-gas samples will be analyzed for the
12 analytes listed in Table B3-2 of Permit Attachment B3. If additional packaging configurations
13 are identified, an appropriate Permit Modification will be submitted to incorporate the DAC
14 using the methodology in BWXT (2000). Consistent with footnote "a" in Table B1-8, any waste
15 container selected for headspace gas sampling that cannot be assigned a packaging configuration
16 specified in Table B1-8 shall be assigned a conservative default packaging configuration..

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

20 The Permittees shall require site personnel to collect samples in SUMMA® or equivalent
21 canisters using standard headspace-gas sampling methods that meet the general guidelines
22 established by the EPA in the Compendium Method TO-14A or TO-15, Compendium of
23 Methods for the Determination of Toxic Organic Compounds in Ambient Air (EPA, 1999) or by
24 using on-line integrated sampling/analysis systems. Samples will be directed to an analytical
25 instrument instead of being collected in SUMMA® or equivalent canisters if a single-sample on-
26 line integrated sampling/analysis system is used. If a multi-sample on-line integrated
27 sampling/analysis system is used, samples will be directed to an integrated holding area that
28 meets the cleaning requirements of Section B1-1c(1). The leak proof and inert nature of the
29 integrated holding area interior surface must be demonstrated and documented. Samples are not
30 transported to another location when using on-line integrated sampling/analysis systems;
31 therefore, the sample custody requirements of Section B1-4 and B1-5 do not apply. The same
32 sampling manifold and sampling heads are used with on-line integrated sampling/analysis
33 systems and all of the requirements associated with sampling manifolds and sampling heads
34 must be met. However, when using an on-line integrated sampling/analysis system, the sampling
35 batch and analytical batch quality control (QC) samples are combined as on-line batch QC
36 samples as outlined in Section B1-1b.

37 B1-1a(2) Manifold Headspace Gas Sampling

38 This headspace-gas sampling protocol employs a multiport manifold capable of collecting
39 multiple simultaneous headspace samples for analysis and QC purposes. The manifold can be
40 used to collect samples in SUMMA® or equivalent canisters or as part of an on-line integrated

1 sampling/analysis system. The sampling equipment will be leak checked and cleaned prior to
2 first use and as needed thereafter. The manifold and sample canisters will be evacuated to 0.0039
3 inches (in.) (0.10 millimeters [mm]) mercury (**Hg**) prior to sample collection. Cleaned and
4 evacuated sample canisters will be attached to the evacuated manifold before the manifold inlet
5 valve is opened. The manifold inlet valve will be attached to a changeable filter connected to
6 either a side port needle sampling head capable of forming an airtight seal (for penetrating a filter
7 or rigid poly liner when necessary), a drum punch sampling head capable of forming an airtight
8 seal (capable of punching through the metal lid of a drum for sampling through the drum lid), or
9 a sampling head with an airtight fitting for sampling through a pipe overpack container filter vent
10 hole. Refer to Section B1-1a(4) for descriptions of these sampling heads.

11 The manifold shall also be equipped with a purge assembly that allows applicable QC samples to
12 be collected through all sampling components that may affect compliance with the quality
13 assurance objectives (**QAOs**). The Permittees shall require the sites to demonstrate and
14 document the effectiveness of the sampling equipment design in meeting the QAOs. Field blanks
15 shall be samples of room air collected in the sampling area in the immediate vicinity of the waste
16 container to be sampled. If using SUMMA® or equivalent canisters, field blanks shall be
17 collected directly into the canister, without the use of the manifold.

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

26 As illustrated in Figure B1-2, the sampling manifold must consist of a sample side and a standard
27 side. The dotted line in Figure B1-2 indicates how the sample side shall be connected to the
28 standard side for cleaning and collecting equipment blanks and field reference standards. The
29 sample side of the sampling manifold shall consist of the following major components:

- 30 • An applicable sampling head that forms a leak-tight connection with the headspace
31 sampling manifold.
- 32 • A flexible hose that allows movement of the sampling head from the purge assembly
33 (standard side) to the waste container.
- 34 • A pressure sensor(s) that must be pneumatically connected to the manifold. This
35 manifold pressure sensor(s) must be able to measure absolute pressure in the range from
36 0.002 in. (0.05 mm) Hg to 39.3 in. (1,000 mm) Hg. Resolution for the manifold pressure
37 sensors must be ± 0.0004 in. (0.01 mm) Hg at 0.002 in. (0.05 mm) of Hg. The manifold
38 pressure sensor(s) must have an operating range from approximately 59°F (15°C) to
39 104°F (40°C).

- 1 • Available ports for attaching sample canisters. If using canister-based sampling methods,
2 a sufficient number of ports shall be available to allow simultaneous collection of
3 headspace-gas samples and duplicates for VOC analyses. If using an on-line integrated
4 sampling/analysis system, only one port is necessary for the collection of comparison
5 samples. Ports not occupied with sample canisters during cleaning or headspace-gas
6 sampling activities require a plug to prevent ambient air from entering the system. In
7 place of using plugs, sites may choose to install valves that can be closed to prevent
8 intrusion of ambient air into the manifold. Ports shall have VCR® fittings for connection
9 to the sample canister(s) to prevent degradation of the fittings on the canisters and
10 manifold.
- 11 • Sample canisters, as illustrated in Figure B1-3, are leak-free, stainless steel pressure
12 vessels, with a chromium-nickel oxide (**Cr-NiO**) SUMMA®-passivated interior surface,
13 bellows valve, and a pressure/vacuum gauge. Equivalent designs, such as Silco Steel
14 canisters, may be used so long as the leak proof and inert nature of the canister interior
15 surface is demonstrated and documented. All sample canisters must have VCR® fittings
16 for connection to sampling and analytical equipment. The pressure/vacuum gauge must
17 be mounted on each manifold. The canister must be helium-leak tested to 1.5×10^{-7}
18 standard cubic centimeters per second (cc/s), have all stainless steel construction, and be
19 capable of tolerating temperatures to 125°C. The gauge range shall be capable of
20 operating in the leak test range as well as the sample collection range.
- 21 • A dry vacuum pump with the ability to reduce the pressure in the manifold to 0.05 mm
22 Hg. A vacuum pump that requires oil may be used, but precautions must be taken to
23 prevent diffusion of oil vapors back to the manifold. Precautions may include the use of a
24 molecular sieve and a cryogenic trap in series between the headspace sampling ports and
25 the pump.
- 26 • A minimum distance, based upon the design of the manifold system, between the tip of
27 the needle and the valve that isolates the pump from the manifold in order to minimize
28 the dead volume in the manifold.
- 29 • If real-time equipment blanks are not available, the manifold must be equipped with an
30 organic vapor analyzer (**OVA**) that is capable of detecting all analytes listed in Table B3-
31 2 of Permit Attachment B3. The OVA shall be capable of measuring total VOC
32 concentrations below the lowest headspace gas PRQL . Detection of 1,1,2-trichloro-
33 1,2,2-trifluoroethane may not be possible if a photoionization detector is used. The OVA
34 measurement shall be confirmed by the collection of equipment blanks at the frequency
35 specified in Section B1-1 to check for manifold cleanliness.

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

- 37 • A cylinder of compressed zero air, helium, argon, or nitrogen gas that is hydrocarbon and
38 carbon dioxide (**CO₂**)-free (only hydrocarbon and CO₂-free gases required for Fourier

1 Transform Infrared System [**FTIRS**]) to clean the manifold between samples and to
2 provide gas for the collection of equipment blanks or on-line blanks. These high-purity
3 gases shall be certified by the manufacturer to contain less than one ppm total VOCs. The
4 gases must be metered into the standard side of the manifold using devices that are
5 corrosion proof and that do not allow for the introduction of manifold gas into the purge
6 gas cylinders or generator. Alternatively, a zero air or nitrogen generator may be used,
7 provided a sample of the zero air or nitrogen is collected and demonstrated to contain less
8 than one ppm total VOCs. Zero air or nitrogen from a generator shall be humidified
9 (except for use with FTIRS).

- 10 • Cylinders of field-reference standard gases or on-line control sample gases. These
11 cylinders provide gases for evaluating the accuracy of the headspace-gas sampling
12 process. Each cylinder of field-reference gas or on-line control sample gas shall have a
13 flow-regulating device. The field-reference standard gases or on-line control sample gas
14 shall be certified by the manufacturer to contain analytes from Table B3-2 of Permit
15 Attachment B3 at known concentrations.
- 16 • If using an analytical method other than FTIRS a humidifier filled with American Society
17 for Testing and Materials (**ASTM**) Type I or II water, connected, and opened to the
18 standard side of the manifold between the compressed gas cylinders and the purge
19 assembly shall be used. Dry gases flowing to the purge assembly will pick up moisture
20 from the humidifier. Moisture is added to the dry gases to condition the equipment blanks
21 and field-reference standards and to assist with system cleaning between headspace-gas
22 sample collection. If using FTIRS for analysis, the sample and sampling system shall be
23 kept dry.

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

- 28 • A purge assembly that allows the sampling head (sample side) to be connected to the
29 standard side of the manifold. The ability to make this connection is required to transfer
30 gases from the compressed gas cylinders to the canisters or on-line analytical instrument.
31 This connection is also required for system cleaning.
- 32 • A flow-indicating device or a pressure regulator that is connected to the purge assembly
33 to monitor the flow rate of gases through the purge assembly. The flow rate or pressure
34 through the purge assembly shall be monitored to assure that excess flow exists during
35 cleaning activities and during QC sample collection. Maintaining excess flow will
36 prevent ambient air from contaminating the QC samples and allow samples of gas from
37 the compressed gas cylinders to be collected near ambient pressure.

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

- 4 • The ambient-pressure sensor must have a sufficient measurement range for the ambient
5 barometric pressures expected at the sampling location. It must be kept in the sampling
6 area during sampling operations. Its resolution shall be 0.039 in. (1.0 mm) Hg or less, and
7 calibration performed by the manufacturer shall be based on National Institute of
8 Standards and Technology (NIST), or equivalent, standards.
- 9 • The temperature sensor shall have a sufficient measurement range for the ambient
10 temperatures expected at the sampling location. The measurement range of the
11 temperature sensor must be from 18°C to 50°C. The temperature sensor calibration shall
12 be traceable to NIST, or equivalent, standards.

13 B1-1a(3) Direct Canister Headspace Gas Sampling

14 This headspace-gas sampling protocol employs a canister-sampling system to collect headspace-
15 gas samples for analysis and QC purposes without the use of the manifold described above.
16 Rather than attaching sampling heads to a manifold, in this method the sampling heads are
17 attached directly to an evacuated sample canister as shown in Figure B1-4.

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

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

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

8 The SUMMA® or equivalent sample canisters as specified in EPA's Compendium Method TO-
9 14A or TO-15 (EPA 1999) shall be used when sampling each drum. These heads shall form a
10 leak-tight connection with the canister and allow sampling through the drum-lid filter, through
11 the drum lid itself and/or rigid poly liner when necessary (by use of a punch or self-tapping
12 screw), using an airtight fitting to collect the sample through the filter vent hole of a pipe
13 overpack container, or using a hollow side port needle. Figure B1-4 illustrates the direct canister-
14 sampling equipment.

15 B1-1a(4) Sampling Heads

16 A sample of the headspace gas directly under the container lid, pipe overpack filter vent hole, or
17 rigid poly liner shall be collected. Several methods have been developed for collecting a
18 representative sample: sampling through the filter, sampling through the drum lid by drum
19 punching, sampling through a pipe overpack container filter vent hole, and sampling through the
20 rigid poly liner. The chosen sampling method shall preserve the integrity of the drum to contain
21 radionuclides (e.g., replace the damaged filter, replace set screw in filter housing, seal the
22 punched drum lid).

23 B1-1a(4)(i) Sampling Through the Filter

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

- 31
- The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum
32 headspace. A representative sample cannot be collected from the drum headspace until
33 the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample
34 may be collected from inside the 90-mil rigid poly liner. If the sample is collected by
35 removing the drum lid, the sampling device shall form an airtight seal with the rigid poly
36 liner to prevent the intrusion of outside air into the sample (using a sampling needle
37 connected to the sampling head to pierce the rigid poly liner satisfies this requirement). If
38 headspace-gas samples are collected from the drum headspace prior to venting the 90-mil
39 rigid poly liner, the sample is not acceptable and a nonconformance report shall be

1 prepared, submitted, and resolved. Nonconformance procedures are outlined in Permit
2 Attachment B3.

- 3 • For sample collection, the drum's filter shall be sealed to prevent outside air from
4 entering the drum and diluting and/or contaminating the sample.

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

- 10 • The housing of the filter shall allow insertion of the sampling needle through the filter
11 element or a sampling port with septum that bypasses the filter element into the drum
12 headspace.
- 13 • The side-port needle shall be used to reduce the potential for plugging.
- 14 • The purge assembly shall be modified for compatibility with the side-port needle.

15 B1-1a(4)(ii) Sampling Through the Drum Lid By Drum Lid Punching

16 Sampling through the drum lid at the time of drum punching or thereafter may be performed as
17 an alternative to sampling through the drum's filter if an airtight seal can be maintained. To
18 sample the drum headspace-gas through the drum lid at the time of drum punching or thereafter,
19 the lid shall be breached using an appropriate punch. The punch shall form an airtight seal
20 between the drum lid and the manifold or direct canister sampling equipment. To assure that the
21 sample collected is representative, all of the general method requirements, sampling apparatus
22 requirements, and QC requirements specified in EPA's Compendium Method TO-14A or TO-15
23 (EPA 1999) as appropriate, shall be met in addition to the following requirements:

- 24 • The seal between the drum lid and sampling head shall be designed to minimize intrusion
25 of ambient air.
- 26 • All components of the sampling system that come into contact with sample gases shall be
27 purged with humidified zero air, nitrogen, or helium prior to sample collection.
- 28 • Equipment blanks and field reference standards shall be collected through all the
29 components of the punch that contact the headspace-gas sample.
- 30 • Pressure shall be applied to the punch until the drum lid has been breached.
- 31 • Provisions shall be made to relieve excessive drum pressure increases during drum-punch
32 operations; potential pressure increases may occur during sealing of the drum punch to
33 the drum lid.

- 1 • The lid of the drum's 90-mil rigid poly liner shall contain a hole for venting to the drum
2 headspace. A representative sample cannot be collected from the drum headspace until
3 the 90-mil rigid poly liner has been vented. If the DAC for Scenario 1 is met, a sample
4 may be collected from inside the 90-mil rigid poly liner. If headspace-gas samples are
5 collected from the drum headspace prior to venting the 90-mil rigid poly liner, the sample
6 is not acceptable and a nonconformance report shall be prepared, submitted, and
7 resolved. Nonconformance procedures are outlined in Permit Attachment B3.
- 8 • During sampling, the drum's filter, if present, shall be sealed to prevent outside air from
9 entering the drum.
- 10 • While sampling through the drum lid using manifold sampling, a flow-indicating device
11 or pressure regulator to verify flow of gases shall be pneumatically connected to the drum
12 punch and operated in the same manner as the flow-indicating device described above in
13 Section B1-1a(2).
- 14 • Equipment shall be used to adequately secure the drum-punch sampling system to the
15 drum lid.
- 16 • If the headspace gas sample is not taken at the time of drum punching, the presence and
17 diameter of the rigid liner vent hole shall be documented during the punching operation
18 for use in determining an appropriate Scenario 2 DAC.

19 B1-1a(4)(iii) Sampling Through a Pipe Overpack Container Filter Vent Hole

20 Sampling through an existing filter vent hole in a pipe overpack container (**POC**) may be
21 performed as an alternative to sampling through the POC's filter if an airtight seal can be
22 maintained. To sample the container headspace-gas through a POC filter vent hole, an
23 appropriate airtight seal shall be used. The sampling apparatus shall form an airtight seal
24 between the POC surface and the manifold or direct canister sampling equipment. To assure that
25 the sample collected is representative, all of the general method, sampling apparatus, and QC
26 requirements specified in EPA's Compendium Method TO-14A or TO-15 (EPA 1999) as
27 appropriate, shall be met in addition to the following requirements:

- 28 • The seal between the POC surface and sampling apparatus shall be designed to minimize
29 intrusion of ambient air.
- 30 • The filter shall be replaced as quickly as is practicable with the airtight sampling
31 apparatus to ensure that a representative sample can be taken. Sites must provide
32 documentation demonstrating that the time between removing the filter and installing the
33 airtight sampling device has been established by testing to assure a representative sample.
- 34 • All components of the sampling system that come into contact with sample gases shall be
35 cleaned according to requirements for direct canister sampling or manifold sampling,
36 whichever is appropriate, prior to sample collection.

- 1 • Equipment blanks and field reference standards shall be collected through all the
2 components of the sampling system that contact the headspace-gas sample.
- 3 • During sampling, openings in the POC shall be sealed to prevent outside air from
4 entering the container.
- 5 • A flow-indicating device shall be connected to sampling system and operated according
6 to the direct canister or manifold sampling requirements, as appropriate.

7 B1-1b Quality Control

8 For manifold and direct canister sampling systems, field QC samples shall be collected on a per
9 sampling batch basis. A sampling batch is a suite of samples collected consecutively using the
10 same sampling equipment within a specific time period. A sampling batch can be up to 20
11 samples (excluding QC samples), all of which shall be collected within 14 days of the first
12 sample in the batch. For on-line integrated sampling/analysis systems, QC samples shall be
13 collected and analyzed on a per on-line batch basis. Holding temperatures and container
14 requirements for gas sample containers are provided in Table B1-1. An on-line batch is the
15 number of headspace-gas samples collected within a 12-hour period using the same on-line
16 integrated analysis system. The analytical batch requirements are specified by the analytical
17 method being used in the on-line system. Table B1-2 provides a summary of field QC sample
18 collection requirements. Table B1-3 provides a summary of QC sample acceptance criteria.

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

- 21 • The on-line blank replaces the equipment blank and laboratory blank
- 22 • The on-line control sample replaces the field reference standard and laboratory control
23 sample
- 24 • The on-line duplicate replaces the field duplicate and laboratory duplicate

25 The acceptance criteria for on-line batch QC samples are the same as for the sampling batch and
26 analytical batch QC samples they replace. Acceptance criteria are shown in Table B1-3. A
27 separate field blank shall still be collected and analyzed for each on-line batch. However, if the
28 results of a field blank collected through the sampling manifold meets the acceptance criterion, a
29 separate on-line blank need not be collected and analyzed.

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

1 B1-1b(1) Field Blanks

2 Field blanks shall be collected to evaluate background levels of program-required analytes. Field
3 blanks shall be collected prior to sample collection, and at a frequency of one per sampling
4 batch. The Permittees shall require the site project manager to use the field blank data to assess
5 impacts of ambient contamination, if any, on the sample results. Field blank results determined
6 by gas chromatography/mass spectrometry and gas chromatography/flame ionization detection
7 shall be acceptable if the concentration of each VOC analyte is less than or equal to three times
8 the method detection limit (**MDL**) listed in Table B3-2 in Permit Attachment B3. Field blank
9 results determined by FTIRS shall be acceptable if the concentration of each VOC analyte is less
10 than the program required quantitation limit listed in Table B3-2. A nonconformance report shall
11 be initiated and resolved if the final reported QC sample results do not meet the acceptance
12 criteria.

13 B1-1b(2) Equipment Blanks

14 Equipment blanks shall be collected to assess cleanliness prior to first use after cleaning of all
15 sampling equipment. On-line blanks will be used to assess equipment cleanliness as well as
16 analytical contamination. After the initial cleanliness check, equipment blanks collected through
17 the manifold shall be collected at a frequency of one per sampling batch for VOC analysis or one
18 per day, whichever is more frequent. If the direct canister method is used, field blanks may be
19 used in lieu of equipment blanks. The Permittees shall require the site project manager to use the
20 equipment blank data to assess impacts of potentially contaminated sampling equipment on the
21 sample results. Equipment blank results determined by gas chromatography/mass spectrometry
22 or gas chromatography/flame ionization detection shall be acceptable if the concentration of each
23 VOC analyte is less than or equal to three times the MDL listed in Table B3-2 in Permit
24 Attachment B3. Equipment blank results determined by FTIRS shall be acceptable if the
25 concentration of each VOC analyte is less than the program required quantitation limit listed in
26 Table B3-2.

27 B1-1b(3) Field Reference Standards

28 Field reference standards shall be used to assess the accuracy with which the sampling
29 equipment collects VOC samples into SUMMA® or equivalent canisters prior to first use of the
30 sampling equipment. The on-line control sample will be used to assess the accuracy with which
31 the sampling equipment collects VOC samples as well as an indicator of analytical accuracy for
32 the on-line sampling system. Field reference standards shall contain a minimum of six of the
33 analytes listed in Table B3-2 in Permit Attachment B3 at concentrations within a range of 10 to
34 100 ppmv and greater than the MDL for each compound. Field reference standards shall have a
35 known valid relationship to a nationally recognized standard (e.g., NIST), if available. If NIST
36 traceable standards are not available and commercial gases are used, a Certificate of Analysis
37 from the manufacturer documenting traceability is required. Commercial stock gases shall not be
38 used beyond their manufacturer-specified shelf life. After the initial accuracy check, field
39 reference standards collected through the manifold shall be collected at a frequency of one per
40 sampling batch and submitted as blind samples to the analytical laboratory. For the direct

1 canister method, field reference standard collection may be discontinued if the field reference
2 standard results demonstrate the QAO for accuracy specified in Appendix B3. Field reference
3 standard results shall be acceptable if the accuracy for each tested compound has a recovery of
4 70 to 130 percent .

5 B1-1b(4) Field Duplicates

6 Field duplicate samples shall be collected sequentially and in accordance with Table B1-1 to
7 assess the precision with which the sampling procedure can collect samples into SUMMA® or
8 equivalent canisters. Field duplicates will also serve as a measure of analytical precision for the
9 on-line sampling system. Field duplicate results shall be acceptable if the relative percent
10 difference is less than or equal to 25 for each tested compound found in concentrations greater
11 than the PRQL in both duplicates.

12 B1-1c Equipment Testing, Inspection and Maintenance

13 All sampling equipment components that come into contact with headspace sample gases shall
14 be constructed of relatively inert materials such as stainless steel or Teflon®. A passivated
15 interior surface on the stainless steel components is recommended.

16 To minimize the potential for cross contamination of samples, the headspace sampling manifold
17 and sample canisters shall be properly cleaned and leak-checked prior to each headspace-gas
18 sampling event. Procedures used for cleaning and preparing the manifold and sample canisters
19 shall be equivalent to those provided in EPA's Compendium Method TO-14A or TO-15 (EPA
20 1999). Cleaning requirements are presented below.

21 B1-1c(1) Headspace-Gas Sample Canister Cleaning

22 SUMMA® or equivalent canisters used in these methods shall be subjected to a rigorous
23 cleaning and certification procedures prior to use in the collection of any samples. Guidance for
24 the development of this procedure has been derived from Method TO-14A or TO-15 (EPA
25 1999). Specific detailed instructions shall be provided in laboratory standard operating
26 procedures (SOPs) for the cleaning and certification of canisters.

27 Canisters shall be cleaned and certified on an equipment cleaning batch basis. An equipment
28 cleaning batch is any number of canisters cleaned together at one time using the same cleaning
29 method. A cleaning system, capable of processing multiple canisters at a time, composed of an
30 oven (optional) and a vacuum manifold which uses a dry vacuum pump or a cryogenic trap
31 backed by an oil sealed pump shall be used to clean SUMMA® or equivalent canisters. Prior to
32 cleaning, a positive or negative pressure leak test shall be performed on all canisters. The
33 duration of the leak test must be greater than or equal to the time it takes to collect a sample, but
34 no greater than 24 hours. For a leak test, a canister passes if the pressure does not change by a
35 rate greater than ± 2 psig per 24 hours. Any canister that fails shall be checked for leaks, repaired,
36 and reprocessed. One canister per equipment cleaning batch shall be filled with humid zero air or
37 humid high purity nitrogen and analyzed for VOCs. The equipment cleaning batch of canisters

1 shall be considered clean if there are no VOCs above three times the MDLs listed in Table B3-2
2 of Permit Attachment B3. After the canisters have been certified for leak-tightness and found to
3 be free of background contamination, they shall be evacuated to 0.0039 in. (0.10 mm) Hg or less
4 for storage prior to shipment. The Permittees shall require the laboratory responsible for canister
5 cleaning and certification to maintain canister certification documentation and initiate the
6 canister tags as described in Permit Attachment B3.

7 B1-1c(2) Sampling Equipment Initial Cleaning and Leak Check

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

13 B1-1c(3) Sampling Equipment Routine Cleaning and Leak Check

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

22 VOCs shall be removed from the internal surfaces of the headspace sampling manifold to levels
23 that are less than or equal to three times the MDLs of the analytes listed in Table B3-2 of Permit
24 Attachment B3, as determined by analysis of an equipment blank or through use of an OVA. It is
25 recommended that the headspace sampling manifold be heated to 150° Centigrade and
26 periodically evacuated and flushed with humidified zero air, nitrogen, or helium. When not in
27 use, the manifold shall be demonstrated clean before storage with a positive pressure of high
28 purity gas (i.e., zero air, nitrogen, or helium) in both the standard and sample sides.

29 Sampling shall be suspended and corrective actions shall be taken when the analysis of an
30 equipment blank indicates that the VOC limits have been exceeded or if a leak test fails. The
31 Permittees shall require the site project manager to ensure that corrective action has been taken
32 prior to resumption of sampling.

33 B1-1c(4) Manifold Cleaning After Field Reference Standard Collection

34 The sampling system shall be specially cleaned after a field reference standard has been
35 collected, because the field reference standard gases contaminate the standard side of the
36 headspace sampling manifold when they are regulated through the purge assembly. This cleaning
37 requires the installation of a gas-tight connector in place of the sampling head, between the

1 flexible hose and the purge assembly. This configuration allows both the sample and standard
2 sides of the sampling system to be flushed (evacuated and pressurized) with humidified zero air,
3 nitrogen, or helium which, combined with heating the pneumatic lines, should sweep and
4 adequately clean the system's internal surfaces. After this protocol has been completed and prior
5 to collecting another sample, the routine system cleaning and leak check (see previous section)
6 shall also be performed.

7 B1-1c(5) Sampling Head Cleaning

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

16 B1-1d Equipment Calibration and Frequency

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

22 The OVA shall be calibrated once per day, prior to first use, or as necessary according to the
23 manufacturer's specifications. Calibration gases shall be certified to contain known analytes
24 from Table B3-2 of Permit Attachment B3 at known concentrations. The balance of the OVA
25 calibration gas shall be consistent with the manifold purge gas when the OVA is used (i.e., zero
26 air, nitrogen, or helium).

27 B1-2 Sampling of Homogeneous Solids and Soil/Gravel (Summary Categories S3000/S4000)

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

34 B1-2a Method Requirements

35 The methods used to collect samples of transuranic (**TRU**) mixed waste, classified as
36 homogeneous solids and soil/gravel from waste containers, shall be such that the samples are

1 representative of the waste from which they were taken. To minimize the quantity of
2 investigation-derived waste, laboratories conducting the analytical work may require no more
3 sample than is required for the analysis, based on the analytical methods. However, a sufficient
4 number of samples shall be collected to adequately represent waste being sampled. For those
5 waste streams defined as Summary Category Groups S3000 or S4000 in Attachment B, debris
6 that may also be present within these wastes need not be sampled.

7 Samples of retrievably stored waste containers will be collected using appropriate coring
8 equipment or other EPA approved methods to collect a representative sample. Newly generated
9 wastes that are sampled from a process as it is generated may be sampled using EPA approved
10 methods, including scoops and ladles, that are capable of collecting a representative sample. All
11 sampling and core sampling will comply with the QC requirements specified in B1-2b.

12 B1-2a(1) Core Collection

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

19 To provide a basis for describing the requirements for core collection, diagrams of a rotational
20 coring tool (i.e., a light weight auger) and a non-rotational coring tool (i.e., a thin-walled
21 sampler) are provided in Figures B1-5 and B1-6, respectively.

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

- 23 • Each coring tool shall contain a removable tube (liner) that is constructed of fairly rigid
24 material unlikely to affect the composition and/or concentrations of target analytes in the
25 sample core. Materials that are acceptable for use for coring device sleeves are
26 polycarbonate, teflon, or glass for most samples, and stainless steel or brass if samples
27 are not to be analyzed for metals. The Permittees shall require site quality assurance
28 project plans (**QAPjPs**) to document that analytes of concern are not present in liner
29 material. The Permittees shall also require sites to document that the materials are
30 unlikely to affect sample results through the collection and analysis of an equipment
31 blank prior to first use as specified in the 'Equipment Blanks' section of this appendix.
32 Liner outer diameter is recommended to be no more than 2 in. and no less than one in.
33 Liner wall thickness is recommended to be no greater than 1/16 in. Before use, the liner
34 shall be cleaned in accordance the requirements in Section B1-2b. The liner shall fit flush
35 with the inner wall of the coring tool and shall be of sufficient length to hold a core that is
36 representative of the waste along the entire depth of the waste. The depth of the waste is
37 calculated as the distance from the top of the sludge to the bottom of the drum (based on
38 the thickness of the liner and the rim at the bottom of the drum). The liner material shall
39 have sufficient transparency to allow visual examination of the core after sampling. If

1 sub-sampling is not conducted immediately after core collection and liner extrusion, then
2 end caps constructed of material unlikely to affect the composition and/or concentrations
3 of target analytes in the core (e.g., Teflon®) shall be placed over the ends of the liner.
4 End caps shall fit tightly to the ends of the liner. The Permittees shall require site specific
5 QAPjPs to indicate the acceptable materials for core liners and end caps.

- 6 • A spring retainer, similar to that illustrated in Figures B1-5 and B1-6, shall be used with
7 each coring tool when the physical properties of the waste are such that the waste may
8 fall out of the coring tool's liner during sampling activities. The spring retainer shall be
9 constructed of relatively inert material (e.g., stainless steel or Teflon®) and its inner
10 diameter shall not be less than the inner diameter of the liner. Before use, spring retainers
11 shall be cleaned in accordance with the requirements in Section B1-2b.
- 12 • Coring tools may have an air-lock mechanism that opens to allow air inside the liners to
13 escape as the tool is pressed into the waste (e.g., ball check valve). If used, this air-lock
14 mechanism shall also close when the core is removed from the waste container.
- 15 • After disassembling the coring tool, a device (extruder) to forcefully extrude the liner
16 from the coring tool shall be used if the liner does not slide freely. All surfaces of the
17 extruder that may come into contact with the core shall be cleaned in accordance with the
18 requirements in Section B1-2(b) prior to use.
- 19 • Coring tools shall be of sufficient length to hold the liner and shall be constructed to
20 allow placement of the liner leading edge as close as possible to the coring tools leading
21 edge.
- 22 • All surfaces of the coring tool that have the potential to contact the sample core or sample
23 media shall be cleaned in accordance with the requirements in Section B1-2(b) prior to
24 use.
- 25 • The leading edge of the coring tools may be sharpened and tapered to a diameter
26 equivalent to, or slightly smaller than, the inner diameter of the liner to reduce the drag of
27 the homogeneous solids and soil/gravel against the internal surfaces of the liner, thereby
28 enhancing sample recovery.
- 29 • Rotational coring tools shall have a mechanism to minimize the rotation of the liner
30 inside the coring tool during coring activities, thereby minimizing physical disturbance to
31 the core.
- 32 • Rotational coring shall be conducted in a manner that minimizes transfer of frictional
33 heat to the core, thereby minimizing potential loss of VOCs.
- 34 • Non-rotational coring tools shall be designed such that the tool's kerf width is minimized.
35 Kerf width is defined as one-half of the difference between the outer diameter of the tool
36 and the inner diameter of the tool's inlet.

1 B1-2a(2) Sample Collection

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

- 3 • Sampling shall be conducted as soon as possible after core collection. If a substantial
4 delay (i.e., more than 60 minutes) is expected between core collection and sampling, the
5 core shall remain in the liner and the liner shall be capped at each end. If the liner
6 containing the core is not extruded from the coring tool and capped, then two alternatives
7 are permissible: 1) the liner shall be left in the coring tool and the coring tool shall be
8 capped at each end, or 2) the coring tool shall remain in the waste container with the air-
9 lock mechanism attached.
- 10 • Samples of homogeneous solids and soil/gravel for VOC analyses shall be collected prior
11 to extruding the core from the liner. These samples may be collected by collecting a
12 single sample from the representative subsection of the core, or three sub-samples may be
13 collected from the vertical core to form a single 15-gram composite sample. Smaller
14 sample sizes may be used if method PRQL requirements are met for all analytes. The
15 sampling locations shall be randomly selected. If a single sample is used, the
16 representative subsection is chosen by randomly selecting a location along the portion of
17 the core (i.e. core length). If the three sub-sample method is used, the sampling locations
18 shall be randomly selected within three equal-length subsections of the core along the
19 long axis of the liner and access to the waste shall be gained by making a perpendicular
20 cut through the liner and the core. The Permittees shall require sites to develop
21 documented procedures to select, and record the selection, of random sampling locations.
22 True random sampling involves the proper use of random numbers for identifying
23 sampling locations. The procedures used to select the random sampling locations will be
24 subject to review as part of annual audits by the Permittees. A sampling device such as
25 the metal coring cylinder described in EPA's SW-846 Manual (1996), or equivalent, shall
26 be immediately used to collect the sample once the core has been exposed to air.
27 Immediately after sample collection, the sample shall be extruded into 40-ml volatile
28 organics analysis (VOA) vials (or other containers specified in appropriate SW-846
29 methods), the top rim of the vial visually inspected and wiped clean of any waste residue,
30 and the vial cap secured. Sample handling requirements are outlined in Table B1-4.
31 Additional guidance for this type of sampling can be found in SW-846 (EPA 1996).
- 32 • Samples of the homogeneous solids and soil/gravel for semi-volatile organic compound
33 and metals analyses shall be collected. These samples may be collected from the same
34 sub-sample locations and in the same manner as the sample collected for VOC analysis,
35 or they may be collected by splitting or compositing the representative subsection of the
36 core. The representative subsection is chosen by randomly selecting a location along the
37 portion of the core (i.e. core length). The Permittees shall require sites to develop
38 documented procedures to select, and record the selection, of random sampling locations.
39 True random sampling involves the proper use of random numbers for identifying
40 sampling locations. The procedures used to select the random sampling locations will be

1 subject to review as part of annual audits by the Permittees. Guidance for splitting and
2 compositing solid materials can be found in SW-846 (EPA 1996). All surfaces of the
3 sampling tools that have the potential to come into contact with the sample shall be
4 constructed of materials unlikely to affect the composition or concentrations of target
5 analytes in the waste (e.g., Teflon®). In addition, all surfaces that have the potential to
6 come into contact with core sample media shall either be disposed or decontaminated
7 according to the procedures found in Section B1-2(b). Sample sizes and handling
8 requirements are outlined in Table B1-4.

9 Newly generated waste samples may be collected using methods other than coring, as discussed
10 in Section B1-2a. Newly generated wastes samples will be collected as soon as possible after
11 sampling, but the spatial and temporal homogeneity of the waste stream dictate whether a
12 representative grab sample or composite sample shall be collected. As part of the site audit, the
13 Permittees shall assess waste sampling to ensure collection of representative samples.

14 B1-2b Quality Control

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

21 B1-2b(1) Co-located Samples

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

1 B1-2b(2) Equipment Blanks

2 In accordance with SW-846 (EPA 1996), equipment blanks shall be collected from fully
3 assembled sampling and coring tools (i.e., at least those portions of the sampling equipment that
4 contact the sample) prior to first use after cleaning at a frequency of one per equipment cleaning
5 batch. An equipment cleaning batch is the number of sampling equipment items cleaned together
6 at one time using the same cleaning method. The equipment blank shall be collected from the
7 fully assembled sampling or coring tool, in the area where the sampling or coring tools are
8 cleaned, prior to covering with protective wrapping and storage. The equipment blank shall be
9 collected by pouring clean water (e.g., deionized water, HPLC water) down the inside of the
10 assembled sampling or coring tool. The water shall be collected in a clean sample container
11 placed at the leading edge of the sampling or coring tool and analyzed for the analytes listed in
12 Tables B3-4, B3-6, and B3-8 of Permit Attachment B3. The results of the equipment blank will
13 be considered acceptable if the analysis indicates no analyte at a concentration greater than three
14 times the MDLs listed in Tables B3-4 and B3-6 or in the Program Required Detection Limits
15 (**PRDL**) in Table B3-8 of Permit Attachment B3. If analytes are detected at concentrations
16 greater than three times the MDLs (or PRDLs for metals), then the associated equipment
17 cleaning batch of sampling or coring tools shall be cleaned again and another equipment blank
18 collected. Equipment from an equipment cleaning batch may not be used until analytical results
19 have been received verifying an adequately low level of contamination in the equipment blank.

20 Equipment blanks for coring tools shall be collected from liners that are cleaned separately from
21 the coring tools. These equipment blanks shall be collected at a frequency of one per equipment
22 cleaning batch. The equipment blanks shall be collected by randomly selecting a liner from the
23 equipment cleaning batch, pouring clean water (e.g., deionized water or HPLC water) across its
24 internal surface, collecting the water in a clean sample container, and analyzing the water for the
25 analytes listed in Tables B3-4, B3-6, and the PRDLs in Table B3-8 of Permit Attachment B3.
26 The results of the equipment blank analysis will be considered acceptable if the results indicate
27 no analyte at a concentration greater than three times the MDLs listed in Tables B3-4, B3-6, or
28 B3-8 of Permit Attachment B3. If analytes are detected at concentrations greater than three times
29 the MDLs (or PRDLs for metals), then the associated equipment cleaning batch of liners shall be
30 cleaned again and another equipment blank collected. Equipment from an equipment cleaning
31 batch may not be used until analytical results have been received verifying an adequately low
32 level of contamination in the equipment blank.

33 Sampling equipment (e.g., bowls, spoons, chisel, VOC sub-sampler) shall also be cleaned.
34 Equipment blanks shall be collected for the sampling equipment at a frequency of one per
35 equipment cleaning batch. After the sampling equipment has been cleaned, one item from the
36 equipment cleaning batch is randomly selected, water (e.g., deionized water, HPLC water) is
37 passed over its surface, collected in a clean container, and analyzed for the analytes listed in
38 Tables B3-4, B3-6, and B3-8 of Permit Attachment B3. The results of the equipment blank will
39 be considered acceptable if the results indicate no analyte present at a concentration greater than
40 three times the MDLs listed in Tables B3-4 and B3-6 and in the PRDLs in B3-8 of Permit
41 Attachment B3. If analytes are detected at concentrations greater than three times the MDLs (or

1 PRDLs for metals), then the associated equipment cleaning batch of sampling equipment shall be
2 cleaned again and another equipment blank collected. Equipment from an equipment cleaning
3 batch may not be used until analytical results have been received verifying an adequately low
4 level of contamination in the equipment blank. The above equipment blanks may be performed
5 on a purchased batch basis for sampling equipment purchased sterile and sealed in protective
6 packaging. Equipment blanks need not be performed for equipment purchased in sealed
7 protective packaging accompanied by a certificate certifying cleanliness.

8 The results of equipment blanks shall be traceable to the items in the equipment cleaning batch
9 that the equipment blank represents. All sampling items should be identified, and the associated
10 equipment cleaning batch should be documented. The method of documenting the connection
11 between equipment and equipment cleaning batches shall be documented. Equipment blank
12 results for the coring tools, liners, and sampling equipment shall be reviewed prior to use. A
13 sufficient quantity of these items should be maintained in storage to prevent disruption of
14 sampling operations.

15 The Permittees may require a site to use certified clean disposable sampling equipment and
16 discard liners and sampling tools after one use. In this instance, cleaning and equipment blank
17 collection is not required.

18 B1-2b(3) Coring Tool and Sampling Equipment Cleaning

19 Coring tools and sampling equipment shall be cleaned in accordance with the following
20 requirements:

- 21 • All surfaces of coring tools and sampling equipment that will come into contact with the
22 samples shall be clean prior to use. All sampling equipment shall be cleaned in the same
23 manner. Immediately following cleaning, coring tools and sampling equipment shall be
24 assembled and sealed inside clean protective wrapping.
- 25 • Each reusable sampling or coring tool shall have a unique identification number. Each
26 number shall be referenced to the waste container on which it was used. This information
27 shall be recorded in the field records. One sampling or coring tool from each equipment
28 cleaning batch shall be tested for cleanliness in accordance with the requirements
29 specified above. The identification number of the sampling or coring tool from which the
30 equipment blank was collected shall be recorded in the field records. The results of the
31 equipment blank analysis for the equipment cleaning batch in which each sampling or
32 coring tool was cleaned shall be submitted to the sampling facility with the identification
33 numbers of all sampling or coring tools in the equipment cleaning batch. If analytes are
34 detected at concentrations greater than three times the MDLs (or PRDLs for metals), then
35 the associated equipment cleaning batch of sampling equipment shall be cleaned again
36 and another equipment blank collected. Equipment from an equipment cleaning batch
37 may not be used until analytical results have been received verifying an adequately low
38 level of contamination in the equipment blank.

- 1 • Sample containers shall be cleaned in accordance with SW-846 (EPA 1996).

2 B1-2c Equipment Testing, Inspection and Maintenance

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

11 Coring tools and sample collection equipment shall be maintained in accordance with
12 manufacturer's specifications. Clean sampling and coring tools and sampling equipment shall be
13 sealed inside clean protective wrapping and maintained in a clean storage area prior to use.
14 Sampling equipment shall be properly maintained to avoid contamination. A sufficient supply of
15 spare parts should be maintained to prevent delays in sampling activities due to equipment down
16 time. Records of equipment maintenance and repair shall be maintained in the field records in
17 accordance with site SOPs.

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

- 19 • Sample collection equipment in the immediate area of sample collection shall be
20 inspected daily for cleanliness. Visible contamination on any equipment (e.g., waste on
21 floor of sampling area, hydraulic fluid from hoses) that has the potential to contaminate a
22 waste core or waste sample shall be thoroughly cleaned upon its discovery.
- 23 • The waste coring and sampling work areas shall be maintained in clean condition to
24 minimize the potential for cross contamination between waste (including cores) and
25 samples.
- 26 • Expendable equipment (e.g., plastic sheeting, plastic gloves) shall be visually inspected
27 for cleanliness prior to use and properly discarded after each sample.
- 28 • Prior to removal of the protective wrapping from a coring tool designated for use, the
29 condition of the protective wrapping shall be visually assessed. Coring tools with torn
30 protective wrapping should be returned for cleaning. Coring tools visibly contaminated
31 after the protective wrapping has been removed shall not be used and shall be returned
32 for cleaning or properly discarded.
- 33 • Sampling equipment shall be visually inspected prior to use. All sampling equipment that
34 comes into contact with waste samples shall be stored in protective wrapping until use.
35 Prior to removal of the protective wrapping from sampling equipment, the condition of
36 the protective wrapping shall be visually assessed. Sampling equipment with torn

1 protective wrapping should be discarded or returned for cleaning. Sampling equipment
2 visibly contaminated after the protective wrapping has been removed shall not be used
3 and shall be returned for cleaning or properly discarded.

- 4 • Cleaned sampling and coring equipment will be physically segregated from all equipment
5 that has been used for a sampling event and has not been decontaminated.

6 B1-2d Equipment Calibration and Frequency

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

11 B1-3 Radiography

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

18 A radiography system (e.g., real time radiography, digital radiography/computed tomography)
19 normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation
20 protection, a waste container handling system, an audio/video recording system, and an operator
21 control and data acquisition station. Although these six components are required, it is expected
22 there will be some variation within a given component between sites. The radiography system
23 shall have controls or an equivalent process which allow the operator to control image quality.
24 On some radiography systems, it should be possible to vary the voltage, typically between 150 to
25 400 kilovolts (kV), to provide an optimum degree of penetration through the waste. For example,
26 high-density material should be examined with the X-ray device set on the maximum voltage.
27 This ensures maximum penetration through the waste container. Low-density material should be
28 examined at lower voltage settings to improve contrast and image definition. The imaging
29 system typically utilizes either a fluorescent screen and a low-light television camera or x-ray
30 detectors to generate the image.

31 To perform radiography, the waste container is scanned while the operator views the television
32 screen. A video and audio recording is made of the waste container scan and is maintained as a
33 non-permanent record. A radiography data form is also used to document the Waste Matrix Code
34 to ensure that the waste container contains no ignitable, corrosive, or reactive waste by
35 documenting the absence of liquids in excess of TSDF-WAC limits or compressed gases, and
36 verify that the physical form of the waste is consistent with the waste stream description
37 documented on the WSPF. Containers whose contents prevent full examination of the remaining
38 contents shall be subject to visual examination unless the site certifies that visual examination

- 1 would provide no additional relevant information for that container based on the acceptable
2 knowledge information for the waste stream. Such certification shall be documented in the
3 generator/storage site's record.
- 4 For containers which contain classified shapes and undergo radiography, the radiography video
5 and audio recording will be considered classified. The radiography data forms will not be
6 considered classified.
- 7 The radiography system involves qualitative and semiquantitative evaluations of visual displays.
8 Operator training and experience are the most important considerations for ensuring quality
9 controls in regard to the operation of the radiography system and for interpretation and
10 disposition of radiography results. Only trained personnel shall be allowed to operate
11 radiography equipment.
- 12 Standardized training requirements for radiography operators shall be based upon existing
13 industry standard training requirements.
- 14 The Permittees shall require each site to develop a training program that provides radiography
15 operators with both formal and on-the-job (**OJT**) training. Radiography operators shall be
16 instructed in the specific waste generating practices, typical packaging configurations, and
17 associated waste material parameters expected to be found in each Waste Matrix Code at the site.
18 The OJT and apprenticeship shall be conducted by an experienced, qualified radiography
19 operator prior to qualification of the training candidate. The training programs will be site-
20 specific due to differences in equipment, waste configurations, and the level of waste
21 characterization efforts. For example, certain sites use digital radiography equipment, which is
22 more sensitive than real-time radiography equipment. In addition, the particular physical forms
23 and packaging configurations at each site will vary; therefore, radiography operators shall be
24 trained on the types of waste that are generated, stored, and/or characterized at that particular
25 site.
- 26 Although the Permittees shall require each site to develop its own training program, all of the
27 radiography QC requirements specified in this WAP shall be incorporated into the training
28 programs and radiography operations. In this way data quality and comparability will not be
29 affected.
- 30 Radiography training programs will be the subject of the Permittees' Audit and Surveillance
31 Program (Permit Attachment B6).
- 32 A training drum with internal container of various sizes shall be scanned biannually by each
33 operator. The audio and video media shall then be reviewed by a supervisor to ensure that
34 operators' interpretations remain consistent and accurate. Imaging system characteristics shall be
35 verified on a routine basis.
- 36 Independent replicate scans and replicate observations of the video output of the radiography
37 process shall be performed under uniform conditions and procedures. Independent replicate

1 scans shall be performed on one waste container per day or once per testing batch, whichever is
2 less frequent. Independent observations of one scan (not the replicate scan) shall also be made
3 once per day or once per testing batch, whichever is less frequent, by a qualified radiography
4 operator other than the individual who performed the first examination. A testing batch is a suite
5 of waste containers undergoing radiography using the same testing equipment. A testing batch
6 can be up to 20 waste containers without regard to waste matrix.

7 Oversight functions include periodic audio/video tape reviews of accepted waste containers and
8 shall be performed by qualified radiography personnel other than the operator who dispositioned
9 the waste container. The results of this independent verification shall be available to the
10 radiography operator. The Permittees shall require the site project manager to be responsible for
11 monitoring the quality of the radiography data and calling for corrective action, when necessary.

12 B1-4 Visual Examination

13 In lieu of radiography, the waste container contents may be verified directly by visual
14 examination of the waste container contents. Visual examination may be performed on waste
15 containers to verify the Waste Matrix Code and to verify that the container is properly included
16 in the appropriate waste stream. Visual examination shall be conducted to describe all contents
17 of a waste container, clearly identifying all discernible waste items, residual materials, packaging
18 materials, or waste material parameters. All visual examination activities shall be documented on
19 video/audio media, or alternatively, by using a second operator to provide additional verification
20 by reviewing the contents of the waste container to ensure correct reporting. The results of all
21 visual examination shall be documented on visual examination data forms.

22 Visual examination recorded on video/audio media shall meet the following minimum
23 requirements:

- 24 • The video/audio media shall record the waste packaging event for the container such that
25 all waste items placed into the container are recorded in sufficient detail and shall contain
26 an inventory of waste items in sufficient detail that another trained visual examination
27 expert can identify the associated waste material parameters.
- 28 • The video/audio media shall capture the waste container identification number.
- 29 • The personnel loading the waste container shall be identified on the video/audio media or
30 on packaging records traceable to the loading of the waste container.
- 31 • The date of loading of the waste container will be recorded on the video/audio media or
32 on packaging records traceable to the loading of the waste container.

33 Visual examination performed using two generator site personnel shall meet the following
34 minimum requirements:

- 1 • At least two generator site personnel shall approve the data forms or packaging logs
2 attesting to the contents of the waste container.
- 3 • The data forms or packaging logs shall contain an inventory of waste items in sufficient
4 detail that another trained visual examination expert can identify the associated waste
5 material parameters.
- 6 • The waste container identification number shall be recorded on the data forms or
7 packaging logs.

8 Visual examination video/audio media of containers which contain classified shapes shall be
9 considered classified information. Visual examination data forms or packaging logs will not be
10 considered classified information.

11 Visual examination records may be used for characterization of TRU mixed waste. The visual
12 examination records must meet the minimum requirements listed above and shall be reviewed by
13 operators trained and qualified to the requirements listed below. The operators will prepare data
14 forms based on the visual examination records. Visual examination batch data reports will be
15 prepared, reviewed, and approved as described in Permit Attachment B, Section B-4, and Permit
16 Attachment B3.

17 Standardized training for visual inspection shall be developed. Visual inspectors shall be
18 instructed in the specific waste generating processes, typical packaging configurations, and
19 expected waste material parameters expected to be found in each Waste Matrix Code at the site.
20 The training shall be site specific to include the various waste configurations generated/stored at
21 the site. For example, the particular physical forms and packaging configurations at each site
22 will vary so operators shall be trained on types of waste that are generated, stored, and/or
23 characterized at that particular site. Visual examination personnel shall be requalified once every
24 two years.

25 Each visual examination facility shall designate a visual examination expert. The visual
26 examination expert shall be familiar with the waste generating processes that have taken place at
27 that site and also be familiar with all of the types of waste being characterized at that site. The
28 visual examination expert shall be responsible for the overall direction and implementation of the
29 visual examination at that facility. The Permittees shall require site QAPjPs to specify the
30 selection, qualification, and training requirements of the visual examination expert.

31 B1-5 Custody of Samples

32 Chain-of-Custody on field samples (including field QC samples) will be initiated immediately
33 after sample collection or preparation. Sample custody will be maintained by ensuring that
34 samples are custody sealed during shipment to the laboratory. After samples are accepted by the
35 analytical laboratory, custody is maintained by assuring the samples are in the possession of an
36 authorized individual, in that individual's view, in a sealed or locked container controlled by that
37 individual, or in a secure controlled access location. Sample custody will be maintained until the

1 sample is released by the site project manager or until the sample is expended. The Permittees
2 shall require that site QAPjPs or site-specific procedures include a copy of the sample chain-of-
3 custody form and instructions for completing sample chain-of-custody forms in a legally
4 defensible manner. This form will include provisions for each of the following:

- 5 • Signature of individual initiating custody control, along with the date and time.
- 6 • Documentation of sample numbers for each sample under custody. Sample numbers will
7 be referenced to a specific sampling event description that will identify the sampler(s)
8 through signature, the date and time of sample collection, type/number containers for
9 each sample, sample matrix, preservatives (if applicable), requested methods of analysis,
10 place/address of sample collection and the waste container number.
- 11 • For off-site shipping, method of shipping transfer, responsible shipping organization or
12 corporation, and associated air bill or lading number.
- 13 • Signatures of custodians relinquishing and receiving custody, along with date and time of
14 the transfer.
- 15 • Description of final sample container disposition, along with signature of individual
16 removing sample container from custody.
- 17 • Comment section.
- 18 • Documentation of discrepancies, breakage or tampering.

19 All samples and sampling equipment will be identified with unique identification numbers.
20 Sampling Coring tools and equipment will be identified with unique equipment numbers to
21 ensure that all sampling equipment, coring tools, and sampling canisters are traceable to
22 equipment cleaning batches.

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

- 26 • Sample ID number
- 27 • Sampler initials and organization
- 28 • Ambient temperature and pressure (for gas samples only)
- 29 • Sample description
- 30 • Requested analyses
- 31 • Data and time of collection
- 32 • QC designation (if applicable)

1 B1-6 Sample Packing and Shipping

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

7 When preparing SUMMA® or equivalent canisters for shipment, special care shall be taken with
8 the pressure gauge and the associated connections. Metal boxes which have separate
9 compartments, or cardboard boxes with foam inserts are standard shipping containers. The
10 chosen shipping container shall meet selected DOT regulations. If temperatures shall be
11 maintained, an adequate number of cold packs necessary to maintain the preservation
12 temperature shall be added to the package.

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

23 All sample containers should be affixed with signed tamper-proof seals or devices so that it is
24 apparent if the sample integrity has been compromised and that the identity of the seal or device
25 is traceable to the individual who affixed the seal. A seal should also be placed on the outside of
26 the shipping container for the same reason. Sample custody documentation shall be placed inside
27 the sealed or locked shipping container, with the current custodian signing to release custody.
28 Transfer of custody is completed when the receiving custodian opens the shipping container and
29 signs the custody documentation. The shipping documentation will serve to track the physical
30 transfer of samples between the two custodians.

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

35 B1-7 List of References

36 Bechtel BWXT Idaho, LLC (BWXT), 2000, Determination of Drum Age Criteria and Prediction
37 Factors Based on Packaging Configurations, INEEL/EXT-2000-01207, October 2000, Liekhus,

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4 Organic Compound Concentrations in Transuranic Waste Containers, INEL-95/0109/Revision 1,
5 M.J. Connolly, et. al.
- 6 U.S. Environmental Protection Agency (EPA), 1999, Compendium of Methods for
7 Determination of Toxic Organic Compounds in Ambient Air (EPA/625/R-96/10b, January
8 1999).
- 9 U.S. Environmental Protection Agency (EPA), 1996. Test Methods for Evaluating Solid Waste,
10 "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 B1-1
GAS SAMPLE REQUIREMENTS**

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

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^a Alternately, canisters that meet QAOs may be used.

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

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**TABLE B1-2
 SUMMARY OF DRUM FIELD QC HEADSPACE SAMPLE FREQUENCIES**

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

- 3 ^a Analysis of field blanks for VOCs (Table B3-2 of Appendix B3), only, is required. For on-line integrated
 4 sampling/analysis systems, if field blank results meet the acceptance criterion, a separate on-line blank is not
 5 required.
- 6 ^b One equipment blank or on-line sample shall be collected, analyzed for VOCs (Table B3-2), and demonstrated
 7 clean prior to first use of the headspace gas sampling equipment with each of the sampling heads, then at the
 8 specified frequency, for VOCs only thereafter. Daily, prior to work, the sampling manifold, if in use, shall be verified
 9 clean using an OVA.
- 10 ^c One field reference standard or on-line control sample shall be collected, analyzed, and demonstrated to meet the
 11 QAOs specified in Permit Attachment B3 prior to first use, then at the specified frequency thereafter.
- 12 ^d A sampling batch is a suite of samples collected consecutively using the same sampling equipment within a
 13 specific time period. A sampling batch can be up to 20 samples (excluding field QC samples), all of which shall be
 14 collected within 14 days of the first sample in the batch.
- 15 ^e One equipment blank and field reference standard shall be collected after equipment purchase, cleaning, and
 16 assembly.
- 17 ^f An on-line batch is the number of samples collected within a 12-hour period using the same on-line integrated
 18 sampling/analysis system. The analytical batch requirements are specified by the analytical method being used in
 19 the on-line system.

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**TABLE B1-3
 SUMMARY OF SAMPLING QUALITY CONTROL SAMPLE ACCEPTANCE CRITERIA**

QC Sample	Acceptance Criteria	Corrective Action ^a
Field blanks	VOC amounts $\leq 3 \times$ MDLs in Table B3-2 for GC/MS and GC/FID; < PRQLs in Table B3-2 for FTIRS	Nonconformance if any VOC amount $> 3 \times$ MDLs in Table B3-2 for GC/MS and GC/FID; \geq PRQLs in Table B3-2 for FTIRS
Equipment blanks	VOC amounts $\leq 3 \times$ MDLs in Table B3-2 of for GC/MS and GC/FID; < PRQLs in Table B3-2 for FTIRS	Nonconformance if any analyte amount $> 3 \times$ MDLs in Table B3-2 for GC/MS and GC/FID; \geq PRQLs in Table B3-2 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 ≤ 25	Nonconformance if RPD > 25

- 3 ^a Corrective action is only required if the final reported QC sample results do not meet the acceptance criteria.
 4 MDL = Method detection limit
 5 %R = Percent recovery
 6 RPD = Relative percent difference

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**TABLE B1-4
 SAMPLE HANDLING REQUIREMENTS FOR HOMOGENEOUS
 SOLIDS AND SOIL/GRAVEL**

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

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- ^a Quantity may be increased or decreased according to the requirements of the analytical laboratory, as long as the QAOs are met.
 - ^b Holding time begins at sample collection (holding times are consistent with SW-846 requirements).
 - ^c 40-ml VOA vial or other appropriate containers shall have an airtight cap.
 - ^d 40-day holding time allowable only for methanol extract - 14-day holding time for non-extracted VOCs.
 - ^e Appropriate containers should be used and should have Teflon® lined caps.
 - ^f Polyethylene or polypropylene preferred, glass jar is allowable.
 - ^g 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 B1-5
 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. ^a
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.

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^a 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 B1-6
SCENARIO 1 DRUM AGE CRITERIA (IN DAYS) MATRIX**

Summary Category Group	DAC (Days)
S5000	53

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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 B1-7
 SCENARIO 2 DRUM AGE CRITERIA (IN DAYS) MATRIX**

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

3 ^a The documented filter H₂ diffusivity must be greater than or equal to the listed value to use the DAC for the listed
 4 filter H₂ diffusivity (e.g., a container with a filter H₂ diffusivity of 4.2×10^{-6} must use a DAC for a filter with a
 5 3.7×10^{-6} filter H₂ diffusivity). If a filter H₂ diffusivity for a container is undocumented or unknown or is less than
 6 1.9×10^{-6} filter H₂ diffusivity, a filter of known H₂ diffusivity that is greater than or equal to 1.9×10^{-6} filter H₂
 7 diffusivity must be installed prior to initiation of the relevant DAC period.

8 ^b The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for
 9 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
 10 rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during
 11 packaging (Attachment B, Section B-3d(1)), repackaging (Attachment B, Section B-3d(1)), and/or venting (Section
 12 B1-1a[4][ii]), that container must use a DAC for a rigid liner vent hole diameter of 0.30 in.

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

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**TABLE B1-8
SCENARIO 3 PACKAGING CONFIGURATION GROUPS**

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

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

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

6 ^b A “filtered inner lid” is the inner lid on a double lid drum that contains a filter.

7 Definitions:

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

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

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**TABLE B1-9
SCENARIO 3 DRUM AGE CRITERIA (IN DAYS) MATRIX FOR S5000 WASTE
BY PACKAGING CONFIGURATION GROUP**

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

Packaging Configuration Group 5			
Filter H₂ Diffusivity^{a, c} (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP		
$> 7.4 \times 10^{-6}$ (SWB)	15		
3.33×10^{-5} (TDOP)	15		
Packaging Configuration Group 6			
Filter H₂ Diffusivity^{a, c} (mol/s/mol fraction)	Headspace Sample Taken Inside SWB/TDOP		
$> 7.4 \times 10^{-6}$ (SWB)	56		
3.33×10^{-5} (TDOP)	56		
Packaging Configuration Group 7^d			
Filter H₂ Diffusivity^a (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H₂ Diffusivity (mol/s/mol fraction)^a		
	7.4×10^{-6}	1.85×10^{-5}	$9.25 \times 10^{-5}^e$
3.7×10^{-6}	13	7	2
7.4×10^{-6}	10	6	2
1.85×10^{-5}	6	4	2
Packaging Configuration Group 8			
Filter H₂ Diffusivity^a (mol/s/mol fraction)	Inner Lid Filter Vent Minimum H₂ Diffusivity (mol/s/mol fraction)		
	7.4×10^{-6}		
3.7×10^{-6}	21		

- 1 ^a The documented filter H₂ diffusivity must be greater than or equal to the listed value to use the DAC for the listed
 2 filter H₂ diffusivity (e.g., a container with a filter H₂ diffusivity of 4.2×10^{-6} must use a DAC for a filter with a
 3 3.7×10^{-6} filter H₂ diffusivity). If a filter H₂ diffusivity for a container is undocumented or unknown or is less than
 4 1.9×10^{-6} filter H₂ diffusivity, a filter of known H₂ diffusivity that is greater than or equal to 1.9×10^{-6} filter H₂
 5 diffusivity must be installed prior to initiation of the relevant DAC period.
- 6 ^b The documented rigid liner vent hole diameter must be greater than or equal to the listed value to use the DAC for
 7 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
 8 rigid liner vent hole of 0.375 in.). If the rigid liner vent hole diameter for a container is undocumented during
 9 packaging, repackaging, and/or venting (Section B1-1a[64][ii]), that container must use a DAC for a rigid liner vent
 10 hole diameter of 0.30 in.
- 11 ^c The filter H₂ diffusivity for SWBs or TDOPs is the sum of the diffusivities for all of the filters on the container
 12 because SWBs and TDOPs have more than 1 filter.

Waste Isolation Pilot Plant
Hazardous Waste Facility Permit
Renewal Application
September 2009

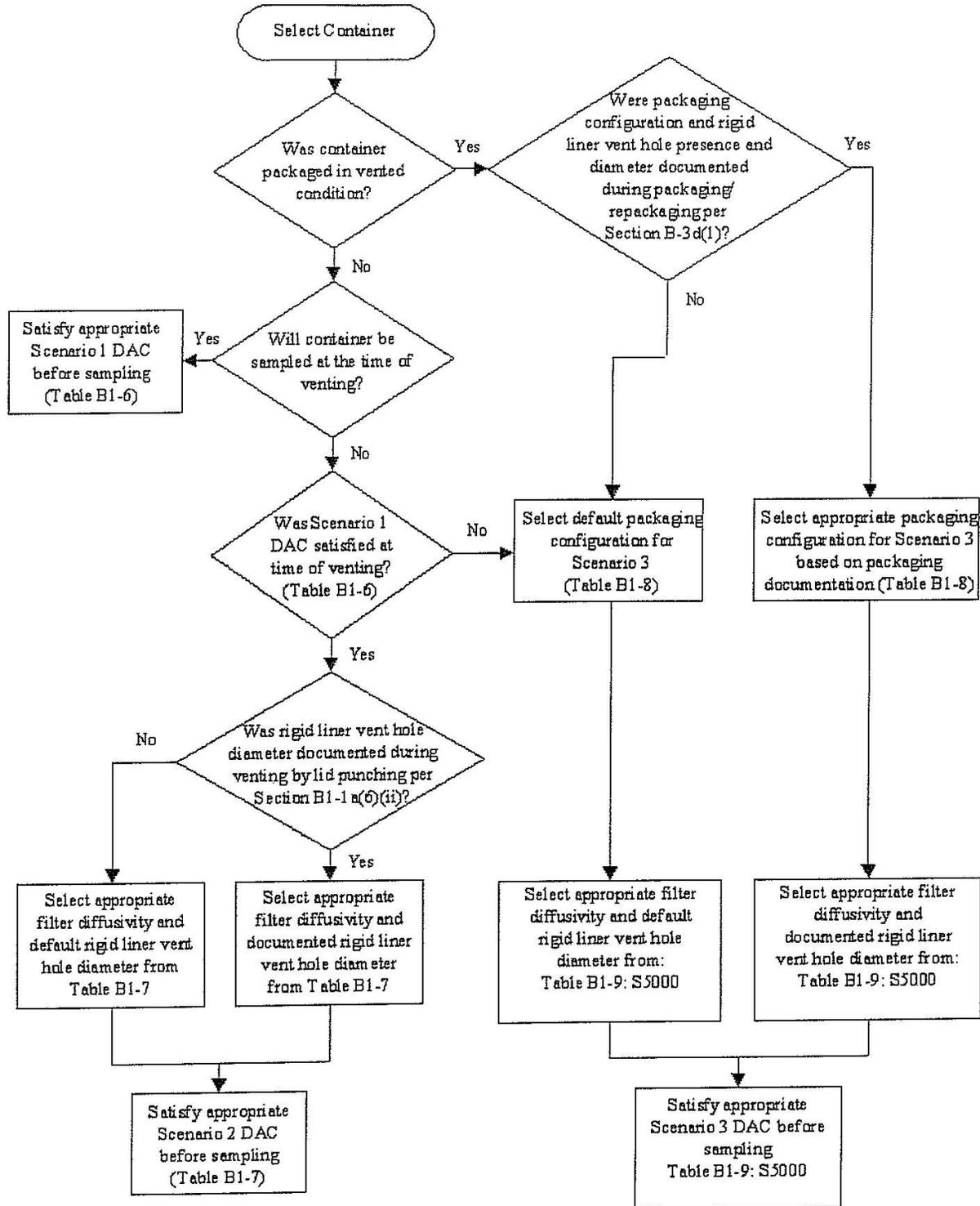
- 1 ^d Headspace sample taken between inner and outer drum lids. If headspace sample is taken inside the filtered inner
2 drum lid prior to placement of the outer drum lid, then a DAC value of 2 days may be used. Footnote e is also
3 applicable. Packaging Configuration Group 7 DAC values apply to drums with up to two lids.
- 4 ^e While a DAC value of 2 days may be determined, containers must comply with the equilibrium requirements
5 specified in Section B1-1a (i.e., 72 hours at 18°C or higher). The equilibrium requirement for headspace gas
6 sampling shall be met separately.

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FIGURES

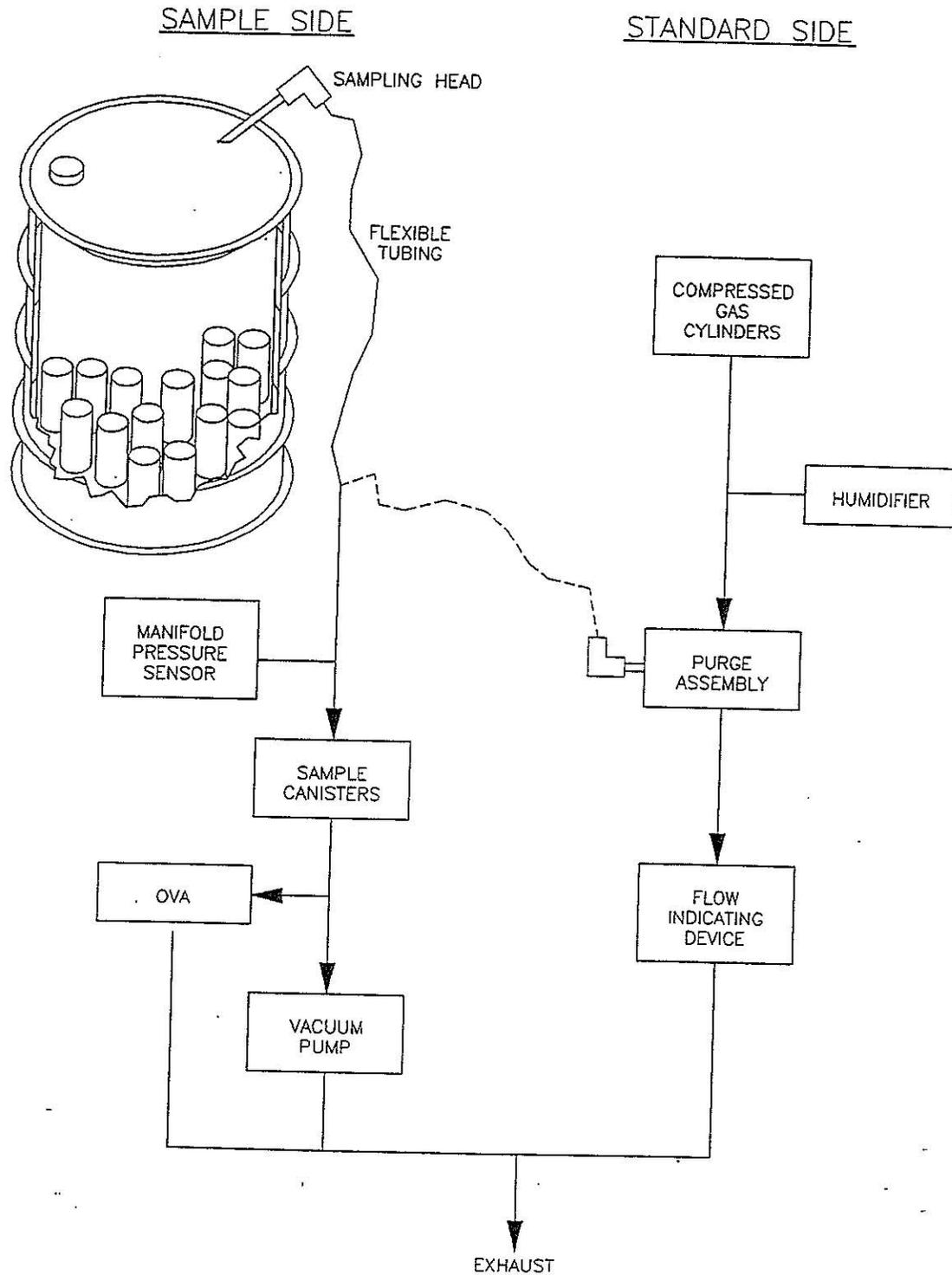
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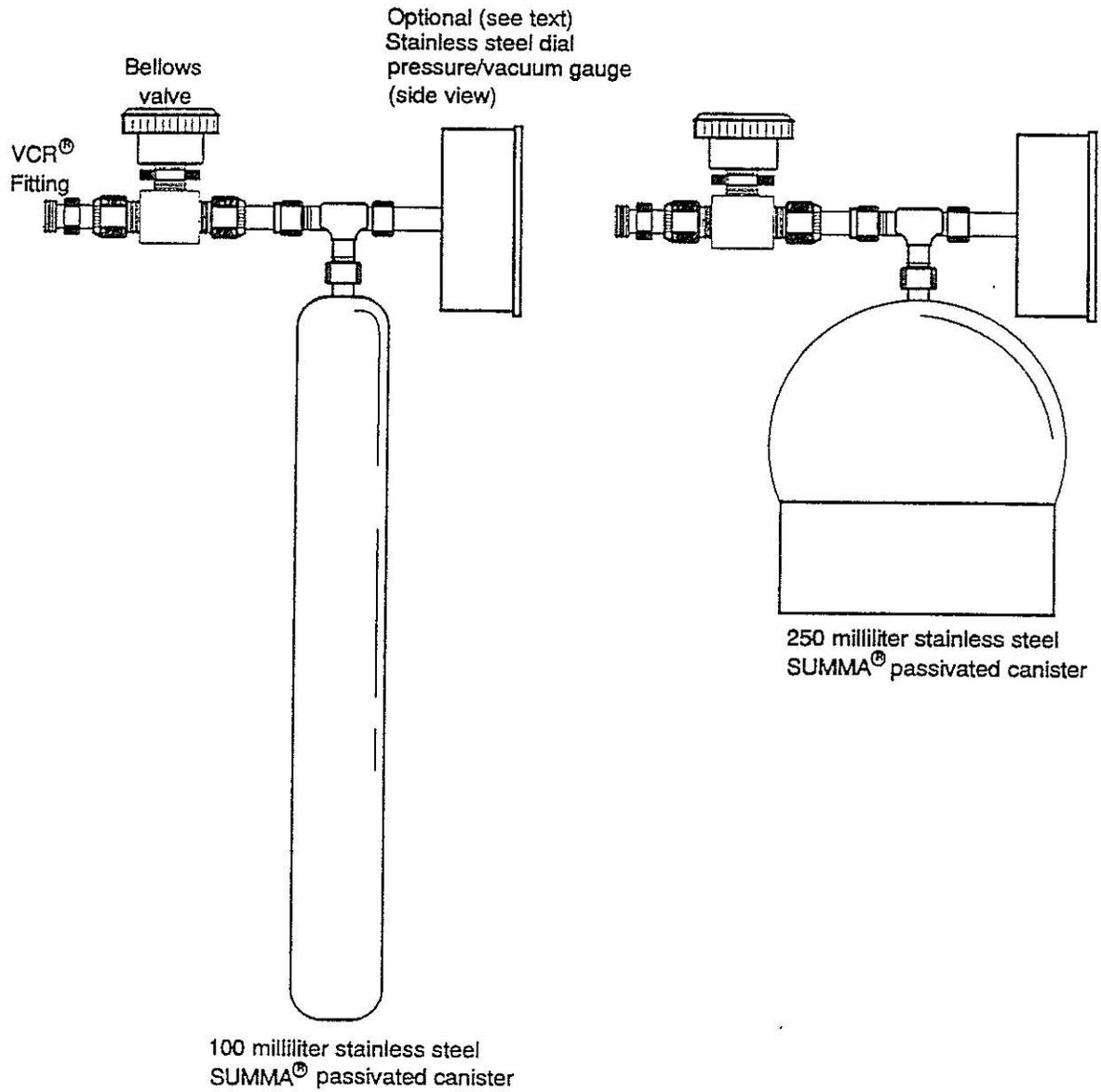
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Figure B1-1
 Headspace Gas Drum Age Criteria Sampling Scenario Selection Process



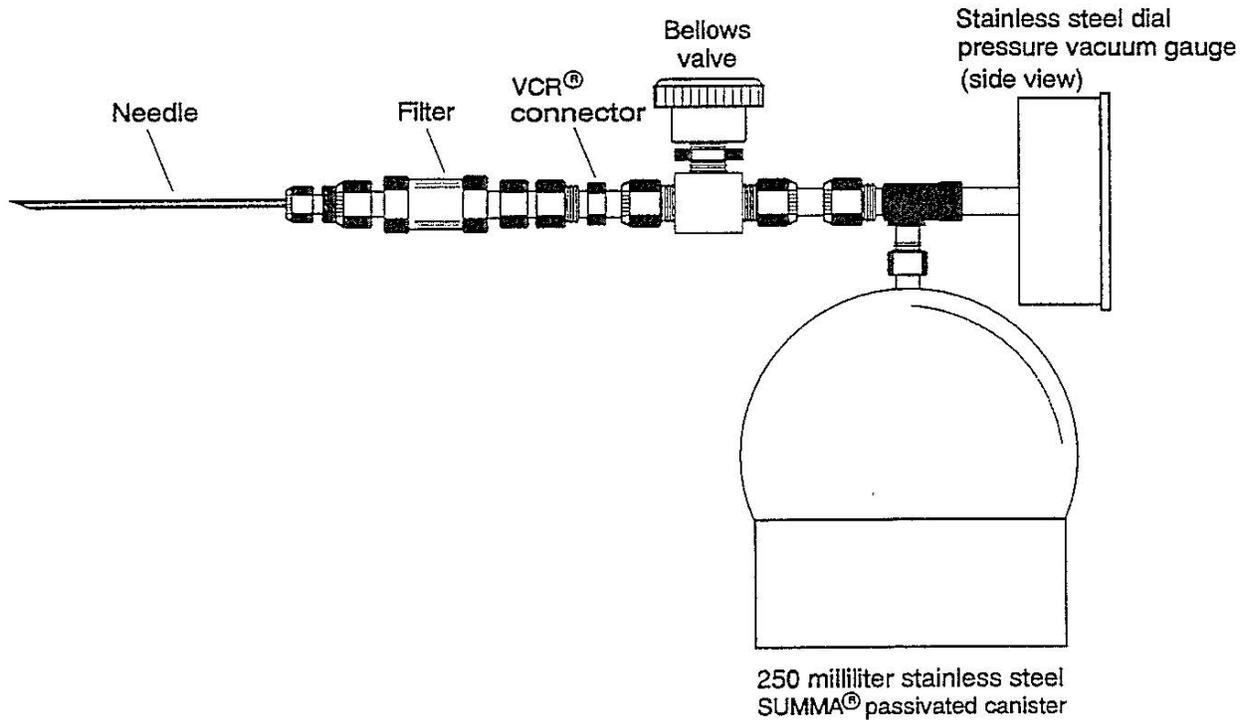
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Figure B1-2
Headspace Sampling Manifold



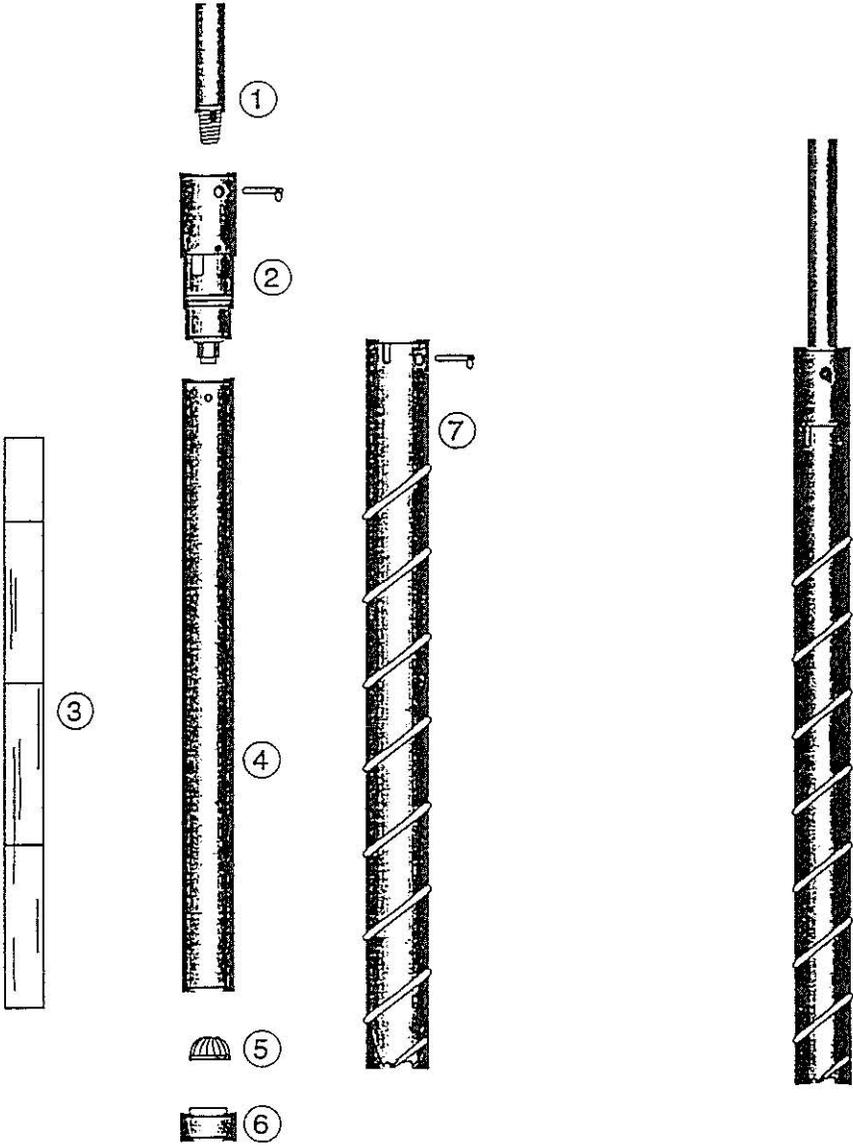
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Figure B1-3
SUMMA[®] Canister Components Configuration (Not to Scale)



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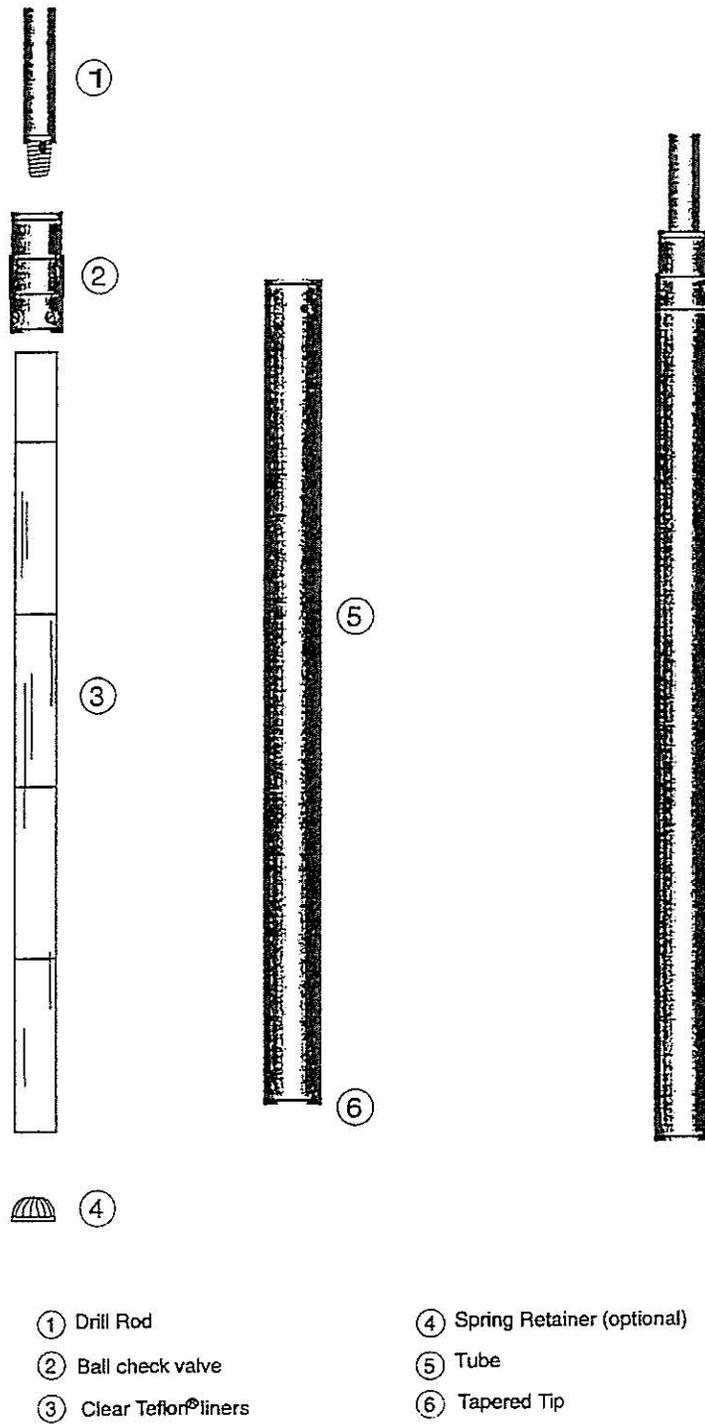
Figure B1-4
Schematic Diagram of Direct Canister with the Poly Bag Sampling Head



- ① Drill Rod
- ② Thrust Bearing Ball Check Valve
- ③ Clear Teflon[®] Liners
- ④ Core Barrel
- ⑤ Spring Retainer (optional)
- ⑥ Core barrel tip
- ⑦ Auger and Pin

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Figure B1-5
 Rotational Coring Tool (Light Weight Auger)



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Figure B1-6
 Non-Rotational Coring Tool (Thin Walled Sampler)