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CCP-TP-194

Revision 2

CCP
Drum Venting and Gas Determination

EFFECTIVE DATE: 09/20/2010

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RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	02/02/2008	Initial issue.
1	07/08/2010	Performed major rewrite and removed Host site personnel from performing tasks in the CCP procedure.
2	09/20/2010	Revised as result of corrective action report (CAR)-ORNL-0008-10.

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1.0 PURPOSE

The purpose of this procedure is to provide the direction for venting drums managed by the Oak Ridge National Laboratory (ORNL) as contact-handled (CH) waste (mixed or non-mixed) at the Transuranic (TRU) Waste Processing Center (TWPC) using a Nuclear Filter Technologies (NFT) Drum Venting System (DVS). As part of the venting process, measurement of the hydrogen and flammable volatile organic compounds (VOCs) concentrations are made via manual injection of a syringe sample using a Gas Chromotograph/Mass Spectrometer (GC/MS) instrument and reporting the results to the Transuranic (TRU) Waste Processing Center (TWPC).

1.1 Scope

The procedure includes the activities of installing a filter vent and/or sample port in an unvented drum and performing headspace gas (HSG) analysis from a syringe sample.

2.0 REQUIREMENTS

2.1 References

Baseline Documents

- Test Plan for the Air Handling System of TRU Waste Drum Venting System No. 3 (DVS-3), 007-DVS3-QA, October 2008, Revision 4
- Site Acceptance Re-Test Plan & Procedures for TRU Waste Drum Venting System No. 3 (DVS-3), QA-DVS3-009, June 2009, Revision 2

Referenced Documents

- CCP-QP-008, *CCP Records Management*
- CCP-QP-040, *Support Training*

2.2 Training Requirements

2.2.1 Personnel performing this procedure will be trained and qualified in accordance with CCP-QP-040, *CCP Support Training.*

2.3 Equipment List

2.3.1 DVS sampling and analysis equipment

2.3.2 Special equipment

[A] Non-sparking Spanner Socket and Ratchet designed to fit filters and sample ports

[B] Filter vents and sample ports

[C] Room Temperature Vulcanizing (RTV) sealant

[D] In accordance with applicable Activity Hazard Analysis (AHAs), personal protective equipment (PPE) will be worn as required for all drum handling operations

[E] Spray bottle of water

[F] Kimwipes®

[G] Tapmatic® Edge Lube Wax

[H] High-Efficiency Particulate Air (HEPA) Vacuum rated at Ninety cubic feet per minute (cfm)

2.3.3 Software

[A] Varian MS Workstation

2.4 Quality Control (QC) Requirements

2.4.1 **4-Bromofluorobenzene (BFB) Tune Check** - BFB is introduced into the Gas Chromatograph/Mass Spectrometer(GC/MS) system. Upon analysis of BFB, the mass spectrum shall meet the criteria listed in Table 1, BFB Key Ions and Abundance Criteria.

2.4.2 **Initial Calibration (ICAL)** - An ICAL must be run at startup, after major repairs, or if Continuing Calibration Verification (CCV) is unable to meet requirements. A three to five point curve is generated to establish the ability to quantitate chemical compounds and serves to define the quantitation range. The ICAL is determined using a certified calibration gas standard. The Percent Relative Standard Deviation (%RSD) values for each target VOC's must be less than or equal to 35. The coefficient of determination, r^2, for the Hydrogen calibration must be greater than or equal to 0.990.

2.4.3 **Continuing Calibration Verification (CCV)** - A CCV check will be performed to verify the analytical systems are capable of accurately quantifying the target compounds. The % Recovery for the target compounds must be less than or equal to 30% of the certified calibration gas standard. The CCV is a minimum of one compound associated with each internal standard and hydrogen.

2.5 Definitions

2.5.1 **Exceeds Calibration** – When the concentration of a flammable VOC or hydrogen is greater than the calibration range of the GC/MS instrument.

2.6 Precautions and Limitations

2.6.1 **IF** in the opinion of the operator, a procedure cannot be performed as written,
THEN the system or component will be placed in a safe condition and CCP management informed so the discrepancy can be corrected.

2.6.2 Opening or entering the Drum Containment Cabinet is not permitted when the amber light is illuminated and rotating. The amber light is located on the top of the operator workstation and indicates that the equipment is in operation when illuminated and rotating.

2.6.3 A Radiological Control Technician (RCT) shall be available as required by the Radiation Worker Permit (RWP) during operations to monitor drums, the DVS equipment area, and applicable personnel for contamination.

2.6.4 Two people are required to be present in the Drum Venting Building (DVB) when a drum is being loaded into the Drum Containment Cabinet, during preparation of a drum for processing in the Drum Containment Cabinet, or when unloading from the Drum Containment Cabinet. One person shall be a qualified CCP DVS Operator. The second person may be any person qualified to be in the DVB unescorted.

2.6.5 All work shall be performed in accordance with the approved Host site RWP. As low as reasonable achievable (ALARA) techniques shall be practiced at all times.

2.6.6 Radio communications shall be established between the Control Point and the DVB prior to processing drums.

2.6.7 Drum movements shall be made in accordance with Host site requirements.

2.6.8 Handling techniques MUST prevent the worker from placing the upper body (head and torso) over unvented drums without a drum lid restraint. Safety-toed boots/shoes and safety glasses shall be worn at all times in the DVB. Leather gloves shall be worn when manually handling drums.

2.6.9 DVS Operators shall not remove the drum lid restraint or drum cap.

2.6.10 All DVS operators shall review the applicable AHA prior to performing any work.

2.6.11 Whenever the Drum Containment Cabinet door, Survey Access door, or Glove Box Access door is open, an RCT must perform a radiological survey and confirm that the survey results meet the RWP requirement.

2.6.12 Airflow through the DVS Drum Containment Cabinet and Glove Box shall be verified prior to opening the Drum Containment Cabinet door, Survey Access door, or Glove Box Access door following drum venting operations.

2.6.13 All DVS operators shall review the Material Safety Data Sheets (MSDS) for all chemicals used in this process.

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3.0 RESPONSIBILITIES

3.1 Drum Venting System (DVS) Operator

3.1.1 Performs all activities in this procedure related to the command and control of the venting and analysis equipment, including entering data into Attachments.

3.2 Vendor Project Manager (VPM)

3.2.1 Oversees operations and maintenance of analytical operations and manages data generated from results reporting of sampling.

4.0 PROCEDURE

4.1 Daily Prerequisite Actions

4.1.1 Perform Inspection tour of the DVS processing area for obstacles that can interfere with equipment operations and remove obstacles if applicable.

4.1.2 Establish and verify radio communication with Host site control point.

4.1.3 Turn on the ventilation system for the DVS if not already running.

4.1.4 Verify the exhaust for the DVB is running.

4.1.5 If the DVB exhaust is not running then stop and notify the Host site for further instructions.

4.1.6 Open the main valves on the DVS internal standard, nitrogen-carrier, and nitrogen-purge compressed gas cylinders. Helium remains on at all times, **AND** record the pressure of each cylinder in the DVS Operational Logbook.

4.1.7 Obtain a copy of Attachment 1, Prerequisite Checklist, and answer the following questions:

[A] Are there any holes, rips, or tears in the rubber gloves on the Glove Box?

[B] Does the vacuum digital readout and vacuum gauge have current calibration decals?

[C] Do the DVS HEPA filters have current Dioctylphthalate (DOP) or equivalent testing?

[D] Are the calibration gases to be used within the expiration date?

[E] With all doors closed, is the Pressure Device Indicator (PDI) DVS – 1 Drum Containment Cabinet Magnahelic ≥ 0.40, and ≤ 1.4 inch water column (wc)?

[F] With all doors closed, is the PDI DVS – 2 Glove Box Magnahelic ≥ 0.35 and ≤ 0.9 inch wc?

[G] With Drum Containment Cabinet door open, is the PDI DVS – 3 Stage 2 HEPA filter ≥ 0.5 and ≤ 4.70 inch wc?

[H] With Drum Containment Cabinet door open, is the PDI DVS – 4 Stage 3 HEPA filter ≥ 0.5 and ≤ 4.70 inch wc?

4.1.8 Print name, sign, and date completed Attachment 1.

WARNING

If the DVS Exhaust System shuts down or becomes inoperable during the filter drilling operation, the filter will be seated and equipment will be placed in safe condition and the appropriate notifications made.

NOTE

Section 4.2 is a stand-alone section and may be performed independently of other sections.

4.2 GC/MS System Check

4.2.1 **IF** criteria cannot be met on any segment of Section 4.2, **THEN** troubleshoot and correct the problem.

4.2.2 Choose File to activate Daily Checks method.

4.2.3 Select Manual Control button on Microsoft (MS) 2000 window.

4.2.4 Select ON/OFF icon (turns from black to green), and Start on Segment #1, Air/Water.

[A] Verify Base Amount is less than 500.

[B] Verify ion count is less than 2,000.

4.2.5 Select Segment #2 HMN/Background.

[A] Ensure that the baseline reads from 50 up to 650 spectral points.

[B] Ensure ion time is between 20,000 and 25,001.

4.2.6 Select Segment #3 CALGAS.

[A] Select CALGAS icon (turns from black to green).

[B] Select Centroid Spectrum, **AND** verify all ions are present and properly assigned: (i.e. 69, 131, 264, 414, 464, 502, and 614).

4.2.7 Select Segment #4, choose profile spectrum.

[A] Verify the 131 and 132 peaks are centered.

[B] Verify the valley between peaks is clearly visible.

4.2.8 Deselect CALGAS **AND** select ON/OFF (turns green to black).

4.2.9 Select Segment # back down to 1.

NOTE

Section 4.3 is a stand-alone section and may be performed independently of other sections.

4.3 Initial Calibration

4.3.1 Obtain a blank Calibration Level spreadsheet and certificate of analysis (COA) for the gas to be used.

[A] Enter the concentrations for the target analytes from the COA into the spreadsheet.

[B] Acquire all calibrated levels for each target analyte.

4.3.2 Perform Auto Tune

[A] Select Auto Tune button on MS 2000 Window.

[B] Check the following boxes: Air/Water Check, Electron Multiplier Tune, and FC-43 Mass Calibration.

[C] Start Auto Tune.

[D] When complete, select Setpoints tab, **AND** document Electron Multiplier Voltage in the DVS Operational logbook.

4.3.3 BFB Analysis

[A] Turn HV1 and HV3 valves to Calibrate.

[B] Activate the BFB method, **AND** select the Acquisition box on the MS 2000 window.

[C] Select Inject Single Sample.

[D] Enter Initials.

[E] Select OK.

[F] For sample name enter BFBmmddyy where mm is month, dd is day, and yy is last two digits of year.

[G] For Sample Type select Analysis.

[H] For the Injection Notes, enter the Lot # and expiration date of the BFB standard, **AND** select OK.

[I] Select Data Files, create the daily data folder under the appropriate month, AND select OK.

[J] To begin sequence, select Inject.

[K] Obtain BFB.

[L] **WHEN** the Waiting signal begins flashing,
THEN manually inject 1micro-liter (µL) of the BFB standard into the GC/MS liquid injection port.

[M] When the BFB run is complete, choose the chromatogram icon (Review/Process MS Data) on the System Control window.

[N] Select appropriate file.

[O] Select Open File(s).

[P] Select and drag an area that highlights the BFB peak.

[Q] Select a scan point on the peak to view the spectrum for the scan point RT.

[R] Select MS Custom Report icon, (Custom MS Reports).

[S] Select custrept.mdb.

[T] Select File, Data Folder, Year Folder, Month Folder, and Daily Data Folder.

[U] Highlight the current BFB Data File and select OPEN.

[V] Select Edit, Configure Graphic, and Graphic 1.

[W] Enter Scan Point RT, making sure that the Apex Scans to Average block is set to 1 for single scan or 3 for a multiple scan average if applicable.

[X] Click save, close, and then select save.

[Y] Select View to verify BFB Tune Criteria.

[Z] **IF** the criteria passes,
THEN print and return to System Control, **AND** proceed to step 4.3.4.

[AA] **IF** the criteria DOES **NOT** pass,
THEN close the BFB Report Window, **AND** repeat steps 4.3.3[Q] – 4.3.3[Z], **AND** select another scan until no alternate scan is found to work.

[BB] **IF** an acceptable single scan **CANNOT** be met,
THEN close the BFB Report Window, **AND** repeat steps 4.3.3[Q] – 4.3.3[Z], **AND** set APEX Scans to Average block to 3.

[CC] **IF** acceptable scans **CANNOT** be found,
THEN troubleshoot and correct the problem.

NOTE

The ICAL Method shall be performed for both VOCs and Hydrogen and requires injecting each Standard Calibration gas individually.

4.3.4 ICAL Method

[A] Create an analytical method by selecting View/Edit Method icon and select Open Existing Method File.

[B] Open the most recent method and Save As the new method name VOC mmddyy where mm is month, dd is day, and yy is last two digits of year.

[C] In the new saved method, enter the concentrations of the calibrated levels for both VOC(s) and Hydrogen.

[C.1] Select MS Data Handling – Compound Table.

[C.2] Double click Calculations column to enter each compound's Cali Level Amount from the Calibration Level spreadsheet.

[C.3] Select TCD Data Handling – Peak Table.

[C.4] Enter the calibration Level Amounts from the Calibration Level spreadsheet.

[D] Notify another DVS Operator to verify the correct information is listed.

[E] Save method again.

[F] Close window.

[G] Under File Menu, select New Sample List and save as ICALmmddyy, where mm is month, dd is day, and yy is last two digits of year.

[H] In the table, complete the cells to be used for a 3 to 5 level calibration curve. Below is an example and the units are milliliters (mL):

	Sample Name	Sample Type	Cali Level	Injection Notes
		New Calibration Block		
	10mL ICAL-VOC	Calibration	1	10mL (cyl#ABC123456) + 40mL air
	20mL ICAL-VOC	Calibration	2	20mL (cyl#ABC123456) + 30mL air
	30mL ICAL-VOC	Calibration	3	30mL (cyl#ABC123456) + 20mL air
	40mL ICAL-VOC	Calibration	4	40mL (cyl#ABC123456) + 10mL air
	50mL ICAL-VOC	Calibration	5	50mL (cyl#ABC123456)
	10mL ICAL-H	Calibration	1	10mL (cyl#ABC123456) + 40mL air
	20mL ICAL-H	Calibration	2	20mL (cyl#ABC123456) + 30mL air
	30mL ICAL-H	Calibration	3	30mL (cyl#ABC123456) + 20mL air
	40mL ICAL-H	Calibration	4	40mL (cyl#ABC123456) + 10mL air
	50mL ICAL-H	Calibration	5	50mL (cyl#ABC123456)

[I] Select Data File for correct daily data folder, **AND** select OK.

[J] Select Begin, **AND** enter initials, and Select OK.

[K] **IF** new method is displayed,
THEN select OK.

[L] **IF** new method is not displayed,
THEN browse the files to choose the new method recently created, **AND** open method.

[M] Select OK.

4.3.5 ICAL Standard Preparations and Analysis

[A] Purge the 50 mL gas-tight syringe a minimum of three times, using ambient air or nitrogen.

[B] Perform a series of dilutions using a gas-tight syringe and stock gas standard.

[C] When the prompt WAITING is received on the software start injecting the gas mixture into the GC/MS gas injection port.

[D] Repeat steps 4.3.5[A] – 4.3.5[C] as necessary to obtain a three to five point calibration curve for VOCs and Hydrogen.

[E] Close sample list when complete.

[F] Return both Manual Injection Valves HV1 and HV3 towards Back Run Position.

4.3.6 Method

[A] **IF** criteria cannot be met on any segment of Section 4.3.6,
THEN troubleshoot and correct the problem.

[B] After all standard runs are complete, select RECALCULATE.

[C] Select View Calibration Curves.

[D] Open Current Method.

[E] On the View Curves Window:

[E.1] For VOCs, highlight 2000 Module 40 Channel 1, AND select OK.

[E.2] For Hydrogen, highlight 3800 Module 44 Channel Front, AND select OK.

[F] Evaluate calibration curves.

[F.1] Verify each target compound contains 3-5 points, not to include the origin.

[F.2] Verify each internal standard (bromochloromethane, 1,4 difluorobenzene, and chlorobenzene-d5) contains 2 points, to include the origin.

[F.3] Ensure all %RSD values for each target VOC is less than 35.

[F.4] Ensure coefficient of determination, r^2**,** for Hydrogen is greater than or equal to 0.990.

4.3.7 VOC Peak Identification

[A] Select View/Edit Methods icon on the System Control Window.

[B] Open an Existing Method File.

[C] Select OK.

[D] Select current Method, **AND** open.

[E] Select Compound Table under MS Data Handling.

[F] To select the appropriate data file for each compound (the highest standard used in the calibration curve);

[F.1] Select Data File.

[F.2] Open Current File.

[F.3] Select Highest Calibration.

[F.4] Select Open File.

[G] Open the compound of interest and perform the following:

[G.1] Select the Identification tab.

[G.2] Calculate the difference between peak start and peak end, **AND** enter value of peak window as Search Window.

[G.3] Select the Integration tab, **AND** enter peak window again as Integration Window.

[G.4] Multiply the known peak window and 60 sec, **AND** enter value as Peak Width (i.e., peak window 0.400 x 60 sec = 24).

[G.5] Select the Reference Spectrum tab.

[G.6] Identify area where peak demonstrates an optimal spectrum of primary quantitation ions, **AND** select Put Sample In Ref.

[G.7] Select Compound Attributes tab.

[G.8] Identify the retention time for each compound at the apex and ensure the value is entered as Retention Time.

[G.9] Select Next, **AND** select YES to Update the Retention Time.

[G.10] Repeat steps 4.3.7[G.1] – 4.3.7[G.9] for all compounds.

[G.11] Update the Upper Calibration Range for the VOCs in Attachment 2.

4.3.8 Hydrogen Peak Identification

[A] Open Peak Table under GC Control, Channel-Front = TCD, Data Handling.

[B] Enter average retention time.

[C] Select Define Peak Window.

[D] Ensure peak window is set at 0.15 min., AND select Save.

[E] Update the Upper Calibration Range for Hydrogen in Attachment 2.

[F] Close View/Edit Method Window.

[G] Select Yes at the Method Builder Save Changes window.

NOTE

Section 4.4 is a stand-alone section and may be performed independently of other sections.

4.4 HSG Analysis

4.4.1 BFB tune check

[A] Turn HV1 and HV3 valves to Calibrate.

[B] Activate the BFB method, AND select the Acquisition box on the MS 2000 window.

[C] Select Inject Single Sample.

[D] Enter Initials.

[E] Select OK.

[F] For sample name enter BFBmmddyy, where mm is month, dd is day, and yy is last two digits of year.

[G] For Sample Type select Analysis.

[H] For the Injection Notes, enter the Lot # and expiration date of the BFB standard, **AND** select OK.

[I] Select Data Files, create the daily data folder under the appropriate month, and select OK.

[J] To begin sequence, select Inject.

[K] Obtain BFB.

[L] **WHEN** the Waiting signal begins flashing, **THEN** manually inject 1µ of the BFB standard into the GC/MS liquid injection port.

[M] When the BFB is complete, choose the chromatogram icon (Review/Process MS Data) on the System Control window.

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[N] Select appropriate file.

[O] Select Open File(s).

[P] Select and drag an area that highlights the BFB peak.

[Q] Select a scan point of the peak to view the spectrum for the scan point RT.

[R] Select MS Custom icon, (Custom MS Reports).

[S] Select custrept.mdb.

[T] Select File, Data Folder, Year Folder, Month Folder, and Daily Data Folder.

[U] Highlight the current BFB Data File and select OPEN.

[V] Select Edit, Configure Graphic, and Graphic 1.

[W] Enter Scan Point RT, making sure that the Apex Scans to Average block is set to 1 for single scan or 3 for a multiple scan average if applicable.

[X] Click save, close, and then select save.

[Y] Select View to verify BFB Tune Criteria.

[Z] **IF** the criteria pass,
THEN select printer icon, **AND** proceed to step 4.4.2.

[AA] **IF** the criteria do not pass,
THEN close the BFB Report Window, **AND** repeat 4.4.1[Q] – 4.4.1[Z], AND select another scan until no alternate scan is found to work.

[BB] **IF** an acceptable single scan cannot be met,
THEN close the BFB Report Window, **AND** repeat steps 4.4.1[Q] – 4.4.1[Z], **AND** set APEX Scans to Average block to 3.

[CC] **IF** acceptable scans cannot be found,
THEN troubleshoot and correct the problem.

4.4.2 Continuing Calibration Verification (CCV) Analysis

NOTE
The Continuing Calibration Verification Analysis shall be performed for both VOCs and Hydrogen and requires injecting each Standard Calibration gas individually.

[A] Activate the current method, **AND** select Inject Single Sample.

[B] Enter initials, **AND** select OK.

[C] For sample name enter CCV-VOCmmddyy for VOC injection or CCV-Hmmddyy for Hydrogen injection, where mm is month, dd is day, and yy is last two digits of year.

[D] For Sample Type select Analysis.

[E] For the Injection Notes, enter the gas cylinder number and expiration date of the calibration gas standard, AND select OK.

[F] Select Inject.

[G] Prepare the CCV gas standard by filling a 50mL gas-tight syringe with 25mL of the certified calibration gas standard and 25mL of air.

[H] Ensure both manual Injection valves HV1 and HV3 are turned toward Calibrate front position.

[I] When the Waiting signal begins flashing inject the CCV gas standard.

[J] Press the green Start button on the GC Control Panel.

[K] Repeat step 4.4.2[A] through 4.4.2[J] for Hydrogen or VOC whichever is applicable.

[L] Return both Manual Injection Valves HV1 and HV3 towards Back Run Position.

[M] For VOC results perform the following:

[M.1] **WHEN** the CCV run is complete,
THEN choose the chromatogram icon (Review/Process MS Data) on the System Control window.

[M.2] Select appropriate file.

[M.3] Select Open File(s).

[M.4] Select Quantitation.

[M.5] Select Review Results of Active File.

[N] For Hydrogen results perform the following:

[N.1] **WHEN** the CCV run is complete,
THEN choose Preview Standard Chromatogram and Results report icon on the System Control Window.

[N.2] Open file of interest.

[N.3] Set Channel to Front=TCD Results.

[N.4] Select Review Results of Active File.

[O] **IF** the percent recovery (%R) for the CCV compounds is 70% to 130% of the certified calibration gas standard AND **IF** the %R of the internal standard concentration is 50% to 200% of the certified internal standard,
THEN proceed.

[P] **IF** the %R of the CCV compounds or the internal standard do not meet the acceptance criteria,
THEN troubleshoot and correct the problem.

NOTE

Sections 4.4.3 and 4.4.4 must be performed in series but may be performed independent of other sections.

4.4.3 Syringe Sample Injection

[A] Receive syringe sample from Host site.

[B] Record the drum number on Attachment 2.

[C] Record N/A in the FILTER TYPE INSTALLED box.

[D] Ensure both Manual Injection Valves HV1 and HV3 are towards the Calibrate Position.

[E] Activate the current method, AND select Inject Single Sample.

[F] Enter initials, AND select OK.

[G] For sample name, enter drum ID number.

[H] For sample Type, select Analysis.

[I] For the Injection Notes, enter any pertinent information regarding the sample or N/A, AND select OK.

[J] Select Inject.

[K] **WHEN** the Waiting signal begins flashing, **THEN** inject the syringe sample.

[L] Press the green Start button on the GC Control Panel.

[M] Allow analysis to complete.

4.4.4 Data Evaluation

[A] For VOC results perform the following:

[A.1] **WHEN** the GC/MS run is complete, choose the chromatogram icon (Review/Process MS Data) on the System Control window.

[A.2] Select appropriate file.

[A.3] Select Open File(s).

[A.4] Select Quantitation.

[A.5] Select Review Results of Active File.

[B] For Hydrogen results perform the following:

[B.1] **WHEN** the GC/MS run is complete, choose Preview Standard Chromatogram and Results Report icon on the System Control Window.

[B.2] Highlight file of interest.

[B.3] Set Channel to Front=TCD Results.

[B.4] Select Open file.

NOTE

The software automatically performs tentatively identified compounds (TIC) identification by searching a National Institute of Standards and Technology (NIST) Mass Spectral Library for all unknown (non-target) compounds having a total ion area greater than 10 percent of the nearest IS. If the unknown has a total ion area greater than 10 percent of the nearest IS, then the unknown meets the first criteria for being reportable. If the unknown meets all of the following guidelines, then the unknown meets the second criteria for being reportable in accordance with the following guidelines:

- Relative intensities of major ions in the reference spectrum (ions greater than 10 percent or most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within plus or minus 20 percent of the relative intensities in the reference spectrum.
- Molecular ion that is present in the reference spectrum (with a relative abundance of greater than 10 percent of the most abundant ion) should be present in the sample spectrum.
- Ions that are present in the sample spectrum, but not present in the reference spectrum, should be reviewed for possible background contamination or presence of co-eluting compounds.
- Ions present in the reference spectrum, but not in the sample spectrum, should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks.

NOTE

The concentration of the reportable TIC compound shall be estimated using the internal standard nearest the retention time of the TIC. Quantitation shall use a response factor or one. Quantitation is performed by first multiplying the area count of the TIC by the concentration of internal standard and then dividing by the area count of the internal standard.

[C] Enter the following information in Attachment 2:

[C.1] **IF** an unknown is a reportable TIC,
THEN determine if the TIC VOC has a National Fire Protection Association (NFPA) 704 Hazard Rating Index for flammability of 4 (Danger: Flammable gas or extremely flammable liquid), 3 (Warning: Flammable liquid flash point below 100 ºF), or 2 (Caution: Combustible liquid flash point of 100 ºF to 200 ºF) and
IF the reportable TIC has a rating of 2, 3, or 4,
THEN enter the name and concentration of each reportable flammable TIC.

[C.2] The concentration of each flammable VOC detected and zero if not detected.

[C.3] The hydrogen concentration detected, and zero if not detected.

[C.4] For each flammable VOC detected whose concentration exceeds the calibration curve limit, enter “Y” ELSE enter N/A.

[C.5] Enter “Y” if the concentration of hydrogen exceeded the calibration curve, or enter N/A.

[C.6] Calculate and enter the total flammable VOC concentration.

[C.7] Enter the date of analysis.

[D] Print the Gas Determination Result Report.

[E] Print name, sign, and date the Gas Determination Result Report.

[F] Notify the Host site and VPM, as soon as reasonable, if a drum is identified with one or more of the following conditions:

- The sum of the flammable VOCs is greater than 6,000 parts per million by volume (ppmV).
- Any flammable compound indicates it exceeds the calibration curve of the GC/MS.
- Hydrogen has a concentration that exceeds 3.2 Vol%.

[G] Repeat steps 4.4.3[A] through 4.4.4[F] until all of the sample syringes have been analyzed.

4.5 Drum Venting System (DVS)

4.5.1 Staging Drums

WARNING

DO **NOT** place upper body (Head and Torso) over an unvented drum without a drum lid restraint when handling.

[A] **IF** an adequate supply of filter vents and/or sample ports are in the Glove Box,
THEN go to 4.5.1[K].

[B] **IF** more filters are needed,
THEN lubricate the drill bit and threads of each new filter with Tapmatic® Edge Lube wax.

[C] **IF** more sample ports are needed,
THEN ensure that the set screw is removed from all sample ports prior to insertion into the Glove Box.

[D] Verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[E] Open the external Glove Box Access door to allow the RCT to perform a radiological survey.

[F] Close the external Glove Box Access door after the radiological survey is complete and wait for survey results.

[G] **WHEN** notified to proceed by the RCT,
THEN open the external Glove Box Access door and place new filters vents and/or sample ports in the Glove Box.

[H] Close the external Glove Box Access door.

[I] Working through the glove ports, open the internal Glove Box Access door, **AND** place the filters in the holder.

[J] Close the internal Glove Box Access door.

[K] On Attachment 2 enter the drum number.

4.5.2 Loading Drum Containment Cabinet

NOTE
Section 4.5.2 may be performed independently of other sections.

[A] If an Inadvertent Closure of the Isolation Valve should occur when opening and/or closing the Drum Containment Cabinet door, go to Section 4.7.

[B] Clean the top of the drum using a spray bottle of water and Kimwipes® cloth if applicable.

[C] Verify that the dolly is secured to the trolley using chains and hooks.

[D] Ensure that the trolley is positioned at the end of the trolley rail that is farthest away from the Drum Containment Cabinet door.

[E] Request that the Waste Operator place the drum on the dolly.

[F] Verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[G] Remove T-Handles on the Drum Containment Cabinet door, **AND** open the Drum Containment Cabinet door to allow the radiological survey to be performed.

[H] After the radiological survey is complete,
THEN Close the Drum Containment Cabinet door and secure by fastening T-Handle #2.

[I] When notified to proceed by the RCT, open the Drum Containment Cabinet door.

[J] Roll the trolley all the way to the front of the Drum Containment Cabinet.

[K] Secure the trolley by placing the trolley brake onto the trolley rail.

[L] Request that the Waste Operator remove the drum lid restraint from the drum.

[M] Unhook the trolley chains and hooks from the dolly.

[N] Roll the dolly and drum into the Drum Containment Cabinet.

[O] Place the drum movement restraint in place.

[P] Remove the trolley brake from the trolley rail.

[Q] Roll the trolley back to the end of the trolley rail farthest from the Drum Containment Cabinet.

[R] Close Drum Containment Cabinet door and secure by fastening T-handle #2 first, and then all other T-Handles, hand tight.

[S] Verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[T] Record in the DVS Operational logbook that the Drum Containment Cabinet, Survey Access, and Glove Box Access doors are secured and print name, sign, and date.

4.5.3 Filter Vent /Sample Port Installation

[A] If an Inadvertent Closure of the Isolation Valve should occur when opening and/or closing the Drum Containment door go to Section 4.7.

[B] Switch the toggle for the touch screen from B to A.

[C] **WHEN** the Change Parameters prompt is displayed, **THEN** press No on the touch screen.

[D] **IF** the INCORRECT filter type is highlighted on the touch screen,
THEN change filter type, **AND** press Yes.

[D.1] **IF** processing a 55-gallon Overpack drum,
THEN press Long Op on the touch screen, **AND** select Next.

[D.2] **IF** processing a single drum,
THEN press Standard on the touch screen, **AND** select Next.

[D.3] **IF** processing an 85- or 79-gallon Overpack,
THEN press 85 Overpack on the touch screen, **AND** select Next.

[E] **IF** the CORRECT filter type is highlighted on the touch screen,
THEN press No.

[F] **WHEN** the Insert Filter Only screen is displayed,
THEN press Continue.

[G] **IF** processing a single drum with a Standard filter,
THEN record the Standard filter type and installation date on Attachment 2. For all other filter types proceed to 4.5.3[H].

[H] Working through the glove ports, insert a Standard filter in the collet, **AND** press Close.

[I] Press Lower Powerhead on the touch screen.

[J] **IF** Drum Load Error appears on the touch screen,
THEN troubleshoot and correct the problem.

[K] Verify Lowering Powerhead in Progress on the touch screen.

[L] **IF** Seal Test Passed is displayed,
THEN proceed to step 4.5.3[N].

[M] **IF** Seal Test Failed is displayed,
THEN press Abort on the touch screen, AND perform the following:

[M.1] Allow the Manifold Filter Test to complete.
IF Manifold Filter Test-Pass is displayed,
THEN press continue, **AND** proceed to step 4.5.3[M.3].

[M.2] **IF** this is the first displayed Manifold Filter Test-Failed,
THEN press Retest, ELSE troubleshoot and correct the problem.

[M.3] Verify Survey Lid & Unload Drum is displayed on the touch screen,
THEN press continue.

[M.4] Verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[M.5] Remove all the T-Handles on the Drum Containment Cabinet door or Survey Access door, **AND** open the Drum Containment Cabinet or Survey Access door to allow the radiological survey to be performed.

[M.6] After the radiological survey is complete,
THEN close the Drum Containment Cabinet or Survey Access door.

[M.7] **WHEN** notified to proceed by the RCT,
THEN open the Drum Containment Cabinet or Survey Access door.

[M.8] Through the Survey Access door or Drum Containment Cabinet door, recover the filter and reposition the drum.

[M.9] Ensure Seal Disk is intact, cleaned of metal shavings, and deemed operable.
IF Seal Disk is **NOT** operable,
THEN troubleshoot and correct the problem.

[M.10] **IF** Seal Disk is clean and deemed operable,
THEN close and secure the Survey Access door or Drum Containment Cabinet door.

[M.11] Verify airflow through the Drum Containment Cabinet and Glove Box.

[M.12] **IF** this is the first display of Seal Test Failed, **THEN** return to step 4.5.3[C], ELSE troubleshoot and correct the problem.

[N] Press Calibrate on the touch screen.

[N.1] Press N2 Purge on the touch screen.

[N.2] Press Continue on the touch screen.

[N.3] Select Manifold Leak Test.

[N.4] Press Start on the touch screen.

[N.5] **IF** the screen displays Manifold Leak Test – Pass, **THEN** push Continue on the touch screen, **AND** proceed to step 4.5.3[N.9].

[N.6] **IF** Manifold Leak Test – Failed is displayed, **THEN** press Repeat on the touch screen.

[N.7] **IF** the screen then displays Manifold Leak Test – Pass, **THEN** push Continue on the touch screen, **AND** proceed to step 4.5.3[N.9].

[N.8] **IF** Manifold Leak Test – Failed is displayed a second time, **THEN** troubleshoot and correct the problem.

[N.9] Select Return on the touch screen

[O] Select appropriate steps according to container type:

[O.1] **IF** processing a single drum only, **THEN** proceed to step 4.5.3[V].

[O.2] **IF** processing an Overpack drum only, **THEN** proceed to step 4.5.3[P].

[P] Select Raise Powerhead.

[Q] Working through the glove ports, grasp the Standard filter in the Powerhead socket.

[R] Press collet Open button, **AND** remove the Standard filter from the Powerhead socket.

[S] Insert the appropriate filter vent or associated sample port into the Powerhead collet, **AND** press the collet Close button.

[T] On Attachment 2 record drum number, if applicable, and record the filter vent or sample port type and installation date, if applicable on Attachment 2.

[U] Press the Lower Powerhead button on the touch screen.

[V] Ensure the Powerhead is fully lowered.

[W] Switch the toggle for the touch screen from A to B.

[X] Ensure that the DVB exhaust fan is turned off using switch on the east wall labeled DVB EXHAUST.

[Y] Ensure that ALL personnel have exited the DVB and that all personnel doors are secured.

[Z] From the Remote Operator Enclosure (ROE), select the appropriate steps based on container type being processed:

[Z.1] Single Drum Only: Select Bore, verify that Bore to Sample Depth in Progress is displayed on the touch screen.

[Z.2] **IF** Impenetrable Object Detected appears on the touch screen for longer than 30 seconds,
THEN press Abort, **AND** troubleshoot and correct the problem.

[Z.3] Overpack Drum 1st Drum lid only:
WHEN Bore through 1st Drum Lid is displayed on the touch screen,
THEN select Bore, **AND** verify that Bore to Sample Depth in Progress is displayed on the touch screen.

[Z.4] **IF** Impenetrable Object Detected appears on the touch screen for longer than 30 seconds,
THEN press Abort, **AND** troubleshoot and correct the problem.

[Z.5] Overpack Drum 2nd lid only:
WHEN Bore through 2nd Drum Lid is displayed on the touch screen,
THEN select Bore, **AND** verify that Bore to Sample Depth in Progress is displayed on the touch screen.

[Z.6] **IF** Impenetrable Object Detected appears on the touch screen for longer than 30 seconds,
THEN press Abort, **AND** troubleshoot and correct the problem.

[AA] **WHEN** GC/MS selection screen is displayed,
THEN push Install on the touch screen.

[BB] Verify Install Filter is displayed on the touch screen.

[CC] Verify Lowering Drum is displayed on the touch screen.

[DD] Verify that the Powerhead is retracted.

[EE] Verify that Manifold Filter Test In Progress is displayed.

[FF] **IF** the screen displays Manifold Filter Test – Pass,
THEN push Continue on the touch screen, **AND** proceed to step 4.5.3[JJ].

[GG] **IF** Manifold Filter Test – Failed is displayed,
THEN press Retest.

[HH] **IF** the screen then displays Manifold Filter Test – Pass,
THEN push Continue on the touch screen, **AND** proceed to step 4.5.3[JJ].

[II] **IF** Manifold Filter Test – Failed is displayed a second time,
THEN press Continue on the touch screen **AND** troubleshoot and correct the problem.

[JJ] Verify Survey Lid & Unload Drum screen is displayed on the touch screen, **THEN** press Continue on the touch screen.

[KK] If another filter vent or sample port is to be installed on this drum then proceed to the next step 4.5.3[LL], ELSE proceed to Section 4.5.4.

[LL] Request that the RCT perform a radiological survey of the inside of the DVB.

[MM] After given permission to proceed, **THEN** notify the Waste Operator when ready to re-enter the DVB.

[NN] Request the Waste Operator to verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[OO] Remove all T-Handles on the Survey Access door, **AND** open the Survey Access door to allow the radiological survey to be performed.

[PP] Ensure that the metal shavings are vacuumed up using appropriate PPE and a HEPA vacuum, if applicable.

[QQ] Request that the RCT perform a radiological survey of the drum lid.

[RR] Close the Survey Access door.

[SS] **WHEN** notified to proceed by the RCT,
THEN open Survey Access door.

NOTE

Sample ports or additional filter vents can be installed by using either method defined in step 4.5.3[TT]. The first method selected must be through the survey access door. If the first method selected does not work then the second method is to be performed.

[TT] Rotate the drum through the Survey Access door and go to step 4.5.3[UU] **OR** proceed to step 4.5.3[TT.1].

[TT.1] Close and secure the Survey Access door with all T-Handles fastened hand tight.

[TT.2] **IF** an Inadvertent Closure of the Isolation Valve should occur when opening and/or closing the Drum Containment Cabinet,
THEN go to Section 4.7.

[TT.3] Remove T-Handles on the Drum Containment Cabinet door, **AND** open the Drum Containment Cabinet door to allow the radiological survey to be performed.

[TT.4] **WHEN** notified to proceed by the RCT,
THEN rotate the waste container through the Drum Containment Cabinet door.

[TT.5] Close the Drum Containment Cabinet door and secure by fastening T-handle #2 first, and then all other T-Handles, hand tight.

[TT.6] Verify airflow through the Drum Containment Cabinet and Glovebox.

[TT.7] Proceed to step 4.5.3[WW].

[UU] Close and secure the Survey Access door with all T-Handles fastened hand tight.

[VV] Verify airflow through the Drum Containment Cabinet and Glove Box.

[WW] Record in the DVS Operational logbook that the Drum Containment Cabinet, Survey Access and Glove Box Access doors are secured and print name, sign, and date.

[XX] Proceed to step 4.5.3[A].

4.5.4 Drum Removal from Drum Containment Cabinet

WARNING

When a Host site qualified attendant is required, the Host site qualified attendant must attend the drum. The drum shall remain in the Drum Containment Cabinet and the DVS operator SHALL **NOT** perform any step of 4.5.4 until the Host site qualified attendant is in the DVB.

NOTE

Section 4.5.4 may be performed independently of other sections.

[A] If an Inadvertent Closure of the Isolation Valve should occur when opening and/or closing the Drum Containment Cabinet door, go to Section 4.7.

[B] Request that the RCT perform a radiological survey of the inside of the DVB.

[C] After given permission to proceed, **THEN** notify the Waste Operator when ready to re-enter the DVB.

[D] Request Waste Operator to verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[E] Remove all T-Handles on the Survey Access door, **AND** open the door to allow the radiological survey to be performed.

[F] Ensure that metal shavings are vacuumed up using appropriate PPE and a HEPA vacuum.

[G] Request that the RCT perform a radiological survey of the drum lid.

[H] Close the Survey Access door.

[I] Request Waste Operator to verify airflow through the DVS Drum Containment Cabinet and Glove Box.

[J] **WHEN** notified to proceed by the RCT,
THEN open the Drum Containment Cabinet door to allow the radiological survey to be performed.

[K] Close the Drum Containment Cabinet door and secure by fastening T-Handle #2.

[L] **WHEN** notified to proceed by the RCT,
THEN remove T-Handle #2 **AND** open the Drum Containment Cabinet door.

[M] Position trolley at the Drum Containment Cabinet, **AND** secure it by placing the trolley brake onto the trolley rail.

[N] Remove the drum movement restraint.

[O] Roll the dolly out of the Drum Containment Cabinet onto the trolley, **AND** secure with hooks and chains.

[P] Remove the trolley brake from the trolley rail.

[Q] Roll the trolley to the end of the trolley rail farthest away from the Drum Containment Cabinet door.

[R] Close the Drum Containment Cabinet door and fasten T-Handle #2 hand tight.

[S] Ensure that metal shavings are vacuumed from the drum lid using appropriate PPE and HEPA vacuum, if applicable.

CAUTION

DO NOT inject RTV directly into any exposed holes in the stem as this could impede sampling or block the vent path.

[T] Place RTV sealant around the filter vent and sample port (if installed), including any exposed holes in the stem.

[U] Request that the Waste Operator install the drum cap.

[V] Request that the Waste Operator install the drum lid restraint.

[W] Request that the Waste Operator remove the drum from the dolly.

[X] **IF** another drum is to be processed,
THEN return to 4.5.2[A],
ELSE proceed to Section 4.6.

4.6 Shutdown of Daily Operations

[A] Turn OFF the DVS exhaust system.

[B] Visually verify that the powerhead is in its Home position.

[C] Leave the main power and the GC/MS breakers inside the Analytical Cabinet ON.

[D] Verify that all cabinet doors are closed and securely fastened.

[E] Document that the Drum Containment Cabinet, Survey Access, and Glove Box Access doors are closed and securely fastened in the DVS Operational Logbook and print name, sign, and date.

[F] Ensure the main valve is closed on all compressed gas cylinders EXCEPT for Helium, which remains ON at all times.

[G] Submit a copy of the Attachment 2, for each drum analyzed or filter vent/sample port installed, to the Host site.

[H] Submit the records generated by this procedure to the facility records custodian to be managed in accordance with CCP-QP-008,*CCP Records Management*.

NOTE

Section 4.7 is a stand alone section and may be performed independently of other sections.

4.7 Inadvertent closure of Isolation Valve

4.7.1 **IF** the Isolation Valve inadvertently closes while the Drum Containment Cabinet door is closed, **AND** is prior to processing the drum,
THEN perform the following:

[A] Remove T-Handles and open the Drum Containment Cabinet door to allow the radiological survey to be performed.

[B] After the radiological survey is complete,
THEN visually inspect the Isolation Valve to determine that it is closed.

[C] **IF** the Isolation Valve is closed and with the RCT's approval,
THEN reach in the Drum Containment Cabinet and take hold of the end of the valve shaft.

[D] Pull the valve open until the detent pin engages.

[E] Close the Drum Containment Cabinet door and secure by fastening all T-Handles hand tight.

[F] Verify the airflow through the Drum Containment Cabinet and Glove Box.

[G] Record in the DVS Operational Logbook that the Drum Containment Cabinet, Survey Access and Glove Box Access doors are secured and print name, sign, and date.

[H] Resume operations.

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4.7.2 **IF** the Isolation Valve inadvertently closes when the Drum Containment Cabinet door is opened,
THEN perform the following:

[A] Visually inspect the Isolation Valve to determine that it is closed.

[B] **IF** the Isolation Valve is closed and with the RCT's approval, **THEN** reach in the Drum Containment Cabinet and take hold of the end of the valve shaft.

[C] Pull the valve open until the detent pin engages.

[D] Resume operations.

5.0 RECORDS

5.1 Records generated during the performance of this procedure are maintained in accordance with CCP-QP-008. The records are the following:

5.1.1 Prerequisite Checklist

5.1.2 Gas Determination Result Report

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Table 1. BFB Key Ions and Abundance Criteria

MASS	ION ABUNDANCE CRITERIA
50	15 to 40 percent of mass 95
75	30 to 60 percent of mass 95
95	Base peak, 100 percent relative abundance
96	5 to 9 percent of mass 95
173	<2 percent of mass 174
174	>50 percent of mass 95
175	5 to 9 percent of mass 174
176	> 95 percent and <101 percent of mass 174
177	5 to 9 percent of mass 176

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Attachment 1 – Prerequisite Checklist

	Yes	**No**
Are there any holes, rips, or tears in the rubber gloves on the Glove Box?		
Does the vacuum digital readout and vacuum gauge have current calibration decals?		
Do the DVS HEPA filters have current DOP or equivalent testing?		
Are the calibration gases to be used within the expiration date?		.
With all doors closed, is the PDI DVS - 1 Drum Containment Cabinet Magnahelic ≥0.40 and ≤ 1.4 inch wc?		
With all doors closed, is the PDI DVS - 2 Glove Box Magnahelic ≥ 0.35 and ≤ 0.9 inch wc?		
With Drum Containment Cabinet door open, is the PDI DVS – 3 Stage 2 HEPA filter ≥ 0.5 and ≤ 4.70 inch wc?		
With Drum Containment Cabinet door open, is the PDI DVS – 4 Stage 3 HEPA filter ≥ 0.5 and ≤ 4.70 inch wc?		

DVS Operator: Print Name _____ Signature _____ Date _____

Attachment 2 – Gas Determination Result Report (Example)

Drum Number	
Filter Type or Sample Port Installed	
Analysis Date or Filter Vent/Sample Port Installation Date	

Additional Filter Type or Sample Port Installed

Flammable Volatile Organic Compounds (VOC's)

Compound	Concentration (ppmV)	Upper Calibration Range	Exceeds Calibration	Lower Flammable Limit
Methanol				60000 ppmV
Ethyl Ether				18500 ppmV
1,1-Dichloroethene				73000 ppmV
Acetone				26000 ppmV
trans 1,2-Dichloroethene				56000 ppmV
1,1-Dichloroethane				97000 ppmV
cis 1,2-Dichloroethene				97000 ppmV
2-Butanone (MEK)				18000 ppmV
Benzene				14000 ppmV
1,2-Dichloroethane				62000 ppmV
1-Butanol				14000 ppmV
MIBK				14000 ppmV
Toluene				12700 ppmV
Chlorobenzene				13000 ppmV
Ethylbenzene				12000 ppmV
mp-Xylene				11000 ppmV
o-Xylene				10000 ppmV

Flammable Tentative Identified Compounds (TIC)

Compound	Concentration (ppmV)

Comments

Total Flammable VOC's	

Compound	Concentration (Vol%)	Upper Calibration Range	Exceeds Calibration	Lower Flammable Limit
Hydrogen				4.0 Vol%

DVS Operator Print Name _____ Signature _____ Date _____