



Work Instruction (WI)

DIRECTIVE NO. 250-WI-8500.3.6B
EFFECTIVE DATE: 09/30/2019
EXPIRATION DATE: 09/30/2024

APPROVED BY Signature: Original signed by
NAME: Kimberly Finch, P.E.
TITLE: Chief, Medical and Environmental Management
Division

COMPLIANCE IS MANDATORY

Responsible Office: 250 / Medical and Environmental Management Division

Title: Chemical Reuse Center Operations

PREFACE

P.1 PURPOSE

The purpose of this document is to provide guidance for managing the Chemical Reuse Center at Goddard Space Flight Center (GSFC).

P.2 APPLICABILITY

- a. This Work Instruction applies to all Medical and Environmental Management Division (MEMD) personnel managing the Chemical Reuse Center at GSFC's Greenbelt (GB) and Wallops (WFF) sites.
- b. In this document, all document citations are assumed to be the latest version unless otherwise noted.
- c. In this document, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms "may" or "can" denote discretionary privilege or permission; "should" denotes a good practice and is recommended but not required; "will" denotes expected outcome; and "are/is" denotes descriptive material.

P.3 APPLICABLE DOCUMENTS AND FORMS

- a. 40 Code of Federal Regulations (CFR) Parts 261–262, Resource Conservation and Recovery Act (RCRA) Regulations
- b. 49 CFR Parts 171–172, Hazardous Materials Regulations (DOT)
- c. RCRA Online (R.O.) 14760, Discarded Residual Gases in Compressed Gas Cylinders
- d. NASA GPR 8500.3, Waste Management
- e. GB Waste Analysis Plan (250-WAP)
- f. WFF WAP
- g. Hazardous Material Management System (HMMS)
- h. Compressed Gas Association (CGA) Standards C-6, Standard for Visual Inspection of Steel Compressed Gas Cylinders; CGA C-13, Guidelines for Periodic Visual Inspection and

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Requalification of Acetylene Cylinders; CGA C-16, CGA Cylinder Registration Program for Cylinder Owner Symbols; CGA P-1, Standard for Safe Handling of Compressed Gas in Containers; CGA TR-2 High Pressure Steel Cylinders In-Service Performance; CGA P-22 The Responsible Management and Disposition of Compressed Gases and Their Containers; CGA P-38 Guidelines for Devalving Cylinders
<https://portal.cganet.com/Publication/Index.aspx>

P.4 CANCELLATION

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P.5 TOOLS, EQUIPMENT, AND MATERIALS

Personal Protective Equipment (PPE) shall consist of safety glasses, chemical resistant gloves, and protective footwear when handling gas cylinders. A cart should be used for transporting chemicals. Additional precautions may be necessary if you are working with a compressed gas cylinder that contains a highly reactive or highly toxic gas (see Safety Precautions and Warnings below).

Other required tools and equipment may include, but not be limited to, a fume hood, a vise, tongue and groove pliers, a drill or saw, helium for purging, a check valve, hose, appropriate connectors, and water for rinsing.

P.6 SAFETY PRECAUTIONS AND WARNINGS

- a. Before transporting chemicals to and from the Chemical Reuse Center, MEMD will review the safety data sheet (SDS) or material safety data sheet (MSDS) for potential hazards of unfamiliar chemicals. After reviewing the SDS/MSDS, proper PPE requirements can be determined. Compressed gas cylinders must be secured when not in use.
- b. It is common to find a reactive, toxic, or corrosive gas such as hydrogen cyanide, carbon monoxide, or arsine on GSFC. Compressed gas cylinders containing these gases shall be returned to the supplier (reuse) or managed as regulated waste through a disposal facility.
- c. Removing the valve of a compressed gas cylinder can present a significant hazard if the cylinder is not fully relieved of pressure. All cylinders will be managed by strictly following each step in this Work Instruction to ensure the safety of personnel.

P.7 TRAINING

MEMD Hazardous Waste personnel that transport chemicals to and from the reuse center are required to take the following training:

- a. Hazard Communication (HazCom) Training in compliance with 29 CFR 1910.1200
- b. Resource Conservation and Recovery Act (RCRA) Generator's Training in compliance with 40 CFR 265.16

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- c. HAZWOPER Training in compliance with 29 CFR 1910.120
- d. Hazardous Material Transportation Safety in compliance with 49 CFR172.704

P.8 RECORDS

No Records

P.9 MEASUREMENT/VERIFICATION

- a. Quarterly custom report from HMMS based on total material issued for reuse from the Chemical Reuse Center.
- b. **“Cost Savings for 250 reuse” formula** ((Number of reuse containers x MEMD management cost per container) + (total weight of all reuse containers x MEMD disposal cost per pound)) - (MEMD management hours x MEMD support contractor hourly rate) = total savings for MEMD from chemical reuse or recycling.

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INSTRUCTIONS

1. After receiving a request to pick up expired or unwanted hazardous materials, MEMD shall evaluate the potential for hazardous materials (HM) to be reused by other organizations on Center by contacting the HM office (Code 270) to see if there are users who purchase the chemical in question. If the material is still viable for reuse, then the material is not “waste-like.” Refer to Appendix C “Evaluation Criteria for Chemical Reuse”.
2. If the material is viable for reuse, MEMD shall contact the HM office to ensure the material is properly inventoried in accordance with the Center’s policy.
 - 2.1. The material for reuse shall be stored at an issue point (IP) that is designated by MEMD.
 - 2.2. The material shall be stored in a location that is appropriate (with compatible chemicals).
3. When a customer requests a material for reuse, the HM office will notify MEMD of the request. MEMD will deliver the material to the HM clerk at the shipping and receiving department so that the HM inventory data can be updated and the material delivered.
4. The Chemical Reuse Center inventory will be evaluated prior to a hazardous waste pickup. This evaluation will assess whether or not the material is still viable for reuse or if the material has a market for future use at GSFC or offsite. If the material is no longer a candidate for reuse, the material will be disposed of during the next available hazardous waste pickup.
5. Additional Guidance for Compressed Gas Cylinder Management
 - 5.1. Visual Inspection
 - 5.1.1 CAUTION: Persons performing compressed gas cylinder dispositioning shall be “less-than-90-day facility waste handler” qualified. Persons performing gas cylinder dispositioning must be supervised by an individual experienced in gas cylinder safety until the supervising individual is confident in their ability to safely manage cylinders. They should also have reviewed the following Compressed Gas Association (CGA) standards: CGA C-6; CGA C-13; CGA C-16; CGA P-1; CGA TR-2; CGA P-22; CGA P-38.
 - 5.1.2 The first step to managing a compressed gas cylinder is to conduct a visual inspection. The person conducting the inspection should use the knowledge gained from reviewing the various CGA documents in determining if the cylinder should be moved. It is critical that each and every cylinder is evaluated following the compressed gas cylinder management checklist and using information from the CGA standards. If the cylinder exhibits any sign of compromised status, notify a MEMD civil servant immediately.

Examples of compromised status:

- a. Serious dents;
- b. Creases;
- c. Cracks in the neck;
- d. Signs of corrosion around the valve that appear to be from cylinder contents.

5.2. Prioritized Options for Proper Cylinder Management – See Figure 2 Compressed Gas Cylinder Evaluation Process

- a. Redistribute to other appropriate GSFC User;
- b. Return to the manufacturer;
- c. Manage as hazardous waste.
- d. Empty, devalue, and scrap the cylinder.

5.2.1 At GB the Code 250 Master Cylinder Sheet shall be completed and the Cylinder Management Checklist (Appendix E) should be referenced when managing compressed gas cylinders.

5.2.1.1 Redistribute to other appropriate GSFC User. Gas cylinders that are not empty should be redistributed to other campus users if a valid user exists. Appropriate documentation, such as assignment in the hazardous waste database reuse center shall be completed if a cylinder can be reused. Coordinate with the Code 270 Supply Management Office to verify that the cylinder is not under a gas supplier contract.

5.2.1.2 Return to the manufacturer. If redistribution is not an option, call the supplier to see if they will accept the gas cylinder back for reuse/recycling. If applicable, get an estimate of the cost (supplier fee plus shipping costs).

- a. For a cylinder that is not highly hazardous:
 - 1) Ship cylinder back to the supplier if the cost is deemed appropriate.
 - 2) If the cylinder would require handling as hazardous waste and the supplier is willing to accept it back, the cylinder may be shipped back at a higher cost (cost exceeding \$750 should be further evaluated in comparison to the cost if treated as a waste).
- b. Some suppliers are willing to pick up a cylinder free of charge. If so, schedule a pick-up and document the relevant information in the Code 250 Master Cylinder Sheet located in the E-4 RCRA TSCA – Hazwaste folder.

5.2.1.3 As stated in RO. 14760, “EPA has determined that returning a compressed gas cylinder to the supplier does not constitute generation of waste under RCRA. Neither the returned cylinder nor the residue it contains is a “solid waste,” even if the cylinder is not empty (i.e. it is still pressurized). A shipment of cylinders from the customer back to the supplier does not have to be manifested as waste. However, Department of Transportation (DOT) requirements will apply, and the cylinders may have to be transported as DOT hazardous materials.”

5.2.2 Scrap the cylinder.

5.3 Cylinder with Non-Hazardous Gases

5.3.1 If a gas is a non-hazardous gases listed in Appendix D, or a mixture of these gases and cannot be redistributed to other users or returned to the manufacturer, follow the procedures in this section to safely scrap the cylinder.

5.3.2 Cylinders with trace gases where the balance is one of the non-hazardous gases listed in Appendix D should be evaluated to determine if the amount of trace gas exceeds its threshold limit value (TLV). If below the TLV, treat as though the cylinder only contains the gases listed in Appendix D.

5.3.3 Ensure that the cylinder is empty.

5.3.3.1 Inspect the cylinder valve for any physical defect or corrosion that may have compromised the valve. Do not attempt to manipulate the valve if there is a problem with it. Cap or plug the outlet and seek assistance.

5.3.3.2 If the valve appears to be safely operable, place the cylinder in a fume hood, or well-ventilated area (loading dock) and slowly open the valve. Allow the cylinder to sit for a few minutes to assure that ambient pressure is reached. Look and listen for evidence of gas releasing from the cylinder.

5.3.3.3 Use helium to validate the valve is working. If pressurized gas was heard being released during section 5.3.3.2 above, this step is not necessary. Use the appropriate connectors and a hose to hook up a helium tank to the cylinder. Open the valves to pressurize the cylinder with 10 psi. Close the valves and remove the hose connection. Release the pressure in the cylinder by opening the valve. You should hear the pressure being released. After allowing the cylinder to reach ambient pressure, remove the fill adapter.

5.3.4 Decommission the Cylinder

5.3.4.1 The cylinder can be decommissioned by devalving, cutting in half, or drilling a hole in the side.

5.3.4.2 Place the cylinder in a vise. Remove the valve and the additional internal valve, or drill a hole in the side of the cylinder, or cut the cylinder in half, so it cannot be re-pressurized.

5.3.4.3 Remove the label and send the cylinder to a metals recycler.

5.3.5 Other Cylinders – Evaluate cylinders with gases not listed in Appendix D on a case-by-case basis. Cylinders shall not be stored at the Less-than-90-Day Facility unless authorized by the MEMD civil servant Hazardous Waste Program Manager.

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5.3.6 Cylinders Not Suitable for Above Actions - All cylinders not suitable for reuse, return to the manufacturer or scrap, shall be disposed of through the appropriate waste management methods and in accordance with GPR 8500.3 Waste Management.

5.3.7 Management of Master Cylinder Spreadsheet – Create a new tab for the current year to manage the cylinder information for each year separately. Previous information will be archived. This will keep the master sheet manageable.

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Figure 1- Chemical Reuse Flow Diagram

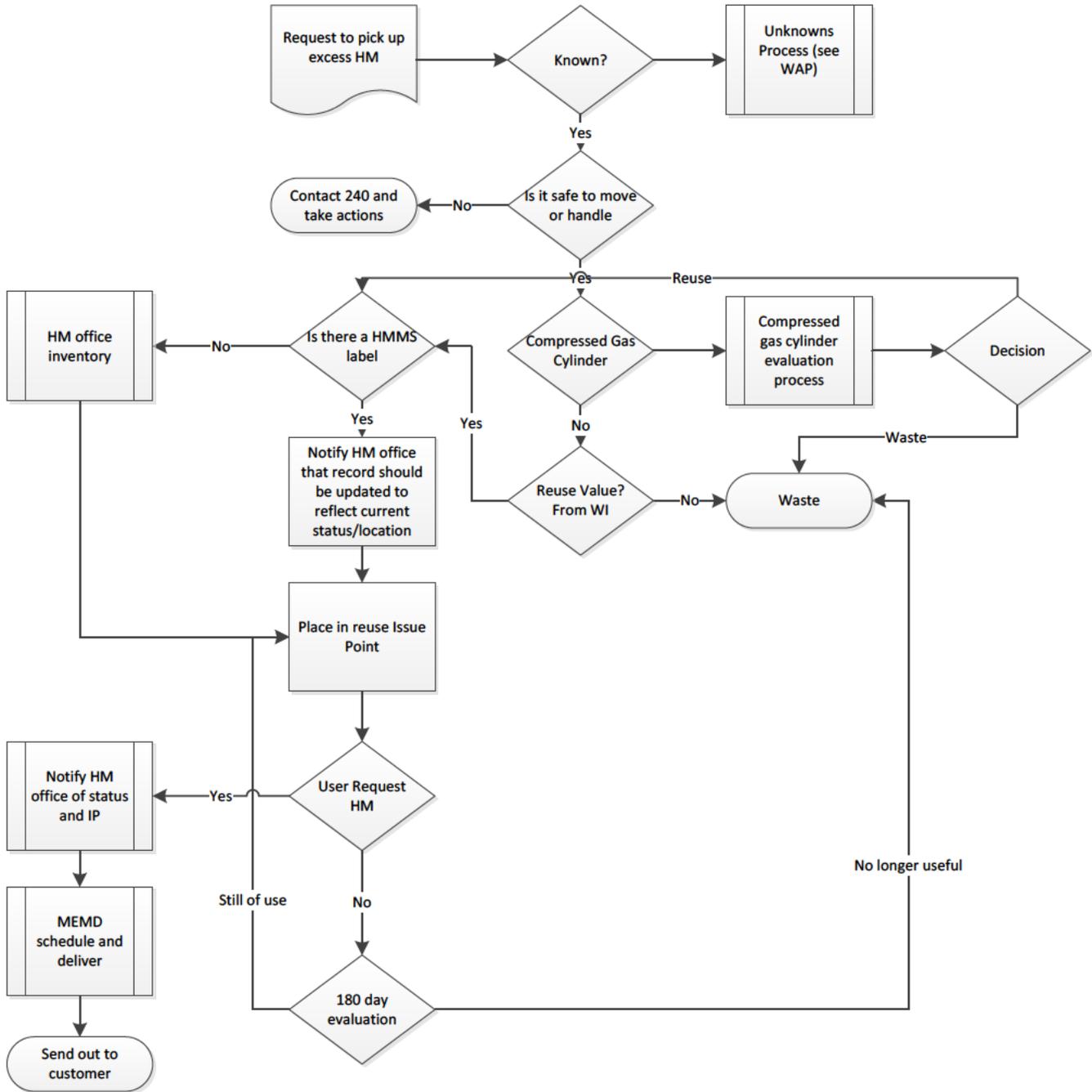
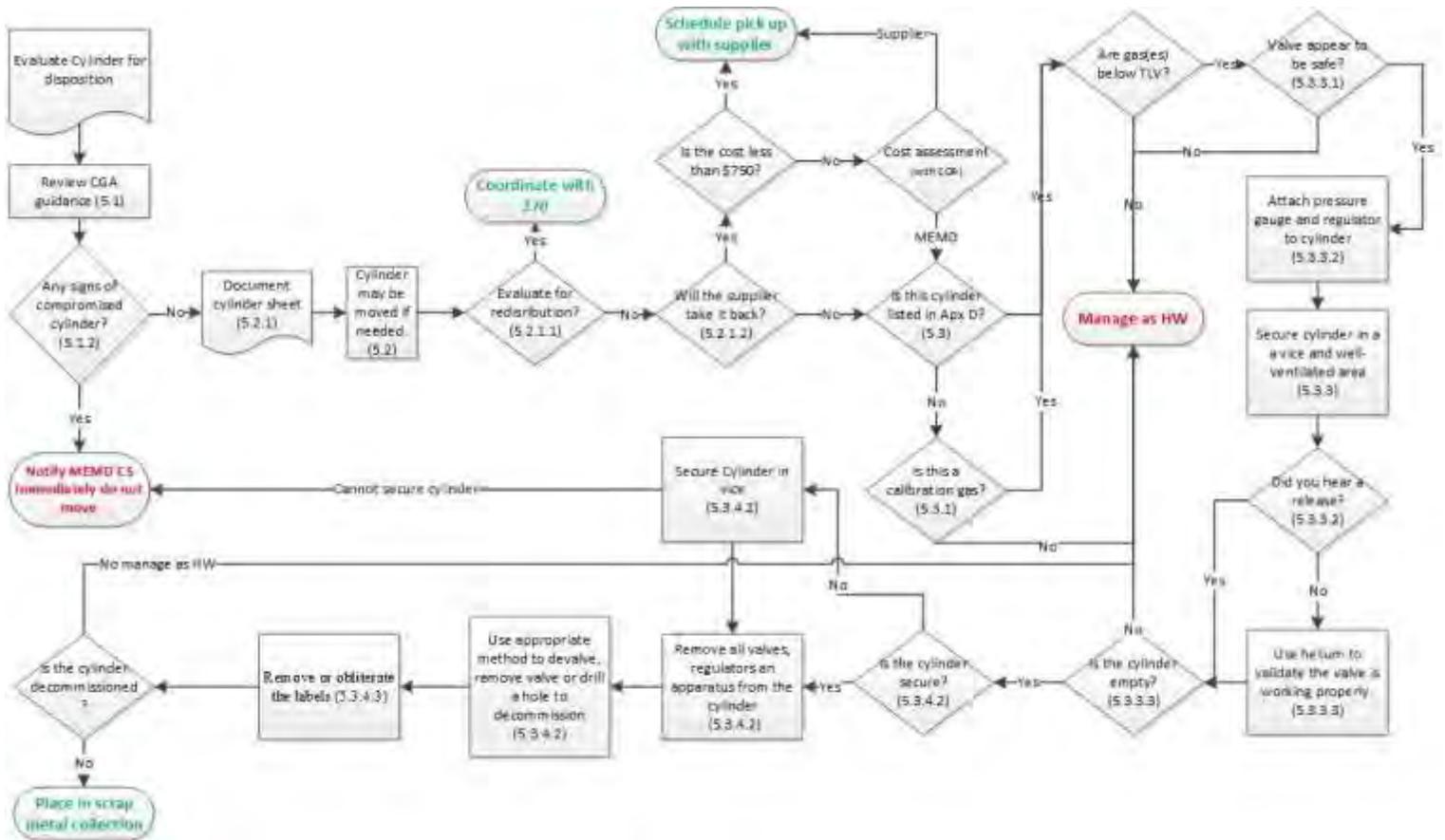


Figure 2 - Compressed Gas Cylinder Evaluation Process



Appendix A – Definitions

- A.1 HM Office - The Hazardous Materials (Code 270) office deals with the logistics and procurement of hazardous materials at GSFC.
- A.2 Hazardous Materials Management System - This database is used to manage hazardous materials and hazardous waste at GSFC.
- A.3 Issue Point - Location where hazardous material is issued.
- A.4 Safety Data Sheet (SDS) - A document that describes the physical and chemical properties of a product, its health hazards, and precautions for safe storage, handling and use. This includes legacy Material Safety Data Sheets that are applicable.
- A.5 Serial Number - Unique identifier for hazardous material containers.

Appendix B – Acronyms

CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CWA	Clean Water Act
DOT	Department of Transportation
ECR	Environmental Compliance Restoration
EPA	Environmental Protection Agency
GPR	Goddard Procedural Requirements
GSFC	Goddard Space Flight Center
HM	Hazardous Material
HMMS	Hazardous Materials Management System
ILMD	Information and Logistics Management Division
IP	Issue Point
MEMD	Medical and Environmental Management Division
MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
PPE	Personnel Protection Equipment
RCRA	Resource Conservation and Recovery Act
R.O.	RCRA Online
SDS	Safety Data Sheet
TLV	Threshold Limit Value
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
WI	Work Instruction

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Appendix C – Evaluation Criteria for Chemical Reuse

Item	Yes	No	Notes
Is this container safe to transport?			
Is the material safe to handle/use (i.e., clear of contamination; contain no organic peroxide crystals; stable/non-reactive with age)? (See GB 250-WAP)			
Are the containers in good condition (vs. crushed, bulging, corroded, leaking)?			
Does the material appear to have been stored appropriately? Is the material being stored according to the manufacturer's recommendations? Is the material stored with compatible chemicals?			
Recommendation for transporting.			
Do we want to offer this chemical for reuse?			
If the product is consumed/stored on center, will it affect regulatory reporting (think ECR/TRI/RCRA/CWA)?			
Is the material a listed waste?			
Is there an SDS available for the material?			
Does the condition of the material suggest that it is a valuable product (does appearance match SDS or experience/knowledge, are there crystals, are there visual signs of phase separation)?			
Recommendation for offering this chemical for reuse.			
Is there a market for this chemical?			
Has the material expired?			
Are there restrictions on where this material can be used (flight/missions projects)?			
Can records be provided that show existing customers, past transactions of material reuse, or present and future markets for materials?			
Has the material container been opened?			
Is there a market outside of GSFC for the material?			
Recommendation for marketing this chemical for reuse.			
If any answers are 'No' or 'unknown' and the recommendation is to keep the material for potential reuse the evaluation will be discussed with the civil servant program manager. The civil servant program manager will decide if the chemical can be offered for reuse prior to accepting custody or continuing to offer the material for reuse.			

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Appendix D – Gases authorized for devalving

The following gases or a mixture of these gases are authorized for valve removal:

Air	Krypton
Argon	Neon
Carbon Dioxide	Nitrogen
Helium	Xenon

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Appendix E - Compressed Gas Cylinder Checklist

Work Instruction Reference Section	Work Instruction Section Title			
5.1	Visual Assessment			
	Cylinder Management Checklist Item	Yes	No	Comments
5.1.1	Are you familiar with CGA Guidance?	<input type="checkbox"/>	<input checked="" type="checkbox"/> *	If No, review CGA Guidance
5.1.1	Does the cylinder appear to be compromised?) if YES STOP and Notify MEMD Civil Servant Immediately	<input checked="" type="checkbox"/> *	<input type="checkbox"/>	
5.1.1	Have you documented in the MEMD Master Cylinder Sheet?	<input type="checkbox"/>	<input type="checkbox"/>	
5.2	Options for Cylinder Reuse			
	Cylinder Management Checklist Items	Yes	No	Comments
5.2.1	CAUTION: revalidate item 5.1.2 to ensure the cylinder is safe to handle			
5.2.1.1	Is the cylinder under 270 contract/ can it be reused at GSFC? If yes request pick up with 270.	<input type="checkbox"/>	<input type="checkbox"/>	
5.2.1.2	Will the manufacturer accept the cylinder back? If yes, schedule pickup with supplier.	<input type="checkbox"/>	<input type="checkbox"/>	
5.2.1.2. (b)	Is the MEMD Master Cylinder Sheet updated appropriately?	<input type="checkbox"/>	<input type="checkbox"/>	
5.3	Disposition by Scrap			
	Cylinder Management Checklist Items	Yes	No	Comments
5.3.1	Verify the cylinder meets the requirements of Appendix D. if NO, STOP, manage as HW.	<input type="checkbox"/>	<input checked="" type="checkbox"/> *	If No, manage as HW

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5.3.3.1	Does the cylinder valve show signs of physical defects or corrosion. If YES, STOP, manage as HW.	<input type="checkbox"/> *	<input type="checkbox"/>	If Yes, manage as HW
5.3.3.2	Are the pressure gauge and regulator secured to the cylinder valve?	<input type="checkbox"/>	<input type="checkbox"/>	
5.3.3.1	Is the cylinder secured in a vice and in a well-ventilated area?	<input type="checkbox"/>	<input type="checkbox"/>	
5.3.3.2	Did the pressure gauge show greater than ambient pressure? If NO, go to 5.3.3.3. If YES, allow the cylinder to empty (5.3.3.2)	<input type="checkbox"/>	<input type="checkbox"/> *	
5.3.3.2	Did you hear gas release? if valve didn't operate properly, STOP, and Notify MEMD Civil Servant Immediately	<input type="checkbox"/> Go to 5.3.4.2	<input type="checkbox"/> * Go to 5.3.3.3	
5.3.3.3	Use helium to pressurize the cylinder and validate the valve is working properly	<input type="checkbox"/>	<input type="checkbox"/>	
5.3.3.3	Is the cylinder empty? if NO, STOP, manage as HW	<input type="checkbox"/>	<input type="checkbox"/> *	If No, manage as HW
5.3.3.3	Verify that the cylinder valve is working by observing a change in pressure on regulator or by placing a balloon on the end of the valve and observing change in pressure.	<input type="checkbox"/>	<input type="checkbox"/>	If No, manage as HW
5.3.4.2	Is the cylinder secured in a vice? If NO, STOP, and secure; if it cannot be secured STOP and notify MEMD Civil Servant.	<input type="checkbox"/>	<input type="checkbox"/> *	
5.3.4.2	Remove all valves, regulators and apparatus from the cylinder	<input type="checkbox"/>	<input type="checkbox"/>	
5.3.4.2	Use appropriate method to devalue, remove valve or drill a hole to decommission	<input type="checkbox"/>	<input type="checkbox"/>	If No, contact MEMD civil servant
5.3.4.2	The cylinder label is removed prior to recycling as scrap metal.	<input type="checkbox"/>	<input type="checkbox"/>	

*Red check box denotes "Stop and evaluate before proceeding"

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CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	02/02/2017	Initial Release
A	02/15/2018	<p>Added Wallops site in P2.</p> <p>Incorporated the “Compressed Gas Management Work Instruction” into Section 5 of the instructions.</p> <p>Added the “Compressed Gas Cylinder” Checklist as Appendix E.</p> <p>Added “Gases Authorized for Devalving” as Appendix D.</p> <p>Changed the document number of the “Waste Analysis Plan” from 250-WI 8500.3.4 to 250-WAP.</p> <p>Removed “Code 250 Master Cylinder Sheet” and “Cylinder Management Checklist” from the “Records” section.</p> <p>Added bullets “b” and “c” to section P.6.</p> <p>Updated Chemical Reuse flow chart to include “Compressed Gas Evaluation Process”.</p> <p>Added “Compressed Gas Evaluation Process” flow chart.</p>
B	09/30/2019	<p>P.3h- Moved to h. - Compressed Gas Association (CGA) Standards C-6, Standard for Visual Inspection of Steel Compressed Gas Cylinders; CGA C-13, Guidelines for Periodic Visual Inspection and Requalification of Acetylene Cylinders; CGA C-16, CGA Cylinder Registration Program for Cylinder Owner Symbols; CGA P-1, Standard for Safe Handling of Compressed Gas in Containers; CGA TR-2 High Pressure Steel Cylinders In-Service Performance; CGA P-22 The Responsible Management and Disposition of Compressed Gases and Their Containers; CGA P-38 Guidelines for Devalving Cylinders https://portal.eganet.com/Publication/Index.aspx</p> <p>P.6a - Added, “Compressed gas cylinders must be secured when not in use.”</p> <p>5.1.1- Removed bullets referencing CGA standards by number and name</p> <p>5.1.1- Added CGA standards reference by number</p> <p>Section 5.3.5 - Added, “Cylinders shall not be stored at the Less-than-90 Day Waste Accumulation Facility unless authorized by the MEMD civil servant hazardous waste program manager.”</p> <p>5.3.7- Removed “Thirty days after the end of each year”</p> <p>Added “Figure 1” to designate the “Chemical Reuse Flow Diagram”</p>

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		Added “Figure 2” to designate the “Compressed Gas Cylinder Evaluation Process” Removed column “N/A” from Appendix E
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