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KSC-SPEC-P-0026
July 1, 2002

PROPELLANTS, RECOVERED HALON-1301, SPECIFICATION FOR

SPACEPORT SERVICES DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center

KSC FORM 16-12 (REV. 6/95) PREVIOUS EDITIONS ARE OBSOLETE (CG 11/95)

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Approved by:

for Michael L Summer 7/23/02
J. Chris Fairey, Director
Spaceport Services Directorate

JOHN F. KENNEDY SPACE CENTER

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ABBREVIATIONS AND ACRONYMS

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CCAFS	Cape Canaveral Air Force Station
CFR	Code of Federal Regulations
DAFM	Directorate of Aerospace Fuels Management
DLA	Defense Logistics Agency
DOT	Department of Transportation
EO	Executive Order
EPA	Environmental Protection Agency
HARC	Halon Alternatives Research Corporation
J-BOSC	Joint-Base Operations Support Contractor
JPC	Joint Propellants Contractor
JSC	Lyndon B. Johnson Space Center
KSC	John F. Kennedy Space Center
mL	milliliter
MLP	Mobile Launcher Platform
MPE	Materials and Processes Engineer
NFPA	National Fire Protection Association
O&M	Operations & Maintenance
ODSR	Ozone Depleting Substance Reserve
OSHA	Occupational Safety and Health Administration
PAFB	Patrick Air Force Base
PTCR	Pad Terminal Connection Room
SGS	Space Gateway Support
TA-E1-B	Propellants & Life Support Office
ULC	Underwriters Laboratories of Canada

PROPELLANTS, RECOVERED HALON-1301, SPECIFICATION FOR

1. SCOPE

This specification covers the requirement for Halon-1301 recovered from Halon-charged systems. This specification provides a means of recovering Halon-1301 for either reclamation for alternate reuse or reprocessing to original manufacturing purity. This document is mandatory for use by all NASA organizations and programs of the John F. Kennedy Space Center (KSC), NASA organizations and programs at the Cape Canaveral Air Force Station (CCAFS), and NASA Field Centers.

1.1 Purpose. – The purpose of the Halon Bank is to collect excess Halon-1301 from other NASA Centers or other donor sources to ensure adequate inventories for critical Shuttle launch systems through the life of the Shuttle Program (Year 2020). KSC began collecting Halon-1301 from deactivated Halon systems.

1.2 Background. – In July 1992, the Environmental Protection Agency (EPA) issued its final rule implementing Section 604 of the Clean Air Act Amendments of 1990 and required producers of Class I substances, including Halons, to cease manufacturing these products. The Parties of the Montreal Protocol agreed to accelerate the phase-out of Halons to the end of 1993. Many fire suppression systems have switched their fluids or control systems to an EPA-approved substitute. There is still a Shuttle Program demand for Halon where there is currently no substitute for this fluid in launch critical systems.

1.3 Assignment Of Responsibilities. – The Halon-1301 inventory shall be managed primarily to provide long-term support to NASA critical systems. KSC critical systems will receive priority support; however, critical systems at other NASA Centers may also be supported by the Halon Bank upon execution of an Inter-Center agreement between KSC and the other Center. KSC critical systems were designated in the KSC Chlorofluorocarbon/Halon Phase-out Plan, dated March 1991, and are the onboard orbiter Halon system and payload refrigerant loop, the Pad Terminal Connection Rooms (PTCR's), and the three Mobile Launcher Platforms (MLP's).

Halon-1301 commodity, systems, operational control, and management shall be divided between the NASA Propellants & Life Support Office, TA-E1-B, and Joint-Base Operations Support Contractor (J-BOSC) as described below. Each office and its associated contractors and subcontractors shall make every effort to minimize loss of either quantity or quality of the commodity and will base management decisions on continued support of the critical systems. Critical Halon-1301 systems are classified as safety critical and must be operational to ensure safe Shuttle launch operations. Parties to this plan will place necessary emphasis on this plan to ensure that data regarding Halon-1301 storage locations, active fire suppression systems, and commodity inventory is accurate and available at all times.

The NASA Propellants & Life Support Office and J-BOSC shall have Halon-1301 control and management responsibility for J-BOSC propellant services. J-BOSC shall provide the following propellant services: (a) manage and provide propellants and related resources for KSC, CCAFS,

and Patrick Air Force Base (PAFB), including scheduling, acquisition, storage, processing, certification, delivery, pick-up, recovery, excessing, disposal, and/or recycling; (b) provide on-site management of the Air Force Directorate of Aerospace Fuels Management (DAFM) Missile Fuels controlled storage functions; and (c) provide life support services supporting NASA/KSC, CCAFS, and PAFB.

J-BOSC shall serve as the point of contact between the designated supplier/generator and will be the on-site manager of the controlled storage functions. J-BOSC shall function as a Controlled Storage Point receiving, storing, issuing reporting, forecasting, and accounting for propellants, oxidizers, pressurants, and other related inventory. J-BOSC shall maintain, control, and inventory missile fuels, including commodity sampling and implementing procedures to ensure contamination control and product integrity. Particular subtasks include:

a. Store Halon-1301 general inventory at K7-314, Propellants North Storage Area, or other site determined by J-BOSC
b. Operate the zero-loss recovery system currently located at K7-314
c. Operations & Maintenance (O&M) of storage containers and systems for general inventory per applicable KSC procedures and Department of Transportation (DOT) regulations
d. Mark general inventory systems to preclude inadvertent cross connection to non-Halon-1301 systems
e. Maintain general inventory records to include quantity of product contained in each specific container, each transaction adding or removing product to general inventory (date, source, container number, quantity), and sample analysis, if applicable
f. Maintain activity records reflecting Halon-1301 transactions and ending balance and provide status reports to Halon Working Group upon request
g. Accept delivery of the commodity shipped to the Halon Bank from other Centers/Agencies following the same procedures as other commodity deliveries
h. Reclaim Halon-1301 from fire suppression system cylinders

2. APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract.

In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement. All applicable DOT, Occupational Safety and Health Administration (OSHA), NASA, and KSC safety requirements shall be adhered to as they relate to the control, storage, handling, transfer, and transportation of Halon under this plan.

2.1 Governmental.

2.1.1 Specification.

Lyndon B. Johnson Space Center (JSC), NASA

SE-S-0073	Space Shuttle Specification for Fluid Procurement and Use Control

2.1.2 Code of Federal Regulations (CFR)

29 CFR Part 1910	U.S. Department of Labor (Occupational Safety and Health Standards), Nationally Recognized Testing Laboratories-Fees
29 CFR Part 1910, Subpart H	Hazardous Materials
29 CFR Part 1910, Subpart L	Fire Protection
29 CFR Part 1910, Subpart Z	Toxic and Hazardous Substances
Section 1000	Permissible Exposure Limits
Section 1200	Hazardous Communication Standard
40 CFR Part 82, Subpart H	Halon Emissions Reduction
40 CFR 82.270(c)	Technician Training Requirement
40 CFR 82.270(d)	Proper Disposal Requirement
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 172.102	Special Provisions
49 CFR 172.200	Applicability
49 CFR 172.201	General Entries
49 CFR 172.202	Description of Hazardous Material on Shipping Papers
49 CFR 172.203	Additional Description Requirements
49 CFR 172.204	Shipper's Certification
49 CFR 172.205	Hazardous Waste Manifest
49 CFR 172.304	Marking Requirements
49 CFR 172.400	General Labeling Requirements
49 CFR 172.406	Placement of Labels
49 CFR 172.502	Prohibited and Permissive Placarding
49 CFR 172.504	General Placarding Requirements
49 CFR 172.600	Applicability and General Requirements
49 CFR 172.602	Emergency Response Information
49 CFR 172.604	Emergency Response Telephone Numbers
49 CFR 172.700	Purpose and Scope
49 CFR 173	Shippers – General Requirements for Shipments and Packagings
49 CFR 173.34	Qualification, Maintenance and Use of Cylinders
49 CFR 173.301	General Requirements for Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

49 CFR 177.817	Shipping Papers
49 CFR 177.834	General Requirements
49 CFR 177.840	Class 2 (Gases) Materials
49 CFR Part 178	Specifications for Packagings

(Application for copies of the Code of Federal Regulations should be addressed to the Superintendent of Documents, Government Printing Office, North Capitol and H Streets N.W., Washington, D.C. 20401.)

2.1.3 Other Documents.

PRO-P-0001	KSC/CCAFS Propellants/Pressurants Sampling Plan

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer or the Materials and Processes Engineer [MPE].)

2.2 Non-Governmental.

American National Standards Institute (ANSI)

ANSI Z129.1	For Hazardous Industrial Chemicals – Precautionary Labeling

(Application for copies should be addressed to American National Standards Institute, 25 West 43rd Street, New York, NY 10036.)

American Society for Testing and Materials (ASTM)

ASTM D5631	Standard Practice for Handling Transportation and Storage of Halon-1301, Bromotrifluoromethane (CF_3BR)
ASTM D5632	Standard Specification for Halon-1301, Bromotrifluoromethane (CF_3BR)
ASTM E29	Standard Practice for Using Significant Digits in Test Data To Determine Conformance With Specifications

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshokocken, PA 19428-2959.)

National Fire Protection Association (NFPA)

NFPA 10	Portable Fire Extinguishers
NFPA 12A	Halon 1301 Fire Extinguishing Systems

(Application for copies should be addressed to the National Fire Protection Association, 3333 N. Mayfair Road, Milwaukee, WI 54222-3219.)

Underwriters Laboratories of Canada (ULC)

ULC/ORD-C1058.5-1993 Halon Recovery and Reconditioning Equipment
ULC/ORD-C1058.18-1993 Servicing of Halon Extinguishing Systems

(Application for copies should be addressed to Underwriters Laboratories of Canada, 7 Crouse Road, Toronto, ON MIR 3A9.)

3. REQUIREMENTS

3.1 Chemical and Physical Properties. – The chemical and physical properties of the recovered propellants shall conform to table 1 when tested in accordance with the applicable test methods (4.5).

Table 1. Halon-1301 Analysis Parameters (Characteristic) (ASTM D5632)

Purity	99.6% by Volume (Minimum)
Acidity	3.0 ppm (Maximum)
Moisture	10 ppm (Maximum)
Nonvolatile Residue	0.01% by Weight (Maximum)
Halogen Ion	Passes Test
Suspended Matter	None

3.2 Limiting Values. – The following statement applies to all specified limits in this specification: For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off to the nearest unit in the last righthand place of figures used in expressing the limitation value, in accordance with the rounding off method of ASTM E29.

3.3 Filter. – There are no filter requirements for Halon-1301.

3.4 Qualitative Requirements. – Halon-1301 shall be a clear, liquified gas with a slight eterral odor (refer to ASTM 5632).

Table 2. Halon-1301 Properties

Boiling Point	-72 °F,-58 °C
Melting Point	-270 °F,-168 °C
Vapor Pressure (MM Hg/70 °F)	220 PSIG
Vapor Density (Air=1)	5.14
Specific Gravity	1.54
Evaporation Rate and Ref	Not Applicable
Solubility in Water	Negligible
Percent Volatiles by Volume	100

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. – Unless otherwise specified in the contract, J-BOSC is responsible for the performance of all inspection requirements as specified herein. Except as oth-

erwise specified in the contract, J-BOSC may use its own or any other facility suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to the prescribed requirements.

4.2 Classification of Tests. – The inspection and testing of the propellant shall be classified as quality conformance tests.

4.3 Quality Conformance Tests. – Quality conformance tests shall consist of individual tests (4.3.1) and sampling tests (4.3.2).

4.3.1 Individual Tests. – The commodity shall be sampled by the Examination of Product test described in 4.5.1.

4.3.2 Sampling Tests. – The commodity shall be selected in accordance with PRO-P-0001 and subjected to the following tests.

Table 3. Halon-1301 Sample Requirements

Sample	Location	Frequency	Specification
S_1	Cylinder, Propellants North, K7-314	Each cylinder received upon receipt	ASTM D5632
S_2	Cylinder, Propellants North, K7-314	At the discretion of System Engineer or Fluids Management for periodic system validation	ASTM D5632

4.3.2.1 Sampling Plan.

4.3.2.1.1. Lot. A lot shall consist of the commodity contained in individual containers. The commodity is consolidated into a larger volume from several containers in a batch process to form a new homogeneous mixture.

4.3.2.1.2 Sample. A sample consists of not less than 600 milliliters (mL) of commodity. Unless otherwise specified, a quality conformance test shall be made on each required sample of the commodity as it is taken directly from the recovery or consolidation containers. The cylinders or containers intended for sampling shall be specially cleaned and handled in accordance with the procedure described in PRO-P-0001.

4.3.2.1.3 System Cylinders. System cylinder sampling shall be at the discretion of J-BOSC Fluids Management if the individual recovery system cylinders are each provided with an identification tag in accordance with 5.4.1 of the propellant contained therein. System cylinders whose contents, concentrations, and/or origins are not otherwise known shall each be considered a lot and shall be individually sampled.

4.3.2.1.4 One-Ton Cylinders. Each 1-ton cylinder shall constitute a lot. J-BOSC Fluids Management may defer tank sampling until an adequate inventory of recovered propellant has been accumulated in that tank. This will preclude repetitive sampling of partial tank loads of recovered propellants.

4.3.2.1.5 Other Containers. Unless otherwise specified, other containers shall be sampled in accordance with 4.3.2.1.2.

4.4 Rejection. When any sample of the propellant tested in accordance with 4.5 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected.

4.5 Test Methods.

4.5.1 Examination of Product. Refer to ASTM D5632.

5. PREPARATION FOR DELIVERY

The DOT regulations relate to the transportation of hazardous materials. Under 49 CFR Part 172, bromotrifluoromethane (known as both R 12B1 and Halon-1301) is classified as a hazardous material because it is a compressed gas and is therefore subject to the requirements of DOT hazardous materials regulations and procedures. Halon-1301 is classified as Division 2.2 hazardous material. Division 2.2 refers to a nonflammable, nonpoisonous compressed gas. Each cylinder must be labeled with a "Class 2" green hazard label with the #UN 1009 clearly printed on it. These labels must be affixed to the outside of each cylinder or crate, along with a Material Safety Data Sheet.

Under Part 172, Special Provision 18 of Section 172.102 contains additional requirements when using the shipping description "fire extinguishers" for transportation. Section 172.700 specifies requirements for hazardous materials training and function-specific training as related to handling and transportation of hazardous materials and requalification of hazardous materials packaging.

5.1 Inter-Center Transfer and Banking of Halon-1301. – Requests for Halon-1301 for critical systems at other NASA Centers will be met only from KSC banked quantities in excess of the 6,000-pound bulk reserve and the critical spares or if a Center has donated a specific quantity to the bank with stipulation of having a future need for the Halon.

At such time as an Inter-Center Agreement between NASA Centers is adopted, this plan will provide the guidelines for the banking of the Halon-1301 on Kennedy Space Center property. Any unique or unresolved issues will be addressed on a case-by-case basis in the Inter-Center agreement prepared by TA-E1-B.

5.2 Preparation of Containers/Cylinders. – The generator/shipper shall establish the condition of all Halon containers/cylinders to ensure that they are free from contamination and suitable for shipment and storage. Leased or Government-owned containers shall be cleaned and repaired in accordance with the schedule established in the contract.

5.2.1 Cleaning and Repair. – Unless otherwise provided for in the Joint Propellants Contractor (JPC) contract, any physical damage to containers which would endanger safe transportation of the commodity shall be repaired prior to reuse. If evidence of excessive internal particulate contamination is found, the containers shall be cleaned by a suitable method to remove the contamination.

5.3 Filling. – Portable cylinders shall not be filled to maximum fill density of 124% of the water capacity by weight of the container.

5.4 Labeling and Marking. – Each container shall be marked, labeled, and placarded in accordance with DOT regulations. In addition, a precautionary label and container color code shall be used.

5.4.1 Identification Tag. – Unless otherwise specified by the procuring activities, an identification tag shall be secured to each container and shall contain the following information:

a. Propellant name
b. Quantity
c. Facility of origin
d. Name of generating contractor or program
e. Date of recovery from a propellant system

5.4.2 Precautionary Label. – A precautionary label prepared in accordance with ANSI Z129.1 shall be applied to each container.

6. NOTES

6.1 Intended Use. – The recovered propellants that conform to this specification are intended to be utilized in critical Shuttle systems primarily at NASA/KSC.

J-BOSC fills the KSC user-provided containers at Propellants North Operations, K7-314. Other NASA Centers may be supported upon execution of a NASA Inter-Center Agreement.

6.2 Definitions. – For the purpose of this specification, the following definitions shall apply.

a. Particulate. The undissolved solids retained on a 10-micron filter membrane.

b. Pollution Control. U.S. Public Laws dictate increased effort to improve air, land, and water pollution control of toxic propellant vapors, leaks, spills, and disposal during all phases of manufacture, transfer, storage, and transportation operations. NASA propellants users are enjoined to approach the appropriate pollution control district to mutually resolve all problem areas and to develop adequate control and disposal methods for situations that are likely to develop in any of the phases.

NOTICE: The Government drawings, specifications, and/or data are prepared for the official use by, or on the behalf of, the United States Government. The Government neither warrants these Government drawings, specifications, or other data, nor assumes any responsibility or obligation, for their use for the purposes other than the Government project for which they were prepared and/or provided by the Government, or an activity directly related thereto. The fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded, by implication or otherwise, as licensing in any manner the holder or any other person or corporation, nor conveying the right or permission to manufacture, use, or sell any patented invention that may related thereto.

Custodian:

NASA – John F. Kennedy Space Center
Kennedy Space Center, FL 32899

Preparing Activity:

John F. Kennedy Space Center
Propellants and Life Support
Center Services Division
Spaceport Services Directorate

APPENDIX A

HALON-1301 TRANSFER FROM NASA CENTERS TO THE KENNEDY SPACE CENTER HALON BANK

The current owner of the Halon-1301 will:

1. Complete the attached form "Halon-1301 Transfer to Kennedy Space Center" and fax to the Propellants North Supervisor at 321-861-0070 or send via inter-office mail to Kennedy Space Center, Mail Code WYLE-341. A digital photo will accompany this request and shall be transmitted electronically or as a printed color copy to the Propellants North Systems Engineer prior to KSC's authorization to proceed with the shipment. KSC will return a notification to proceed prior to shipping. This form will be available online at http://propellants.ksc.nasa.gov/.

2. Notify your local transportation office and arrange shipment of the Halon cylinders to Kennedy Space Center. When preparing the cylinders for shipping all DOT and EPA regulations will apply. All units must be secured with metal strapping onto hardwood skids with wooden side support rails and secured by strapping cylinders in the horizontal position. The cylinders shall not overhang or extend beyond the perimeter of the skid. Cylinders transported in the vertical position shall be secured to the side rails on or in a truck designed for this method. One copy of the completed and signed copy of the manifest or shipping document shall accompany each shipment. The generator/shipper shall provide the attachment for "pipe to port" connection and any other associated piping. Cylinders shall be transported with the originally approved safety devices, such as discharge port cap, complete with predrilled vent holes, with all actuators removed and equipped with threaded actuator prevention plugs and explosive detonators disposed of. Any material listed that has a "UN" number associated with it will need shipping papers to accompany it when it is offered for shipment or is transported.

The current owner will be responsible for product quality and packaging of all containers submitted for KSC processing and storage. Cylinders that do not meet specified purity or packaging requirements may be returned to the current owner for disposition at the current owner's expense.

Bill of Lading shall be prepared indicating the following:

Total number of cylinders
Total shipment weight overall
Emergency contact phone number
Ship To address

The shipping address for the cylinder is:

J-BOSC Receiving
Building M6-744, Central Supply Warehouse
Kennedy Space Center, FL 32899
Attention: Propellants North Supervisor, WYLE-341, Facility K7-416

3. After shipping arrangements have been made, contact Propellants North Systems Engineer, and tell him how the cylinders are being shipped (rail, truck, etc.).

Contact the Propellants North Systems Engineer at 321-861-6783, Mail Code WYLE-338, or the NASA Propellants and Life Support Systems Engineer at 321-867-8589, TA-E1-B, if you have any questions.

HALON-1301 TRANSFER FROM NASA CENTERS TO THE KENNEDY SPACE CENTER HALON BANK

Kennedy Space Center will:

1. Review the completed Halon-1301 Transfer to Kennedy Space Center form and notify the user to proceed with shipping

2. Accept delivery of the Halon-1301 shipped from other Centers

3. Reclaim the Halon-1301 from the system cylinders

4. Maintain general inventory and activity records

For more information, go to NASA Kennedy Space Center Propellants and Life Support web page at: http://propellants.ksc.nasa.gov/

USAF HALON-1301 TRANSPORTATION AND DISPOSAL PROCEDURE

Note 1: *This procedure is applicable to SGS/J-BOSC operations and specific to USAF Halon-1301 cylinders.*

Note 2: *This procedure assumes that the cylinders are properly safed (to include removal of explosives, if any) and capable of being transported safely per DOT standards.*

1. SGS will generate a Shipping List, which identifies the number of cylinders and the amount of Halon-1301 each cylinder contains (quantity of Halon by weight, in pounds).

2. SGS will forward the Shipping List to Patrick AFB HazMart (45SBSS/LGSDHM Point of Contact, currently Mr. Rob Henn), (321) 494-9663, for evaluation.

3. With Patrick AFB HazMart 45SBSS/LGSDHM approval only, SGS will load cylinders into shipping racks and transport them to PAFB Facility #310.

4. PAFB HazMart crew will ship Halon-1301 cylinders to Defense Logistics Agency (DLA) repository in Richmond, VA, per USAF procedures.

5. SGS will notify 45 CES/CEVC by E-mail of the quantity (weight in pounds) of Halon being removed from the wing. NOTE: POC for PAFB Enviromental Flight is Mr. Wayne Neville, (wayne.neville@patrick.af.mil)

Rev: 1, 02/01/01

TO: PAFB HAZMART, FACILITY #310

FROM: AL STUDT, SPACE GATEWAY SUPPORT,
SGS-363013, 321-861-6327

SOURCE: CCAFS FACILITY # 62700

ITEMS SHIPPED:

(12) HALON-1301 CYLINDERS. UN 1009.

TOTAL WEIGHT - 4132 POUNDS.

WEIGHT OF HALON-1301 ONLY - 2189 POUNDS

(4) CYLINDER RACKS (return)

RECEIVED BY:

PRINTED NAME:_____

ORGANIZATION:_____

SIGNATURE:_____**DATE:**_____**TIME:**____

Figure A-1. Sample of Shipping Document

REQUEST TO TRANSFER HALON-1301 TO KENNEDY SPACE CENTER

HALON-1301: CIRCLE ONE: YES NO

If no, contact a local vendor for recycling or reclamation. If unable to locate a local vendor, contact Propellants and Life Support, TA-E1-B, 321-867-8589.

A list of vendors on the site does not imply recommendation.

Sender Information:

Name: _____

NASA Center: _____

Phone No: (___) _____

Fax Number: (___) _____

Cylinder Information:

Manufacturer: _____

Model Number: _____

Part Number: _____

Cylinder Type: _____
(DOT Number)

Number of Cylinders _____

Tare Weight: _____

Current Weight: _____

Fax completed form to Propellants and Life Support, TA-E1-B, 321-867-7369.

APPENDIX B

LIST OF REFERENCES

Federal Documents

Presidential Executive Orders

(1) EO 12843, Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances

Montreal Protocol

Comprehensive documentation and reports surrounding the Montreal Protocol and its implementation
www.unep.ch.ozone

NASA and KSC Documents

NASA Issuances
KSC Issuances

Ozone Depleting Substance Reserve (ODSR)

https://denix.cecer.army.mil/denix/Public/News/DLA/ODS/odsres.html

Defense Logistics Agency (Halon decommissioning)

www.dla.mil

U.S Environmental Protection Agency

www.epa.gov

National Fire Protection Association

www.nfpa.org

Halon Alternatives Research Corporation (HARC)

www.harc.org