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Guidance for Short-Term Storage of Elemental Mercury by Ore Processors

1.0. Introduction

The Mercury Export Ban Act of 2008, Public Law No. 110-414, enacted October 14, 2008 (MEBA of 2008), as amended by the Frank R. Lautenberg Chemical Safety for the 21st Century Act, Public Law No. 114-182, enacted June 22, 2016, (Chemical Safety Act of 2016), established new requirements pertaining to elemental mercury and certain mercury compounds. Those requirements are located in the Toxic Substances Control Act (TSCA) and the Solid Waste Disposal Act, known as Resource Conservation and Recovery Act (RCRA). Among other things, MEBA amends TSCA and RCRA to ban the export of elemental mercury and certain mercury compounds, as well as provide for long-term management and storage of elemental mercury. The Chemical Safety Act of 2016 also established a provision for interim onsite storage, beyond 90 days, subject to certain conditions for generators that are incidentally producing elemental mercury waste from the beneficiation or processing of ore or related pollution control activities (i.e., Ore Processors). Such storage, which is contingent on specific requirements, is provided for in the Chemical Safety Act of 2016. Ore Processors are not required to store elemental mercury onsite beyond 90 days but have the option to do so under this provision.

1.1. Background

The U.S. Department of Energy (DOE) Office of Environmental Management (EM), in consultation with the U.S. Environmental Protection Agency (EPA) and all appropriate State agencies in potentially affected States, initially issued an interim guidance document in November 2009 to establish basic standards and procedures for packaging, transportation, receipt, management, and long-term storage of elemental mercury at a DOE-designated facility or facilities, as mandated by 42 USC § 6939f(d)(1).

Subsequently, the Chemical Safety Act of 2016 among other things, added section 5(g)(2)(D), which allows onsite interim storage of elemental mercury generated as a part of ore processing and/or related pollution control activities without being subject to RCRA’s storage prohibition of section 3004(j). It also added 42 U.S.C. 6939f(b)(C), which states that “title to all elemental mercury accumulated in” Ore Processor facilities in accordance with 42 U.S.C. 6939f(g)(2)(D) will be transferred to the DOE Secretary, if the DOE-designated long-term storage facility, mandated by 42 USC § 6939f(a), is not able to accept elemental mercury by January 1, 2020. If this occurs, DOE is responsible for transferring the elemental mercury that has accumulated in Ore Processing facilities to a storage facility that is permitted under section 3005(c) of the Solid Waste Disposal Act (42 U.S.C. 6925(c)). Finally, it adds Section 5(g)(2)(E), which requires

1 Hazardous waste regulations under the Solid Waste Disposal Act limit on-site waste storage for large quantity hazardous waste generators to 90 days subject to certain conditions. Provisions of the Chemical Safety Act of 2016 provide relief from this limit for certain Ore Processors.
DOE to issue additional guidance for management of the elemental mercury that accumulates in short-term storage at Ore Processor facilities covered under Section 5(g)(2)(D).

Specifically, the Chemical Safety Act of 2016 states that Ore Processors who are incidentally generating elemental mercury from their beneficiation activities or related pollution control activities may accumulate and store the mercury produced onsite for more than 90 days, if they choose to do so, without a permit issued under section 3005(c) of the Solid Waste Disposal Act (42 U.S.C. 6925(c)); and shall not be subject to the storage prohibition of section 3004(j) of that Act. However, this exemption is contingent on the following conditions:

1. the DOE-designated facility is unable to accept the elemental mercury for long term storage due to reasons beyond the control of the generator;
2. the generator certifies in writing to the Secretary of Energy that the mercury will be shipped to the DOE-designated facility when it is able to accept the mercury;
3. the generator certifies in writing to the Secretary of Energy that only mercury produced or recovered onsite is being stored, and the generator will not sell or otherwise place into commerce, the mercury; and
4. the generator has obtained an identification number under section 262.12 of title 40, Code of Federal Regulations (CFR), as in effect on the date that the Chemical Safety Act of 2016 was enacted.

Ore Processor generators remain subject to all other applicable provisions of the Solid Waste Disposal Act and its regulatory programs. To ensure that such short-term storage is conducted in a manner that is protective of human health and the environment, the Chemical Safety Act of 2016 requires that the Secretary of Energy issue guidance that establishes requirements for management and short-term storage of elemental mercury at qualified Ore Processor facilities. Thus, this document describes the standards and management practices that are unique to onsite, short-term storage by Ore Processors that satisfy all of the criteria identified in 42 U.S.C. 6939f(g)2)(D).

1.2. Purpose

This document is intended to provide general guidance on standards and procedures, as well as best management practices (BMPs) and other criteria, as appropriate that are current, consistent, and best suited for responsible management of elemental mercury that is stored at Ore Processor facilities due to allowable accumulation, in accordance with the provisions of the Chemical Safety Act of 2016. This guidance is focused on short-term onsite storage for more than 90 days by qualified Ore Processors. Because of the interim nature of this storage scenario, and based on discussions with Ore Processors, as well as their regulators, the requirements and BMPs described herein are not intended, or anticipated, to result in significant changes in current practices by Ore Processors in management and storage of elemental mercury within their current satellite and central accumulation areas (See 40 CFR 262.15). However, if accumulated quantities of elemental mercury waste represent increased risk to health or the environment, additional regulatory requirements may be invoked.
In accordance with the requirements of the Chemical Safety Act of 2016, this guidance document also includes criteria related to the types of acceptable containers that can be used for short-term storage of elemental mercury by the Ore Processors. Container specifications and material acceptance criteria are designed to ensure that the elemental mercury is stored in a manner that is protective of human health and the environment. This is in concert with current RCRA and U.S. Department of Transportation (DOT) regulations for packaging and storage. Based on available information, the container requirements described herein are not anticipated to result in any changes to ongoing practices by the Ore Processors.

This guidance document refers to Federal regulations (RCRA, DOT, Occupational Safety and Health Act [OSHA], etc.), MEBA of 2008, and the Chemical Safety Act of 2016 as requirements (i.e., standards and related procedures). This guidance document is not meant to modify or replace regulations that undergo periodic revisions. In the event of a conflict between this document and promulgated regulations, the regulations govern.

Various specific regulatory citations are made throughout this guidance document for the purpose of identifying the anticipated regulatory framework that will be necessary to conduct short-term storage of elemental mercury; however, this does not imply that other hazardous waste regulations are not applicable. It should also be noted that, in addition to Federal regulations, States may have supplemental hazardous waste and other regulations with which the Ore Processors must comply.


1.3.  Key Assumptions

The following assumptions have been identified relative to onsite short-term storage and the requirements described in this guidance document:

1. Short-term storage at Ore Processor facilities is not anticipated to extend beyond January 1, 2020. However, if short-term onsite storage at Ore Processor facilities, in accordance with 42 U.S.C.A. § 6939f (g)(2)(D), is required beyond January 1, 2020, certain requirements (e.g., purity of 99.5 percent by volume to maintain container integrity and
pedigree) will have to be reconsidered to ensure protection of human health and the environment.

2. While elemental mercury exists as a liquid at ambient conditions, it is defined as a “solid” hazardous waste, per 40 CFR 261, and will carry both the U151 listed and D009 characteristic waste codes. The Ore Processors will formally document the waste determination in accordance with applicable requirements of 40 CFR 262.

3. Ore Processors that elect to conduct onsite short-term storage of elemental mercury are subject to all applicable hazardous waste regulations under RCRA (as codified at 40 CFR 260–273), with the exception of the various accumulation time limits described in 40 CFR 262 that are dependent on the generator category determination, as defined in 40 CFR 262.13.

4. The Ore Processors are responsible for identifying and complying with the specific applicable requirements (i.e., standards and procedures) of RCRA, DOT, OSHA, National Fire Protection Association (NFPA), and other applicable regulations, including State regulations.

5. Ore Processors are currently maintaining and operating central accumulation areas for elemental mercury that are compliant with applicable requirements of 40 CFR 262, such that containers have good integrity (i.e., no corrosion), are protected from weather/water, and are stored on containment trays/pallets or in facilities with sealed/bermed floors. The established framework of procedures for management and operation of their central accumulation areas is adequate to implement and support new requirements resulting from accumulated quantities of elemental mercury during short-term storage, as appropriate.

6. Records on all waste movements into and out of the accumulation areas, with the required information on quantities, dates, hazards, etc., are maintained in accordance with 40 CFR 262 requirements, and this will continue for the duration of short-term storage.

7. The requirements described in this guidance document may potentially impact maintenance and operation of central accumulation areas, but they are not intended to impact management and operation of satellite accumulation areas described in 40 CFR 262.15 (i.e., short-term accumulation quantities will only be stored in central accumulation areas).

8. Ore Processors are currently using elemental mercury storage and shipping containers that are commercially available and compliant with all applicable RCRA and DOT requirements and are anticipated to continue doing so.

9. Ore Processors are conducting their operations, including worker health, safety, training, communication, emergency preparedness, etc. in accordance with the applicable regulations and procedures prescribed under OSHA (29 CFR 1910).

10. Ore Processors are labeling, managing, and transporting containers used for elemental mercury storage in accordance with all applicable DOT regulations (49 CFR 171–180) and RCRA regulations for transporters (40 CFR 263).

11. Prior to shipment of elemental mercury to the DOE-designated long-term storage facility, the Ore Processors will complete any actions necessary to ensure that the packages and contents are compliant with the waste acceptance criteria (WAC) of the facility, as
verified through sampling and analysis and/or acceptable knowledge, in accordance with facility waste analysis plan (WAP).

12. The final WAC and WAP for the DOE-designated long-term storage facility will be available in a timely manner for Ore Processors to ensure compliance prior to shipment to the facility.

13. Ore Processors are implementing appropriate fire protection systems and processes for elemental mercury storage areas in accordance with all applicable National Fire Protection Association (NFPA) regulations and local ordinances, or as approved by the authority having jurisdiction.

2.0. Standards and Procedures Applicable to Ore Processors

This section identifies the regulatory requirements (e.g., RCRA and DOT) and related procedures; as well as BMPs, and other criteria applicable to Ore Processors that elect to conduct onsite short-term storage of elemental mercury, as allowed under 42 U.S.C. 6939f(g)(2)(D).

2.1. Regulatory Standards and Procedures

This section is not intended to be an exhaustive description of every regulatory requirement applicable to the Ore Processors as related to management of hazardous wastes. Rather, the following discussion will focus on those regulatory requirements that are specific to short-term storage of accumulated volumes of elemental mercury waste beyond normal regulatory timeframes.

In general, Ore Processors must be in full compliance with applicable requirements of 40 CFR 262, with the exception of the accumulation time limits identified in 40 CFR 262.14, 262.16, and 262.17. As previously described, the Chemical Safety Act of 2016 exempts the qualified Ore Processors from these time limits.

In addition, short-term storage of elemental mercury by the Ore Processors may be subject to applicable financial assurance requirements of State statutes and regulations (e.g., bonding and financial assurance requirements included in Nevada Administrative Code 519A.345(8)(c) and 519A.360). Ore Processors should consult with the appropriate State authorities to determine the applicability of such requirements.

Allowable accumulation times, as well as maximum accumulation amounts, are prescribed in 40 CFR 262 in accordance with the generator’s category. Specifically, 40 CFR 262.13 defines three categories of generators: Very Small Quantity Generator (VSQG), Small Quantity Generator (SQG), and Large Quantity Generator (LQG). The generator category is determined by the amount of hazardous waste generated monthly (refer to Table 1 in 40 CFR 262.13). The Ore Processors are responsible for determining their generator categories. For elemental mercury, which is a hazardous waste with the characteristic of toxicity (i.e., not acutely hazardous), 40 CFR 262 does not define a maximum accumulated amount of non-acute hazardous waste for LQGs; however, it does for VSQGs and SQGs, 1,000 kilograms (kg) and 6,000 kg, respectively. This is the maximum amount of non-acute hazardous waste that can accumulate onsite and the
generator still be eligible for the exemptions from a permit or interim status, as well as the requirements of 40 CFR 124, 264 through 267, and 270.

Under normal circumstances, accumulation of over 1,000 kg 6,000 kg by a VSQG or SQG is either unlikely, or relatively easy to manage through offsite shipments. Under the new short-term storage scenario allowed by the Chemical Safety Act of 2016, exceeding 6,000 kg in onsite storage could likely occur, especially for SQGs. The Chemical Safety Act of 2016 does not specifically provide an exemption for these maximum accumulation amounts. Nevertheless, it does state that the management requirements for short-term storage must ensure protection of human health and the environment.

2.1.1. Regulatory Impacts for Large Quantity Generators

In 40 CFR 262.17, the conditions for exemption from RCRA permitting and section 3010 notification requirements, as well as 40 CFR 124, 264 through 267, and 270 requirements are described for LQGs. As previously stated, the regulations do not limit the amount of non-acute hazardous waste that LQGs can accumulate; however, this is predicated on the assumption that the waste will only be stored for a maximum of 90 days prior to shipment offsite to a RCRA-permitted treatment, storage, or disposal facility, subject to certain conditions. This has been the practice of the LQG Ore Processors, with the waste being shipped offsite for purification to 99.5% elemental mercury by volume, as required for long term storage, followed by placement in commercial RCRA-permitted storage facilities. Based on current estimates of elemental mercury generation and the assumption that short-term onsite storage at Ore Processor facilities will continue at least until January 1, 2020, amounts on the order of 100,000 kg could feasibly accumulate at some Ore Processor sites in this timeframe. This represents a significantly greater risk to human health and the environment in the event of a catastrophic event, such as a fire or explosion at the facility. Subpart M of 40 CFR 262 (40 CFR 262.250 – 265) describes Preparedness, Prevention, and Emergency Procedures for Large Quantity Generators. Several of the requirements prescribed in Subpart M are predicated on the amount of hazardous waste stored onsite. Accordingly, these requirements and procedures must be re-evaluated to determine if changes are required to ensure adequate protection of human health and the environment. Specific requirements that should [or: may need to be] be re-evaluated include, at a minimum:

- Fire protection equipment capabilities, including water supply (40 CFR 262.252);
- Emergency response arrangements with local authorities (40 CFR 262.256); and

Re-evaluation and determination of actions needed to ensure adequacy of these capabilities and procedures should be conducted in consultation with the appropriate State authorities, which may result in additional requirements or limits on volumes stored.

2.1.2. Regulatory Impacts for Small Quantity Generators

In 40 CFR 262.16, the conditions for exemption from RCRA permitting and Section 3010 notification requirements, as well as 40 CFR 124, 264 through 267, and 270 requirements are
described for SQGs. Section 40 CFR 262.16(b)(1) limits the maximum amount of accumulated hazardous waste to less than 6,000 kg. It is feasible that some SQGs could exceed this amount of elemental mercury in onsite storage as a result of the exemption to the 180-day\(^3\) limit provided in the Chemical Safety Act of 2016. Preparedness and Prevention requirements for SQGs are described in 40 CFR 262.16(b)(8), and Emergency Procedures are described in 40 CFR 262.16(b)(9). While they are similar to the requirements described in Subpart M for LQGs, they do not include all of the requirements. If any SQG accumulates more than 6,000 kg of hazardous waste, they must comply with the LQG standards. Storing elemental mercury beyond the standard 180-day limit for SQGs or complying with LQG standards may mean re-evaluating their procedures and these SQG requirements to determine if they are adequate to protect human health and the environment. Specific requirements that must be re-evaluated include, at a minimum:

- Fire protection equipment and capabilities, including water supply (40 CFR 262.16(b)(8)(ii)(C) and (D));
- Emergency response arrangements with local authorities (40 CFR 262.16(b)(8)(vi)); and
- Emergency procedures and employee training adequacy (40 CFR 262.16(b)(9)).

Additionally, a Contingency Plan may be required, as described in 40 CFR 262.260–263). This should be determined in consultation with State authorities, along with the evaluation of adequacy of the Preparedness and Prevention and Emergency Procedure protocols that have been established for the SQG.

### 2.1.3. Regulatory Impacts for Very Small Quantity Generators

In 40 CFR 262.14, the conditions for exemption from RCRA permitting and Section 3010 notification requirements, as well as 40 CFR 124, 262, 264 through 267, and 270 requirements are described for VSQGs. In other words, if the generator satisfies the definition of a VSQG and meets the criteria described in 40 CFR 262.14, they are exempt from all other hazardous waste regulations. Per 40 CFR 262.14(a)(4), if the generator accumulates more than 1,000 kg of hazardous waste onsite, but less than 6,000 kg, and meets all of the more stringent conditions for exemption in 40 CFR 262.16 for SQGs, then the VSQG retains the exemption, as previously described. However, if the total amount of elemental mercury accumulated onsite exceeds 6,000 kg, similar to the impacts to SQGs described in Section 2.1.2., the VSQG must re-evaluate their procedures and requirements to determine if they are adequate to protect human health and the environment. Specific requirements that must be re-evaluated include, at a minimum:

- Fire protection equipment and capabilities, including water supply (40 CFR 262.16(b)(8)(ii)(C) and (D));
- Emergency response arrangements with local authorities (40 CFR 262.16(b)(8)(vi)); and

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\(^3\) Note that the Chemical Safety Act of 2016 only identifies exemption from the 90-day limit, which is generally applicable to LQGs. SQGs can accumulate waste for up to 180 days under current RCRA regulations. Additionally, 40 CFR 262.16(c) allows up to 270-day accumulation for generators that must transport their hazardous waste more than 200 miles for subsequent treatment, storage, and/or disposal.
• Emergency procedures and employee training adequacy (40 CFR 262.16(b)(9)).

Additionally, a Contingency Plan may be required, as described in 40 CFR 262.260 - 263. This should be determined in consultation with State authorities, along with the evaluation of adequacy of the Preparedness and Prevention and Emergency Procedure protocols that have been established for the VSQG as a result of accumulating over 1,000 kg of non-acute hazardous waste.

2.2. Short-Term Storage Procedures and Best Management Practices

This section describes some key criteria and BMPs relevant to short-term storage and accumulation at Ore Processor facilities. Because these are not RCRA-permitted storage facilities, additional attention and rigor should be applied to the storage conditions.

1. Elemental mercury should be stored only in the facility or designated area. Elemental mercury should not be mixed with other hazardous wastes if at all possible.
2. Routine access to the mercury storage area should be limited to only essential, trained personnel.
3. Eating, drinking, smoking, or chewing in the mercury storage area should be avoided. Clothing should be changed if it has become contaminated.
4. Elemental mercury should be stored in DOT-approved containers with proper RCRA labelling such that the containers can be readily shipped if required, thus eliminating the need for additional handling and potential worker exposure or spills. The preferred location for the label on a 3-liter container is the shoulder. For a 1-MT container there are two preferred label locations—one on the top near the plug and one on the side. The preferred orientation of the side label is perpendicular to the “C” channels; this orientation causes the label to be facing the correct direction in the spill tray. The preferred label locations will ensure the labels are readily visible and, thereby, facilitate the inspection of the container labels throughout short-term storage, as well as eventual long-term storage.
5. The 1-MT containers should not be stacked directly on top of each other to avoid damage. If stacking is required, seismically-qualified rack systems should be used. Similar rack systems should be used for storing 3-liter flasks (i.e., large quantities), if stacking is required.
6. Porous or combustible materials (e.g., wood) for pallets or other storage components should be avoided, preferably, or minimized to the extent practicable, if used.
7. Elemental mercury resulting from ore processing or related pollution control activities does not have to be purified prior to being placed in a container for onsite short-term storage, provided that a new container is used, or one with a pedigree that is known to have never had corrosive contaminants (i.e., chloride salt solutions, water, nitric acid solutions) introduced into the container. Long-term storage in a DOE-designated facility is anticipated to require purification to 99.5% by volume elemental mercury; however, this is not necessary for the anticipated short-term storage, which is not anticipated to continue beyond January 1, 2020. If short-term storage extends beyond January 1, 2020, the purity requirement for onsite storage will be re-evaluated.
8. Prior to making the decision to temporarily store large quantities (i.e., >6,000 kg), the Ore Processor should consider consulting with their State regulators to determine if the planned storage location would be considered an “excluded zone”, in accordance with EPA publication *Sensitive Environments and the Siting of Hazardous Waste Management Facilities* (5305W, May 1997).

9. Accumulating large quantities of elemental mercury represents an increased risk of exposure to workers and the environment. Accordingly, the mercury should be stored in an area that is as cool and dry as feasible. Lower temperatures reduce volatilization in the event of a leaking container or spill, and dry conditions reduce corrosion of the containers. If these idealized conditions are not possible, then the storage area should have adequate ventilation to maintain a safe concentration of mercury vapor in the air within the storage area during normal operations, as well as in the event of a release/spill. If the storage area does not have an adequate fixed ventilation system, or any at all (e.g., use of protected, but open-air storage), the desired air quality can be achieved using floor fans or similar. OSHA limits the concentration of mercury vapor exposure to personnel to 0.1 mg/m³. The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned mercury vapor a threshold limit value (TLV) of 0.025 mg/m³ as a time-weighted average (TWA) for a normal 8-hour work day and a 40-hour work week and considers mercury vapor an A4 substance (not classifiable as a human carcinogen). Ore Processors that choose to conduct onsite short-term storage of elemental mercury should consult with their State regulatory authorities to establish the acceptable exposure level and, at a minimum, understand the required air velocity and number of room air changes per hour (ACH) for a known quantity of mercury (e.g., per gram) necessary to achieve and maintain that level. For example, at 25°C for a 1-gram mercury spill in a 50 m³ space, using a fan that provides a 5 m/s air flow, about 9 ACH will be required to obtain a concentration below the ACGIH TWA TLV of 0.025 mg/m³. A higher ambient temperature would not require as many ACH due to the increase volatility of mercury.

10. Constant mercury analyzer air monitors are not required for onsite short-term storage; however, Ore Processors should consider using a commercially available handheld portable mercury detector and/or have workers wear mercury detection badges, or other air monitoring technique.

### 2.3. Container Standards for Short-Term Storage

In the United States, the packaging and transport of all hazardous materials, including hazardous wastes, are regulated by the DOT, and the regulations are found in 49 CFR (*Transportation*). Mercury is classified as a corrosive (Hazard Class 8 material). As such, there are specific requirements for ground, water, and air shipments of mercury.

Containers used for storage and transportation of elemental mercury should comply with applicable DOT standards and RCRA labelling requirements. General requirements for

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4 This is not a factor if stainless steel containers are used. However, currently the Ore Processors that are eligible to conduct onsite short-term storage under the Chemical Safety Act of 2016 are exclusively using containers fabricated of ASTM A36 carbon steel.
packaging and packages are provided in 49 CFR 173.24. This subsection refers to 49 CFR 178, to which any specification package used for the shipment of mercury must meet the requirements of that section.

To minimize risk to human health or the environment, the same containers that are acceptable for transportation and long-term storage should be used for short-term storage. Thus, it is important to ensure that the containers used satisfy both storage and transportation requirements. 49 CFR 173.164 addresses the specific requirements for transporting mercury. The primary form of mercury transport is anticipated to be ground, which is addressed in Subsection 173.164(d) (i.e., transport other than by aircraft). For transportation by other than aircraft, mercury must be packaged:

1. in any packaging which meets the requirements of Part 178 of this subchapter at the Packing Group III performance level; or
2. in non-specification reusable metal packaging.

Virtually all non-air transport of elemental mercury is performed in non-specification reusable metal packaging, including the containers anticipated to be used for short-term and long-term storage, as well as transport of elemental mercury.

Labelling requirements, including locations, content, and hazard information are described in 40 CFR 262.12, 14, 16 and 17, as well as 49 CFR 172, Subpart E, and 29 CFR 1910.1200. Preferred locations of the labels for the containers expected to be stored in the DOE-designated long-term storage facility, as well as the Ore Processor onsite short-term storage areas, are described above in Section 2.2.

Two primary container designs have been identified for long-term storage of elemental mercury in the DOE-designated facility: a) 3-liter flasks (i.e., nominally 76 pounds of mercury) of various designs, and b) 1 MT containers. These flasks and containers can be fabricated from either carbon steel or stainless steel, including threaded plugs used to seal the containers after filling. They can be produced using either seamless or welded fabrication techniques. All carbon steel used should comply, at a minimum, with ASTM A36, Standard Specification for Carbon Structural Steel. Any other standard carbon steel that provides higher yield strength without compromising resistance to corrosion from elemental mercury is acceptable. All stainless steel used should comply with at least one of the following standards, depending on the type of container construction selected more than one standard may apply:

- ASTM A276, Standard Specification for Stainless Steel Bars and Shapes
- ASTM A511, Standard Specification for Seamless Stainless Steel Mechanical Tubing and Hollow Bar

Additionally, while not specifically required by ASME Boiler and Pressure Vessel Code (B&PVC) based on the service, all mercury containers should be pressure tested to 15 pounds of force per square inch (psi) above atmospheric pressure (i.e., psi gauge), at a minimum, in accordance with the protocol described in the ASME B&PVC. Although air transport is not anticipated, this test will also satisfy International Air Transport Association Packing Instruction 803 (IATA 5.0.2.9), for 3-liter (i.e., less than 35 kg) flasks.

For containers fabricated using A36 structural steel, or other carbon steel, the outer surface must be coated with an epoxy, alkyd enamel, or other direct-to-metal corrosion resistant coating. A light color should be used to assist in visual detection of leaks. The inner surface should not be coated. Threads on openings should also not be coated.

The configuration of the containers must be demonstrated to be capable of supporting the hoop stress induced in the wall due to the weight of the column of mercury. This is a function of the diameter and wall thickness of the container and can be demonstrated with a simple calculation. For steel containers, this is easily achievable.

### 2.4. Container Criteria and Best Management Practices

This section describes some key criteria and BMPs relevant to the selection and management of containers used for short-term storage and accumulation at Ore Processor facilities. Given the desire to minimize handling and thus reduce risk to workers and the environment, attention should be focused on ensuring that the containers and management of those containers can be readily transitioned from short-term storage to transport for eventual placement in the DOE-designated long-term storage facility without the need for repackaging the mercury.

1. The 1-MT containers fabricated from A36 structural steel are considered the most cost effective and storage space efficient option and is the preferred configuration. The Ore Processors that are eligible to conduct short-term storage under the Chemical Safety Act of 2016 are understood to be almost exclusively using 1-MT containers fabricated from A36 structural steel.

2. To ensure the structural integrity of the container, the containers used for short-term storage are preferred to be new, or to have only been used for storage of elemental mercury with a known pedigree that they have not been damaged from any previously contained materials and that those materials would not adversely react with mercury.

3. Removing elemental mercury from a container should be performed using a vacuum pump rather than a “tilt and pour” technique to minimize the risk of a spill. The theoretical maximum vacuum lift for mercury at standard temperature and pressure conditions is nominally 0.76 meters. Accordingly, the container design should provide a maximum distance from the top lip of the fill opening to the bottom of the container that
is less than 0.7 meters to ensure that the container can be completely emptied using vacuum.

4. 49 CFR 173.24 requires that containers account for volume of liquid at 55°C during transport. Thus, the container design should be such that when the target mass is added into the container a minimum of 15% head space remains to accommodate potential expansion and/or increased vapor pressure.

5. Figure 1. (next page) provides an example of a 3-liter flask that satisfies all of the design standards and criteria described herein. Approved 3-liter flasks are commercially available and routinely used that are similar to this design, although not exactly the same. Both seamless and welded configurations are acceptable provided fabrication standards have been used and the container tested as described herein.

6. Figure 2 (next page) provides an example of a 1-MT container that satisfies all of the suggested design standards and criteria described herein. Approved 1-MT containers are commercially available and routinely used that are similar to this design, although not exactly the same. No seamless 1-MT containers are being manufactured or used in the U.S. They are considered cost-prohibitive and, given proper welding procedures and techniques, do not offer additional protection.
Figure 1. Example of 3-liter Flask for Storing Elemental Mercury. (Note: all dimensions in millimeters, NPT = National Pipe Thread).
Figure 2. Example of 1-MT Container for Storing Elemental Mercury. (Note: all dimensions in millimeters, NPT = National Pipe Thread).