



**Best Practice Guidance
for the
Safe Handling of Intermediate Bulk Containers (IBCs)**

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The purpose of this document is to provide best practice guidance and other useful information for the safe handling of intermediate bulk containers (IBCs) that distributors should consider in an effort to prevent injury and hazardous materials releases. This guidance will be focused on metal, rigid plastic and composite IBCs used to transport Cl mission chemicals, including sodium hydroxide, potassium hydroxide, sodium hypochlorite (bleach) and hydrochloric acid. Refer to CI Pamphlet 65, Personal Protective Equipment for Chlor-Alkali Materials, to ensure the appropriate personal protective equipment (PPE) is used when handling these materials.

Please note that the guidance included in this document is general and different considerations may be necessary depending on the material being transported. Specific practices and procedures should be developed on a case-by-case basis based on the company's/facility's own circumstances and conditions.ⁱ

Transportation Regulatory Requirements

IBCs used to transport hazardous materials must meet certain transportation regulatory requirements in the U.S. and Canada. Following are some of the regulations IBC handlers should understand.

I. **U.S. Department of Transportation (DOT)**

The DOT regulates the acceptance and transportation of hazardous materials in the United States in Title 49 CFR Parts 100-199, which are executed by the Pipeline and Hazardous Materials Safety Administration (PHMSA). DOT's hazardous materials regulations (also referred to as the HMR) generally cover package design, construction, inspection, testing, marking and handling. While all regulations relevant to transporting hazardous materials should be reviewed, the following are some specifically related to the transportation of IBCs.

a. *Preparation of IBCs for Transport*

General requirements for preparing an IBC for transport can be found in 49 CFR 173.35. This section notes when liners should be used for the container. It also provides requirements for filling limits for different packing groups. Special marking and identification requirements specific to IBCs can be found in 49 CFR 178.702-703.

Any IBC (other than a multiwall paper IBC) may be reused. Before an IBC is filled and offered for transport, it must be given an external visual inspection by the person filling the IBC to ensure that (49 CFR 173.35(b)):

- The IBC is free from corrosion, contamination, cracks, cuts or any other defect that presents an unsafe condition; and
- The IBC is marked in accordance with 49 CFR 178.703.

The HMR also provides general requirements for the transport of hazardous materials by highway in 49 CFR Part 177. Some key requirements for preventing IBC incidents during transportation include the securement (49 CFR 177.834(a)) and segregation requirements (49 CFR 177.848). The regulations require that the materials are segregated on a truck based on their compatibility with other materials and that the packages are secured in a manner that prevent shifting and movement of the packages in order to avoid damage under normal transportation conditions.

b. Packaging Design/Construction

Requirements for specifications and testing of different types of IBCs can be found in 49 CFR Part 178 Subparts N and O. Subpart N provides performance-oriented standards for metal, rigid plastic, composite, fiberwood, wooden and flexible IBCs. Subpart O provides specific design qualification and requalification testing requirements for IBCs with which the manufacturer must comply.

c. Qualification and Maintenance

Requirements for the qualification and maintenance of IBCs can be found in 49 CFR Part 180 Subpart D. This section provides requirements for the periodic retesting and inspection, as well as needed repairs, of IBCs in order to continue authorized transport of an IBC. These requirements are designed to test an IBC in accordance with the applicable requirements in 49 CFR Parts 173 and 178. If an IBC does not meet these requirements, it is no longer authorized for transport.

- i. **Inspections** - Following are some inspection requirements noted in 49 CFR 180.352(b) for metal, rigid plastic and composite IBCs that help prevent releases:
- External visual inspection:
 - Initially inspect after production, then every 2.5 years starting the date of manufacture or date of repair. Missing or damaged markings, or markings difficult to read, must be restored or returned to original condition. IBC must be inspected for cracks, warpage, corrosion or any other defect that presents an unsafe condition. If any such defects are found, the IBC must be removed from service or repaired.
 - Service equipment (i.e. valves, pressure relief devices) is fully functional and free from damage. Missing, broken or damaged parts must be repaired or replaced.
 - Internal visual inspection:

- Internally inspect every 5 years for cracks, warpage, corrosion or any other defect that presents an unsafe condition. If any such defects are found, the IBC must be removed from service or repaired.
 - Metal IBCs must be inspected for minimum wall thickness to ensure requirements in 49 CFR 178.705(c)(1)(iv) are met. Metal IBCs not conforming to this section must be removed from service.
- ii. **“Retesting”** – IBCs must be tested in accordance with the leakproofness test every 2.5 years from the date of manufacture or the date of repair, as required by 49 CFR 180.352. Refer to manufacturer specifications if valves or other components need to be replaced.
- iii. **Record Retention** – Records for periodic retests, initial and periodic inspections, and tests performed if an IBC has been repaired or remanufactured must be kept by the owner/lessee. Records for periodic tests must be kept at each location where the test was conducted for at least 2.5 years or until the next tests are performed. (49 CFR 180.352(g))

d. *Training*

In 49 CFR 172.704, DOT has established training requirements for employees involved in the transportation of hazardous materials, including general awareness, function-specific, safety, and security training. Hazmat employees must receive recurrent training once every three years. Additional requirements for drivers of hazardous materials can be found in 49 CFR 177.816, which also refers to the Federal Motor Carrier Safety Administration’s (FMCSA’s) driver training requirements in 49 CFR Parts 390-397.

e. *Incident Reporting*

DOT requires an immediate notification by telephone of certain hazardous materials transportation incidents (49 CFR 171.15) and a written report using DOT Form F 5800.1 for certain incidents including all those requiring an immediate notification (49 CFR 171.16). In general, if an unintended release occurs during the loading, unloading or transport of a hazardous material while the carrier/driver is present, an incident report needs to be submitted to DOT.

II. Transport Canada

Canadian regulations are covered by Transport Canada (TC) in the Transportation of Dangerous Goods Act and Regulations. These regulations include, by reference, various standards and specifications, including Canadian General Standards Board (CGSB) and Canadian Standards Association (CSA) publications. Regulations pertaining specifically to IBCs can be found in CAN/CGSB-43.146, “Design, Manufacture and Use of Intermediate Bulk Containers for the Transportation of Dangerous Goods,” which parallels most of the requirements in the DOT regulations.

Service Life – One of the major differences between US and Canadian regulations is that the Canadian standard establishes a maximum 60-month service life for plastic IBCs, with few exceptions (CAN/CGSB-43.146, Section 13.2.12).

Best Practice Guidance

The following is not an exhaustive list of best practices that IBC handlers should consider. Because of the wide variety of products which IBCs are used to transport, different companies may have different policies and, therefore, different considerations may be needed depending on the product being transported.

I. Useful Service Life

Following are some considerations for maintaining the IBC package material and structure through its useful life.

a. Material Compatibility

It is important to ensure that the hazardous material to be transported in an IBC is compatible with the package's material of construction, as well as service equipment/components (valves, gaskets, etc.). Incompatibility between the hazardous materials and the container material can cause degradation and eventually failure of the IBC. The severity of degradation depends on multiple variables, such as the physical and chemical properties of the material being transported and the frequency at which a single container is refilled. For example, stress-cracking is a particular issue when transporting sodium hypochlorite (bleach) in plastic IBCs.

b. Storage Conditions

The conditions under which IBCs are stored can play a big role in the longevity of an IBC's useful service life. Factors such as climate, storage location, stacking practices should be considered. Following are some specific factors that might be considered.

- i. Extreme temperatures, cold or hot, can severely impact package integrity
- ii. Exposure to sun/UV light may have harmful impacts on plastic IBCs
- iii. Consideration should be given to stacking height. IBC markings will indicate if an IBC is constructed for stacking and if so, the allowable stacking weight limit. Many IBC manufacturers provide recommendation for weight limits. Also, stacking empty IBCs too high could result in an incident causing injuries
- iv. Uneven surfaces should be avoided

c. Dedicated/Restricted Service

To help maintain the package's integrity and extend its useful life, many users will put some of their IBCs into dedicated (or restricted) service to avoid accidental mixing and accelerated degradation of the package. This means that the IBCs are designated to transport only one specific product or similarly classified products that have similar physical and chemical properties. Some users may define this practice within the context of "single-use" containers versus "multi-use" containers.

To provide additional protection for IBCs, some users have also established the practice of only allowing one delivery of the IBC, which may be referred to as "one trip" IBCs, depending on the hazardous material being transported. This means that certain materials are only filled one time for one delivery in a new or re-manufactured IBC.

d. Packaging Manufacturer Recommendations

While US DOT regulations do not establish a maximum service life for IBC containers (i.e. maximum number of years an IBC is authorized for use), packaging manufacturers sometimes provide recommendations for maximum use life. Users of IBCs are encouraged to consult with their packaging manufacturers and, at a minimum, follow their recommendations on maximum use life, if available.

e. Quality Assurance Program

While it is not a specific requirement for IBCs under the regulations, it is helpful to establish a quality assurance program (QAP) to ensure that a certain level of confidence is met with respect to the continued safe use of IBCs. A QAP may contain practices the company uses to achieve compliance with the regulatory requirements for inspections and testing. It may also include procedures for monitoring service experience and recording and investigating failures. Based on service experience and package failure information, a company might establish inspection/maintenance intervals that are more frequent than is required by regulation. A company might also establish maximum use life for different types of IBCs even though it may not be required by regulation. All of these aspects of a QAP can help prevent future incidents.

II. Filling/Discharging Material

Following are a list of considerations that may be taken into account when filling an IBC with product or discharging product from the IBC in order to prevent an incident. Checklists are useful to ensure all steps are taken during inspections before and after filling and discharging material.

a. *Pre-Fill Inspection*

- i. Verify the test date stamped on the IBC is not overdue (See regulatory requirements above).
- ii. Verify that the IBC, as well as its steel or poly-frame, are in good condition (i.e. no corrosion, contamination, cracks, cuts or other damage) and safe for transport. If damage

or defect is discovered, the IBC should be removed from service and inspected further. (See regulatory requirements above).

- iii. Verify that the service equipment and components (i.e. valves, gaskets, caps, relief devices, etc.), as well as hoses and hose connections, are in good condition. If any of this equipment is determined to be in inadequate condition, they should be replaced. (See regulatory requirements above).
- iv. It is crucial to verify that the product to be filled is compatible with the materials of the various components of the container. Issues with incompatibility can cause damage to the IBC and result in an unsafe package.
- v. Verify there is enough capacity in the IBC to fill with the specified amount of material.
- vi. Verify the recommended temperature range for package use and ensure the product to be filled is within this range. Caution should be given when blending or diluting products, because some processes can generate enough heat that can lead to degradation of the container.
- vii. The accidental mixing of incompatible materials can result in a serious incident. Therefore, it is important to confirm that the material being loaded into the IBC is the same as the material that was previously loaded, if the IBC has not yet been washed. The Chlorine Institute has specific guidance on avoiding the accidental mixing of sodium hypochlorite, which can be found here:
<http://www.chlorineinstitute.org/stewardship/sodium-hypochlorite-stewardship.cfm>.

b. Filling

- i. Ensure that there is effective monitoring while filling hazardous materials. This includes ensuring that any monitoring or gauge devices are operating properly.

c. Post-Fill Inspection

- i. Ensure the total amount filled in the IBC does not exceed its maximum filling limit (per 49 CFR 173.35(l)).
- ii. If disconnecting hoses from the process, ensure that all hoses/piping have been evacuated of product and that the air system and/or pumps have been shut down and pressure has been relieved.
- iii. Close per package manufacturer instructions. Note: DOT requires these instructions be filed at the facility and readily available to employees. DOT inspectors may ask to see the instructions during an inspection.

d. Pre-Discharge Inspection

- i. If unloading the contents of an IBC into a storage tank, verify there is enough available capacity in the storage tank to unload the specified amount.
 - ii. Ensure that there is effective monitoring while loading or unloading hazardous materials. This includes ensuring that any monitoring or gauge devices are operating properly.
 - iii. The accidental mixing of incompatible materials can result in a serious incident. If product is unloaded from the IBC into a storage tank, confirm that the product is being loaded into the correct storage tank. The Chlorine Institute has specific guidance on avoiding the accidental mixing of sodium hypochlorite, which can be found here:
<http://www.chlorineinstitute.org/stewardship/sodium-hypochlorite-stewardship.cfm>
- e. *Discharging*
- i. Ensure that there is effective monitoring while discharging hazardous materials. This includes ensuring that any monitoring or gauge devices are operating properly.
 - ii. Sufficient venting is needed when using a vacuum pump or gravity to unload an IBC.
 - iii. The use of pressure padding is generally not recommended for plastic IBCs.
- f. *Post-Discharge Inspection*
- i. If disconnecting hoses from the process, ensure that all hoses/piping have been evacuated of product and that the air system and/or pumps have been shut down and pressure has been relieved.
 - ii. Ensure that transfer hoses have been evacuated and are capped prior to placing back on truck.
 - iii. Close per package manufacturer instructions. Note: DOT requires these instructions be filed at the facility and readily available to employees. DOT inspectors may ask to see the instructions during an inspection.

III. Truck Loading/Unloading

Following are a list of considerations that may be taken into account when loading IBC onto the truck or offloading from the truck in order to prevent a release.

- a. *Forklift/Pallet Jack Handling* – Forklifts and/or pallet jacks are often used for the purposes of loading IBCs onto a truck or offloading IBCs from a truck. Following are a list of considerations specifically related to the use of forklifts and pallet jacks.
 - i. Ensure that the IBC is centered on the forks.

- ii. Only use forklifts and pallets jacks to carry IBCs as they are intended.
 - 1. Do not push IBCs into place with other IBCs on the forklift/pallet jack.
 - 2. With respect to forklifts, in particular, parts other than the forks should not be used to move/shift IBCs into place.
 - iii. Some forklifts have forks that extend beyond the width of the IBC. For those forklifts, caution should be given to avoid puncturing an adjacent IBC.
 - iv. Follow facility speed limits and other traffic rules.
 - v. Avoid unnecessary obstacles, such as slopes and uneven or damaged surfaces.
 - vi. Ensure compliance with general requirements and operator training requirements per OSHA regulations for operating forklifts (29 CFR 1910.178).
- b. Truck lift gates should not be used for supporting an IBC for a period of time. Lift gates are typically rated to only hold a maximum weight, which the IBC may exceed. Avoiding this will also help prevent an IBC from accidentally falling or being pushed off the lift gate.
- c. *Blocking and Bracing* – As noted above, DOT has certain regulatory requirements for securing and segregating IBCs onto a truck. In addition to those requirements, the following may be considered as it relates to securing (or “blocking and bracing”) IBCs on the truck.
- i. Ensure that all securement straps/chains/bars, etc. are in good condition, rated for the load being secured, and will work as intended.
 - ii. Avoid over-tightening securement straps. If secured too tight, the package could crack.
 - iii. Be careful when pushing IBCs to ensure proper placement. Pushing packages against each other could cause damage to either or both containers. When pushing the package, buckles and other fixtures on the floor may be in the way and can cause damage.
 - iv. Ensure IBC is placed inside the track to provide adequate spacing from objects and materials, such as metal on the wall and metal buckles on the floor, that could damage the package during transport.
 - v. Follow manufacturer recommendations for stacking IBCs (stack testing done in accordance with 49 CFR 178.815). Certain IBCs may not be able to support above a certain load limit. Stacking full IBCs on transport vehicles is not recommended.
 - vi. Particularly when there is less than a full truck load being shipped, maintaining center of gravity on the truck is important. Ensure that the IBCs are placed in a manner that the

weight/load displacement is centered to help avoid losing control of the truck due to movement or sloshing of the package contents.

- vii. Verify the truck axle weight limits are not exceeded.

IV. **Delivery**

In addition to the considerations listed above for filling/discharging product or loading/unloading the truck, following are a list of considerations, particularly for the driver, related to the delivery and transport of IBCs.

- a. Verify that all labels/markings/placards on the truck are correct before releasing the shipment.
- b. Verify shipping papers are correct before releasing the shipment.
- c. Follow all facility traffic rules.
- d. Review industry guidance on preventing rollover accidents. DOT developed a rollover prevention video that provides guidance to help avoid these types of accidents (<https://vimeo.com/31563777>).
- e. Typically DOT does not allow the unloading of material while the IBC is still sitting on the truck. However, many users have applied for a special permit (DOT SP-12412) that allows them to do just that under specific circumstances (i.e. only when materials loaded, if accidentally mixed, would not create an unsafe condition) as long as specific requirements are followed. In order to use this practice, one must apply for “party status” to this special permit. A copy of the special permit and instructions for applying can be found on the DOT website: <http://www.phmsa.dot.gov/hazmat/approvals-permits>.

ⁱ *The information in this pamphlet is drawn from sources believed to be reliable. The Institute and its members, jointly and severally, make no guarantee and assume no liability in connection with any of this information. Moreover, it should not be assumed that every acceptable procedure is included or that special circumstances may not warrant modified or additional procedures. The user should be aware that changing technology or regulations may require a change in the recommendations herein. Appropriate steps should be taken to ensure the information is current when used. These suggestions should not be confused with federal, state, provincial, municipal or insurance requirements, or with national safety codes.*