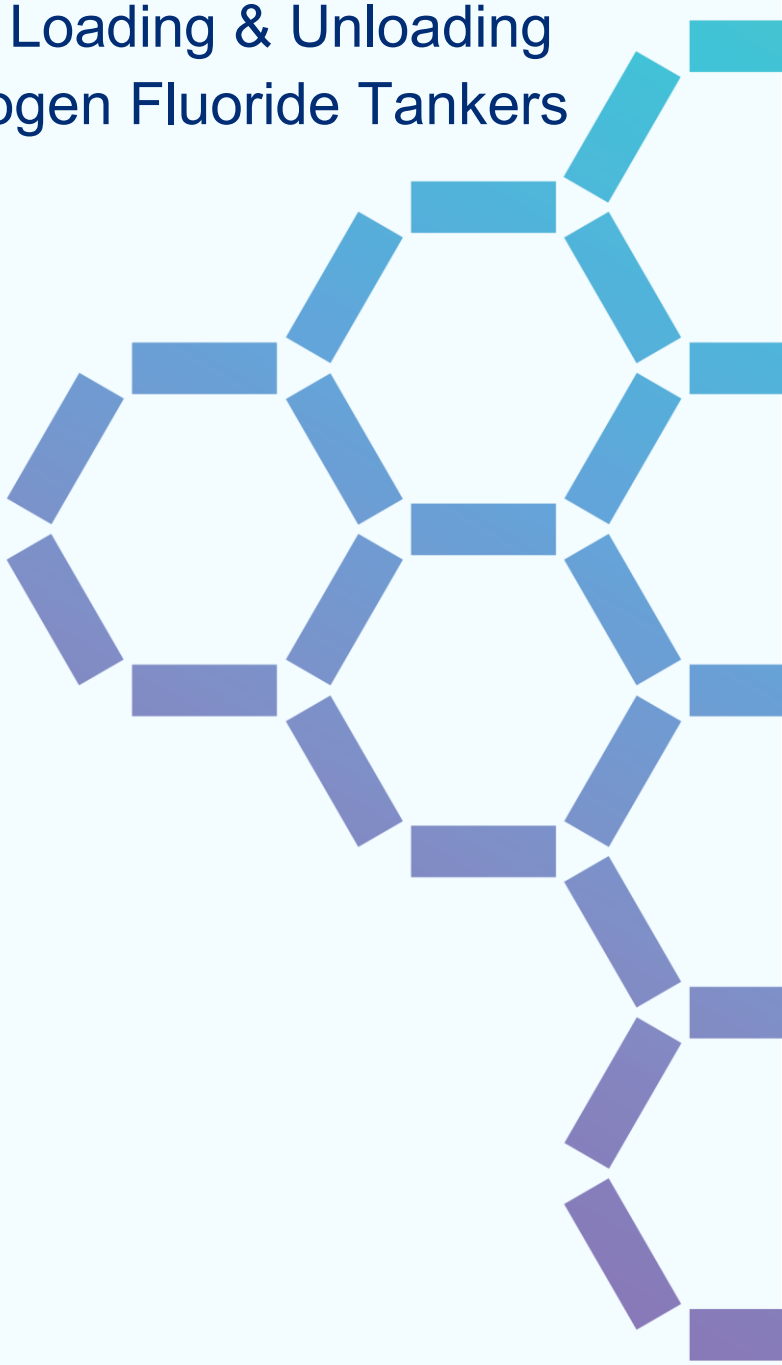
Hydrofluoric Acid Guidance – Section C
Best Practice for Loading & Unloading Anhydrous Hydrogen Fluoride Tankers



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Rev. 1 Reviewed by CIA HF Network Sector Group June 2025

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Introduction

The Hydrofluoric Acid Sector Network of the Chemical Industries Association (CIA) has developed this Guidance. It is intended to identify best practice for the loading and unloading of **anhydrous hydrogen fluoride tankers only**. The Guidance is based on many years of practical experience and draws on experience from within the CIA HF Sector Network. As such it reflects the current best practice (at the time of publication) and is recommended for use in conjunction with any additional Guidance from the supplier(s) of HF. In this Guidance,

Note: While this Guidance has been prepared on the basis of experience in loading/offloading anhydrous hydrogen fluoride (hydrofluoric acid), site operators should note that much of the advice and Guidance may be very usefully considered for other HF operations and facilities – particularly for the information on layout of transfer areas, and vehicle management **(C1. Layout),** and provision of equipment such as safety showers, HF detection, and alarms **(C2. Equipment).**

It is also suggested that this Guidance should be considered alongside **CIA HF Sector Network Guidance Section D – The Use of Flexible Hoses** which also covers loading/unloading activities.

The Guidance is a recommendation and not a mandatory standard to which all users of HF must adhere. It should not be used as a substitute for any applicable specific legislative requirement. Whilst all reasonable efforts have been made to ensure the accuracy of the contents and correspondence to legislative requirements at the time of publication, readers must refer to these themselves to ensure their compliance with current legal duties.

Acronyms

AHF	Anhydrous Hydrogen Fluoride
HF	Hydrogen Fluoride; Hydrofluoric Acid when water is present
ISO Tank	A type of portable Tank
OBRA	Occupied Buildings Risk Assessment
PTFE	Polytetrafluoroethylene
PPE	Personal Protective Equipment
CCTV	Closed-Circuit Television

C1. Layout

Loading and unloading facilities can be located either in an enclosed purpose-built building or an open well-ventilated area, away from populated areas such as office blocks and other non-operational areas. For new facilities the design, layout, construction as well as operation should reflect current best practice. An enclosed purpose-built building must be professionally designed to cater for control of all emissions. An open-air facility should be covered to protect the tanker connections from adverse weather.

Whichever layout design type is used, the facility should be clearly marked as a loading/unloading area. Through traffic (vehicles and pedestrians) in the area should be restricted. The loading/ unloading area should be segregated by fencing or other barrier to prevent unauthorized access.

There should be suitable access to the area for emergency services and sufficient room to allow tanker manoeuvring. The area should be essentially level but with a slight slope to direct any spillage or water to

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a preferred destination and to prevent spilled material pooling around the tanker. Use should be made of kerbs, bunds, gulleys and sumps for collection and direction of material spillages, rainwater or applied water. The tanker hard standing and any adjacent spillage collection area should be constructed of material of adequate chemical resistance to ensure spillage collection and to minimise ground contamination. Warning notices or lights should be used to indicate that loading/unloading operations are in progress. The area should be well lit.

C2. Equipment

Safety showers must be provided at the loading/unloading point. These should be fitted with individual alarms relayed to a normally manned area (normally the Control Room), so that assistance can be promptly provided in the event of an emergency.

A First Aid box must be provided containing at least eye wash bottles and HF antidote (calcium gluconate) gel. The location of the First Aid kit should be clearly signposted.

There should be an adequate HF detection and alarm system in the area to warn people in the vicinity of a potential release of HF. Any such alarms should also be relayed back to a normally manned area, such as a control room. A method of communication between the loading/ unloading area and the control room must be provided. When establishing a communication system, the potential effects on communication from PPE being worn by the loaders/ unloaders should be considered.

Loading/unloading platforms should have access stairs and be designed to give good accessibility to valves and to enable operators wearing protective clothing and breathing equipment to move about easily in their duties.

Consideration should be given to the provision of water deluge systems, fire hydrants, polyacrylamide, and so on, for mitigation of leaks.

If the tractor unit is not separated from the trailer, or if by any means it is possible for the tanker to move whilst connected, then the wheels must be chocked. If trailers are uncoupled, then a stand should be placed under the front of the trailer in addition to the normal trailer support.

Barriers should be used to prevent tanker driveaway, and where possible these should be interlocked with loading hoses/pipes so that the barrier can only be raised when all hoses/pipes are properly stowed away. Alternatively robust procedures should be used as a means of eliminating driveaway when connected.

The loading/unloading point should be correctly labelled. All valves must be correctly numbered and clearly tagged. All labels and numbers must be reconciled with the operating procedures, engineering documents and drawings.

Remote control of valves to enable the acid flow to be stopped and the AHF isolated in the event of an issue during loading/unloading should be installed both on the process side and the tanker side. These valves should also be able to be operated remotely to enable the process lines and or tanker to be vented and purged. The remote control should be placed at sufficient distance from the area to enable it to be used in case of emergency. More than one remote control point should be considered so that it is still accessible in the event of a leak.

Connections between the tank and loading/unloading point should be made of steel pipes or suitably designed flexible hoses. If flexible hoses are used, strict control over hose specification, construction, examination, testing, identification and storage must be employed **(see CIA HF Sector Network Guidance Section D – ‘The use of flexible hoses for the loading and unloading of anhydrous or**

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aqueous HF'). Procedures should also be in place to prevent cross connection of liquor and gas lines.

Connections must be designed to accommodate changes in alignment both pre- and during loading due to potential issues of correct alignment of the tank during berthing and movement of the tank (for example due to changes in weight affecting suspension and so on). The hoses, pipework and/or joints on the system and/or tank should not be unduly stressed.

Gaskets must be made of material resistant to AHF and be used once only unless specifically designed for re-use in HF duty. **Asbestos or PTFE envelope asbestos gaskets must not be used.**

Note: Asbestos-containing gaskets can release harmful asbestos fibres into the air, especially during maintenance, repair, or removal activities. Inhaling these fibres can lead to serious respiratory diseases, including lung cancer, mesothelioma, and asbestosis.

A venting, recovery or scrubbing system is required on the system. Vent headers should be designed to prevent back flow of water from scrubbers to AHF pipework or storage tanks.

Note: The Control Room should be a toxic gas safe haven conforming to current OBRA Guidance, see ***CIA Guidance for the location and design of occupied buildings on chemical manufacturing and similar major hazard sites.***

C3. Operation

All documentation associated with the operation must always be kept current. Documentation should be available for the following topics:

- Loading/unloading operation
- Chemical Safety Data Sheets
- Alarm systems
- Emergency procedures
- Training.

Loading/unloading operations of HF should be regarded as a **safety critical** operation, and be carried out following a prescribed procedure which should cover the following checks:

- Verification of documentation accompanying tanker to confirm the load
- Sufficient ullage in storage tank to accept load
- Safety equipment operational and in good condition
- Details of pressure test requirements
- List of the PPE required
- A step-by-step guide to operation of valves

  Note: The sequence of actions and system design should be such during loading or unloading that the valves associated with the isolation of/or containing an inventory of AHF (e.g. tank valves), cannot be operated prior to the connections having been made and proven leak tight. For the example where actuated valves on the tank are used, connection of the motive force to the valve should be at the end of the sequence after making all connections between the tank and process.
- Signature of operator to confirm operation carried out as per procedure.

The use of a checklist to assist the operations team is recommended.

All joints should be leak tested before commencing loading/ unloading.

Dry inert gas should be used, with precautions in place to avoid back flow of HF into the inert gas system. The pressure of the inert gas should be limited to the strict minimum required for tanker

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discharge and sufficient to activate ISO Tank discharge valves (if using the same supply).

The filling line, and particularly the connection, should be self-draining. Any liquid acid which remains should be purged by either:

1. blowing through with dry inert gas,
2. external steam heating of lines (if appropriate – any risk of stress corrosion cracking should have been assessed),
3. ambient temperature vaporization.

Operations must be monitored at all times either by operator in attendance or by use of monitored CCTV.

C4. Emergency Procedures

An emergency plan and alarm system details should be written down, periodically tested, and all personnel trained in these aspects of the operation.

PPE suitable for HF duty should be provided in a suitable storage area in such a way that it will always be accessible in case of emergency.

Note: See CIA HF Sector Network Guidance Section B – 'Personal protective equipment in use at HF handling facilities').

A means of indicating wind direction should be installed so that personnel can readily determine the direction of dispersion of any leak.

Information on First Aid treatment of HF exposure should be included in the emergency procedures.

Note: See CIA HF Sector Network Guidance Section F – 'Emergency response to incidents involving HF'.

C5. Training

Operators should be formally trained as part of a structured competence system, and a record kept of their current training and competence in the following topics:

- System design
- Operational hazards
- Standard operating procedures
- Emergency procedures and actions.

Periodic exercises should be carried out to train operators in emergency procedures.

Refresher training should be carried out by all personnel on loading/unloading procedures.

Note: See CIA HF Sector Network Guidance Section A – 'Training requirements for HF handling facilities'

C6. Auditing

To ensure that relevant procedures and standards are maintained, regular auditing of loading/ unloading systems is imperative. Periodic auditing will confirm that systems are working correctly and are being followed and can identify issues that require attention.

Auditing should be considered at a number of differing levels, e.g. frequent audits from within the work group and less frequent, external auditing by non-facility personnel. The audit schedule should also include a task observation audit to ensure procedures are correctly followed.

All audits and actions generated should be fully documented with individual actions and responsibilities clearly identified and followed up.

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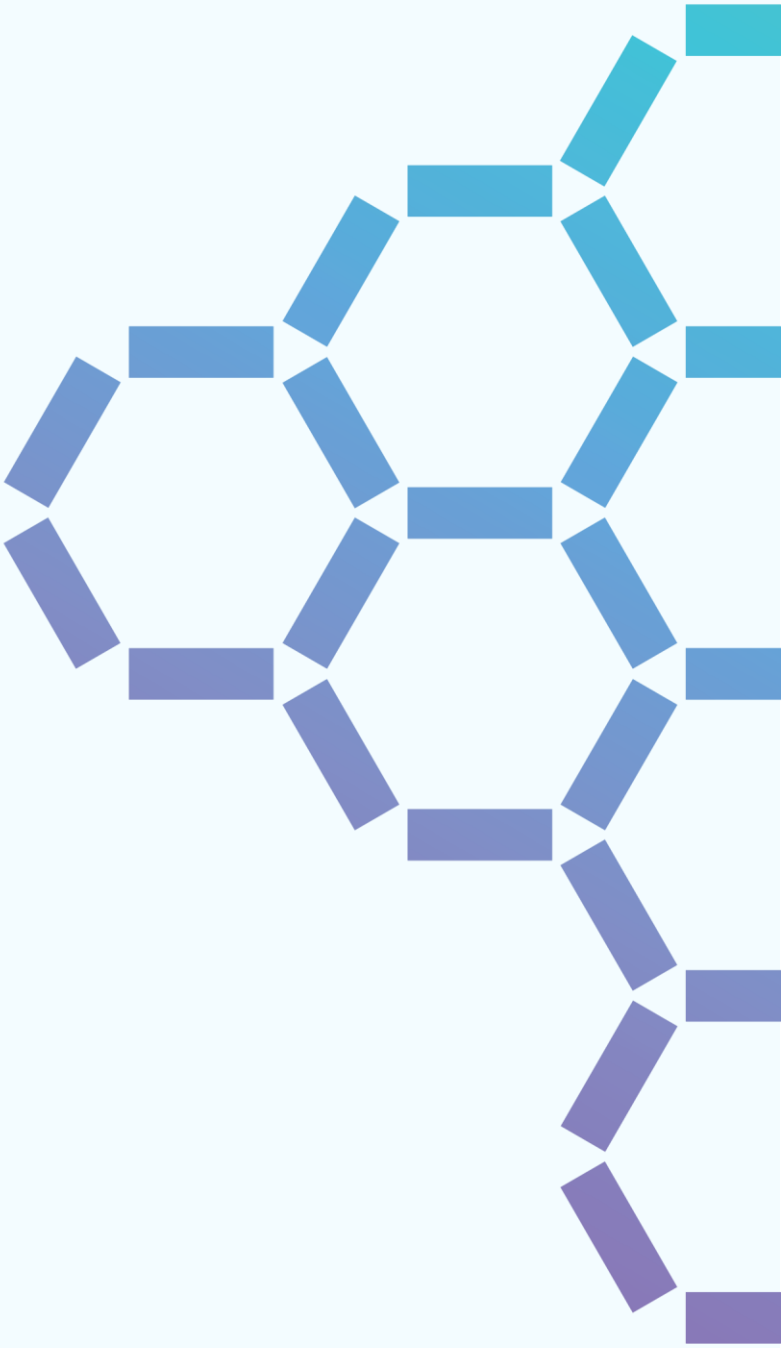

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