

BEST PRACTICE DOSSIER FOR RESPONSIBLE TRANSPORTATION AND HANDLING OF DRUMMED METHYL CHLOROFORMATE (MCF) AND ETHYL CHLOROFORMATE (ECF)

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Chloroformates Sector Group

The Chloroformates Sector Group (a Sector Group of Cefic; CFSG) is the European group which represents European producers of Methyl chloroformate (MCF) and Ethyl chloroformate (ECF).

CFSG is working to:

- Promote the safe production, handling, transport and storage of chloroformates;
- Foster science and innovation around chloroformate safety;

This document is provided to share CFSG experience to assist downstream operations. When applied, it should help to prevent incidents and improve procedures. Anyone involved in handling chloroformates or empty chloroformate containers can benefit from the information presented here.

Questions on the content of this document should initially be raised with your provider of chloroformates but can also be sent to the contact on the final page of this guidance.

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This document was originally prepared in English by our technical experts. For our members' convenience, it may have been translated into other EU languages by translators/ CFSG members. Although every effort was made to ensure that the translations were accurate, CFSG shall not be liable for any losses of accuracy or information due to the translation process.

RESPONSIBLE CARE IN ACTION

This document is part of a series which European producers, acting through their Chloroformate Sector Group (CFSG), have drawn up to promote continuous improvement in the general standards of health, safety and the environment associated with chloroformate manufacture and handling in the spirit of *Responsible Care*[®].

The voluntary recommendations, techniques and standards presented in these documents are based on the experiences and best practices adopted by member companies of the CFSG at their date of issue. They can be considered, in full or partly, whenever individual companies review their operation of existing processes and in the design of new installations. They are in no way intended as a substitute for the relevant applicable national or international regulations.

It has been assumed in the preparation of these publications that the users will ensure that the contents are relevant to the application selected and are correctly applied by appropriately qualified and experienced people for whose guidance they have been prepared. The contents are based on the best available information at the time of writing and on good engineering, medical or technical practice but it is essential to take account of appropriate subsequent developments or legislation. As a result, the text may be modified in the future to incorporate evolution of these and other factors.

This edition of the document has been drawn up by a team of experts from the CFSG to whom all welcome suggestions concerning possible revision should be addressed through the CFSG secretariat (cover page).

MAIN MODIFICATIONS IN THIS EDITION

EDITION	Section	Nature
1	-	None in this edition
2	ALL	Changes to clarify the recommendatory nature of the document
3	ALL	Changes added to provide legal/ technical background to some of the recommendations

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1. INTRODUCTION

This is a practical guide to establish best practice guidance for transportation and handling of MCF/ ECF drums. It aims at establishing *safety recommendations* to avoid incidents, environmental damages and maintain occupational health and safety under the *Responsible Care*[®] initiative. Customers are encouraged to consider the advantages and disadvantages of bulk deliveries compared to drum handling and *we suggest they consult their specific chloroformate supplier*.

With foremost consideration to local rules and requirements, this guidance provides information on best containment practices with respect to MCF/ ECF drums. It encourages adaptations to transportation, unloading and storage procedures that align with such practices. It will also provide guidance on the handling of empty drums.

Finally, this guide is intended to improve customer knowledge on best practice to protect operators and residents.

However, please note that the provided information and our technical advice is subject to change without notice and given in good faith but without warranty or guarantee, express or implied, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information provided and to test products as to their suitability for the intended processes and uses. Furthermore, users remain solely and primarily responsible at all times to ensure compliance with any applicable legal, contractual or other obligation in relation to MCF/ ECF drums. The application, use and processing of chloroformate products and the products manufactured by users on the basis of this technical advice are beyond our control and, therefore, entirely the users responsibility.

2. TRANSPORTATION

Objective:

To mitigate downstream transportation risks in the Supply Chain from origin to the customer.

- For packaged goods of MCF and ECF, UN and local requirements may apply. Composite steel drums with a HDPE inliner (e.g. 6 kg; minimum 1,8 mm thickness of the wall) and a third bung hole into the interspace between the inliner and drum body are mandatory according to current European regulations¹ (meeting at minimum UN 6HA1/X 1,6/300²). The third bung hole should be used to depressurise and decontaminate the interspace. Drums should always be secured onto and transported on pallets.
- Regardless of the size of the consignment, a door-to-door delivery concept that minimises the transportation time and the number of handling steps occurring (e.g. elimination of interim warehouses) is recommended as best practice. Full control over the selection of haulage companies by the manufacturer is also strongly recommended to ensure that only qualified parties are involved in shipping these very toxic chloroformate compounds. The carrier is responsible for choosing the safest transportation route. Waiting times at change over and customs clearance should be minimised wherever possible. To address potential theft or terrorist concerns, the requirements of ADR 1.10¹ ([security provision](#)) apply in Europe and/ or where applicable.
- Road haulage of MCF/ ECF drums in Europe is subject to a strict prohibition¹ of additional cargo accompanied by a consistent use separated driver cabin and is recommended as a best practice everywhere. Opening of containers or repacking of drums should not be allowed during transport. The driver is responsible for wearing breathing protection (filter mask) when opening the container at the destination and keeping an appropriate ventilation period (CFSG member experience suggests a minimum one hour or per more strict local regulation) before unloading. Safe overseas transportation of MCF and ECF drums in line with IMDG codes¹ requires special care to minimise emission of MCF or ECF caused by temperature dependent permeation through the inliner of the composite drum.
- CFSG member experience suggests that the best practice for overseas transportation of MCF and ECF drums into moderate climate destination zones (e.g. such countries classified as WHO climate zones I and II) can be done in a standard container, without ventilation. A single layer mode (half container load, HCL) is generally recommended,

¹ ADR 2021 [Volume 1](#) and [Volume 2](#) (UNECE website – checked November 2021)

² Recommendations on the Transport of Dangerous Goods Model Regulations – 22nd Revised Edition (Vol. I & II)

but a double layer mode (full container load, FCL) is possible upon careful consideration.

- Temperatures under 20°C are preferred but over 40°C should be avoided. As such, upon overseas transportation of MCF and ECF drums into hot-/ tropical climate destination zones (e.g. such countries classified as WHO climate zones III and IV), consideration should be given to transport using temperature controlled reefer containers, according to IMDG transport legislation¹.
- Regardless of the destination, every container should carry a warning sign at the door indicating the possibility of a toxic atmosphere within. The warning sign should also indicate an appropriate ventilation period (CFSG member experience suggests a minimum one hour) before unloading the container at the destination.
- The unloading location should have appropriate warning signage and be secure and controlled so that anyone entering the area has appropriate PPE and is aware of the risks.

3. STORAGE

Objective:

To safeguard appropriate storage of MCF/ ECF drums at the storage facility

- Drums of MCF and ECF should be stored in a secured, roofed warehouse approved for flammable liquids with effective ventilation. Recommended storage temperatures should be <20°C. If average storage temperatures are expected to be >25°C, consultation with your supplier is encouraged to consider if special storage arrangements should be used. Since both chloroformates can form explosive mixtures with air, explosion prevention should be carried out carefully. Unauthorised access should be prevented.
- The warehouse should be equipped, at a minimum (e.g. AwSV in Germany)³, with containment or a spill-collection system in the storage area. Further local regulations may apply.
- CFSG member experience suggests that best practice for forklifts used for unloading and transportation of MCF/ ECF drums means they should have their speed reduced to below 6 km/h and/ or use protected forks (e.g. with integrated folding tip, or other forklift fork tip protector) to avoid puncturing a drum. The forklift driver is strongly encouraged to have a filter mask, ready to use, at hand.

³ 2017 Verordnung über Anlagen zum Umgang mit wassergefährdenden Stoffen 1,2 (AwSV) - DE

- Areas in warehouses should be clearly marked to indicate dangerous goods (like MCF/ ECF) content. PPE and safety showers should be in place. Properties of MCF/ ECF should be well known to the staff and the correct use of PPE should be subject of regular training. It is advantageous to incorporate local fire brigades into such drills.
- Whilst sampling is not normally recommended, during any essential sampling, all sampling sites should have safe sampling devices and/ or procedures. Best safety conditions here are achieved with closed systems. Open sampling needs effective suction hoods. Individuals doing sampling need detailed training for the handling of the special drum (three bungholes). Wearing PPE is mandatory and clear shutoff during sampling is necessary.

Detection and warning devices in the storage areas should be carefully operated, monitored and maintained.

4. HANDLING

Objective:

To safeguard appropriate handling of MCF/ ECF at the customers facility

- The most favourable way in terms of safety to open drums and to discharge MCF/ ECF drums is to handle them in separate and closed process chambers with sufficient forced ventilation. The emissions generated during discharge of MCF and/ or ECF should be treated by using a suitable waste gas treatment system (e.g. alkaline scrubber, activated charcoal, incineration etc.) and be in accordance with all local regulations. In case of any irregularities, the reactor content should be able to be contained immediately in the respective chamber to thus avoid risks for employees, environment and surrounding areas.
- Similar to other areas within this process, leakage detection is important. Early detection of small leakages, to prevent the workforce from being potentially exposed to MCF or ECF, is strongly recommended. Advanced warning sensors with appropriate detection limits should be installed in all relevant areas of storage and production.
- Customer information for unloading, storage and handling of MCF and ECF in drums for chloroformates must be provided to the customer. This information (e.g. on drum opening procedure/ PPE advice) may also be directly requested by the customer for provision by the supplier at any time.
- Customers should have a written emergency response plan for the production plant and the handling/ production site (including measures for the neighbourhood) in case of MCF/ ECF leakages (large spills).

- Customers should have written procedures both for destruction of collected MCF/ ECF (large spills) or expired material and for cleaning of contaminated technical equipment in place.
- Customers should use a validated procedure to decontaminate and then destroy used drums.
- Maintenance departments should only receive rinsed and decontaminated equipment or parts for repair. Properties of MCF/ ECF should be well known to the staff. Special care is necessary if external service providers are involved.
- Quality Control departments should carefully be trained in terms of taking, handling and disposal of MCF/ ECF samples. Special care is necessary if external laboratories are involved.

To help inform customers about the intensive safety requirements for MCF/ ECF, a customer approval process by the supplier may take place. This might include a questionnaire to assess the safety features at the customer's site, followed by a customer site visit from the manufacturer's product steward. Product stewardship might also include consulting and guidance for the handling and storage of MCF/ ECF. This approval may be subject to (regular) review/ return visits depending on the responses to the initial survey and/ or customer follow up and request.

Industrial consumers of chloroformates, engineering and equipment supply companies worldwide and chlorine producers outside Europe may establish a permanent relationship with CFSG or comment on this document by contacting:

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