Guidelines for the preparation for permanent storage of metallic mercury above ground or in underground mines

Env Prot 19

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This document can be obtained from:
EURO CHLOR - Avenue E. Van Nieuwenhuyse 4, Box 2 - B-1160 BRUSSELS
Telephone: 32-(0)2-676 72 65 - Telefax : 32-(0)2-676 72 41

Euro Chlor

Euro Chlor is the European federation which represents the producers of chlorine and its primary derivatives.

Euro Chlor is working to:

- improve awareness and understanding of the contribution that chlorine chemistry has made to the thousands of products, which have improved our health, nutrition, standard of living and quality of life;
- maintain open and timely dialogue with regulators, politicians, scientists, the media and other interested stakeholders in the debate on chlorine;
- ensure our industry contributes actively to any public, regulatory or scientific debate and provides balanced and objective science-based information to help answer questions about chlorine and its derivatives;
- promote the best safety, health and environmental practices in the manufacture, handling and use of chlor-alkali products in order to assist our members in achieving continuous improvements (*Responsible Care).*

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Prior to 1990, Euro Chlor's technical activities took place under the name BITC (Bureau International Technique du Chlore). References to BITC documents may be assumed to be to Euro Chlor documents.

RESPONSIBLE CARE IN ACTION

Chlorine is essential in the chemical industry and consequently there is a need for chlorine to be produced, stored, transported and used. The chlorine industry has co-operated over many years to ensure the well-being of its employees, local communities and the wider environment. This document is one in a series which the European producers, acting through Euro Chlor, have drawn up to promote continuous improvement in the general standards of health, safety and the environment associated with chlorine manufacture 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 Euro Chlor at their date of issue. They can be taken into account in full or partly, whenever companies decide it individually, in the operation of existing processes and in the design of new installations. They are in no way intended as a substitute for the relevant national or international regulations which should be fully complied with.

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 most authoritative information available 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 the Environmental Protection Working Group to whom all suggestions concerning possible revision should be addressed through the offices of Euro Chlor.

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1. INTRODUCTION

In the period up to 2020, European chlor-alkali plants using mercury technology will be progressively shut down and partially replaced by plants using membrane technology. As a result, several thousand tonnes of mercury currently in use in the plants will be redundant and will have to be dealt with in an environmentally satisfactory way.

Some years ago, the Euro Chlor members committed to sell the mercury recovered form shut down plant to the mine of Almadén to replace fresh mined mercury (emissions).

In the frame of the new EU Regulation proposed to ban the export of mercury from Europe (Ref 1), Euro Chlor has published an agreement that was accepted by the European Commission for permanent storage of the redundant mercury in the metallic form (see Ref. 2).

This guideline refers to this permanent storage of metallic mercury. It aims to give chlor-alkali producers practical advice on recovery, transport and storage that will help them to comply with the Regulation and with established good practice.

Remark: a part of the recovered mercury will be withheld for supplying the European mercury electrolysis plants still remaining in production. This mercury will be temporarily stored on the production sites or possibly in dedicated storages, but this subject is not covered by this document.

2. LEGISLATION

Broadly, Regulation proposal COM 2006/636:

- specifies a framework for the permanent storage of metallic mercury (in line with the voluntary agreement); national/regional authorities must set waste acceptance criteria and risk assessment/approval/permitting for metallic mercury waste storage locations;
- allows for temporary storage of metallic mercury at chlor-alkali plants, and for transfers between chlor-alkali plants;
- derogates (from certain aspects of waste transfer legislation) transfers of mercury from one chlor-alkali plants to another, and from chlor-alkali plants to storage facilities.

Care must be taken with the national and international legislation for handling and transport:

- mercury is hazardous and must be separated from non-hazardous wastes;
- limitations and obligations can apply to trans-frontier movements;
- RID and/or ADR regulations will apply to transport.

3. UNDERLYING PHILOSOPHY

The philosophy underlying this guideline is minimisation of mercury handling (and hence minimisation of the potential loss to the environment). It is recommended that the mercury is recovered, cleaned and packed into the final storage containers at the source plant. The sealed containers can then be transported and emplaced in the storage location without further open handling of the mercury.

Restricting mercury handling to the source plant has the additional advantages that the source plant is likely to have an infrastructure already set up for open mercury handling (e.g. experienced personnel, suitable equipment, suitable operating procedures, suitable health monitoring facilities).

4. PROJECT MANAGEMENT

As described in the ***Env Prot 3 - Decommissioning of Mercury Chlor-Alkali Plants*** (Ref. 3)***,*** it is vital that a well-documented plan be prepared for the recovery, packaging, transport and storage of the mercury, and that this plan be formally approved by the appropriate national/regional regulatory authorities. In many cases this plan will be a subset of a project to close and dismantle the chlor-alkali plant.

It is recommended that managers (and other personnel) from the chlor-alkali plant are involved in the planning and execution of the operations to recover/pack/store the mercury. If it is necessary to use contractors, they should be involved in the planning as early as possible, so that they are able to benefit from the experience of the chlor-alkali plant personnel.

A set of dedicated written procedures should be prepared, distributed and explained to the groups participating in the work. These should include the health and hygiene standards for handling mercury. Existing procedures for medical monitoring (vapour exposure and mercury in urine) can be adapted from those used for the production plant.

If contractors are to be involved in the work, they should be given special training on the health hazards of mercury, the necessary precautions and the procedures used.

5. MERCURY CONTAINERS

In principle the containers should be:

- approximately 1-2 tonnes capacity (to be handled by forklift truck); systematic use of standard 34.5 kg bottles is not practical due to the very large number required;
- constructed in carbon steel with a single top connection (no bottom connections);
- designed to be stackable;
- designed to prevent external retention of spilled mercury (e.g. minimal crevices, no use of wooden pallets);

- approved to RID/ADR standards;
- provided with a data plate indicating the design code, fabrication company, fabrication date and empty weight;

It is proposed that a standard design be developed for use by all chlor-alkali and storage companies. Development of the design is still in progress.

6. EMPTYING OF EQUIPMENT INTO CONTAINERS

Mercury can be recovered from several sources on the plant:

- liquid from the cells (the largest part)
- liquid from pipes and the bottoms of tanks
- by retorting from sludge and solid wastes

Mercury recovered by retorting can be transferred directly into storage containers. Mercury from the other two sources may be contaminated, so it is necessary to purify it before transfer to storage containers. The most likely contaminants are water-soluble (specifically sodium, which has the potential to generate hydrogen in storage). A technique to remove these contaminants is described in Ref. 3).

Mercury from pipes and the bottoms of tanks can conveniently be treated by transferring it to an empty cell and carrying out the procedure referred to above.

To avoid residual radioactivity in the mercury from the tracers used to measure the plant mercury inventory, no radioactive tracers will be used within the two years preceding emptying of the plant. In case of doubt, the residual radioactivity should be checked to ensure it remains within acceptable limits.

7. LOADING, TRANSPORT AND UNLOADING

During loading/unloading of the containers onto trucks or rail wagons, precautions should be taken to avoid any spill, and emergency aspiration equipment should be available to collect accidental spillage.

The containers are very heavy for their size, so care must be taken:

- to load trucks or wagons so that they are not unbalanced and so that excessive loads are not placed on individual axles;
- to secure the containers so that they do not move during transport.

On arrival at the storage facility the loads and acceptance conditions will be checked, in the event of non-acceptance the mercury will be returned to its owner. If appropriate, the ownership of the mercury can then be passed to the storage facility operator.

8. STORAGE FACILITY

Metallic mercury should be stored in a dedicated area, segregated from all other wastes. The storage area should have the following features:

- this area should remain accessible for a sufficient period of time (to be negotiated) to allow for a possible future recovery of the mercury for reuse by the former owner;
- the area should be dry and geologically stable, to prevent damage to the containers;
- the area should be secured to prevent unauthorised removal of the mercury;
- the floor should be capable of bearing the loads imposed by the mercury containers;
- the floor should be impervious and slope towards a collection sump, so that any mercury spills can be collected;
- the area should be periodically monitored for potential problems such as container corrosion, container movement or mercury leakage;
- a plan to deal with a mercury spillage emergency should be developed and documented, in co-operation with the storage facility operator. Appropriate provision should be made for specialist spillage cleanup equipment and for personal protective equipment such as masks with mercury-specific cartridges.

9. HEALTH AND SAFETY

All normal safety precautions should be taken during the operations required to empty the plant, fill the containers, transport them and emplace them in the storage facility. In the document “Health 2” the full scope of health protection in case of exposure to mercury can be found. As a minimum the following specific health precautions should be in force for personnel handling mercury and mercury containers:

- all personnel should be informed of the health risks of mercury and how to control them;
- all personnel should be provided, and instructed about how and when to use, with the necessary protective equipment, according to the type of work performed (overalls, boots, gloves, eye protection, respiratory protection);
- a clean/dirty system for the segregation of work clothing and footwear from normal clothing should be provided;
- eating areas should be on the ‘clean’ side of the segregation, no working clothing or footwear should be allowed in eating areas;
- no eating, drinking or smoking should be allowed on the dirty side of the segregation. No smoking materials/food/drink should be carried in working clothes because of potential contamination;
- periodic monitoring of the workplace atmosphere for mercury vapour should be carried out, to ensure that the respiratory protection provided is adequate;

- periodic monitoring of mercury in urine should be carried out. The action levels as indicated in the Health 2 document (Ref 4) should be applied.

Once the mercury has been emplaced in the storage facility, the risk of exposure to mercury should be very low. The following precautions should be considered:

- periodic monitoring of the storage facility atmosphere to check that concentrations remain below levels of concern;
- periodic monitoring of mercury in urine for personnel dealing with the waste mercury (analysing the mercury containers, handling them, working in the corresponding storage area) according to the Euro Chlor recommendation Health 2.

10. REFERENCES

1. ***Proposal of Regulation COM 2006/636 - Banning of mercury exports and safe storage of mercury***
2. ***Euro Chlor Voluntary Agreement on Safe Storage of Decommissioned Mercury***
3. ***Env Prot 3 - Decommissioning of Mercury Chlor-Alkali Plants***
4. ***HEALTH 2 - Code of Practice: Control of Worker Exposure to Mercury in the Chlor-Alkali Industry***

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Details of membership categories and fees are available from:

Euro Chlor
Avenue E Van Nieuwenhuyse 4
Box 2
B-1160 Brussels
Belgium

Tel: +32 2 676 7211
Fax: +32 2 676 7241
e-mail: eurochlor@cefic.be
Internet: http://www.eurochlor.org