CODE OF PRACTICE

MERCURY HOUSEKEEPING

Environmental Protection 11

5th Edition

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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).

This reference manual is intended to give only guidelines and recommendations. The information is provided in good faith and has been based on the best information currently available. The information is to be relied upon at the user's own risk. Euro Chlor and its members make no guarantee and assume no liability whatsoever for the use and the interpretation of or the reliance on any of the information in this document.

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 that its activities cause the minimum harm to 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 Working Group to whom all suggestions concerning possible revision should be addressed through the offices of Euro Chlor.

Summary of the Main Modifications in this Version

Section	Nature
1.7.	Plastic pallets were taken into consideration

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The Good Housekeeping Practices detailed in this report result from more than 50 years operating experience from chlorine plants world-wide.

1. Cell Room

1.1. Lighting

Effective lighting (strong, comprehensive, no shadows) is essential for the detection of spilt mercury droplets. Good illumination makes it easier to find and recover mercury and to thoroughly check the state of cleanliness throughout the plant (auxiliary lighting that is not necessarily operated continuously is useful for this purpose). Such lighting should be installed not only in the cellroom but in the cell basements and maintenance areas.

1.2. Cells and Supporting Structures

Mercury leaks can be prevented by good maintenance of cell seals. There should be no breaks in the seals in either the side or end sections of the cell.

The entrapment and accumulation of mercury can be avoided by careful design of the cells' concrete supporting plinths. Sloping surfaces of the plinths and of the beam cross-sections help in this respect and also simplify cleaning.

It is important to prevent corrosion in supporting structures, as the porosity of any corrosion products will result in the formation of mercury sinks. Corrosion can be reduced by judicious use of plastic materials and by coating some exposed steel surfaces with plastics. However, it is necessary to be aware of the danger of coating steel or steel-containing structures- particularly reinforced concrete - as the onset of corrosion may be hidden from view. It is advisable to cover cable support trays as caustic and brine mist can collect on these.

1.3. Vessels/Pumps/End-boxes

Emissions from end boxes and exhaust gas treatment vessels can be avoided by ensuring they are sealed with clamped or bolted gaskets.

To ensure adequately low atmospheric mercury levels, the system vacuum should be set at such a value that suction can be maintained in the end boxes even when 5% of the electrolysers are open. Regular checks of the vacuum efficiency are advisable at various locations throughout the system. Continuous monitoring can simply be achieved by use of a water-filled U-tube with one leg connected to the vacuum system.

Mercury emissions can be reduced if sampling of the amalgam for analysis is minimised. The number of analyses and measurements that involve opening mercury-containing equipment should be carefully studied and limited to those that are necessary for safe operation. A low sampling frequency is only achievable if the operating conditions are constant, brine quality being the critical factor. As well as controlling Ca and Mg levels in the brine, it is important to reduce levels of certain heavy metals that result in the formation of 'mercury butter' (or thick mercury). The frequency of cell cleaning is directly related to the quantity of thick mercury.

Helpful hints

- Do not use rubber hoses for mercury discharge lines.
- Keep the number of flanges in mercury/amalgam pipework as low as possible.
- Install a preventive maintenance schedule on gaskets and valves to avoid leaks.
- Do not design horizontal surfaces on vessel flanges but make them rounded or sloping to prevent mercury hold-ups.
- A vacuum cleaning system is very useful for cleaning mercury spillages. A vacuum pipeline system with frequent mobile attachment connection points is particularly effective.
- Keep vessels containing mercury (for example, front and end-boxes) under slight vacuum.
- Glass or transparent polycarbonate covers on end-boxes give a view of mercury flow without opening the system.

1.4. Floor Areas

Low atmospheric mercury levels in a cell room can only be achieved if high hygiene standards are applied to the general floor area as well as to those areas in the immediate vicinity of the cells.

Except for specific operations, it should be possible to work anywhere in the cellroom without wearing protective apparatus. A general requirement to use protective equipment is a tacit admission that mercury is likely to accumulate and housekeeping standards are inadequate.

Evaporating mercury is drawn through the cellroom by the ventilation fans and/or by rising hot air currents created by the high temperatures in the cells. It is vital to undertake a daily regular and systematic rinsing of the floor with water. Immediate cleaning should be invoked in the event of an accidental spillage.

Helpful hints

- The flooring should be smooth and light coloured to allow detection of mercury droplets. It must be crack-free and impervious.
- Avoid covers on gutters. Mercury will be trapped under them and give rise to extra evaporation.
- Gentle flushing with clean water is advised. High pressure cleaning is likely to scatter the mercury or atomise it.
- Wood, which absorbs mercury, should be avoided in construction materials.

1.5. Flow Gutters

Floor areas should be sloped slightly towards open flow gutters which direct washings to collection vessels from which mercury contaminated materials can settle and be subsequently removed. The vessels should be large enough to contain the entire volume created when rinsing is being carried out. The liquid can then either be transferred to the feed brine circuit or directly to the effluent treatment plant. Untreated liquor should not be discharged to the environment.
The vessels should be cleaned at frequent intervals to remove mercury-contaminated sludge, earth, sand, ash, etc. The fact that these sludges are covered with water is important but is not enough in itself. Water only slows down the evaporation rate but does not stop it (see Note 1). Additionally, if cleaning is not done regularly, any major leak of oxidising agents such as chlorinated brine from an adjacent cell would dissolve all the mercury. There is also the possibility of loss of containment if the brine quantities are too high to be retained in the liquid effluent treatment unit.

1.6. Floor Protection

Any cracks and unevenness that develop in the cell room floor should be filled in and levelled. A continuous and impervious protective coating that is resistant to chemical attack should be applied. This should have a very smooth gloss finish to avoid mercury adhesion and be light in colour to allow easy detection of mercury droplets.
The cellroom should not be used as a storage area. Any materials left lying around the floor area should be cleared away. Unnecessary articles become needlessly contaminated, prevent routine cleaning of floors and are an obstacle to good mercury control schemes. If pallets are used temporarily plastic is preferred.

1.7. Collection of Mercury

Using water jets to clean areas soiled with mercury is not the most suitable technique since it scatters the mercury into small droplets which significantly increase the evaporation rate. (see Note 2).

Although it is possible to cover the nozzle to minimise the atomising effect, it is preferable to collect the mercury using standard industrial suction equipment for dry and liquid substances. The vacuum system should discharge into a collection vessel fitted with a cyclone and carbon filter.

2. Maintenance

2.1. Work Areas

Maintenance areas should be large enough for work to be carried out easily. Contamination of adjacent areas can be avoided by effective bunding (curbing).

Floor surfaces must be resistant to mechanical shock, which can occur when handling the heavy equipment found in cellrooms. Thick reinforced concrete slabs, covered with steel plates welded together and painted, form an excellent choice.

The recommendations given on floor coverings in section 1.6 are also applicable to maintenance areas.

2.2. Activity Planning

A **s**cheduled programme of preventative maintenance should lead to a decrease in cell opening frequency and time and will therefore reduce mercury emissions.

Some polluting activities, such as dismantling graphite gratings in a decomposer (denuder), cannot be eliminated. In this case the work can be organised to minimise its duration. Another good practice is to purge the decomposer with an inert gas prior to maintenance and send this to the weak gas scrubber for treatment.

It is good practice to decontaminate immediately any mercury-contaminated equipment soiled taken out for maintenance. When this is not possible covering contaminated parts with water or plastic sheeting (when it is impractical to submerge the equipment in water) can reduce the evaporation rates.

Mercury can be recovered from cleaning liquids when the concentration becomes too high by carefully feeding them to the brine loop prior to effluent treatment.

2.3. Hot Work

The application of heat to equipment that has been in contact with mercury is a special problem. Washing with water alone will not remove all contamination, as mercury will continue to 'sweat' out of metal during heating. Consideration should be given to heating the equipment in a decontamination oven to remove and collect mercury. If this is not possible then any work involving heating should be undertaken in a well ventilated area. It may be necessary to wear breathing apparatus when undertaking activities such as welding (mercury monitoring should be undertaken when carrying out such tasks).

2.4. Cell Cleaning

When a cell has to be opened for maintenance, the mercury has to be drained in to the decomposer and the brine removed. The residual visible mercury is removed with a vacuum cleaner.

The cell bottom can be treated with a sodium peroxide solution. The solution is prepared by pouring 1.3 litres of 50% caustic soda and 1.0 litres of 35% sodium peroxide solution into a bucket containing 8 litres of water. The solution is distributed over the entire cell base and the base plate is then brushed. The peroxide treatment is repeated 3 - 5 times. The mercury concentration in the air above the cell base is then checked with a portable mercury analyzer (See **Env Prot 11A - Code of Practice - Mercury Housekeeping - Supplier's References**). If a