



**GUIDELINE FOR THE
MINIMISATION OF MERCURY EMISSIONS AND WASTES
FROM MERCURY CHLOR-ALKALI PLANTS**

Env. Prot. 13

2nd 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*).

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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.

Summary of the Main Modifications in this version

Section	Nature
All	Merge with Env. Prot. 10 (will be deleted)
2.1.	Paragraph rewritten by INEOS
2.2.	Addition of other sulphur compounds for precipitation
3.1.	Addition of electrochemical and biochemical reduction techniques
3.5.	Addition of scrubbing with chlorinated brine for chlorine coming directly from the cells and sent to hypo production
3.5.	Mercury content in hypo corrected according to the study done for the hypo risk assessment

TABLE OF CONTENTS

1. INTRODUCTION	7
2. GENERAL INFORMATION	7
2.1. Gaseous Streams	7
2.2. Liquid Streams	8
2.3. Other Sources of Mercury Emissions	8
2.4. Solid Wastes	9
3. SPECIFIC TECHNIQUES	9
3.1. Brine and Water Systems	9
3.2. Caustic Soda and Caustic Potash	11
3.3. Hydrogen	12
3.4. Chlorine	13
3.5. Sodium hypochlorite	14
3.6. Process Exhausts	14
3.7. Cell room ventilation	15
3.8. Solid Wastes from Normal Operation	18
4. SUMMARY	19
5. CONCLUSIONS	19
6. REFERENCES	19

TABLE OF FIGURES

Figure 1: Mercury Recycling in the Mercury Process.....	20
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Figure 2: Waste Treatment Possibilities 21
Figure 3: Recovery of Mercury from the Solid Wastes..... 22

INTERPRETATION OF THIS GUIDELINE

This document presents a statement of the Best Available Techniques for chlorine production plants using the amalgam chlor-alkali electrolysis process, in relation to mercury emissions to air, to water and in products. It includes also information on the handling of solid wastes coming from normal operation (but not mercury containing construction waste or rubber coatings), and has been based on the practices of existing plants whose current performance provides the best examples of mercury emission control. However it must be interpreted on the basis of several important principles contained within the IPPC Directive and the associated Reference Document.

1. The Directive recognises that consideration of Best Available Techniques must include not only technology, i.e. equipment and processes, but also the procedures for operation and maintenance of the plant. Both have been considered.
2. The Directive recognises that Best Available Techniques have to be established in the context of individual plants, since there will be variations in the technology used within an industry.
3. The Directive recognises the need for plants to comply with any Water Quality Objectives or other environmental quality standards, or with any emission standards set by local regulation.

This document has been written to provide guidelines for the performance that can be achieved in each emission category expressed primarily as grams of mercury per tonne of chlorine capacity. Whilst some flexibility may be needed within an individual category, the guidelines lead to a maximum level of total mercury emission from all categories that are applicable to all plants. The guidelines are intended to represent the emission performance that will be achieved over the course of the year. They are not intended to be an instantaneous standard of performance which will be achieved by employing a particular technique, because there will be some variation depending on, for example work load of the plant or weather conditions, equipment being under maintenance, etc. The quoted value is the maximum level of total mercury emission, achieved over the year if the techniques are applied as described.

All Euro Chlor members have accepted the standard defined by this maximum level of mercury emission and will work to achieve it, within the framework of their national and local regulations. In some cases this may require substantial investment and time before the improvements have been made in all plants; this is consistent with Article 5 of the IPPC Directive. Since the Directive recognises BAT as being plant-specific, there may be technical or economic constraints on the improvements possible at some individual plants, but the maximum level of total mercury emission is seen to be achievable on the stated time scale.

The Reference Document on Best Available Techniques in the Chlor-Alkali Manufacturing Industry, adopted in December 2001 by the European Commission,

provides further guidance on techniques and quotes guideline values for emissions on the basis that the best techniques can be applied in all circumstances.

Remark

Some other electrolysis processes use mercury (production of alkoxides, dithionites, sodium and potassium metals ...) but, as they are not a lot of such units in Europe, this guideline is not intended to cover them. They have the same environmental objective to minimise the mercury emissions and apply, when possible, the here described methods, but they also use specific ones.

1. INTRODUCTION

In the electrolysis of brine for the production of chlorine, hydrogen and caustic soda (or caustic potash and some other specialty products like alkoxides ...) by the mercury process, the mercury is in intimate contact with the raw materials and some of the final products. It is thus inevitable that the untreated process streams contain mercury. A key element, therefore, of operating this technology is to apply techniques that minimise any contamination in the final discharged streams and that, wherever possible, the mercury removed is recycled within the process. The purpose of this document is to describe these techniques.

2. GENERAL INFORMATION

Due to the process characteristics, mercury can be emitted from the process through air, water and in the products; solid waste sent to safe deposits can also contain some mercury.

2.1. Gaseous Streams

Hydrogen and process exhaust streams are generally cooled and then treated in operations involving absorption or reaction of the mercury (for example calomel formation in a washing column, fixation on copper or carbon impregnated with sulphur iodine or silver). For some of these operations the mercury emerges in a liquid stream, which may be recycled to the brine system or treated as in paragraph [2.2](#). For other operations the mercury emerges in a solids stream, which may be treated as in paragraph [2.3](#).

Chlorine emerging from the cells contains very little mercury; the normal processes of gas cooling and washing then remove the mercury down to insignificant concentrations. The mercury emerges from these operations in a liquid stream, which may be recycled to the brine system or treated as in paragraph [2.2](#).

2.2. Liquid Streams

Mercury in liquid effluent streams can be removed by the following processes:

- Precipitation of mercury sulphide which is then filtered; the precipitate can be dissolved (solution containing active chlorine) and recycled in the brine loop, or treated as solid waste. The use of thiourea or special mercury binders like trimercaptotriazine is also possible.
- Absorption on ion exchange resins; the regeneration of those resins gives a mercury concentrated liquid that can be recycled in the brine.
- Treatment by a reducing agent in order to precipitate metallic mercury that is filtered and recycled.

The caustic solution produced, is purified from mercury by passage on active carbon, giving rise to solid waste.

Sometimes, the treated liquid stream is further 'polished' by filters. This can give rise to additional solid waste.

2.3. Other Sources of Mercury Emissions

Mercury emissions in the air are influenced by the basic design of the cell room, the area of the cells, the leak tightness, the type of decomposers, the accessibility of the cells and the construction materials. These emissions are also influenced by the use of operating and maintenance techniques which minimise the possibility of mercury emission.

Another source of emissions into air is the evaporation of mercury deposited in the equipment and in the building, for instance in cracks in the floor and in porous concrete and bricks, especially for older cell rooms.

Some accidental mercury spillage can occur during operations involving cells or decomposers, such as opening the cells for anode changing or cleaning, assembling or dismantling equipment, or replacing defective pipes, and cause supplementary emissions in the cell room.

Optimisation by keeping the cells closed as far as possible reduces the emissions due to maintenance operations. A good maintenance and operating strategy can increase the lifetime of the cells parts and reduce the frequency of opening.

Mercury emissions are also significantly reduced by good housekeeping practices which are backed up by people with the motivation to work in such a way. This topic is covered in detail in ***Env Prot 11 - Code of Practice - Mercury Housekeeping.***

Scrap pipes, vessels, pumps, building materials and rubber coating will contain some low residual concentration of mercury. This may be recoverable by oxidising washing (chlorinated brine, bleach or hydrogen peroxide), giving a mercury contaminated liquid effluent to treat, or by retorting. It has to be noted that much is not amenable to retorting because of its bulky size of nature, and landfilling is then the option.

2.4. Solid Wastes

Depending on their composition, solid wastes produced within the process may be treated chemically to re-dissolve ionic mercury in a liquid (then treated as liquid stream) or can be treated thermally (mercury “distillation”). In this case, the gaseous stream out of retorting is handled like any gaseous stream and the final solid waste ash is disposed of to secured landfill or underground (mines).

According to the local legislation, some solid wastes may be suitable for disposal in secure landfill without further treatment.

Generalised flow schemes are shown in Figures [1](#) and [2](#).

3. SPECIFIC TECHNIQUES

3.1. Brine and Water Systems

a) Technique

Three principal processes are used to purify depleted brine leaving the plant, and any other mercury-containing waste water:

They would normally include a first settling to remove large mercury droplets, eventually followed by oxidation using hypochlorite, chlorine or hydrogen peroxide to take remaining metallic mercury into solution.

The design and operation of systems must pay careful attention to the liquid flow rate.

- Precipitation of mercuric sulphide, followed by filtration

By adding sulphide, ionic mercury is precipitated as mercuric sulphide. The solid sulphide is filtered from the waste water on sand, candle, or plate filters.

The filter cake may be then

- dissolved in hypochlorite, chlorine or hydrogen peroxide, and recycled to the brine system
 - treated thermally with air for recovering Hg; the gaseous stream being treated like process exhaust
 - discharged as stabilised mercury sulphide in a secure landfill
- Ion exchange to remove mercury from solution

Depending on the type of resin used, regeneration with hydrochloric acid gives a mercury-containing liquor which can be recycled to the brine system.

➤ Chemical reduction to metallic mercury for recycling in the cells

In the reduction process, an activated charcoal filter is used to separate the metal mercury obtained by adding a reducing agent (for example, hydroxylamine, NaBH₄ etc) from the waste water. After filtration the mercury obtained from this step can be directly recycled to the cells. Care must be taken to avoid recycling nitrogen compounds in the system (NCl₃ formation risk), and take the necessary precautions with the reagents used (some can be carcinogenic).

➤ Electrochemical reduction to metallic mercury for recycling in the cells

The reduction process is carried out at a fixed-bed carbon electrode to remove mercury from waste water.

➤ Biochemical reduction to metallic mercury for recycling in the cells

This technique proposed by the University of Braunschweig (Germany) has been tested by some members, but shows performances of a quite lower level than the preceding ones.

b) Performances

Depending on the local situation, the specific flows ..., these processes should reduce mercury in treated final water stream to lower than 0.1 g of mercury per tonne of chlorine of capacity.

c) Sampling and analysis

The concentration of the mercury in the water leaving the plant should be checked at least once per day (and if necessary on a continuous basis, see also the request of the authorities).

The analytical method has been defined in the Euro Chlor document ***Anal 3-7 - Standardization of Methods for the Determination of Mercury Traces***

d) Remarks

Except in the case of sulphide precipitation, the solids from water and brine treatment contain very low quantity of mercury and can be retorted or, after densification, directly sent to a secured landfill or underground storage (mines). Basically those solids are composed of carbonates and other inert silicates at variable concentrations, according to the quality of the raw material (mine, solar or vacuum salts).

3.2. Caustic Soda and Caustic Potash

a) Technique

There are a variety of filters used within the industry to remove mercury from sodium and potassium hydroxides. These include:

- Plate filters with carbon pre-coat
- Candle filters with carbon pre-coat
- Candle filters without pre-coat.

Although all types of filter can achieve very low levels of mercury in the product, the predominant technique is the plate filter with carbon pre-coat.

The efficiency of the filter depends on a number of factors:

- it must carefully be assembled according to the manufacturers' instructions so as to avoid leak paths
- the pre-coat deposition technique must give a consistent and homogeneous pre-coat layer
- the throughput temperature and pressure of the caustic soda must be maintained within the design range and should be controlled to avoid rapid changes. As an example, a plate filter uses a pre-coat of 3-6 kg/m² of filter area, and operates with a throughput of 0.5-1.0 m³/m².h at a temperature of 50-70°C.

The use of a settling stage, e.g. a holding tank upstream of the filter, will assist filter efficiency and reduce the frequency of filter cleaning.

b) Performances

Such filters will reduce the mercury in caustic soda to about 0.05 mg/kg of 50% caustic soda liquor, which corresponds to about 0.1 g per tonne of chlorine capacity.

c) Sampling and analysis

The concentration of mercury in the product should be checked after filtration at least once per day. The sample point should be arranged to avoid contaminating the sample with mercury droplets, which may have settled in the pipework.

When a new pre-coat has been deposited, the concentration of mercury in the product should be checked several times per day until the required performance has been established.

d) Remarks

The mercury-laden filter material can be treated in a retort to recover the mercury for future use (see section [3.8](#)).

Because of viscosity considerations, caustic is filtered hot. After filtration the caustic is cooled. This may result in further deposition of some mercury in caustic pipework and tanks. Where possible, this mercury is drained off and, after treatment (distillation) if necessary, returned to the mercury store. If this is not possible, the mercury remains in the tanks etc, until maintenance work or demolition is undertaken and the mercury is then recovered.

3.3. Hydrogen

It must be reminded that mercury air emissions from hydrogen burned must be considered as “process exhaust” and not included in the emissions with the products.

a) Technique

Hydrogen leaves the decomposers saturated with water and mercury at a temperature usually around between 90°C and 130°C. Mercury is generally removed in a multi-stage process.

In the first, the hydrogen is cooled by a heat exchanger mounted immediately above the cell or a cooler within the decomposer. The condensed mercury is recycled with water directly to the decomposer.

The second stage may involve either:

- Chilling or washing with chilled water
- compression and cooling
- scrubbing with hypochlorite
- use of a calomel reaction

In the 2 first options, mercury is recovered as metallic mercury; in the 2 last options, the liquid can be recirculated in the brine.

A third stage may involve either iodised or sulphurised charcoal, after sufficient increase of the hydrogen temperature (10 to 20 °C) to avoid water condensation in the charcoal bed. The operating temperature is also important for the efficiency of the process, together with the granule size of the charcoal and the flow rate of hydrogen.

This third stage can also be carried out by reaction of mercury with copper on an alumina carrier, at temperatures between 2°C and 20°C. The copper can be regenerated by heating up.

b) Performances

These techniques should reduce the mercury content to lower than 30 µg/m³ of hydrogen at 1 bar, which corresponds to about 0.01 g per tonne of chlorine capacity.

If the hydrogen is compressed before treatment, then a lower mercury concentration can be achieved (0.003 g per tonne of chlorine capacity as yearly average, which corresponds to about 10 µg/m³ of hydrogen at 1 bar).

c) Sampling and analysis

The concentration of mercury in the hydrogen leaving the plant as a product should be checked at least once per week. Sample points should be arranged to avoid contaminating the sample with solid material, e.g. dust from the charcoal bed, which may have settled in the pipework.

The analytical method has been defined in the Euro Chlor document ***Anal 3-7 - Standardisation of Methods for the Determination of Mercury Traces.***

If purified hydrogen is used in the manufacture of hydrochloric acid by the reaction of hydrogen and chlorine, analysis of the resulting acid solution for mercury provides a satisfactory monitoring method for the mercury concentration in hydrogen. This is due to the ease of sampling and analysis compared with hydrogen gas, and the very low level of mercury in chlorine as described below.

3.4. Chlorine

a) Technique and performances

Chlorine leaves the cells at between 80°C and 95°C. The chlorine gas is usually cooled with chilled water to about 15°C (30 °C if no chilled water). No further mercury treatment is required for gaseous chlorine which contains negligible traces of mercury (i.e. less than 0.001 g/t). Due to the risk of solid chlorine hydrate formation, the temperature will not be lowered below 15 °C.

b) Sampling and analysis

The analytical method has been defined in the Euro Chlor ***Anal 3-7 - Standardisation of Methods for the Determination of Mercury Traces.*** Traces of mercury in chlorine may be due to the presence of mercury in the sulphuric acid used for drying chlorine, rather than to the use of the amalgam process.

c) Remarks

The condensate from chlorine cooling will contain small amount of mercury driven by the chlorine leaving the electrolyzers, and can be recycled in the brine.

3.5. Sodium hypochlorite

As the chlorine is usually coming from the residual liquefaction gas, the mercury content of sodium hypochlorite will primarily reflect the residual mercury traces of the purified caustic soda. In some cases, the chlorine can directly come from the cells, and washing it with chlorinated brine can be useful.

No mercury removal processes are used for the hypochlorite produced. Typical mercury content can reach up to 15 to 30 mg of mercury per tonne sodium hypochlorite product (cf. also hypochlorite risk assessment data).

3.6. Process Exhausts

a) Description

Process exhaust refers to all gaseous streams by which mercury can be emitted to the atmosphere, apart from cell room ventilation air and hydrogen as product. Each plant may have different streams but the typical streams which may have significant mercury content to require the use of a treatment process will include:

- Purge air from cell end-boxes
- Vents from wash water collection tanks
- Exhaust from any vacuum system used to collect spilled mercury (but some portable vacuum cleaner have their own mercury absorption system)
- Hydrogen burnt as a fuel, either by the company operating the chlorine plant or by another company to whom it has been sold as a fuel
- Hydrogen vented to atmosphere due to lack of downstream outlets
- Vents from caustic soda pumping tanks
- Vents from caustic soda filters
- Distillation units for mercury-contaminated solid wastes
- Vents from the mercury contaminated waste storage (if not in closed recipients).

Safety considerations will almost certainly require separate units for different streams. For example, hydrogen streams should not be mixed with streams containing significant amounts of air to avoid formation of explosive mixtures.

Other streams are likely to contain some mercury, but in such low concentrations that they do not require treatment; they correspond to venting of:

- brine saturators
- brine filters and treatment tanks
- caustic soda stock tanks

b) Technique

Two principal single-stage processes are capable of achieving low levels of mercury in process exhaust:

- A chemical process, e.g. scrubbing with hypochlorite or with chlorinated brine, or use of a calomel reaction, which allows for direct recycling of mercury to the brine circuit
- Use of iodised or sulphurised charcoal. In this case, the mercury can then be recovered and recycled as indicated for the hydrogen in section 3.3 point b); the possible risk of carbon ignition has to be taken into consideration when oxygen or chlorine are present in the gas.

c) Performances

As the same techniques are used, the usual performances are quite similar to what can be obtained for hydrogen purification, about 30 µg Hg/m³. According to the wide range of process exhaust flows related to the chlorine production capacities, the corresponding emission can vary widely (see also section 3.7 point b).

d) Sampling and analysis

The concentration of mercury in the major gaseous streams should be checked at least once per week. The flow rate of each stream should be checked at least once per year, although more frequent measurements may be necessary to cover the range of the plant operating conditions. The analytical method has been defined in the Euro Chlor (See ***Anal 3-7 - Standardisation of Methods for the Determination of Mercury Traces***).

e) Remarks

It can be necessary to vent hydrogen at the cell room in emergency or upset conditions. Safety considerations dictate that no treatment system should be used on this stream, despite certain mercury content, in view of the fact that differential pressure across the system would restrict hydrogen flow and reduce the safety.

Regardless of whether they include a treatment process or not, all mercury-contaminated streams must be taken into account in calculating the total mercury loss in process exhaust during the year. Releases during periods when a treatment process is shut-down must also be considered.

3.7. Cell room ventilation

a) Technique

Mercury cells are set up in very large buildings and a huge volume of ventilation air is needed to remove heat from the cells. Due to this huge volume, together with the fact

that the ventilation flow escape to the atmosphere from many points, the use of mercury removal process is not practical. Mercury losses are influenced:

- by the basic design of the cell room and the cells, for example
 - number of the cells,
 - area of the cells,
 - leak tightness,
 - type of decomposers (horizontal or vertical),
 - accessibility,
 - materials of construction,
- by use of operating and maintenance techniques which minimise the possibility for mercury emission;
- by good housekeeping practices; the Euro Chlor document (Env Prot 11 - Code of Practice - Mercury Housekeeping) sets out in detail the good housekeeping practices which have been developed in the industry over the last 50 years. The principal points are as follows:

Cell area floor

The cell room and the cells should be adapted to:

- provide good lighting to help detect mercury droplets
- avoid mercury leakage from the cells by proper sealing
- prevent possible accumulations of mercury on the concrete beams which support the cells.

Similarly, there should be no mercury emissions from vessels, pumps, pipework and instruments within the cellroom. All vessels should be sealed by means of flanged joints or screwed fittings. Preventive maintenance programmes should be used to minimize frequency and duration of cell opening.

To reduce the number of occasions on which cells are opened, the feed brine should be carefully purified at all times.

The floor area should have an impervious coating e.g. an epoxy coating. It should be very smooth and regularly washed with water. Only low water pressure should be used to avoid mercury scattering.

Floor areas should slope towards open flow gutters which should be designed to ensure that any mercury does not flow to drain with the water and that the base of the drain is always covered with water to reduce mercury evaporation. They should be cleaned regularly to remove sludge, earth, sand, etc which may be contaminated with mercury. Any recovered solids should always be covered with water or kept in sealed containers until treated.

Wood floors and other wood coverings should be avoided.

The use of water jets to clean areas soiled with mercury is not recommended. It is preferable to collect the mercury using industrial suction equipment suitable for dry substances and liquids, with a collection vessel fitted with a cyclone and carbon filter to remove mercury from the air exhaust.

Maintenance areas

The maintenance areas shall be large enough to enable work to be carried out easily. They shall be robust and designed to enable mercury to be recovered from floors and working surfaces.

Mercury Storage

All mercury containers, bottles, vessels, etc should be closed and stored in a dedicated storage area. This should have an impervious floor and be designed to recover mercury by rinsing with water or with a vacuum cleaner.

Use of a mercury monitoring system enables emissions sources, whether from production or maintenance activities, to be identified and suitable procedures to limit mercury emissions to be set up.

b) Performances

The guideline for total mercury emissions to air (i.e. including process exhaust and cell room ventilation) is maximum 1 g per tonne of chlorine capacity (yearly average). This reflects the very large ventilation air flow needed for cell room cooling and to comply with health and safety conditions for personnel working in the cell room.

c) Sampling and analysis

Monitoring mercury emissions into the cellroom can be performed using two different but related methods; with a static monitoring device which measures the general surroundings and by a portable monitoring device. The cellroom design will generally determine the appropriate monitoring method. More detailed description of equipment is given in Euro Chlor publication Env Prot 5 - Measurement of Air Flow and Mercury in Cell Room Ventilation).

To determine the total mercury loss, it is necessary to measure the air flow rate and the mercury concentration simultaneously. These two measurements should be taken at the same place(s) in the cell room if possible. The analytical method has been defined in the Euro Chlor documents ***Env Prot 5 - Measurement of Air Flow and Mercury in Cell Room Ventilation*** and ***Anal 3-7 - Standardisation of Methods for the Determination of Mercury Traces***.

Realistic results require measurements to be taken during normal working hours when, for example, most maintenance work takes place, and during the night and the weekends (also in summer and winter periods). The measurements should be repeated at appropriate frequency.

Air flow rates can be measured using an anemometer or by tracer methods. Alternatively it can be calculated from the performance curves of the ventilation fans or from a heat balance of the cell room.

3.8. Solid Wastes from Normal Operation

These consist principally of:

- Solids from brine purification
- Solids from caustic filtration
- Solids from water treatment
- Solids from sludge (sewer, traps, channels)
- Activated carbon from gaseous stream treatment
- Decomposer carbon from decomposer packing
- Residues from retorts.

The appropriate treatment depends on the form of the waste. For example, ultrasonic vibration with recovery of the released mercury has been shown to be effective with certain pore-sized activated carbons but not at all with others. If the mercury is predominantly in the inorganic state, treatment with aqueous chemicals should be avoided to minimise the quantity of contaminated water which will need to be treated.

Available techniques include:

(a) Mechanical/physical treatment

Suitable if significant quantities of metallic mercury are present. Care must be taken not to release mercury to the atmosphere. The final solid residue is land-filled or stored underground (mines).

(b) Chemical treatment

Techniques include treating with hypochlorite, chlorinated brine or hydrogen peroxide. The liquid streams are treated as in 2.2, with the mercury recycled to the brine system.

(c) Distillation

Distillation or retorting is carried out in specially designed units. The mercury is recovered as metallic mercury and can be stored for future make-up to the cells. Special attention should be given to the treatment of the exhaust gases from these units. They should be treated as in 3.6 (Process Exhausts). The solid residue is land-filled or stored underground (mines).

A generalised scheme for handling solid wastes is shown in Figure 2.

These are covered comprehensively in ***Env.Prot. 3 - Decommissioning of Mercury Chlor-Alkali Plants***.

Wherever possible, mercury should be recovered – preferably as the metal.

4. SUMMARY

Whilst recognising that the particular circumstances of each plant will require some flexibility in the standards which can sensibly be set for individual emission categories, the application of the techniques described above will normally result in a maximum total emission of 1.2 g of mercury per tonne of chlorine capacity on an annual basis, based on the described guidelines for each potential emission category.

The industry recognises that control and abatement techniques cannot be applied for optimum effect at all sites and under all operating conditions. For these reasons the values given differ from those quoted in the industry reference document for BAT.

Whilst, for reasons such as design, age and geography, not all plants may be able to achieve these figures, no individual plant should exceed a total mercury emission limit to air, water and in products of 1.5 g/t chlorine capacity.

5. CONCLUSIONS

- A total mercury emission to air, water and products of 1.0 g/t chlorine capacity is achievable¹.
- Techniques other than described in this document may be used, including those in the BAT reference document for the industry.

6. REFERENCES

- ***Anal 3-7 - Standardization of Methods for the Determination of Mercury Traces***
- ***Env Prot 3 - Decommissioning of Mercury Chlor Alkali Plants***
- ***Env Prot 5 - Measurement of Air Flow and Mercury in Cell Room Ventilation***
- ***Env Prot 11 - Code of Practice - Mercury Housekeeping***
- ***BREF for the Chlor Alkali Sector (IPPC)***
- ***EU Legislation about Wastes***

¹ 1.2 g/t in the case of caustic potash and other specialties

Figure 1: Mercury Recycling in the Mercury Process

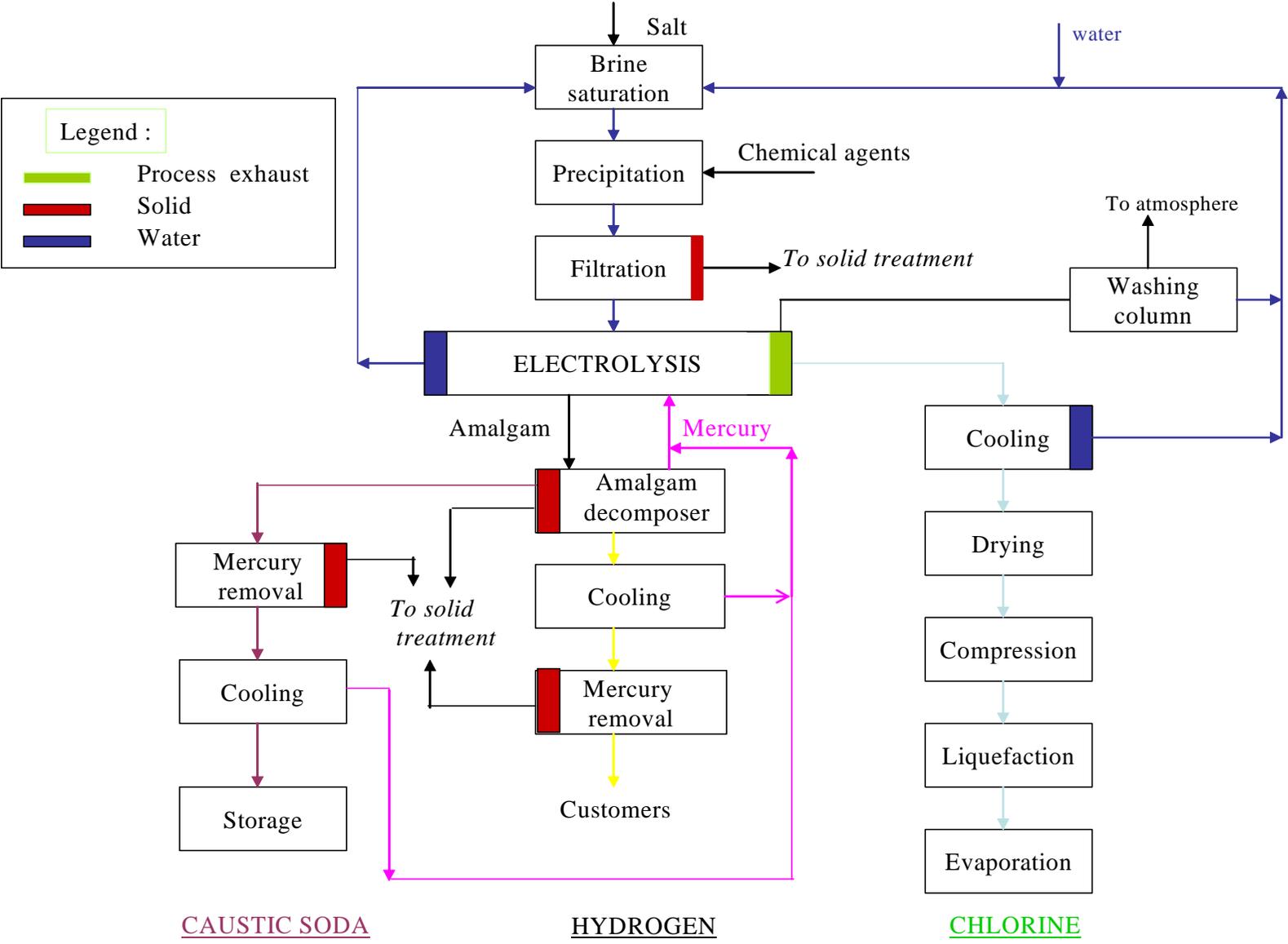
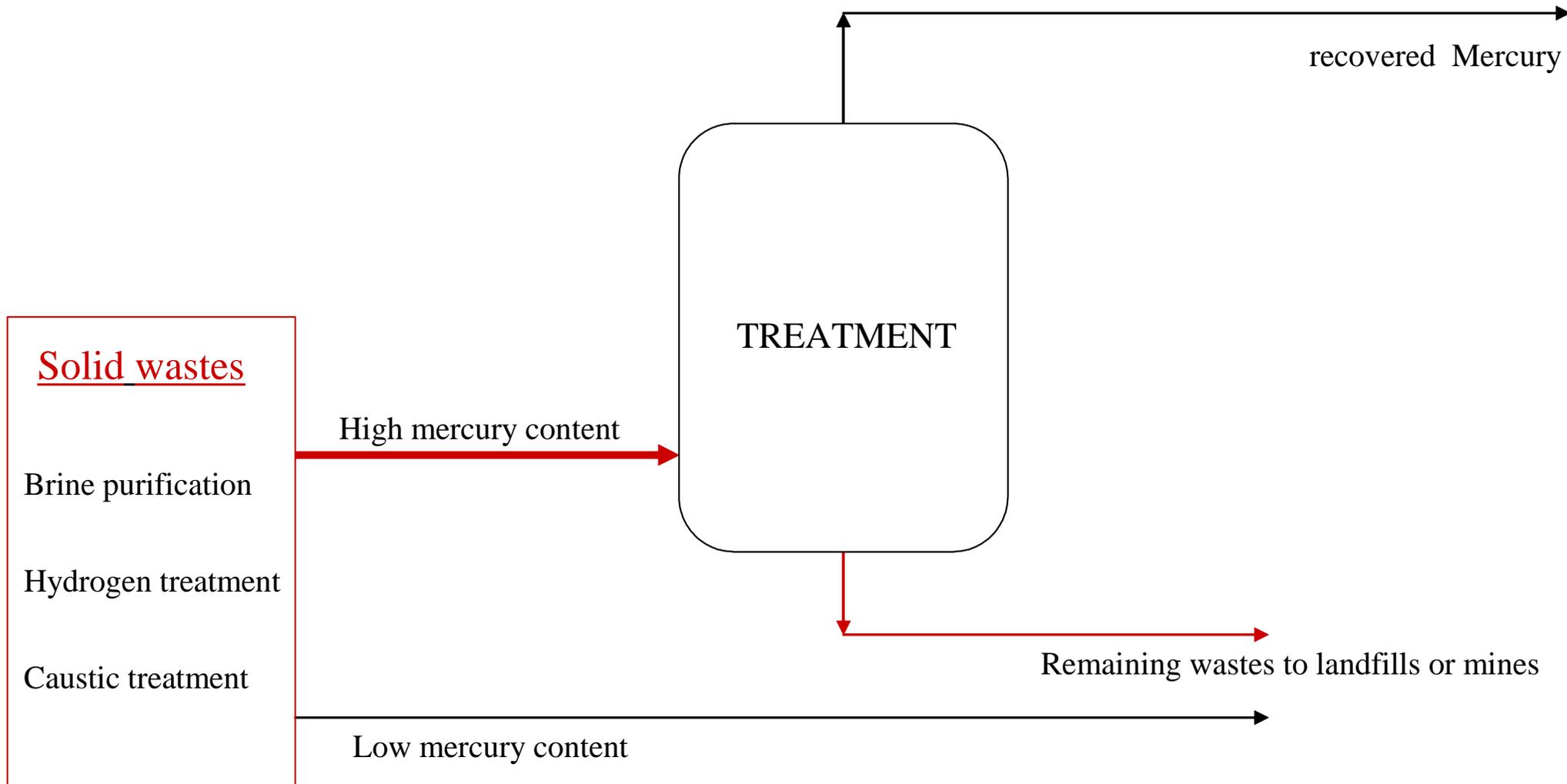


Figure 2: Waste Treatment Possibilities

	Recycle or recovery techniques						Disposal techniques
	Physical/mechanical treatment	Washing	Filtration	Chemical treatment	Electrochemical purification	Distillation	Secured landfill or mines
Old equipment							
Water & brine treatment							
Solids from water & brine treatment							
Caustic treatment							
Solids from caustic treatment							
Gas treatment							
Solids from gas treatment							
Solids from retorts							
Notes	Metallic mercury recovered directly from treatment					For distillation residues, see "Solids from retorts"	

Figure 3: Recovery of Mercury from the Solid Wastes

General case



Industrial consumers of chlorine, engineering and equipment supply companies worldwide and chlorine producers outside Europe may establish a permanent relationship with Euro Chlor by becoming Associate Members or Technical Correspondents.

Details of membership categories and fees are available from:

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Tel: +32 2 676 7211
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