GUIDELINES FOR MERCURY CELL CHLOR-ALKALI PLANTS EMISSION CONTROL: PRACTICES AND TECHNIQUES

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THE CHLORINE INSTITUTE, INC.

Table of Contents

1. INTRODUCTION

1.1 Purpose

The Mercury Control Techniques Task Group has prepared these voluntary emission control guidelines for practices and techniques within mercury cell chlor-alkali plants. These guidelines primarily address enhanced control of mercury emissions and should be used in conjunction with other Chlorine Institute guidelines to establish written procedures at each facility. The intent of these guidelines is to assist the member companies in developing mercury practices and procedures to control mercury emissions.

1.2 Responsible Care

The Institute is an American Chemistry Council Responsible Care® Partnership Association. In this capacity, the Institute is committed to: Fostering the adoption by its members of the Codes of Management Practices; facilitating their implementation; and encouraging members to join the Responsible Care® initiative directly.

Chlorine Institute members who are not American Chemistry Council members are encouraged to follow the elements of similar responsible care programs through other associations such as the National Association of Chemical Distributors' (NACD) Responsible Distribution Program or the Canadian Chemical Producers Association's Responsible Care® program.

1.3 Disclaimer

The information in this guidance document is drawn from sources believed to be reliable. The Institute and its members, jointly and severally, make no guarantee, and assume no liability, in connection with any of this information. Moreover, it should not be assumed that every acceptable procedure is included, or that special circumstances may not warrant modified or additional procedures. The user should be aware that changing technology or regulations may require a change in the recommendations herein. Appropriate steps should be taken to assure that the information is current. These suggestions should not be confused with federal, state, provincial, or municipal regulations nor with national safety codes or insurance requirements.

1.4 Approval

The Board Committee on Mercury Issues approved this guidance document on March 14, 2001.

1.5 Revisions

Suggestions for revisions should be directed to the Secretary of the Institute.

1.6 Reproduction

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2. HOUSEKEEPING PRACTICES

2.1 Prevention of Mercury Leaks

1.) Each facility should track causes and sources of mercury leaks to help prevent reoccurrence.

2.) Leaks from process equipment and piping should be repaired promptly.

3.) The number of piping flanges and fitting should be minimized. Each fitting should be considered a potential leak point.

4.) Non-metallic piping should be well supported and sloped to prevent excessive mercury accumulation and subsequent failure.

5.) Opening of process equipment and other mercury containing vessels should be minimized.

6.) Plugs or caps should be installed in mercury drain/sample valves while not in use.

7.) Draining of mercury contaminated fluids to the cell room floor should be avoided. If draining to the floor is unavoidable the floor area should be washed down immediately afterwards.

8.) Water cover should be considered temporary when used as the primary means to contain mercury emissions. Water cover only slows evaporation of mercury. Mercury should be stored in closed containers.

9.) Facilities should consider re-torquing bolts on mercury cell flanges/side rails after they are placed back in service from maintenance.

2.2 Detection of Mercury Leaks

2.2.1 Design conditions

1.) Cell room floors should be kept clean and free of debris that make mercury inspection and recovery difficult. Storage of nonessential items in the cell room should be avoided. These items make discovery of mercury droplets difficult and they can become contaminated.

2.) Use of wood in the cell room should be avoided. Wood absorbs mercury and is difficult to decontaminate. If wood is used, it should be on a temporary basis only.

3.) Care should be taken to avoid mercury accumulation points in the cell room by properly designing items such as pipe supports, conduit, and cable trays. When selecting materials of construction inside the cell room, select those that are resistant to corrosion and are easy to clean.

4.) Lighting should be adequate throughout the cell room to help in detection of mercury droplets. Lighting should be inspected frequently to ensure that bulbs/fixtures are in working condition.

5.) Cell room floors should be coated with a material that is resistant to absorption of mercury and is colored to provide contrast with mercury droplets.

6.) Concrete floor troughs should have rounded corners to prevent mercury accumulation.

2.2.2 Visual Inspections

1.) Cell room floors and process equipment should be inspected routinely for visible mercury leaks.

2.) In addition to routine inspections, work areas should be inspected as soon as practicable after maintenance activities that could result in spills.

3.) Cell room floor and seam inspections should be performed routinely. Repairs should be made promptly.

4.) Inspections for visible mercury should be conducted routinely with the involvement of plant management and supervisors. The inspection frequency should be set by the plant and be based on past findings.

5.) Routine inspections should be made of mercury storage containers for visible mercury leaks.

2.2.3 Monitoring Inspections

1.) Process areas should be monitored routinely to determine mercury concentration. Deviations from background levels should initiate additional inspections to determine the source.

2.) Some common monitoring methods are listed in the table below.

Table 2-1 – Mercury Monitoring Techniques

Potential Source	Method	Principle of Detection	Typical Equipment
Process Equipment, Non-Combustible Gas or Vapor	1. Portable Mercury Vapor Analyzer – UV Absorption Detector	A sample of gas is drawn through a detection cell where UV light at 253.7 nm is directed perpendicularly through the sample toward a photo detector. Mercury absorbs the incident light in proportion to its concentration in the air stream	Bacharach Model MV2
	2. Portable Mercury Vapor Analyzer – Gold Film Amalgamation Detector	A sample of gas is drawn through a detection cell containing a gold film detector. Mercury amalgamates with the gold film changing the resistance of the detector in proportion to the mercury concentration in the air sample	Jerome Model 411 (*Note - This model is no longer being manufactured.*)
	3. Portable Short-Wave UV Light, Fluorescent Background – Visual Indication	UV light is directed toward a fluorescent background positioned behind a suspected source of mercury emissions. Mercury vapor absorbs the UV light projecting a dark shadow image on the fluorescent background.	Portable short-wave UV light source and any portable fluorescent background.
Hydrogen Gas – Piping & Associated Equipment	Above Methods 1-3	See above	See above
	4. Portable Combustible Gas Meter	Since mercury is likely to be present in significant concentrations in hydrogen from the decomposer until treatment, detection of hydrogen as a combustible gas is a surrogate for mercury vapor.	Any standard portable combustible gas meter.
Area Monitoring	Above Methods 1, 2, or 5. Permanganate Impingement	A known volume of gas sample is adsorbed in $KMnO_4$ solution. Mercury in the solution is determined using CVAA and the concentration of mercury in the gas sample is calculated	SKC Model 224-PCXR4 Gas sample pump or equivalent and LKS Ultrascan Model 709 Flow calibrator or equivalent and CVAA laboratory equipment

2.3 Mercury Cleanup

1.) Mercury spills should be handled promptly and thoroughly. It is the duty of the person that finds visible mercury to initiate cleanup immediately. Cleanup of mercury is only the first step; the cause and/or source should be identified and corrective action taken to prevent a reoccurrence.

2.) Each facility should have defined written procedures for mercury cleanup. Cell room personnel should be trained to handle mercury spills.

3.) Each facility should have procedures that specify wash down requirements. Wash down frequency can be based on visual inspections, monitoring results, or set schedule.

4.) Use of water to wash down mercury from the upper floor of the cell room should be avoided, unless the bottom floor is washed directly afterwards. A droplet of mercury that leaks, or is washed from the top floor of the cell room, and falls to the bottom floor can break into thousands of micro-droplets that are very difficult to see. These micro-droplets have more surface area than the original droplet of mercury resulting in increased evaporation.

5.) Use of high pressure water to wash equipment and floors can be effective. However, high pressure water should be used carefully.

6.) Exhausts from vacuum units should have a mercury control device (i.e. carbon bed).

7.) The vacuum unit's mercury control device should be tested routinely to ensure proper operation.

8.) Mercury vapors from the vacuum unit's collection chamber can continue to saturate the unit's carbon bed while it is not in service. For this reason, the mercury collection chamber of the vacuum unit may need to be isolated from the exhaust carbon bed while the unit is not in service.

9.) Suction hoses for the vacuum unit should be as short as practical with a smooth interior to improve mercury cleanup. Hoses should either be washed or capped after each use.

10.) The following are general guidelines that should be used in developing written cleanup procedures.

   a.) Upon observation of a mercury spill or leak, check to determine the source and take proper action to prevent further release of mercury by containing the spill/leak (e.g. place a container under the leak with water cover).

   b.) Leaks should be repaired as soon as practical.

   c.) If practical, the area should be barricaded to prevent accidental tracking of spilled mercury to other areas.

d.) Mercury should be vacuumed or washed into a floor trap as soon as practical.

e.) If the spill is on the upper floor level, mercury should be recovered and the area rinsed with water. The area of the ground floor under the spill should be cleaned of any mercury that was washed down.

f.) Any mercury that was washed into a mercury trap should be recovered and put into an enclosed container.

g.) Following cleanup, the spill area should be checked with vapor analyzer to verify adequate cleanup.

h.) Proper written documentation should be completed, including actions to prevent a recurrence.

3. CELL MAINTENANCE PRACTICES

3.1 General Maintenance Practices

1.) The following should be considered prior to starting any mercury cell maintenance activity:

a.) Minimize the frequency of the task
b.) Minimize the duration of the "opening"
c.) Maintain conditions that reduce mercury emissions
d.) Avoid spread of mercury to other areas

2.) Each facility should consider utilizing a computer data base system for tracking life of cell/decomposer components. This data should be used to help predict the life of cell parts and allow change-out of the parts before they fail. Each facility should also track the frequency and reasons for opening cells/decomposers.

3.) Each facility should have written procedures for routine cell maintenance activities.

4.) Attempts should be made to prevent leaving a cell component open over night. If the job can not be completed by the end of the workday, efforts should be taken to minimize mercury emissions until work resumes (e.g. cover with water and/or tarps).

5.) Mercury piping flange gaskets etc. that were opened during the maintenance activity should be checked for mercury leaks once they are placed back in service.

3.2 Pre-planning/Preparation

1.) Bolts, clamps, etc. should be lubricated in advance (e.g., using Neverseize, Threadease, or other material) so they will come apart more easily. New bolts can be coated with a material that facilitates disassembly. Teflon-coated bolts may also be considered.

2.) Parts and tools needed for the task should be checked out prior to the job to ensure availability. Where practical, these tools and parts should be assembled the day before the job is scheduled. Some facilities use a tool box or a rolling tool cart with a reel for hoses.

3.) Cells/decomposers should be allowed to cool prior to opening. This cool down period will vary for each facility and should be specified in the facility's written procedures.

4.) Maintenance activities should be scheduled to minimize the duration of the open cell/decomposer. This includes ensuring adequate manpower is available and taking into account the typical duration of the job in relation to the time of day or day of the week. Where feasible, work should be scheduled on a weekly basis.

5.) Hoses that are used to transfer mercury should be flushed with water after each use and/or capped. Connections to piping and equipment that are used to drain mercury should be capped while not in use.

3.3 Cell Opening, Siderail and Endbox Replacement

1.) Facilities should maintain cell switches in good condition. Poor switches can result in hot spots on the cell bottom.

2.) Where feasible, a solid cover connected to a vapor recovery system should be utilized to cover open cells.

3.) The area around and beneath the cell should be barricaded to prevent accidental tracking of potential mercury spills or leaks into other areas. Periodic inspection of such barricaded areas should be made and any mercury spills and leaks should be promptly corrected.

4.) The cell should remain full of water throughout the task until it is necessary to drain the water. Once the task is complete, the cell should be refilled with water as soon as practical until the cell is closed. A moving water cover over mercury is preferred in lieu of stagnant water cover.

5.) Use of a water spray from a distributor positioned near the inlet of the cell should be considered during inlet endbox replacement.

6.) Use of a dam should be considered during cell side/endbox change-out to enable water flow or cover on the cell bottom. A funnel or catch-pan can be used under the cell to capture spills and leaks.

7.) Facilities should consider removing only the minimum number of anode frames during endbox replacement. This allows partial closure of the cell.

8.) Cell repair should remove visible mercury from cell parts before transporting them to another work area, where practical. These parts should be washed above the open cell where the wash water is contained by the cell bottom. When transporting cell components to the work area, the cell parts should be contained (e.g. tarp or catch pan) to prevent spills.

9.) Stepping into the cell bottom should be minimized since decontamination of boots is difficult. Boots should be washed with water before leaving the cell work area. Any mercury contaminated tools should also be washed with water before being removed from the cell work area. Disposable boot covers should be considered.

10.) Mercury contaminated cell parts (e.g., caustic baskets, amalgam traps, pumps, etc.) should be cleaned before releasing to maintenance for repairs. Each facility should have written procedures for cleaning of mercury equipment. This may include steaming, flushing with water, or flushing with a weak bleach solution.

11.) Each time a cell is opened for maintenance, cell components should be inspected and replaced if necessary. A checklist may be useful.

12.) Mercury butter that is removed from the cell bottom should be placed in containers that have water cover. These containers should be washed above the cell bottom before being transported in the cell room to prevent spreading of mercury droplets. Mercury butter should be immediately processed or put into enclosed containers.

13.) Once the cell is reassembled, the area should be washed down and checked for mercury using a mercury vapor analyzer.

3.4 Decomposer Maintenance

1.) Decomposer maintenance can be one of the highest mercury exposure tasks in the cell room. Each facility should make efforts to reduce the frequency and duration of opening the decomposers.

2.) One of the factors that can impact carbon life in a decomposer is the compression of the graphite bed. Each plant should have a written procedure and defined frequency for adjusting the graphite compression.

3.) Consideration should be given to having have a spare decomposer or decomposer basket completely assembled with graphite to change out with decomposers requiring replacement.

4.) If practical, the decomposer should be purged with an inert gas to the hydrogen system before disassembly and purged with an inert gas through a mercury vapor control device after assembly.

5.) Mercury and caustic should be drained from the decomposer into closed. containers.

6.) The decomposer should be filled with cool caustic or water before opening to reduce mercury emissions.

7.) Precautions should be taken to avoid mercury spills when changing graphite packing in decomposers. Graphite and/or the graphite baskets should be washed with water before removing from the decomposer. Tarps or containers should be used while transporting used graphite to prevent mercury from being spilled.

8.) If a vacuum system is used to remove graphite from a decomposer, the vacuum unit should employ a mercury vapor control device (e.g., carbon bed).

9.) Once mercury contaminated graphite is removed from the decomposer it should be immediately retorted or stored in closed containers until it is processed for reuse or disposal.

10.) Mercury contaminated graphite should not be placed directly on the floor.

11.) Facilities should consider the use of vibrators to pack decomposers with graphite.

12.) The decomposer should be temporarily covered (e.g., with a FRP plate and gasket) when work is interrupted. The decomposer should be filled with water or caustic when practical. If practical the temporary cover can be connected to a vapor recovery system.

13.) The decomposer maintenance procedures should include a step to ensure the decomposer mercury distribution system is installed properly. This can be accomplished by verifying proper mercury flow over the distributor and/or checking with a level.

14.) Once the decomposer is reassembled, the area should be washed down and checked for residual mercury using a mercury vapor detector.

4. CELL OPERATING PRACTICES

Each facility should evaluate their operating practices from an emissions minimization standpoint. Many systems impact emissions directly, (e.g. endbox ventilation system, caustic filtration system, etc) others impact emissions indirectly (i.e. necessitate the premature opening of cells and decomposers).

4.1 <u>Cell Opening Reduction</u>

There are three major causes of premature cell openings: cathode problems, anode problems, and premature cell part failure.

4.1.1 Cathode Problems

Stability of the mercury cathode is critical to optimal cell performance and maximum length of time between cell openings. Amalgam stability can be affected by brine quality or mercury flow. A good quality salt source and effective brine treatment will result in low butter buildup in the cell and thus a more stable cathode. Turbidity and/or impurity limits should be set and adhered to. Poor mercury pump performance, inadequate mercury inventory in the cell, poor mercury distribution in the inlet or outlet end box, non-level cell bottom, or irregularities in the cell bottom can result in an unstable cathode.

4.1.2 Anode Problems

Common anode problems are related to anode planarity, electrical connections, anode coating, and anode adjustment. These problems can result in poor cell performance and shorter than optimal duration between cell openings.

a.) Anode planarity is important to achieve a balanced current flow through the cell. Individual anode planarity can be effected by anode supplier quality, as well as shipping problems. Each anode should be examined to ensure flatness. A planarity tolerance for an individual anode should be established. Recurring problems with individual anode planarity should be addressed with the anode supplier or shipper. It is important to ensure the anode plane is as flat as possible during assembly. A leveling table should be considered for adjusting the anodes to within set tolerances. This leveling table should be checked periodically to ensure planarity. Lastly, it is important to ensure the anode plane is parallel to the cell bottom. Each facility should have procedures to ensure individual anode planarity, anode plane assembly flatness, and anode installation level.

b.) Good electrical connections both within the cell as well as between cells are important to achieve optimal cell performance. Good current distribution across a cell does not ensure a consistent anode to mercury gap. Inconsistent electrical connections will result in inconsistent anode to mercury gap in a cell that is adjusted to have equal current distribution. Connections from copper stems to anodes should be made in accordance with the manufacturer's recommendations. Any electrical connections on the cell should be cleaned periodically (e.g., clean flexible connections to stems and bussbars when an anode is installed). Each facility should have a program in place to measure resistance of and/or clean intercell buss connections periodically. Connections that cannot be safely cleaned while the cell room is operating should be cleaned during a scheduled cell room outage.

c.) Damage to anode coating can result in poor cell performance and require a cell to be opened. Anode coating damage can be caused by uneven coating wear, brine impurities, anode damage, mechanical damage during cell assembly, and/or poor coating supplier quality control. The system and methods used to monitor the cell's current distribution should be verified periodically to ensure adequate quality data is being used to protect anodes from damage. Care should be exercised when assembling anodes to avoid damaging the coating. Brine impurities should be closely monitored to avoid contaminants that will blind or passivate the anode coating.

4.1.3 Premature Cell Part Failure

The failure of cell parts will result in the need to open the cell. Cell parts fail because they have reached the end of their useful life, they were mechanically or chemically damaged, or they were subjected to high cell temperatures.

a.) Care should be taken to schedule cell part replacement to coincide with other scheduled work that requires opening the cell (e.g., anode replacement). If a cell is opened for anode replacement and a particular part's history indicates that it will fail before the next time the cell is scheduled for anode replacement, consideration should be given to replacement of that part prematurely. This will avoid having to open the cell merely to replace that piece.

b.) Care should be exercised when installing cell parts to avoid damage that would shorten the expected life.

c.) Hydrocarbons that may be present in the brine may contribute to the shortening of the life of cell parts.

d.) High temperatures can also shorten the life of cell parts. Care should be taken to avoid excessive brine outlet temperature due to inadequate brine flow for a given cell voltage. Mercury temperature from the decomposer may also be excessive, thus shortening inlet endbox life. Consideration should be given to cooling the mercury if this condition exists.

4.2 Endbox Systems

1.) Endbox, caustic basket (i.e., overflow or funnel) and mercury amalgam seal pot covers should be kept closed and sealed unless short-term access is required. Cell room operators should visually check these items each shift, document any problems, and take corrective action to maintain the equipment in good condition.

2.) Bolts and C-clamps that are used to hold the endbox covers in place should be inspected. Stoppers, cups, etc., that are used to seal access ports in the covers should be kept in good sealing condition. These covers should be sealed adequately to minimize emissions. Gaskets or other appropriate material should be used to maintain the seal between the cover and the endbox, the amalgam seal pot, and the caustic basket.

3.) If the end boxes are not sealed, a level of water should be maintained to cover mercury in the endboxes adequately, and the flow should be sufficient to prevent steaming. The endbox water return and/or supply header temperature should be monitored to ensure endbox water flow and that cooling is adequate to prevent boiling in the endboxes. Each facility should establish and maintain a target supply temperature that ensures no steaming occurs.

4.3 Hydrogen Collection

1.) For facilities equipped with a hydrogen cooler on each decomposer, the outlet hydrogen temperature should be monitored and maintained to minimize mercury losses from the cell into the common hydrogen system. A well-defined operating range and measurement frequency should be established, based on system design, fouling rates, etc.

2.) Contact of hydrogen condensate with the floor should be avoided. This condensate should be collected and used in the process where feasible (e.g., used as decomposer or endbox feedwater).

3.) The mercury content of the stream downstream of the final mercury emission control device should be measured periodically. Corrective action should be taken should the system show signs of break-through, malfunction, etc.

4.4 Endbox Ventilation

Mercury emissions from the endbox ventilation system should be measured periodically. Key parameters (e.g., temperature and pressure) should be monitored on a regular basis to give indication of malfunction. Any malfunction that would adversely impact mercury emissions should be corrected as soon as possible.

4.5 Caustic Collection

1.) Solids and liquids that are collected from back flushing the caustic filtration system should not be drained to the cell room floor or run in open trenches.

2.) The solids collected from the caustic filtration system should be kept under a liquid cover, in a closed container, or in a vessel vented to a treatment system until they are removed for processing. The frequency of solids removal should be sufficient to prevent carryover of these solids to other vessels or sumps where mercury recovery is more difficult.

4.6 Brine Processing

1.) An effective brine treatment operation is critical to optimal cell operation. Poor brine treatment leads to increased mercury butter formation or elevated cell gas hydrogen concentration. These situations may require opening a cell(s), thus increasing the potential of mercury exposure to maintenance personnel and increased mercury losses.

2.) Brine should not be purged to the cell room floor.

4.7 General Cell Operation

1.) Decomposer temperatures should be monitored periodically. This temperature can be defined as caustic outlet temperature, mercury outlet temperature, or decomposer body temperature. Each facility should have defined temperature limits and procedures for actions to take to correct the process when outside these limits.

2.) Low mercury flow and/or high outlet amalgam concentration can promote mercury butter formation on the cell bottom. Outlet amalgam concentration should be analyzed or mercury flowrate measured periodically. The frequency of analyses should be determined by historical trends of flow rate changes. Each plant should have defined limits and instructions detailing steps to be taken if amalgam concentration (mercury flow) falls outside these limits. The target should be such that an adequate mercury thickness is achieved across the cell bed. Continuous flow measurement may be more desirable than amalgam measurement since no sampling is required, thus reducing mercury exposure potential to personnel.

3.) Each facility should have a program to check and/or adjust the slope and level of the cell bottoms. The frequency should be based on that facility's historical data.

4.) Mercury pump pressure or decomposer mercury level should be checked periodically. The plant should have procedures for handling surging or fluctuating flows.

5.) Each cell's current distribution should be continuously monitored, and alarmed for high current conditions (electrical short, unbalanced current distribution). Actual anode damage history may be useful in determining at what level of protection to set the current deviation alarm.

6.) Each facility should consider a program to wash or brine flush cells on a routine basis. A routine washing or flushing schedule will remove butter buildup from the cell bottom without opening the cell. Some facilities may be equipped with a wiper that can be run along the cell bed during flushing to help in this butter removal. Butter buildup on the cell bottom increases hydrogen formation in the cell, and makes cell adjustment more difficult. The cell mercury inventory (level) should be checked when a cell is washed and mercury should be added if necessary.

7.) Anode adjustment should consist of three major steps:

- adjusting the anode-to-anode planarity,
- adjusting the anode plane to the cell bottom,
- and then adjusting of individual anode studs (stems) to compensate for irregularities in mercury flow.

It is recommended that the current flow through individual anode studs be measured each time a cell is rebuilt. Individual studs should be adjusted to obtain a balanced current profile across the cell. This adjustment should take place before butter buildup on the cell bottom. Once individual stems are adjusted, they should not be routinely readjusted. If current distribution within the cell changes, it is probably due to butter buildup and the cell should be washed or flushed.

8.) Cathode adjustment should consist of mercury flow regulation. This adjustment should take place after an anode is installed, but before butter buildup on the cell bottom.

4.8 <u>Thermal Treatment Operations (where applicable)</u>

1.) The thermal treatment area should be visually inspected to verify proper maintenance and housekeeping practices periodically. These inspections should be documented as required.

2.) The ambient mercury in air concentration in the thermal treatment unit area should be monitored, and corrective action should be taken when needed.

3.) Process vapor outlet from the thermal treatment unit should be checked periodically and per reporting requirements. This information may be helpful in determining the performance of the exhaust scrubbing system or carbon bed loading.

4.) Thermal treatment units should be operated under vacuum. If practical, automatic shutdown of the unit should occur upon loss of vacuum.

5. MERCURY RECORDKEEPING (ACCOUNTABILITY)

Each facility should track mercury usage and inventory to the best of their ability. Guidelines can be found in a Chlorine Institute Guidance Document “Guidelines for Conducting a Mercury Balance” (Reference 6.1)

5.1 Mercury Storage

1.) Documentation is needed for the mercury received at the plant and amount withdrawn from storage. Access to the mercury should be clearly defined and restricted.

2.) Collected mercury should be stored in vessels designed to prevent mercury emissions.

5.2 Mercury Collection/Redistribution

1.) The responsibility for collecting and tracking mercury from the various collection points in the plant should be established.

2.) Consideration should be given to the installation of low point drains on process lines and equipment potentially containing mercury to facilitate recovery and collection. Likewise, consideration should be given to the installation of mercury traps on appropriate process inlet lines to existing equipment (e.g., large flat bottom waste water holding tanks) that do not have low point drains. New vessels and piping systems should be designed to facilitate mercury recovery and minimize mercury accumulation.

3.) Mercury should be added to the cells based on actual measurement of mercury inventory in a cell (i.e., weight or mercury level). Mercury should not be added to cells based solely on high amalgams, low pump pressure, or high hydrogen. These may be reasons to remove the cell from service, brine or water flush the cell and then re-check the mercury inventory.

The amalgam concentration may be high because too much mercury is bound-up in the cell as butter, and flushing the cell will free the mercury. The goal should be to add mercury to a cell only when it has been determined that the level is truly low.

Addition of mercury to a cell between scheduled flushes should be a flag that there is a problem with the cell (e.g., mercury leaking into another process system or high decomposer temperature). Since flushing of the cells is conducted routinely, the amount of mercury addition to each cell should be consistent and easily tracked.

4.) Mercury that is added to or removed from the cells (mercury butter) and mercury that is collected outside the cells should be tracked by weighing the mercury and maintaining accurate records.

5.) Each facility should utilize a system for tracking mercury usage, collection, and redistribution. There are several computer databases that can be used.

6.) Each facility should track mercury collection rates in each process system (i.e. hydrogen, caustic, outlet endbox water, inlet endbox water, sumps, thermal treatment units). These rates should be reviewed per the facility's tracking schedule to determine trends.

7.) A comparison between the amount of mercury collected outside the cells and the amount of mercury added to the cells should be performed per the facility's tracking schedule.

8.) Mercury collection points should be well defined and the collection frequency specified for each point. Examples include:

- Hydrogen header drains and sealpots
- Hydrogen chiller and compressors
- Caustic header drains
- Outlet endbox surge tank
- Inlet endbox surge tank
- Mercury traps in recycle water headers
- Vapor vent surge tank and vapor vent header drains
- Sumps in cell room trench system
- Recovered mercury from thermal treatment units
- Caustic Receivers

9.) Each collection point should have a specified normal weight range and any abnormal collection weights (high or low) should be addressed.

5.3 <u>Determining Working Mercury Inventory</u>

Each plant should have a written procedure for determining the weight of mercury in a cell. See Reference 6.1.

6. REFERENCES

6.1 *Guidelines for Conducting a Mercury Balance*, an Internal Guidance Document; The Chlorine Institute: Washington, DC, **May 1999**.