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

INTERNAL DOCUMENT

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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

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