

MERCURY CONTROL TECHNOLOGY ASSESSMENT

Ray-O-Vac Corporation

Portage, Wisconsin

Preliminary Survey Report
for the Site Visit of
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Submitted to:

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FOREWORD

A Control Technology Assessment (CTA) team consisting of members of the National Institute for Occupational Safety and Health (NIOSH) and Dynamac Corporation, Enviro Control Division met with representatives of Ray-O-Vac, a Corporation of INCO Electro-Engery, in Portage, Wisconsin on September 22, 1981 to conduct a preliminary survey on the techniques used to control worker exposure to mercury. Participants in the survey were:

Dynamac Corporation

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Mr. David D'Orlando, Engineer
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Ray-O-Vac Corporation

Mr. Frank Clingan, Environmental Compliance Manager
Mr. Richard Goff, Environmental Program Manager
Mr. David Valent, Plant Manager
Mr. Rod McKenzie, Manager of Engineering
Mr. John Collins, Plant Engineer
Ms. Marjorie Paskey, Plant Representative for Teamsters Local 695
Mr. Gary Fredricks, Plant Representative for Teamsters Local 695

The preliminary CTA was completed in one day. The study included a process tour, documentation of control equipment, and review of monitoring programs.

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PLANT DESCRIPTION

The major products produced at the Portage, Wisconsin Plant are mercury-zinc and silver-zinc button cells which are used for micro power applications such as watches and hearing aids.

Button cells have been produced in Portage since 1963. The manufacturing facility was moved from an older plant in downtown Portage to a new plant in 1977. However, much of the cathode powder mixing operation is still conducted at the old plant, a 60 year old converted creamery with tile walls. The plan to relocate the production facility began in 1976 when it was determined that adequate control for operations involving the use of mercury and silver could be attained only by relocating to a new building. The new plant is a block wall and corrugated steel structure which occupies 6,000 square feet. The plant layout is illustrated in Figure 1. Work areas involving the use of mercury or mercury containing items are the Zinc Amalgamation Room, the Mercury Mix Room, the Consolidation Room, the Hand Assembly Room, the Vault and the Production Assembly (Cell Assembly) Area.

This plant currently employs a total of 599 workers. The plant operates two 8-hour shifts.

PROCESS DESCRIPTION

A typical mercury button cell manufactured at this facility consists of an anode assembly and a cathode assembly combined and sealed in an outer can (Figure 2). Mercury is used in the production of both the anode and the cathode.

ANODE

The anode is a zinc-mercury amalgam produced by blending zinc powder with elemental mercury. This operation is conducted in the Zinc Amalgamation Room.

Zinc Screening

Powdered zinc arrives at the plant in polypropylene containers. These containers are emptied into a stainless steel hopper which feeds to a Sweco vibrating screen. The Sweco has two screens of different mesh sizes; one removes oversize particles, the other allows undersize particles to pass through. The on-size particles are moved to the outside of the screen by the machine's vibrating motion. These particles then fall through a discharge chute into a cone shaped bin.

Amalgam Blending

The bin containing zinc is lifted above the "fixed-shell" blender using a hoist. A butterfly valve at the bottom of the bin is opened allowing the zinc to flow from the pod through a slide gate port and into the blender.

Mercury is poured into an exhausted stainless steel container located over the blender and is gravity fed to the blender through a tube. During the mercury filling process, the blender is sealed.

The mercury and zinc are blended together to form an amalgam. The blender is unloaded by opening a valve on the bottom allowing the amalgam to flow through an enclosed chute into a material transport pod similar to the one used for the zinc powder. The pod of amalgam is lifted by hoist to the amalgam screening area.

Amalgam Sizing

Amalgam is emptied from the pod into a covered hopper located over a Sweco screen. A screw auger is used to transport the amalgam from the hopper into the top of the Sweco. The Sweco used for amalgam sizing operates in the same manner as the one used for zinc sizing. On-size particles flow through a discharge chute into a material transport pod. Quart size bottles of amalgam are filled from these pods at a work station in the Zinc Amalgam Room. These bottles are transported to the Cell Assembly Area. Off-size particles flow through discharge chutes into covered, crimp-close containers. These containers of reject material are reclaimed by an outside contractor.

CATHODE

The cathode which is a mixture of mercuric oxide and other ingredients, is pelletized and enclosed in a metal can.

Blending

Most of the mixture for the cathode pellets is presently made by Ray-0-Vac at another plant. The Portage plant does have a planetary mixer, housed in a glove box (see engineering controls) in the Mercury Mix Room, which is periodically used to produce the cathode mixture. The mixture is a combination of mercuric oxide and other ingredients.

Slugging

Cathode powder produced in-house or at the other facility is inspected to determine particle size and density before pressing into pellets.



MERCURY CONTROL STRATEGY

ENGINEERING CONTROLS

Ventilation Systems

There are three ventilation systems serving the rooms where mercury or mercury containing materials are handled. These systems handle general room exhaust and local exhaust ventilation.

Baghouse Filter Exhaust/Supply Systems--

The Zinc Amalgamation Room, Mercury Mix Room, Silver Mix Room, and Consolidation Room are served by 3 exhaust/supply systems (Figures 3 and 4). Each system has an induced draft blower which draws exhaust air through the baghouse, a heat exchanger and a charcoal filter (Zinc Amalgamation Room only). The air is exhausted through a stack. The heat exchanger recovers heat from the exhaust air and the recovered heat is used to preheat outside supply air drawn by a blower adjacent to the exhaust unit. The benefits of this system are: 1) combined mercury particulate removal (baghouse) and vapor removal (charcoal filter) and 2) reduced fuel costs due to heat recovery. Specifications on these systems were not available at the time of the survey.

Charcoal Filter Recirculation System--

The Cell Assembly Room has a recirculation air system with a series of charcoal filters mounted on the exterior walls of the building (Figure 5). Air is drawn through the separate charcoal filters along the wall and combines into a central supply duct.

Equipment Enclosures

Processes in the plant which involve the mixing of powders and the use of pelletizing or consolidating machinery are enclosed in exhausted plexiglass structures.

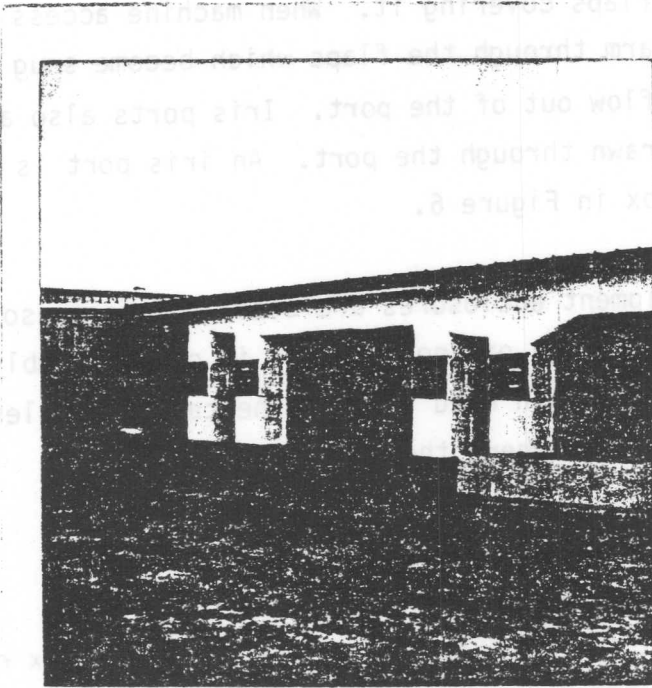


Figure 5. Cell Assembly Room Charcoal Filter System

One of Ray-O-Vac's most interesting controls is a specially designed material transfer container for powders. The basic powder container is a covered control bin with a spring-closed inlet on the top cover and a hand wheel activated butterfly valve at the bottom (Figure 8). These bins can be mounted on carts with roller bearing supports and can be maneuvered to the position above or below mix equipment by using a hoist. Material is introduced to the bin through a flanged delivery chute which is inserted through the inlet gate and attached by fastening quick-release clamps to the flange of the chute.

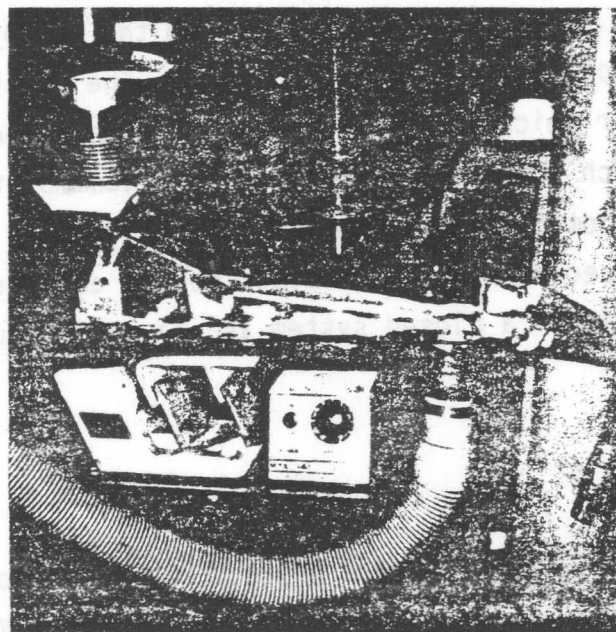


Figure 7. Tablet Deduster

The hopper is covered hopper usually a covered hopper opening in the top which is below the valve at the bottom. These bins are used because the powder is material. This Amalgamation Control. The hopper is installed in the material transfer bin. The hopper in this process is described in Section III. Local exhaust ventilation consisting of two fans is provided for the opening to the fixed-shield hopper (Figure 9). Additional fans include a fan hood mounted above the hopper which feeds the screw conveyor over the screen, and a fan hood at the point where the super mesh bag separator feed (Figure 10).

The following types of personal protective equipment are used at the facility to control worker exposure to mercury:

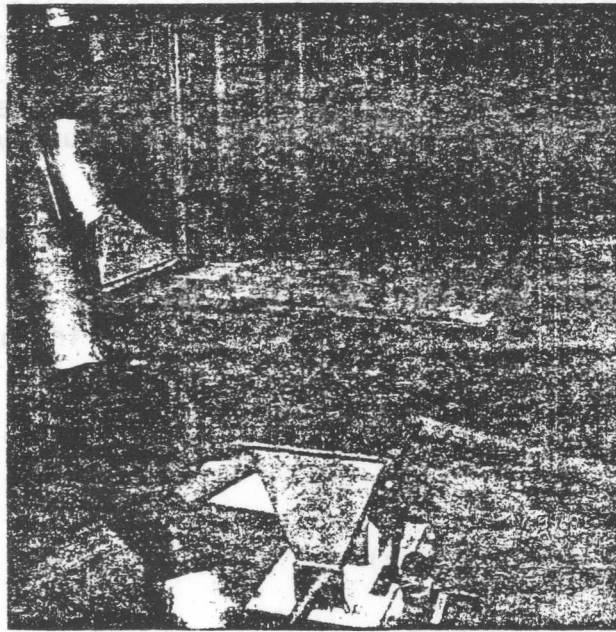


Figure 10. Slot Hood at the Zinc-Amalgam Feeder

MONITORING PROGRAMS

Biological Monitoring

The biological monitoring program at the facility consists of periodic urinalysis for mercury. Employees working in the Cell Assembly Area, Mix Room and Consolidation Room are monitored every 3 months. All other employees including office personnel are monitored every 6 months. Single voiding samples, rather than 24-hour composite samples, are collected. If the mercury concentration in the worker's urine exceeds 0.20 milligrams per liter (mg/L), the employee is monitored on a weekly basis. If the concentration remains elevated, the employee is relocated to an area where the potential for exposure to mercury is lower. The employee is reinstated when the urine-mercury concentration falls below 0.20 mg/L.

Plant representatives have reported a general reduction in Cell Assembly employee's urine-mercury concentrations following the installation of the ventilation system in 1980. This system recirculates air in the Cell Assembly Room through activated carbon filters.

Air Contaminant Monitoring

Different monitoring techniques are routinely used depending upon the form of inorganic mercury present. In the Cell Assembly Area, where previous sampling has indicated that mercury is present in the form of a vapor, air sampling is conducted using a direct reading mercury vapor detector (Bacharach MV-2 and Jerome Model 401). In addition, personal monitoring using gold coil mercury vapor personal dosimeters (Jerome Corp) is conducted in the Cell Assembly Area. This sampling is conducted twice a week. In the Mix Room and Consolidation Rooms, where mercuric oxide (particulate) is present, samples are collected on cellulose ester filters using personal sampling pumps. Sampling to determine the time-weighted average exposure is conducted. Both personal and area samples are collected. Sampling is usually conducted 2 or 3 times per week in the Mix Room and every 2 months in the Consolidation Room.