FINAL REPORT

MERCURY CONTROL TECHNOLOGY ASSESSMENT STUDY

Ray-O-Vac Corporation

Madison, Wisconsin

Preliminary Survey Report
for the Site Visit of
September 23, 1981

Contract No. 210-81-7107

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Submitted to:

Alfred A. Amendola, Project Officer
National Institute for Occupational
Safety and Health
Division of Physical Sciences and Engineering
4676 Columbia Parkway
Cincinnati, Ohio 45226

Submitted by:

Donato R. Telesca, Manager
Engineering Department
Dynamac Corporation
Enviro Control Division
11140 Rockville Pike
Rockville, Maryland 20852

DISCLAIMER

Mention of company name or product in this report does not constitute endorsement by the National Institute for Occupational Safety and Health.

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-Energy, in Madison, Wisconsin on September 23, 1981 to conduct a preliminary survey on the techniques used to control worker exposure to mercury. Participants in the survey were:

Dynamac Corporation

Donato Telesca, Manager, Engineering Department
Mr. David D'Orlando, Engineer
Mr. Robert Reisdorf, Industrial Hygienist

National Institute for Occupational Safety and Health (NIOSH)

Ms. Stephanie Spottswood, Associate Project Officer

Ray-O-Vac Corporation

Mr. Frank Clingan, Environmental Compliance Manager
Mr. Richard Goff, Environmental Program Manager
Mr. Kenneth Kemp, Plant Manager
Mr. Dennis Schmudlach, IAM Representative
Mr. Elmer Davis, UAW Representative

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INTRODUCTION

CONTRACT BACKGROUND

The Mercury Control Technology Assessment Study has been initiated to assess the current technology used to protect the worker from exposure to hazardous levels of mercury. The objective is to identify and evaluate the exemplary methods employed by industries in controlling worker exposure to elemental mercury and mercury compounds. A result of the study will be the publication of a comprehensive document describing the most effective means of controlling emissions and exposures. This report will be available to companies which handle mercury so as to transfer technology within the major mercury using industries. The study will also identify directions where additional research is necessary.

JUSTIFICATION FOR PRELIMINARY SURVEY

Preliminary surveys are intended to generate information about the control strategies used at various facilities and they will be used to determine where in-depth surveys will be conducted. This plant was selected for a preliminary survey because of the controls in effect to protect workers from exposure to mercuric chloride used to make an electrolyte solution.

SUMMARY OF INFORMATION OBTAINED

An opening meeting was held during which the objectives of the program were disussed with plant representatives and local union representatives. Information on the production of zinc-carbon batteries was given to the members of the survey team. A detailed process tour was given with emphasis on the production of the mercury containing cathode base mix. The plant health monitoring program, work practices, and personal protective equipment were discussed.

PLANT DESCRIPTION

The plant is located in an urban area. The products produced at this facility are C, D, and AA size zinc-carbon batteries. Both general purpose and heavy duty (longer life) batteries are produced.

The plant consists of four major buildings (Figure 1) located on the 9.6 acre facility. The oldest building, Building #1, was built in 1916. Operations involving the use of mercury were conducted in the southeast section of this building until 1970, when it was moved to Building #7. Mercury operations are presently conducted in the west quarter of this corrugated steel building (Figure 2).

There are a limited number of workers in the area where mercuric chloride powder is used. One worker handles the powder each shift.

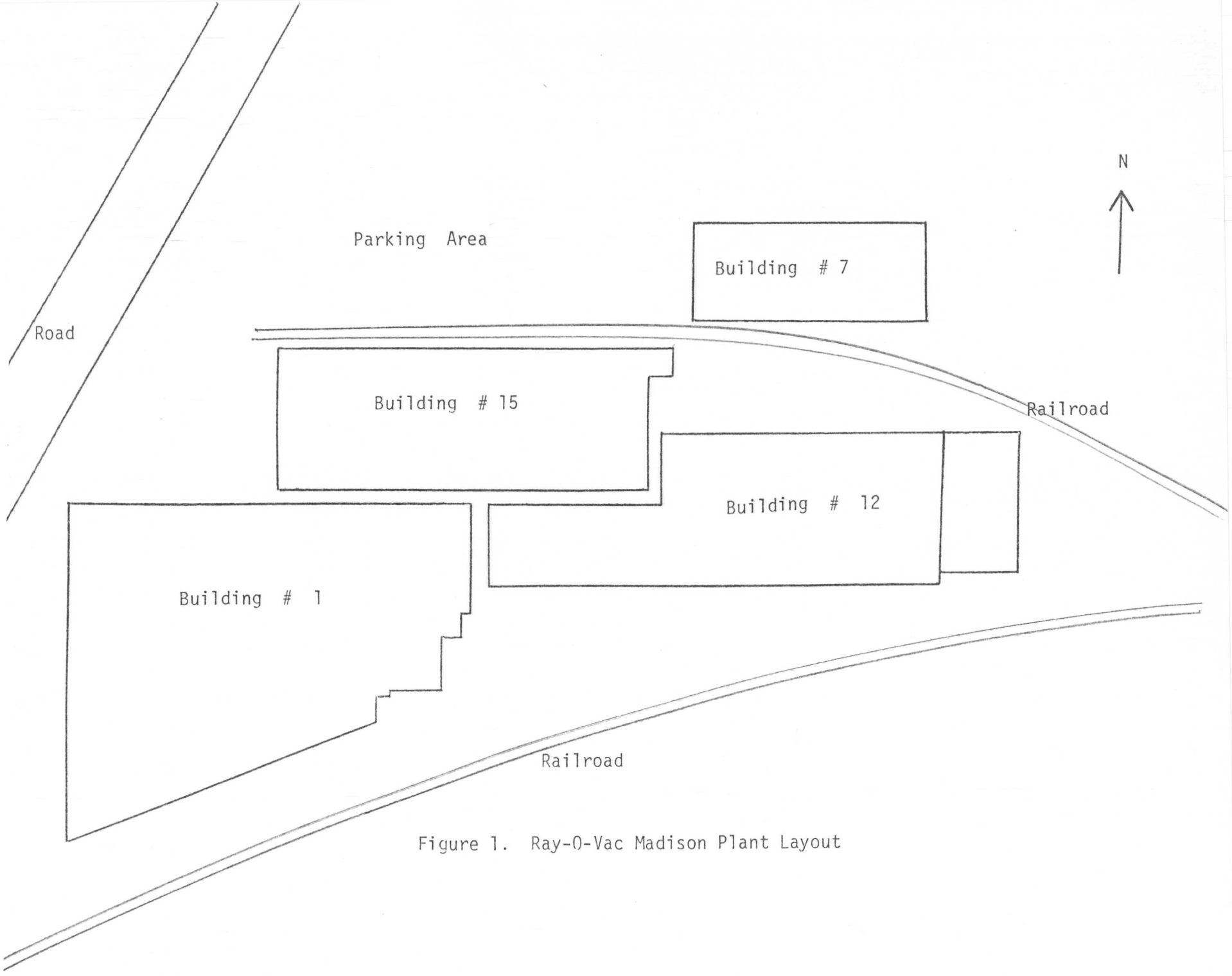

Figure 1. Ray-O-Vac Madison Plant Layout

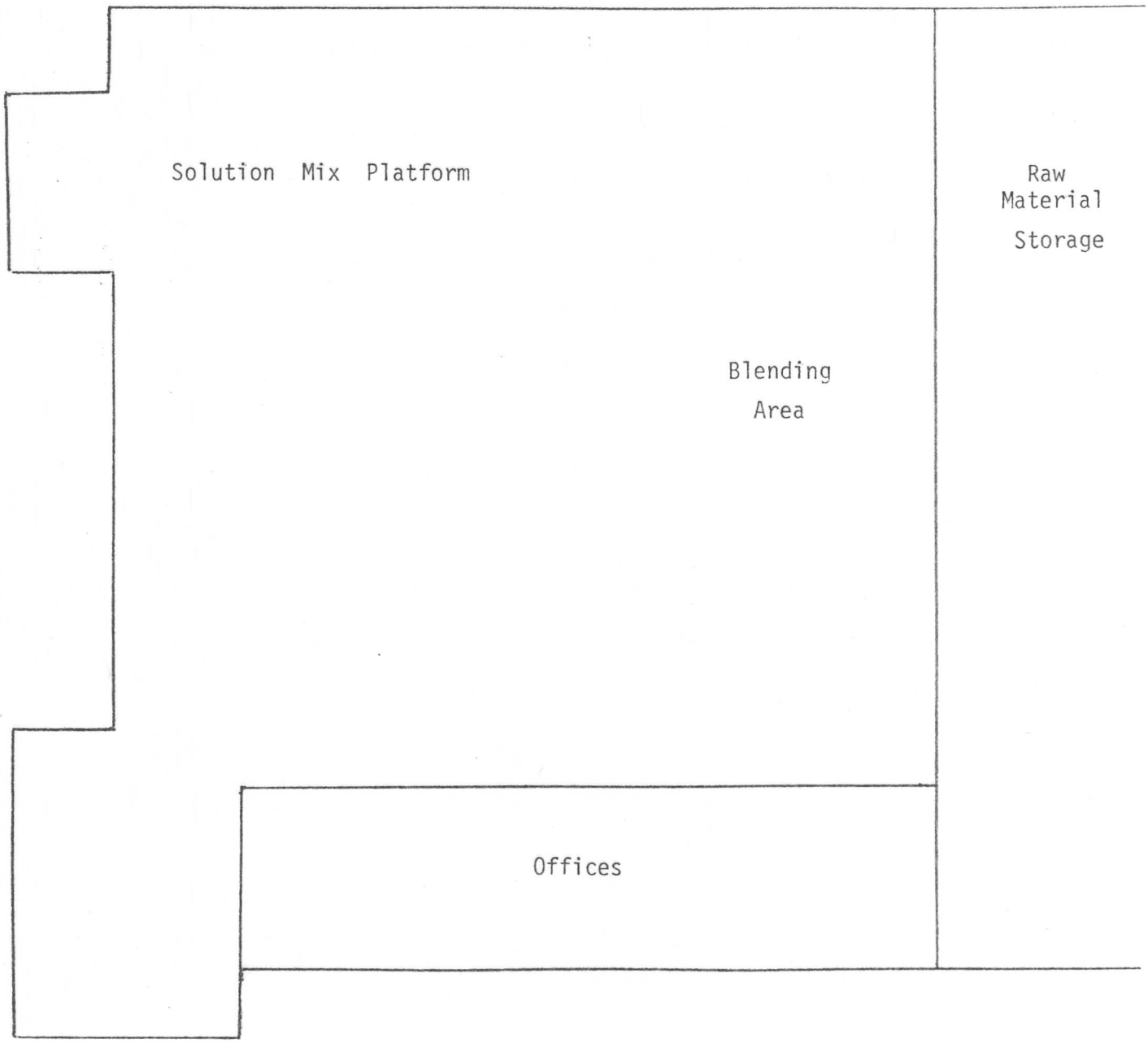

Figure 2. Building #7 West End Layout

PROCESS DESCRIPTION

Mercuric chloride is used in the electrolyte solution, an ingredient of the cathode base mix used in the zinc-carbon cell. The mercury amalgamates with the zinc can (anode) and serves as a corrosion inhibitor. Mercury in the cathode mixture reaches the zinc can by migration through a paper separator.

Mercuric chloride arrives at the plant in 15-pound plastic lined fiber drums. It is mixed with a zinc chloride solution in one of two mix tanks with agitators on the mix platform. Zinc chloride is gravity fed to the mix tank from a hold tank, the cover of the mix tank is removed, and two drums/bags of powdered mercuric chloride are cut open and dumped into the solution. The tank is covered during mixing.

The resulting electrolyte solution flows by gravity to a centrifugal pump in the Blend Area. All flows are controlled by pneumatic control valves. Solution is sprayed into an Abbe Mixer containing a mixture of dry ingredients which includes manganese dioxide and other ingredients. The resulting mixture is the cathode base mix which has a consistency similar to that of damp dirt. When the mixing cycle ends, the mixture is gravity fed through a slide hatch and conveyed into large fiberglass bags.

Cathode mix is transported to the Production Area in where it is inserted into a paper-lined zinc can. A carbon pencil is inserted through the center of the mixture and a support washer is placed inside the can to contain the mixture. At this stage the cathode mix is no longer exposed to ambient air. Asphalt is used to seal the cell, and a metal cap is added to the top of the can. The top of the cell is crimped closed around the metal cap, and the completed battery is ready for testing and packaging.

MERCURY CONTROL STRATEGY

ENGINEERING CONTROLS

It was reported that the plant used polyalomar bags (water soluble) as a control for mercuric chloride in the Mix Area . At the time of the site visit, this control was not in effect. Mercuric chloride was to be purchased in polyalomar bags, which would dissolve in the zinc chloride solution. This would enable the worker to dump the unopened 15-pound bag of powder directly into the mix tank, thereby avoiding potential exposure to the chemical when cutting the bag open. The future use of this control at the plant will be investigated. No other controls directed specifically at preventing worker exposure to mercury were in effect during the survey. However, the baghouse ventilation system used to control general particulate exposure in the building may contribute to the control of particulate mercury.

PERSONAL PROTECTIVE EQUIPMENT

Mix operators wear disposable respirators (Wilson 1410, NIOSH Approval No. TC-21C-214, approved for dusts) to protect against mercuric chloride particulate. The respirators are worn during the addition of mercuric chloride to the mix tank. In addition, cotton work gloves and cloth coveralls are also worn.

WORK PRACTICES

Potential exposure to mercuric chloride exists during the addition of the compound to the mix tank, an operation which lasts several minutes. Mix operators are aware of the potential hazard of working with mercuric chloride (a white finely divided powder) and take the following steps to minimize its dispersion.

- -the bags of mercuric chloride are poured as close to the mix solution as possible.
- -empty plastic bags are placed inside a container for disposal.

MONITORING PROGRAMS

Biological Monitoring

Although only two mix operators may handle mercuric chloride, all eleven workers in the department/building where the electrolyte solution is produced and used take part in the biological monitoring program. The program involves urinalysis for mercury every six months. Single voiding samples rather than 24-hour composite samples are collected.

If a worker's urine-mercury level is at 0.20 milligrams per liter (mg/L) or higher, the worker is rechecked on a weekly basis. If the level remains in excess of 0.20 mg/L the worker will be relocated to an area of lower potential exposure. The employee will be reinstated when the urine-mercury level is below 0.20 mg/L. Generally, workers' urine-mercury levels are much lower than 0.20 mg/L at this facility.

Air Contaminant Monitoring

Air sampling to determine mercury concentrations (as a particulate) has been conducted in the Cell Assembly area where the electrolyte is part of the cathode mixture. Air Sampling results indicate the presence of mercury in the range of 0.0003 to 0.0015 mg/M^3. Sampling is no longer conducted routinely in this area.

Air sampling in the electrolyte mix area was conducted by OSHA in 1977 and by plant representative in 1978. The results were -0.005 and 0.002 mg/M^3 respectively. Samples for mercuric chloride were collected on particulate filters and analyzed for total mercury.

Other Programs

The medical program at the facility is administered by an occupational health physician and a nurse. The program includes semi-annual physical examinations. Emphasis is placed on the detection of toxic levels of manganese, which plant medical representatives and the workers compensation carrier believe is a greater potential problem than mercurialism at this facility.

CONCLUSIONS AND RECOMMENDATIONS

The use of mercuric chloride at this plant is probably infrequent enough that no additional mercury controls are necessary. However, the dissolvable polyalomar bags of mercuric chloride, which were thought to be in use, were of considerable interest to the survey team. It is recommended that the use of dissolvable chemical bags should be investigated further by NIOSH for possible use at other plants.