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File 110-16

PRELIMINARY CONTROL TECHNOLOGY ASSESSMENT

OF

MANSFIELD SANITARY, INCORPORATED
Perrysville, Ohio

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U.S. DEPARTMENT OF HEATH, EDUCATION, AND WELFARE
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health
4676 Columbia Parkway
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March, 1982

Purpose of Survey:	To perform a preliminary survey of the ceramic plumbing fabrication operations at Mansfield Sanitary, Incorporated.
Employer Representatives Contacted:	William F. Gorrell, Safety Director Vivian Etzwiler, Industrial Nurse Gary Young, Personnel Director
Employee Representatives Contacted:	None
Standard Industrial Classification of Plant:	SIC 3259, structural clay products
Analytical Work Performed By:	None

ABSTRACT

A walk-through control technology survey was conducted of a contiguous ceramic plumbing facility and operation at the Mansfield Plumbing Products Company, Perrysville , Ohio on January 20, 1982. This plant uses a variety of clays, parting compounds, and color additives purchased from several different suppliers. The raw materials are blended, formed, dryed, fired, packaged, and shipped. A preliminary assessment of the control technology, including engineering controls, work practices, monitoring, and personal protective equipment was made during the survey. Based on discussions and observations, a detailed assessment may be planned of at least some of the control technology in use at this operation.

INTRODUCTION

The manufacture of ceramic plumbing products involves worker exposure to a variety of potentially harmful chemical and physical agents. Some of the agents of concern are; silica, numerous color additives, temperature extremes, and noise. Our literature review and contacts with people, either directly or indirectly, with ceramic plumbing products indicates that there is control technology in place in the industry to prevent the over exposure of workers to these agents.

The Engineering Control Technology Branch of the Division of Physical Sciences and Engineering, NIOSH is conducting a research study to assess and document the control technology being used to minimize worker exposure in the ceramics industry. Exposures to the above mentioned harmful chemical and physical agents have been documented as a cause of a variety of health problems. This walk-through survey was conducted to obtain information on the use of control protective equipment, when making ceramic plumbing products and to determine the suitability of this plant for a detailed survey.

The primary contact was the company's Safety Director, William F. Gorrell. During our walk-through survey, we met briefly with other management personnel and talked to a number of personnel physically involved in the manufacture of ceramic plumbing products.

PLANT DESCRIPTION

Mansfield Sanitary, Incorporated (Perrysville) is a Division of Interface Corporation. Mansfield produces several million plumbing units per year of high-fired, vitreous china plumbing (bathroom) product lines in a variety of sizes, shapes, and colors. The company normal workforce (non-union) is 550 employees operating three shifts per day, seven days per week, but is presently at reduced levels (475 employees and one and two shifts on certain assembly lines).

Except for the front office-reception area, all of Mansfield's operations are under one roof, an area of approximately, 500,000 square feet. The building is a one story, 1971 vintage, concrete block wall and concrete floor structure with open bays, metal trussed, and no basement. Isolated from the general plant area are; bulk raw material receiving and mix weighing, offices, cafeteria, laboratory, and foundry-metal working operations. The foundry-metal working operations are not part of this control technology assessment and will not be further mentiond in this report.

RAW MATERIALS

Materials received in bulk are flint from Millwood, Ohio and clays including feldspar, pearless china clay, and nepheline syenite from various suppliers. Other raw materials are received in bags, drums, and cartons and include: Millwood sand from Central Silica Company, Zanesville, Ohio; Gum (sodium carboxy methyl cellulose) from Hercules Company; Cultozine Fuchsine from Cyanamid; Industrial Plaster from U.S.G.; G490 glaze stain (blue glaze) from

Harshaw; yellow stain from Drakemelv; glaze (preceipitated calcium carbonate) from Albacar; magnesium aluminum silicate, talc, feldspar, and zirconium silicate (a pacifier) from various other suppliers.

PROCESS DESCRIPTION

Dry bulk raw materials (clays and flint) are received by rail and truck. Bottom dump railroad cars off-load directly into a hopper beneath the tracks. The material is conveyed underground to a bucket elevator, discharges onto a belt conveyor and diverted into one of five storage silos. Trucks are pneumatically unloaded into an underground hopper and the material conveyed underground to the bucket elevator used for railroad cars. The remaining raw materials is received packaged in bags, drums, and cartons and is stored until used.

Desired clay mixes are loaded by by screw conveyor from the storage silos into a batch car. The batch car is equipped with a weigh scale. The loaded car is trammed on an overhead monorail to a vibrating feeder. The car botton dumps into the feeder, the materials is elevated to an upper level by bucket conveyor, discharges onto a belt conveyor, and diverted into one of several heated blungers. These blungers are slow-speed, ceramic lined blenders equipped with a large paddle. (The plant also has three high-speed blenders.) Water is added to the clay mixtures, blended until a temperature of 160^{o}F is reached, and the mix discharged through a fine mesh shaker screen into a holding tank. Diaphragm pumps move the clay mixture (slip) to the reservoir, four 25,000 gallon tanks acting as a backup system. (To maintain uniform quality and color, each days run are madeup and mixed in the reservior). From the reservoir, the slip is pumped to the various pouring stations.

The company uses three methods to product its products; bench casting, assembly line, and automated assembly line. Bench casting was the way all bathroom fixtures used to be made and is entirely a manual system. The caster is given a set of molds to prepare (soaking and drying). He applies parting dust (talc) to the inside of the mold, pours the slip, turns out (removes the product from the mold), assembles the product (toilets are cast in three parts), white finishes (removes parting lines and fills in where needed such as pin hols), and sets the product on a cart while still in the "green" (damp and soft) stage. Bench casting is still in use at Mansfield's operation.

The assembly line is faster than bench casting and used to product a variety of products. The steps are similar to that used in bench casting, applying parting dust, assembling molds, pouring the slip, turning out and assembling the products, white finishing, and setting the "green" product on carts. As in bench casting, the plaster mold absorbs the water creating a void in the mold. Additional slip is added to fill this void before being turned out.

The most modern assembling operation is the automated assembly line, using micro-switches. The molds remain on a closed loop assembly line. Except for manually applying parting dust and white finishing, the operations are automatic; mold assemblying, pouring, turning out, and assembling of product.

To allow for the void created during forming in the mold, a cone attached to the mold is automatically filled during pouring to allow for the absorption. Even on the automated line, a considerable amount of hand work is required.

Certain of the fixtures produced are "hollow-cast" such as toilet bowls. As in other castings, the slip is poured into the mold. In a zone of approximately one-half inch next to the plaster mold, the moisture is drawn out of the slip allowing the product to set up. The remainder of the slip within the mold is drained leaving a cavity and resulting in hollow-casting. Once the product is turned-out, the molds must be dried before they can be reused. For the plaster molds from bench casting and assembly line, warm air currents are used. The open molds are placed on tables in a large open area. The air is heated by scattered heaters as well as heat from the kilns and ovens. A grid of ceiling or paddle fans over these molds created gentle down drafts of warm air. The average drying time is 24 hours, somewhat longer during humid summer days.

For the plaster molds used on the automatic assembly line, they remain on the line in a closed loop system. After turning out the product, the molds remain open. Jets of warm air are blown into the mold, drying the mold in 8 hours. The plaster molds used in these three methods of casting are good for approximately 100 pourings.

The "green" product, after white finishing, is dried either in the area with the ceiling fans or ovens for approximately 24 hours. The dried product is then placed in the slip storage area. Any discarded clay from broken products, unused slip, or other source is recycled. Once the product has been glazed, it can no longer be recycled.

Glazing is what gives the finished product its vitreous appearance and color. The glaze is mixed in one of four procelain lined ball mills. The mills are charged with porcelain balls (grinding media) varying in size from 1/2 to 2 inches in diameter. The mills are maintained three-quarters full with the balls. Water, glaze mix, and color are added to the mills, ground and discharged through a fine mesh screen and pumped to the glaze reservoir. The glaze particles have to be fine enough to be applied to the product with spray guns.

Products from the slip storage area are transported on carts to the glazing stations. The smaller items are placed in spray boothes on a lazy-susan type turn table and sprayed using a hand held spray gun. For the larger items, they are placed on conveyors fitted with turntables. The hard-to-reach areas are sprayed by hand, the item then enters the booth fitted with automatic spray guns to finish glazing the item. The glazed items are placed back onto the carts. The final step before the product enters the kilns is to blow off the excess dust.

The product is fired in one of seven 125 foot long kilns to 2200^{o}F for 12 hours. The glaze, which is almost liquid, and the clays are baked together. The fired product are removed, allowed to cool, and sent to the grading and fitting area. Each item is inspected by sight and sound, a quick visual check

and struck with mallet for a "ring" test. (A cracked product will not produce the same characteristic ringing sound produced by an undamaged product.) The items are assembled, packaged, and stored until shipped.

MOLD CONSTRUCTION

New ideas and redesigns are brought to the Molding Shop. A case mold made of fiber glass and larger than the desired product is fabricated. Fiber glass is used for its wear resistant qualities. From the case mold, a working plaster mold is made. This mold is allowed to age a couple months and then is soaked in water before being used. (The mold must have a certain water content before it can be used.) These plaster molds are good for approximately 100 pouring.

VENTILATION

There appeared to be several good examples of the use of ventilation at Mansfield Plumbing Products. These occurred at loading stations, transfer points, automatic assembly line, and the glazing stations. In the area of loading bulk clay into the batch car, when the screws conveyor is turned on, the exhaust ventilation system is activated. A 12-inch diameter hose directly over and a couple feet above the batch car captures the airborne dust generated during loading. Also, the operator wears a (AOSIU60) particulates filter respirator as added protection.

Where the raw clay material is transferred from the batch car to the vibrator feeder and from the conveyor belts into the blungers, there is exhaust ventilation. As the batch car dumps through a two foot by four foot floor grate into the feeder, there is a capture hood the full length of the grate and at floor level pulling air across the grate opening. Along the conveyor belt, 8-inch diameter echaust ducts are located two pipe diameters down stream from the transfer points. There was considerable dust in this area but its source was not evident.

There are two sources of airborne dust due to the use of parting dust; applying it to the molds and its dropping off the mold while being dried. Both exhaust ventilation and work practices are used to minimize exposures. Exhaust ventilation is used when the dust is being applied. As the molds are drying, exhaust ventilation is used on the automatic assembly line. In the areas using ceiling fans to create convection currents, work practices are used. This involves the use of scrappers in place of brooms for preliminary floor cleaning and wet washings of the floors during off shifts as part of the daily routine. Also observed was the use of vacuum sweeping of the floors in the slip storage area. Where dry broom sweeping is used, an oil based sweeping compound is used to reduce airborne dust.

The exhaust ventilation booths, used for the spraying of glaze, appeared to be very effective. A combination of push-pull, point source, and general exhaust booth ventilation are in use. Fans are located behind the operator, moving

the air past the operator's breathing zone and into the exhaust hood. Hand spraying on larger items is done directly under a capture hood (16-inch diameter flex-hose approximately 16 inches above the item). Also, each booth has one or more exhaust ports to capture the airborne glaze. The company feels that these exhaust booths operate more effectively during the summer.

A couple of areas in which the dust controls appeared to be insufficient are; conveyor belt transfer points of bulk raw clay material into blungers and blowing of excess dust off of the glazed items before they enter the kilns. Each of these areas could add to the background dust levels as well as result in worker overexposure in the dust blowing-off area.

The building is under negative pressure although it did not appear to be excessive. The negative pressure is due in part to the kilns (each consuming 2500 cubic feet of air per hour) and the various exhaust hoods.

SAFETY AND HEALTH

The Safety program includes monthly inspections by a committee of employees. The committee is composed of both management and labor. Five representatives from the various parts of the company are selected to serve for one year. Also, the Safety Director makes unscheduled and frequent inspections between the regularly scheduled safety inspections. In the eleventh month, the five representatives are asked who they would like to have replace them on this committee.

The companies First Aid Station is operated by a full-time industrial nurse. The company doctors are Csar H. Cole and H. Z. Kutneothara at Kettering Hospital. The nurse makes spirometry examinations, which were started in the past year, on some of the employees. Also, she can make audiometric and visual examinations.

For approximately 30 years, the company also provided Aluminum Therapy for those employees desiring participate. It was discontinued in 1980 due in part to the unavailability of replacement parts for the aluminum ball mill.

The company does have very good employee medical records that should be available with the approval of the parent company. Any request for such records should be directed through Gary Young, Personnel Director and William Gorrell, Safety Director.

CONCLUSIONS AND RECOMMENDATIONS

The personnel at the Mansfield Plumbing Products Company were very cooperative. Some of the control technology used to control potentially harmful physical and chemical agents will warrant an in-depth evaluation and documentation in this study. Also, some of their use of work practices and personal protective equipment as controls may also warrant in-depth evaluation and documentation. Any in-depth studies should be scheduled when the controls to be evaluated and documented are in a full production mode.