

Please forward to: Dave Whitfield, WPH-03

D. A. WHITFIELD
MATERIALS AND STANDARDS SECTION
PITTSBURGH OFFICE - 3 WPH

MEMORANDUM

→ Cc: Ginny Hammenrath
Bob Ormerken
Bob Stemler/J. D.
Ann McKee
Scott Anderson
PHS-06

1981-11-17

RE: ENGINEERING STANDARD ON REMOVAL OF REFRACTORY LINING IN
ALUMINUM FURNACES--ENGINEERING STANDARD 26.1.7

The attached standard is the result of comments received for precautions necessary on the removal of refractory containing asbestos or phosphate bonding.

Please review and return by 1981-12-15 with any comments you may have regarding this standard.

H & S
Industrial Hygiene

D. A. WHITFIELD
Mechanical Engineering Division

DAW:bh

Attachments

cc: E. E. Rumberger/T. B. Bonney - AB 6
J. R. Stemler/A. B. McKee - ATC
J. Damiano - ATC
S. Anderson - AB 6
R. C. Holtz - 3 WPH

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Need comments from:
Bob Ormerken
Ginny Hammenrath
Chemical & Ceramic

Most of my comments are editorial. Please note:

- ① Section 2.2: Paragraphs 4 and 5 are superfluous... also paragraphs 3 and 6 can be combined as indicated.
- ② Section 2.2: Paragraph 7 should be deleted. This detail is not necessary. Kitegawa tubes are not commonly used. The industrial hygienist will know interference and sensitivities of other detector tubes.
- ③ Finally, it is still important for this standard to address recommended procedures for removing the hearth. The current practice of oxygen lancing will evolve large clouds of dust.

- Joe Damiano
81 Nov. 21.

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PLAINTIFF'S
EXHIBIT
AL-916



Engineering Standard

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REMOVAL OF REFRACTORY LININGS IN ALUMINUM MELTING AND HOLDING FURNACES

1. SCOPE

This standard covers precautions necessary when removing the refractory lining materials from melting and holding furnaces. The precautions cover a) Phosphate bonded refractory materials and b) Asbestos containing refractory materials. Portions of this standard are taken from OSHA 1910.1001. Refer to Alcoa Hazardous Materials Data Sheet No. 40 for Asbestos and No. 213 for Phosphine.

2. PHOSPHATE BONDED REFRACTORY

2.1 General. There have been several dramatic incidents wherein Alcoa employees engaged in dismantling furnaces have been exposed to phosphine. These exposures have been associated with the use of phosphate-bonded alumina refractories. Phosphate bonded refractory material is commonly found in melting and holding furnaces and ladles. The phosphine problem was first brought to attention during the repair of a DV-38 hearth that had failed prematurely. In order to minimize the dust generation that accompanies dismantling work and to expedite the disintegration of the reacted brick, the workers wet down the floor of the furnace. Their use of the jackhammers brought unexpected results. Striking the DV-38 hearth with a jackhammer produced minor firecracker-like explosions. Small matchlike flames continued to burn in the area where the explosions had occurred. Although an odor was noted, it was interpreted as being the usual acetylene-type that is noted frequently during brick removal. Subsequently, similar incidents were reported. Because the generated gases were spontaneously flammable, phosphine was suspected early, and it eventually was positively identified.

Pyrotechnics have also been reported during the removal of brick that contains no phosphate. Therefore, the presence of fireworks is not positive proof of the presence of phosphine. On the other hand, if explosions and flaming occur, the work's industrial hygienist, with the aid of a detector tube, should determine whether or not phosphine is present.

2.2 Removal of Refractory. The removal of phosphate-bonded refractory materials should be done in the dry condition. All respirators should be NIOSH approved. The selection of appropriate respiratory protection for asbestos (dust respirator, powered air purifying respirator, supplied air respirator, etc.) should be based on the concentrations of asbestos present. It should be noted that the 3M 9906 respirator is not approved for protection against asbestos. The respirators should be equipped with valves so that, on

exhalation, moist breath does not contact the dust collected on the filters and generate phosphine gas. If the refractory contains asbestos, additional precautions may be necessary. (Reference Section 3)

② If for some reason one of these furnaces is wetted down, it will be necessary for the Works Industrial Hygienist to sample the working area to insure that there are no hazardous concentrations of phosphine. If there is any need for a person to enter a contaminated area (i.e., where the phosphine (PH₃) concentration is above the 0.3 ppm TLV) he will require personal protection, such as a gas mask respirator with a canister approved for phosphine (color coded as yellow with an orange stripe around the bottom), an airline respirator, or a self-contained breathing apparatus, depending on the concentration of phosphine.

③ Moisture in the air can release phosphine from stored reacted brick following its removal from a furnace. Therefore it should not be stored in a confined place, especially if employees work in the area. ~~Any concerns about the safety of the area it will be a simple matter to sample the air with a detector tube.~~

④ Because of the relatively high toxicity of phosphine, we must take a rather conservative position to be assured as completely as possible that our employees are protected. Dismantling of a furnace is an infrequent operation of a relatively short duration. For this reason, chronic exposures just don't exist.

⑤ Water is necessary to release the phosphine from the phosphine in the reacted brick. When wetted, the phosphate-containing brick releases phosphine gradually. Furthermore, the spontaneous ignition that often accompanies the release of phosphine results in the conversion of phosphine to a much less toxic material, phosphorous pentoxide.

⑥ However, it must be noted that even the normal humidity of the air is capable of reacting with the phosphine and releasing small amounts of phosphine. The refractory gradually loses its reactivity when it is exposed to air.

⑦ The presence of NH₃ will not cause any appreciable interference for those who have occasion to use the Kitagawa PH₃ detector tube to measure this gas. Hydrogen sulfide, a gas that will interfere, was not detected in the products given off by the brick. Arsine and stibine will also interfere but they are not expected to be present. The above can be interpreted to mean that when sampling

should be made
by the Worker
industrial hygienist.

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the gases produced by the reacted brick with a Mitagawa detector tube the length of stain produced on the tube, for all practical purposes, can be attributed to phosphine.

2.3 Phosphine Gas. Phosphine is a colorless gas with an odor described as like that of garlic, decayed fish, or onions.

The symptoms of acute phosphine poisoning reported include nausea, vomiting, diarrhea, thirst, sensation of pressure in the chest, back pains, dyspnea, feeling of coldness, and stupor or attacks of fainting. Reference Alcoa Material Safety Data Sheet No. 213 for complete health and safety information, and proper precautions.

3. ASBESTOS CONTAINING REFRACTORIES

3.1 General. Most of the furnace equipment presently in service in our Ingot Plants was designed, fabricated and/or purchased during an era when most of the best insulating and refractory lining materials contained asbestos. Many of these pieces of equipment have recently been relined with asbestos free materials, but some still have the asbestos containing materials in place. Relining, remodeling, or even scrapping these items requires special procedures to prevent asbestos exposure of either the worker or of non-involved employees.

Employee exposure to asbestos shall be maintained below the OSHA criteria: 2.0 fibers/cc, at an 8 hour time-weighted average, and 10.0 fibers/cc as a ceiling limit. (Reference *Alcoa Material Safety* Hazardous Material Data Sheet #40 for additional information.)

3.2 Outside Contractors. It is imperative that an outside contractor know he is dealing with asbestos. It is recommended that a copy of this standard and a copy of Alcoa Material Safety Data Sheet No. 40 (asbestos) be included with either the specifications or the order, as well as verbally calling the contractor's attention to the hazard.

The Works Industrial Hygienist should monitor nearby Alcoa work stations during the demolition to insure that Alcoa employees are not overexposed to asbestos.

Alcoa has no direct liability under the asbestos section of OSHA 1910.1001 for the contractor employees while the contractor is demolishing the furnace. The contractor should be required to furnish approved respiratory equipment and special clothing for his employees as noted in OSHA 1910.1001(c)(2)(iii).

3.3 Removal Procedures. Initial site preparation involves taking precautions to contain entrained asbestos fibers to the immediate work area. In the case of a melting furnace or holding furnace, a total enclosure made of plastic sheeting is recommended if feasible.

^{should}
It ~~has to~~ be erected in such a manner that it can be dismantled, when the old lining has been removed, so that all the dust is contained. Attaching plastic to the inside of a lumber frame will allow for easy removal and disposal in approved containers. The size of the enclosure must be large enough to contain the power equipment, a high efficiency vacuum cleaner, and several 55 gallon specially marked steel drums.

Employees engaged in the removal or demolition of structures or equipment covered or insulated with asbestos, shall be provided with respiratory equipment and with special clothing.

3.3.1 Respirators. The Works Industrial Hygienist shall prescribe appropriate respiratory protection to assure that asbestos exposures are below the limits prescribed in 3.1. Based upon previous industrial hygiene sampling of exposures during removal of refractory linings, a properly fitted dust respirator will generally provide a sufficiently high protection factor.

3.3.2 Clothing. Disposable coveralls, gloves, hair covering (under the hard hats) and respirators approved for asbestos shall be worn at all times when work is in progress in the enclosure. The coveralls are to be taped at the ankles and wrists. All disposable clothing is to be removed and discarded each time a workman leaves the work area. Shoes must be wiped with a damp rag or vacuumed so that the area outside the enclosure is not contaminated. Before leaving the contaminated area for any reason, the workmen shall vacuum the protective clothing, remove the head covering, unzip the coveralls and carefully peel them off, with gloves and shoe coverings remaining attached. The respirator is removed last. The disposable clothing and used filter cartridges shall be disposed of in plastic bags, appropriately labeled for asbestos waste. Respirators shall be cleaned and sanitized at the end of every shift. Workers must wash all skin surfaces that have been exposed to asbestos before eating, drinking, smoking or leaving work. No smoking or eating is permitted while in the enclosure.

Should there be phosphate containing refractories, the use of water as a dust suppressant is not permitted (see Section 2).

Hydraulically driven hammers or jack hammers equipped with exhausts exiting outside of the dusty area should be used for removing the refractory lining. Removal of the asbestos containing insulation is best done with pry bars having a vacuum nozzle running continuously at the breakaway point. This material shall be bagged as it is removed rather than permitting it to pile up for cleanup at a later time. The objective for doing this carefully and effectively is to minimize entrainment of dust and potential employee exposures to asbestos.



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Caution signs shall be provided and displayed at each location where removal of refractory linings containing asbestos is in progress.

3.4 Cleanup and Disposal. The cleanup of the enclosed area after the lining materials have all been placed in the properly marked containers must be thorough. The inside of the plastic enclosure, the furnace shell, both the inside and outside surfaces that could be dusty, and finally the floor must be cleaned with the special vacuum cleaner. When this is all completed, the plastic sheeting can be taken down, continuously folding the contaminated side to the inside, and placed in a drum for disposal.

The disposal of all asbestos containing waste material as well as contaminated material requires special procedures. Asbestos containing insulation, contaminated refractory rub-

a high efficiency vacuum cleaner.

ble, the used disposable clothing, loose material picked up with the vacuum cleaner, wiping rags, and finally the plastic enclosure sheeting shall be packaged in plastic bags and then placed in sealed containers. Caution labels shall be affixed to all scrap, waste, debris, and other products containing asbestos, or to their containers. All plastic bags and sealed steel drums shall be affixed with labels that read:

CAUTION
CONTAINS ASBESTOS FIBERS
BREATHING ASBESTOS DUST MAY CAUSE
SERIOUS BODILY HARM

These drums must then be disposed of in an approved land fill.

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