



Babcock & Wilcox

a McDermott company

PLAINTIFF'S EXHIBIT

CHV-775b

Insulating Products Division

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Dear Kaowool Customer:

We are attaching a copy of our booklet entitled "Health and Safety Aspects of Refractory Ceramic Fibers." This covers the test work done over the past years as well as the current work being conducted.

Right now we know of no known chronic health effects in humans from long-term exposure to refractory fibers. We are a member of the "Thermal Insulation Manufacturers Association" (TIMA) who have designed and are funding new studies relating to animals and to people. Results from these studies will not be available for another 3 to 5 years.

The booklet reports on two known investigations recently conducted which have studied the effects of refractory ceramic fibers, but these were only on animals. The results are outlined and while the results differ in many ways, there is little doubt that a higher level of caution now exists about the possible health implications of exposure to ceramic fiber. We will keep you advised of any further developments. In the meantime, we recommend that refractory ceramic fiber products be handled in accordance with the procedures outlined in the attached booklet.

If you have any questions or need any additional information, please contact Mr. Miguel Pereyo, Manager of Operations (404-796-4254), or Mr. James Fernstrom, Business Manager, Ceramic Fiber (404-796-4310).

Sincerely,

Norman K. Russell
Manager
Marketing and Sales

Chevron BB
015750

Refractory ceramic fibers are amorphous, glassy, silica products which are created from thin masses of synthetic raw materials or naturally occurring kaolin clays. The family of fibers manufactured by Babcock & Wilcox is marketed under the trade names of Kaowool, Unifelt, Ultrafelt, CE Kaowool, Kaolana, Fibrilana, Saber Bloc, Pyroloc, Uni-Bloc, and Pyro-Log.

Refractory ceramic fibers (RCF) have been produced in commercial quantities for approximately 25 to 30 years. Due to its relatively short history, we feel that it is necessary to establish through testing whether or not the health effects of these fibers are identical to those reported for glass and rockwool fibers. The RCF industry, through the auspices of the Thermal Insulation Manufacturers Association (TMA), is sponsoring animal inhalation studies as well as epidemiological studies of workers in the industry. Until such time as definite answers are available, it is advisable to follow common sense work practices designed to minimize exposure to these refractory ceramic fibers.

Recommended Handling Procedures

Occupational Exposure Guidelines.

Refractory ceramic fibers (RCF) are not currently regulated in the occupational environment by any federal or state health agency. Babcock & Wilcox has established a work place exposure guideline of 2 fibers/cubic centimeter as a result of the medical and scientific findings available at this time. The work place exposure guideline refers to an airborne concentration of a substance, time weighted average over a 7 to 8-hour workday and a 40-hour workweek, under which is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. No employee should work without protective equipment in environments where airborne concentrations exceed 10 fibers per cubic centimeter even for short periods of time.

Industrial sampling data obtained at Babcock & Wilcox manufacturing locations where refractory ceramic fiber products are manufactured show that exposures are below the work place exposure guideline of 2 fibers per cubic centimeter.

Field installations where confined areas have poor ventilation, it may be possible to exceed the work place exposure guideline of 2 fibers per cubic centimeter. In such situations, temporary exhaust ventilation should be installed. If this is not feasible, the use of respiratory protection and specified work practices must be required as detailed in this document.

Refractory ceramic fibers pose an additional health concern after the product has been in service. Crystalline silica in the form of cristobalite is formed. Cristobalite exposures may cause lung disease (silicosis) if overexposure occurs. The Occupational Safety and Health Organization (OSHA), United States Department of Labor regulates exposure to cristobalite under 29 CFR 1910.1000, Table 2-3, Mineral Dusts.

Recommended Work Practices

The procedures recommended in the following section are good practices that apply when working where all types of dust can be generated.

Loose Clothing. Wearing long-sleeved shirts and blouses, loose at the neck and wrists, along with long pants and caps will protect skin areas from coming in contact with refractory ceramic fiber. Loose clothing also helps prevent fiber from rubbing into the skin. Depending on job conditions, gloves may be necessary.

Minimizing Dust. Mechanical dust collection systems should be used whenever refractory ceramic fiber materials are machine sawed or sanded. Handling and cutting should be done in a manner that will create the least amount of airborne dust.

Skin Irritation. If refractory ceramic fiber particles accumulate on exposed skin areas, do not rub or scratch. Remove the particles by washing the skin thoroughly but gently with warm water and mild soap. Using a good commercial skin cream or lotion after washing may be helpful.

Eye Protection. Safety glasses, goggles, or face shields should be worn whenever refractory ceramic fiber materials are being applied overhead or in areas where loose particles may get into the eyes.

Respirators. Respiratory protection must be worn to protect against breathing air contaminated with potentially harmful materials such as refractory ceramic fiber and cristobalite. Acceptable respirators are those approved by NIOSH for usage in specific airborne concentrations.

Refractory Ceramic Fiber Exposure Respirators

Concentration	Respirator
2.0 - 5.0 f/cc	3M 9900, or 3M 8710 equivalent.
5.0 - 50.0 f/cc	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
50.0 f/cc	MSA 01-00-06 full face piece type C supplied-air or equivalent OSHA approved air source required.

Cristobalite Exposure Respirators

Concentration	Respirator
up to 10 times PEL*	3M 9900, or 3M 8710 equivalent.
10 to 100 times PEL*	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
100 times PEL*	MSA 01-00-06 full face piece type C supplied-air or equivalent. OSHA approved air source required.

Respirator users should be instructed as to the proper use of respirators and their limitations, and must be fit-tested to assess the quality of fit. To test the respirator, cover the air inlets with the palm of the hand, inhale so the facepiece collapses slightly, then hold breath for a few seconds to see that it remains collapsed and there are no leaks. Another method is to place a substance with distinct odor or taste near the respirator seal. It should be undetectable if the respirator fits well.

Disposable respirators should be discarded when soiled or when breathing resistance is noticed by the wearer. Non-disposables must be regularly cleaned, inspected and maintained.

A wearer of respiratory protection experiencing breathing difficulty while using respirators should be evaluated by a physician to determine the ability of the worker to wear a respirator.

Personal Protective Equipment. In work situations in which engineering controls and/or local exhaust ventilation are either technically not feasible or insufficient to reduce the airborne concentrations of refractory ceramic fibers to below a time weighted average of 2 f/cc, the following clothing guidelines are recommended:

1. Special clothing. Provide and require the use of special clothing, such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of refractory ceramic fibers which exceed a

ceiling of 10 f/cc. Provide changing rooms for employees working regularly in such an environment.

2. Clothes lockers. Provide two separate lockers, or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from work clothes.

3. Laundering. Laundering of clothing contaminated with refractory ceramic fibers shall be done so as to prevent the release of airborne fibers in excess of the 2.0 f/cc WEG.

Housekeeping. Avoid unnecessary rehandling of scrap materials by keeping waste disposal equipment as close to working areas as possible. Follow an organized housekeeping program at all times. Vacuum dust with equipment fitted with HEPA filter. If sweeping is necessary, use a dust suppressant.

Waste Management. Wastes generated during application, demolition, breakage or spillage are not hazardous wastes as defined by RCRA (40 CFR Part 261). Comply with federal, state and local regulations. Method of disposal landfill. RQ - N/A.

Skin Irritation

Refractory ceramic fiber and most glass fibers are very similar in their ability to cause skin and upper respiratory irritation. *SKIN IRRITATION* is experienced by some workers in refractory fiber manufacturing facilities as well as some people working with refractory fiber-containing materials. This skin irritation and possible inflammation is a mechanical reaction due to sharp, broken ends of fiber that rub or become embedded in the outer layer of the skin. Skin reactions vary directly with the size and the stiffness of the fiber handled, with fibers of large diameter being more likely to cause irritation and itching. Irritation normally does not persist for any length of time and can be relieved by washing exposed skin areas gently in warm water with mild soap.

Some individuals may be more sensitive to irritation from refractory ceramic fibers than are others, and a relatively small number may be forced to seek other types of employment. The vast majority of workers, however, can control skin irritation by following work practices outlined in this bulletin.

Upper Respiratory Irritation

It is possible that some workers may experience temporary *UPPER RESPIRATORY IRRITATION* (that is, scratchiness or burning of the nose or throat) if airborne refractory fibers are generated during manufacture or handling of refractory fiber-containing

products. Like skin irritation, upper respiratory irritation is a mechanical reaction to sharp, broken fibers. It is not an allergic reaction and the irritation does not persist.

Unprotected exposures to high concentrations of airborne refractory ceramic fiber may produce a transitory condition, usually manifested by coughing or wheezing. Careful attention to housekeeping and proper work practices can effectively control airborne refractory ceramic fiber concentrations to prevent this upper respiratory irritation. The effects subside soon after the worker is removed from exposure and have no known long-lasting impact on health.

After Service

Refractory ceramic fiber which has been in service at elevated temperatures (greater than 1000°C) may undergo partial conversion to cristobalite, a form of crystalline silica which can cause respiratory disease (silicosis). This is a consequence of the crystallization or devitrification of the fibers which occurs at high temperatures. The amount of cristobalite which is formed, the size of the individual crystallites and the nature of the matrix in which they are embedded are all a function of the temperature and the length of time the fiber has been heated.

Under normal use conditions, refractory ceramic fiber will generally be exposed to a temperature gradient. Consequently it is most probable that only the fiber nearest the hot surface will have an appreciable cristobalite content. It is also possible that the devitrified cristobalite-containing fiber will be more friable and therefore may generate a larger amount of dust when fiber is removed from a high temperature application. Experiments have not yet been conducted to ascertain whether or not these devitrified fibers are biologically active in animals.

For these reasons particular care should be taken during the "tear-out" of refractory ceramic fiber linings to minimize generation of dust. Adherence to proper methods of dust suppression and control is imperative. The most prudent approach is to treat devitrified fibers as free crystalline silica. Even with adequate control, Babcock & Wilcox recommends that a respirator approved by NIOSH be used by all workers in the area during removal operations.

Medical and Scientific Studies

There are no known published reports in medical literature dealing with the health experience of people who work with refractory ceramic fibers. Two studies, one in Europe and the other in the United States, are in the initial planning stages to study the

health of workers involved in the manufacturing of refractory ceramic fibers. Initial results from those studies will be available in three to five years.

There are two known investigations which have studied the effects of refractory ceramic fibers on animals. An investigation by Davis, et al, in Edinburgh has been completed and published¹. The other study is nearing completion at the Los Alamos National Laboratories² and should be available for publication within the next year. Summaries of the results of the Davis Study and an interim report of the Los Alamos study will be covered below.

In his experiments, Davis injected refractory ceramic fibers into the abdomens of 32 rats. Intraperitoneal injection of fiber bypasses all of the animals' natural defenses and is used as an indicator of the relative biological activity of fibrous materials, although it does not duplicate any type of human exposure. In this experiment, three of the 32 animals developed primary abdominal tumors. Depending on the dose, scientists have found some tumor formation when injecting virtually all types of fibers directly into the abdomen. Such results from intraperitoneal injections have been found no matter what the experience has been in inhalation experiments.

Davis also exposed forty-eight rats to refractory ceramic fiber by inhalation for seven hours a day, five days a week, over a period of 224 days. The airborne dose of fibers longer than 5 microns was reported to be 95 fibers/cc.

Animals sacrificed at the end of the study were reported to have an average of 5% pulmonary fibrosis. At the end of the study, eight of the rats were found to have tumors with three animals demonstrating carcinomas.

The fibrosis and carcinoma found in the Davis study by inhalation were not expected and clearly point to the need for further study, while raising the normal level of concern.

In 1979, a large scale animal exposure experiment was begun at the Los Alamos National Laboratories involving several types of man-made fibers, including refractory ceramic fiber. In the Los Alamos study, two animal models were used — rats and hamsters. The rats were of a different strain than the ones used in the Davis study mentioned above. The Los Alamos study is not yet complete; results to date concerning refractory ceramic fiber will be summarized here and updated when the study is completed.

To date, inhalation experiments involving rats show no cancer or fibrosis in twenty-five animals examined; this conflicts sharply thus far with the Davis

study. Inhalation experiments on hamsters showed one cancer (mesothelioma) in fifty animals, but no fibrosis was observed. One of 157 control animals developed a spontaneous tumor without exposure to fibers. The exposures were conducted at 200 f/cc, 8 hours a day, 5 days a week, for 24 months.

The researchers at Los Alamos also performed intraperitoneal injections of refractory ceramic fiber using both hamsters and rats. Most of the hamsters did not tolerate the initial injection of the fiber into their abdomens and died immediately after injection due to peritoneal hemorrhaging. Of the five animals so far reported who survived the injection, no tumors were found. Nineteen of the twenty-two rats examined developed tumors (primarily mesotheliomas) after intraperitoneal injection of refractory ceramic fiber. This result was very different from the results obtained by Davis.

While the results from the Davis and Los Alamos studies were conflicting in many ways, there is little doubt a higher level of caution now exists about the possible health implications of exposure to refractory ceramic fiber. In order to help clarify some of the uncertainties raised, new studies have been designed and funded by TIMA to study the human experience as well as further animal studies with refractory ceramic fibers. This effort will begin in late 1985 and begin producing results in three to five years. Until more is known about the possible health effects of refractory ceramic fiber, care should be taken when using these products as detailed in this document.

Footnotes

1. J.M.G. Davis, J. Addison, R.E. Bolton, K. Donaldson, A.D. Jones & A. Wright, "The Pathogenic Effects of Fibrous Ceramic Aluminum Silicate Glass Administered to Rats by Inhalation or Peritoneal Injection," *Biological Effects of Man-made Mineral Fibres*, Vol. 2, p.303.
2. D.M. Smith, Principal Investigator; Interim Progress Report to Medical Scientific Committee of TIMA.

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