

500 Safe Handling Practices for Insulation and Refractory Materials

Abstract

This section provides guidelines for safe handling of insulation and refractory materials that contain asbestos, crystalline silica, or ceramic fiber. It describes the potential health hazards when using these materials and states where these materials are used or have been used in the past. It summarizes the regulations that govern the exposure and work practices related to these materials.

Interim results from toxicity studies conducted by the TIMA, Inc. on laboratory animals were released in October 1990. The studies indicate that when inhaled, the health effects of unfired refractory ceramic fibers (RCF) are similar to those for asbestos.

Current Company guidelines regarding RCF are described in “Loss Prevention Guide No. 13: Refractory Ceramic Fibers,” available from CRTC's Health, Environment and Safety (EH&S) Team.

Continued developments regarding RCF health issues will be incorporated in Section 500. Questions on the suitability of RCF for your application, or for updates on possible alternative materials should be directed to the CRTC Materials and Equipment Engineering Unit.

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510 Where To Go For Help

It is very important that you contact your local safety engineer prior to any projects that involve the handling of asbestos, crystalline silica or ceramic fiber products. The safety engineer can do the following:

- Take samples to determine if the material to be handled contains any of the above materials.
- Give guidance on the proper work procedures to use.
- Review the specification before it's sent out to bid.
- Update you on any changes in state, local, or federal regulations.
- Audit an ongoing project to verify that the contractors are using the proper procedures.

CRTC's Health, Environment and Safety (EH&S) Team can also give guidance on the regulations and work practices required for these materials.

520 Handling and Removing Asbestos-Containing Materials

Asbestos is one of the most regulated substances in the workplace today. Careful handling of asbestos-containing materials is necessary to protect health and achieve compliance.

This section explains what asbestos is, where it has been used, and what its health hazards are. It describes occupational laws governing exposure to asbestos, environmental regulations governing removal and disposal of asbestos, and work practices for safe handling of asbestos-containing materials.

This section also advises how Chevron facilities should manage asbestos jobs when special employee contractors or professional asbestos abatement contractors are involved.

521 Asbestos—Definition and Typical Uses

Asbestos is a naturally-occurring mineral. When separated from rock, asbestos becomes a fluffy, fibrous material that has many uses. The three most common types of asbestos found in today's industrial applications are: chrysotile (white asbestos), amosite (brown asbestos), and crocidolite (blue asbestos).

One may find asbestos-containing materials in the following products:

- **Insulation Materials:** pipe and block insulation, sprayed-on insulation, asbestos packings, laggings, and heat shields.
- **Construction Materials:** roofing, siding, wallboard, floor tiles, acoustic ceiling, asbestos-cement products.
- **Automotive Parts:** brake and clutch linings and pads.

- **Textiles:** fireproof clothing, welding blankets, ropes, tapes.
- **Friction and Chemical Resistance Materials:** gaskets, bearings, packings.
- **Electrical Insulation:** high temperature and/or chemical protection applications.

The use of asbestos has been greatly reduced, with the primary applications being valve packing, gaskets, and Transite board.

Friable and Nonfriable Asbestos

Friability is the ability of a product to release fibers into the air when crumbled by simple hand pressure. A friable asbestos product such as sprayed-on building fireproofing or pipe insulation can readily break away into fine dust. On the other hand, asbestos products such as vinyl asbestos tile or Transite board are considered nonfriable. The asbestos fibers are “locked in” and can't be released unless the product is sawed, drilled, sanded, or otherwise severely treated.

Emphasis of this health and safety guideline is on handling friable asbestos products. Our main concerns are friable asbestos as sprayed fireproofing and construction materials in buildings; and as thermal insulation on pipes, vessels, boilers, heaters, and other equipment.

522 Asbestos Hazards

Asbestos is primarily an inhalation hazard. When inhaled, tiny, sharp asbestos fibers can become embedded in the lungs. Asbestos-related diseases that may develop (perhaps not until 10 to 30 years after exposure) include:

Asbestosis: Permanent scarring of lung tissue, emphysema-like condition.

Lung Cancer: Lung, pleura, and bronchogenic carcinoma.

Mesothelioma: Cancer of the lining of the chest and abdominal cavity, almost exclusively related to asbestos exposure.

Other Cancers: Less commonly, asbestos has been associated with cancers of the digestive system, e.g., the esophagus and stomach.

Asbestos workers who also smoke increase the risk of contracting cancer. Lung cancer occurs five times more often among nonsmoking asbestos workers than in the nonsmoking general public. However, it occurs 50 times more often among asbestos workers who smoke than the nonsmoking general population.

523 Standards and Regulations

OSHA Asbestos Standards

The OSHA standards were extensively revised in 1994. For information on the latest standards, please contact your local environmental, health and safety group or call CRTC's Occupational Health and Safety Team.

524 Safe Work Practices

Large Scale Jobs

Normally Chevron contracts large scale asbestos renovation and removal to asbestos abatement contractors (see Section 525). The engineer's role is normally one of specifying the job and auditing the work.

The following is a list of "engineering controls" and "work practices" which the contractor should follow to reduce the exposure levels.

Engineering Controls include the following:

- Enclosure or isolation of the source of asbestos.
- Exhaust ventilation with a high-efficiency particulate air (HEPA) filter.
- Vacuum cleaners fitted with HEPA filters.

Work Practices which must be used to meet the regulations are listed below:

- Asbestos shall be handled, removed, cut or otherwise worked wet insofar as practicable.
- Asbestos waste removed from vessels, pipes, etc., at elevated locations shall be placed in impermeable bags and sealed before being lowered to ground level.
- Large sections of elevated pipe, vessels, etc., which are protected by a nonasbestos covering, may be lowered to ground level before the asbestos is removed if the exposed ends have been thoroughly wetted and wrapped in plastic.
- Transporting large sections of pipe, vessels, etc., with the asbestos insulation intact, held by an outer wrapping, may be permitted if all loose exposed asbestos ends or sections are securely wrapped with an impermeable material securely tied in place. The transported load must be clearly labeled and posted with asbestos warning signs.
- Block insulation containing asbestos fibers is extremely hazardous to work with. The following procedures shall be used:
 - Always work block insulation as wet as possible.
 - Do not use power tools to remove this material from vessels, pipes, etc.
- Hand cutting or power cutting of hardboard containing asbestos, such as Transite, should only be done 1) under thoroughly wetted conditions, 2) when an adequate ventilation system that will contain the waste residue is in use, or 3) under an enclosure.
- Asbestos installation and removal should be avoided during high wind periods. If the work cannot be postponed, plastic sheeting should be used to contain the asbestos fiber released to the work area. Examples: Plastic sheeting may be fastened to the outer perimeter of staging, forming a shell to contain the fiber release.

- When covering asbestos insulation with new weathercoating (aluminum, Volcote, etc.) the equipment covered should be identified. This can be done with a tagging system or by using orange paint to label the weathercoating “CAUTION ASBESTOS.”
- Housekeeping:
 - Asbestos spills shall be cleaned up immediately.
 - Staging and staging boards must be vacuumed and thoroughly cleaned as the work progresses and at the completion of the job. Under no circumstances should staging be torn down before it is thoroughly cleaned of asbestos fibers.
 - Loose asbestos that collects at ground level should be wetted and cleaned up as soon as it builds up or as soon as is practicable. Under no circumstances should asbestos waste be allowed to wash into the sewer system.

Small Scale Jobs

Company employees should handle only “short duration, small-scale” jobs as defined and regulated under Appendix G of the OSHA Construction Asbestos Standard 1926.58. The types of tasks covered under Appendix G can include the following:

- Removing asbestos pipe insulation as part of another task.
- Removing small quantities of asbestos insulation on beams or above ceilings.
- Replacing asbestos gaskets on valves and flanges.
- Removing and installing small sections of dry wall containing asbestos.
- Installing electrical conduits through or in the vicinity of asbestos-containing materials.

The definition of “small quantities” or “small sections” of asbestos is left to the judgment of the Company supervisor.

Unless the results of previous monitoring indicate exposures are *consistently* below the PEL for these small scale jobs, the following engineering and work practices, used singly or in combination, must be used to reduce asbestos exposures:

Wet Methods. Asbestos-containing materials should be wetted from the initiation of the maintenance or renovation operation, and wetting agents should be used continually throughout the work period.

Glove Bags. The glove bag provides an efficient and cost-effective method of stripping asbestos in small scale removal projects and minor repairs. The polyethylene bag creates a sealed workplace in which to perform the operation. The steps in glove bag use and removal include the following:

- Employees doing the job must wear HEPA respirators.
- Install the glove bag so it completely encloses the work area on the pipe or other equipment.

- Seal all openings in the glove bag with tape (e.g., duct tape) and seal the bottom seam of the bag.
- Wet the asbestos to be removed, and any that has fallen into the bag during installation of the bag.
- Remove the asbestos from the pipe or other equipment, keeping it wet as work progresses.
- After removing the asbestos, use a wire brush to clean the surface of any residual asbestos.
- Use bridging encapsulant to seal any loose edges on the asbestos material left on the equipment.
- Use a HEPA vacuum to collapse the bag after work is completed.
- Squeeze the bag tightly together, twist it and seal with tape. Remove the vacuum hose from the bag and remove the bag from the work area and dispose of it properly.

Mini-Enclosures. Mini-enclosures should be used for jobs which are too large for glove bags. They consist of small enclosures without negative pressure ventilation, constructed out of 6 mil plastic sheet. Workers inside the enclosure must wear Tyvek clothing and a HEPA respirator.

525 Use of Contractor Workers for Asbestos Jobs

When contractors are used for jobs involving asbestos exposure, Chevron's responsibility will vary depending on whether the contractor is considered an independent contractor or a special employee. These two types of contractors are discussed below along with Chevron's responsibilities under the OSHA Asbestos Standards.

Special Employee Contractors

These contractors work full-time at Chevron facilities on a variety of projects, taking work direction from Chevron personnel, using Chevron equipment and following Chevron procedures.

Chevron facilities are responsible for ensuring that all parts of the applicable asbestos standards are being met either by the contractor or by Chevron. Chevron facilities may choose to assist this type of contractor in meeting many of the requirements if the contractor does not have the capability. This includes monitoring, fit testing of respirators, change rooms, or hygiene facilities.

Alternatively, Chevron facilities may choose to require that the contractor meet most of the provisions of the standards without assistance. In many cases, this type of contractor will **not** be able to meet all the requirements without assistance. For instance, Chevron may have to provide lunchrooms and hygiene facilities. Chevron facilities will still need to closely oversee the contractor to ensure that the provisions are being met and work with the contractor to correct any problems. Although Chevron facilities will not normally provide medical surveillance exams for

contractor employees, they should ensure that the contractor is providing medical surveillance as required under the asbestos standards.

Asbestos Abatement Contractors

These are independent contractors specially trained on asbestos removal who work at Chevron facilities on specific projects. The workers take most or all of their direction from contractor personnel, follow contractor procedures and use contractor equipment.

However, Chevron personnel must work with the contractor in the following areas for work covered by the Construction Asbestos Standard:

1. Determine whether the contractor has previously collected adequate monitoring data on other jobs to reliably estimate exposures during the job, and agree on what controls are needed based on the monitoring results.
2. Agree with the contractor on where regulated areas should be set up and how they will be demarcated. If the contractor has adequate previous monitoring results for similar types of jobs performed by the contractor's employees under similar conditions, the data can be used to determine if regulated areas are required. If the contractor has no previous data, the job will require a regulated area.
3. Request that the contractor meet all requirements for asbestos removal, renovation, or demolition operations which may result in exposures above the PEL as required under Section 1926.58(e)(6) and 1926.58(j)(2) of the Construction Asbestos Standard. Chevron personnel should discuss and reach agreement with the contractor on whether the job meets the criteria for the short duration, small job exemption (1926.58 Appendix G).
4. Agree with the contractor on whether negative pressure enclosures are required.
5. Agree with the contractor on where decontamination areas are to be set up including the shower, change room, lunch room.
6. Ensure that the contractor has a "competent" person for asbestos removal, renovation or demolition as described in Section 1926.58(e)(6)(i) of the Construction Asbestos Standard.
7. Request that the contractor certify that all contractor employees received appropriate annual training and are included in an annual medical surveillance program administered by the contractor.
8. Work with the contractor to ensure that all applicable permits, notifications, and waste manifests are in order and that asbestos wastes are disposed of properly.
9. If contractor employees are found to be out of compliance with the asbestos standards, Chevron personnel should treat this as a breach of contract and discontinue work until the breach is remedied.

526 Company's Asbestos Specification

Specification IRM-MS-4776 gives the suggested contract language for work involving asbestos abatement contractors.

530 Safe Handling of Refractory Ceramic Fiber

Where is it Found?

Refractory ceramic fibers (RCF) are amorphous, glassy, alumina silica products (Al_2O_3 , SiO_2) which are created from molten masses of synthetic raw materials or naturally occurring kaolin clays.

RCF has been widely used in the last 20 years as a thermal insulation material in high temperature applications.

Nearly all ceramic fiber sold in the United States is made by four manufacturers:

- Thermal Ceramics
- Carborundum
- Premier
- A.P. Green

Some common trade names for ceramic fiber materials are:

Kaowool	Kaotex
Inswool	Ultrafelt
Fiberfrax	Cease-fire
Cer-wool	Fibermat
Saffil	Nextel
Pyro-Bloc	Z-Blok

Health Hazards

RCF poses two health concerns:

- Results from a October 1990 animal toxicology study revealed that RCF, whether in the fired or unfired condition, is a potent animal carcinogen and that fiber for fiber, RCF may be biologically more active than chrysotile asbestos.
- RCF exposed over time to temperatures in excess of 1800°F converts partially to cristobalite, a specific form of crystalline silica. Crystalline silica has been given a 2A classification (probably carcinogenic to humans) by the International Agency for Research on Cancer (IARC). See Section 540 on Crystalline Silica.

Exposure Standards

Currently, there is neither a specific OSHA PEL nor an ACGIH TLV for RCF. In March 1991 Chevron Corporation adopted an internal exposure standard for RCF

that is the same as the existing OSHA Asbestos Standard: 0.2 fibers per cubic centimeter (f/cc) for an 8-hour time-weighted average (TWA) and 1 f/cc for a 30 minute excursion.

531 Chevron Health and Safety Guidelines

CRTC's Health, Environment and Safety (EH&S) Team has developed the Health and Safety Guideline detailed below. These guidelines should be followed by all Company and contract employees when working with refractory materials containing RCF. If the job involves exposure to asbestos, see Section 520 for guidance. See Loss Prevention Guide No. 13 for additional details on RCF.

Exposure Monitoring

Chevron facilities are encouraged to conduct industrial hygiene exposure monitoring during handling of RCF products. Exposure data can be useful for the selection of personal protective equipment for that specific task or for similar operations in the future. See Loss Prevention Guide No. 13 for information on air sampling and analytical methods for RCF.

In general, RCF related tasks can be divided into two categories, i.e., those performed within a furnace or other enclosed spaces, and those tasks performed outside of enclosed spaces. Based on Chevron's exposure monitoring data, workers are typically exposed to less than 0.2 f/cc of RCF for tasks performed outside of an enclosed space. However, there is an increased risk of higher exposures when working within an RCF-insulated furnace.

Chevron has done some exposure monitoring for RCF, Figure 500-1 is a listing of various tasks performed during a furnace repair, the number of air samples that were taken to generate the data, the exposure range, and the geometric mean. In general, the geometric mean task exposures during removal and installation of RCF blankets, modules, and bulk fibers exceeded 0.2 f/cc. Even those tasks that indirectly cause RCF release, e.g., erecting scaffolding, repairing refractory, and welding or arc gouging within a furnace, can create exposures above the recommended RCF exposure limits (0.2 f/cc for an 8-hour day time-weighted average and 1 f/cc for a 30 minute excursion).

Personnel Protection

The following protective equipment should be worn by all personnel when working with all types of RCF, or when handling refractory materials with potential for generating a visible dust cloud:

1. Respirators: Follow guidelines of Figure 500-2.
2. Eye Protection
 - Safety glasses shall be the minimum protection.
 - Goggles are strongly preferred for added protection. If levels exceed 2 f/cc, goggles are a requirement.

Fig. 500-1 Task Exposures to RCF During Repair of Furnaces

Task Description	Number of Samples	Exposure Range, Fibers/cc	Geometric Mean, Fibers/cc
Tasks Indirectly Causing RCF Release			
Inspection and minor repairs	5	0.023 - 0.34	0.08
Erecting scaffolds	9	0.007 - 2.2	0.18
Refractory repairs	4	0.05 - 0.34	0.14
Welding, burning & arc gouging	16	0.003 - 16.8	0.39
Removing RCF Insulation			
Removing RCF blankets	9	0.059 - 16.6	1.3
Removing RCF modules	8	0.19 - 2.5	0.62
Removing bulk RCF insulation	7	0.18 - 2.2	0.46
Handling RCF waste	3	0.009 - 0.05	0.02
Installing RCF Insulation			
Packing bulk RCF insulation	10	0.094 - 1.7	0.62
Installing RCF blankets	29	0.024 - 2.6	0.14
Installing RCF modules	14	0.061 - 1.7	0.23

Fig. 500-2 Respiration Selection Guide for Various RCF Tasks

RCF-Related Tasks & Activities	RCF	Recommended Respirators
Outside an Enclosed Space		
All RCF tasks, e.g., cutting RCF blanket, heat treating and stress relief, handling exterior insulation covers, and cleanup and disposal of RCF waste.	up to 2 f/cc	Half-face, air-purifying respirator with HEPA filters (10× exposure limit).
Within an Enclosed Space		
Tasks not creating a significant dust cloud, e.g., inspection, erecting scaffolds, repairs, installing modules & bulk RCF, welding and bagging waste.	up to 2 f/cc	Half-face, air-purifying respirator with HEPA filters (10× exposure limit).
Within an Enclosed Space		
Tasks creating a significant dust cloud, e.g., removing blankets, modules, & bulk RCF, installing blankets, and arc gouging.	up to 20 f/cc	Full-face, air-purifying with HEPA filters (50× exposure limit); any powered air-purifying with HEPA (100× exposure limit); or any supplied-air operated in continuous flow mode (100× exposure limit).

3. Skin Protection

- Globes, boots, and whole body clothing should be worn at all times regardless of airborne contaminate level. Paper-type throw-away coveralls are preferred to avoid laundering.
- Head and neck covering should be worn if skin irritation is reported or if airborne contaminant level exceeds 2 f/cc for RCF.

Work Practices

The following practices should be adhered to when working with all types of RCF.

1. Identify RCF Work Areas

- Rope off RCF work areas with “DANGER” tape. Post “Danger Ceramic Fiber” signs.
- Prohibit eating, drinking, smoking, or chewing tobacco or gum in the work areas.

2. Minimize Dust

- RCF and refractory materials should be handled in a wet state during removal when feasible.
- Use hand tools for all sawing and or cutting of RCF. If power tools are used be sure mechanical dust collection systems fitted with HEPA filters are attached.
- Practice good housekeeping. RCF contaminated work surfaces and equipment should be vacuum cleaned at the end of each job or each work shift with equipment fitted with a HEPA filter. If sweeping is necessary, use a dust suppressant.
- For jobs where wet methods are infeasible, we advise spraying a gentle mist of amended water or other dust suppressant on the refractory surface before tear-out work begins.
- Avoid cleanup procedures that may result in water pollution.

Waste Management

RCF wastes, whether new or “after service” are not hazardous as defined by the EPA (RCRA 30 CFR part 261) unless they are contaminated with other hazardous waste materials due to their particular application. In general, these wastes can be disposed of in any landfill. Each facility should adhere to local laws and regulations that may pertain to these materials.

To avoid exposure to hazards during subsequent waste handling, scrap, debris, dusty or loose RCF wastes consigned for disposal shall be collected and placed in impermeable bags or containers.

To avoid air pollution, do not transport loose RCF materials in an open truck, box or other container.

Worker Information and Training

The Company recommends a training program be instituted for employees who handle RCF products. Employees should be informed of the potential health hazards, precautions to ensure safe use, and the necessary work practices and protective equipment to minimize exposure. Be sure to retain all training records. Depending on the local situation, the information and training program may be extended to certain contract workers who either work under the direct supervision of a Chevron employee, or depend on Chevron for product health and safety information.

The Company must make sure that Materials Safety Data Sheets (MSDSs) are available for the insulation and refractory products being used. In general, MSDSs from the RCF manufacturers do not provide adequate health protection information. Chevron's MSDS No. 2917 on Refractory Ceramic Fiber (Generic) is available. This new Chevron MSDS can be obtained through the Chevron Share System.

Contractors who are professional workers specialized in RCF products and other refractory materials should be aware of the latest toxicological developments on RCFs. Nevertheless, Chevron facilities should provide the contractors management with some health and safety information. As examples you may supply them with a copy of Loss Prevention Guide No. 13, Chevron's new MSDS on RCF, and/or a list of Chevron's minimal requirements (respirators and other protective equipment, exposure monitoring, etc.) on working with RCF. The specialty contractors should meet Chevron's minimum requirement. They may institute additional protection and work procedures that are more stringent than Chevron's minimal requirements.

Medical Surveillance

As of the Fall of 1991, there are no legal requirements for providing medical surveillance to RCF workers. However, the Corporate Medical Staff recommends that a program of medical surveillance be made available to those employees who are regularly exposed to RCF. See the latest edition of the Chevron Corporation Periodic Medical Examination Programs or contact the Corporate Medical Staff for any changes to the enrollment criteria for which employees to include in the surveillance program.

540 Crystalline Silica

Where is it Found?

Silica minerals are abundant in both crystalline and noncrystalline (amorphous) forms. Workers in the mining, quarrying, metal foundry, glass, ceramic products and construction industries are among those most frequently exposed to silica-containing dusts. While amorphous silica is merely a nuisance dust, occupational exposure to crystalline silica can cause a variety of nonmalignant respiratory diseases, especially silicosis.

There are two major forms of crystalline silica. These are quartz and cristobalite. The latter is formed when quartz or amorphous silica is heated, as in the calcining of diatomaceous earth or in the silica brick industry. Refractory materials such as

bricks, castable refractories, and concretes usually contain crystalline silica in both the quartz and the cristobalite forms. Crystalline silica concentration in refractory bricks may vary from 1% to 20%, according to Chevron's data.

Health Hazards

In 1986 and 1987, extensive reviews of the available toxicological and epidemiological evidences on silica were conducted under the auspices of the International Agency for Research on Cancer (IARC). Toward the end of 1987, IARC decided to classify crystalline silica as a Group 2A carcinogen (probably carcinogenic to humans). IARC concluded that there is limited evidence that crystalline silica causes cancer in humans, and sufficient evidence that it causes cancer in experimental animals.

Exposure Standards

Occupational exposure to crystalline silica is regulated under the Federal OSHA General Industry Standard (29 CFR 1910.1000), and the Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists. OSHA's Permissible Exposure Limits (PELs) for crystalline silica are: 0.1 mg/m^3 for quartz and 0.05 mg/m^3 for cristobalite, both analyzed as respirable dust and expressed as an eight-hour, time-weighted average.

Personnel Protection

Respirators shown in Figure 500-3 shall be worn by all personnel when working with all types of crystalline silica, or when handling materials containing crystalline silica with the potential for generating a visible dust cloud.

Fig. 500-3 Recommended Respirators, by Concentration of Crystalline Silica

Concentration of Cristobalite (Respirable Dust)	Concentration of Quartz (Respirable Dust)	Respirator Recommendations
0.05 to 0.5 mg/m^3	0.1 to 1.0 mg/m^3	Half-mask air-purifying respirator with high-efficiency filters (e.g., MSA Comfo II with H filter).
up to 2.5 mg/m^3	up to 5 mg/m^3	Full facepiece air-purifying respirator with high-efficiency filters (e.g., MSA Ultra-Twin with H filter).
up to 5 mg/m^3	up to 10 mg/m^3	Type C supplied-air respirator or powered air-purifying respirator with high-efficiency filter.
up to 50 mg/m^3	up to 100 mg/m^3	Full face supplied-air respirator operated in pressure demand mode.

550 Company Specification

Specification IRM-MS-4775 covers the safe handling of materials containing crystalline silica or RCF.