UNGER
CONSTRUCTION CO.

Proof of Training

Print name: _____Signature: _____ Date: _____

Respirable Dust and Silica Dust

Respirable dust is defined as small solid particles, below 75 microns in diameter. In essence particles small enough to remain suspended (airborne) for some time that may be inhaled through the nose or the mouth. Respirable dusts include inert dust, nuisance dust and hazardous dust such as silica.

Purpose

The purpose of this program is to ensure the protection of employees and subcontractors from the hazards associated with airborne respirable dust and silica dust.

Scope

This policy will apply to all work performed by employees and subcontractors including, but not limited to the following activities: construction, installation, demolition, remodeling, relocation, refurbishment, testing, and servicing or maintenance of equipment or machines and at other times when respirable dust or silica dust could be generated. This program is closely linked to our Respiratory Protection program and our Infection Control program.

Responsibilities

Management (Board of Directors and Project Managers)

Management is responsible for ensuring that the materials (e.g., tools, equipment, personal protective equipment) and other resources (i.e., worker training materials) required to fully implement and maintain this program are readily available where and when they are required. Additionally, management will monitor the effectiveness of the program, provide technical assistance as needed, and review the program bi-annually.

Program Manager

Dave Simpson is responsible for the development, documentation, training and administration of the program. This position carries the responsibility of insuring this program is adhered to and that proper reporting is executed.

Supervisors (Superintendents and Foreman)

Supervisors are responsible for ensuring that a task specific job hazard analysis (JHA), also known as a safe work plan, is developed. The JHA will select, implement and document the appropriate site-specific control measures as defined within this policy. Supervisors will direct the work in a manner that ensures the risk to workers is minimized, adequately controlled and that practices defined by this policy will be followed. Supervisors are responsible for ensuring Unger Construction employees and subcontractors are following expectations. Supervisors will be held accountable for enforcing the requirements of this program. Undesirable behavior will not resolve itself, therefore supervisors must be directly involved with modifying behaviors inconsistent with program expectations. Supervisors will be held accountable for enforcing Unger Construction's disciplinary program.

Workers (Employees and Subcontractors)

Unger Construction has high expectations and requires safety excellence for each worker, crew, project and for our entire company. Workers are required to follow the minimum procedures outlined in this program. Workers are responsible for knowing the hazards and the control measures established in the JHA. Workers are responsible for using the assigned PPE in an effective and safe manner. Workers are responsible for stopping unsafe acts and correcting unsafe conditions on the spot as soon as they are discovered. Any deviations from this program must be immediately brought to the attention of your supervisor. Workers that choose to conduct themselves in a manner that is inconsistent with these expectations will be held accountable for those decisions and may incur disciplinary actions.

Training

Before any worker is allowed to perform work with respirable dust or silica dust they must be trained. Each worker must demonstrate an understanding of the required training; the hazards associated with exposure to respirable and silica dust, the signs and symptoms of silica related disease, safe work procedures, exposure reduction methods/strategies (local exhaust ventilation/ wet methods), setup of enclosures, use of respirators and other personal protective equipment.

Proof of training is available on the “S” drive. The training data base can be sorted by employee name or by subject. This ensures supervisors and employees are able to confirm they have the necessary training and if they don’t which employees do. Employees that need training should contact their project manager or superintendent to make arrangements for them to be trained.

Retraining

The need for retraining will be indicated when: A workers work habits or knowledge indicate a lack of necessary understanding, Motivation or skills required to properly handle respirable or silica dust, Changes in the workplace make previous training obsolete, Changes in the types of PPE to be used make previous training obsolete or Upon a supervisor request.

Hazardous Material Survey

Unger Construction requires hazardous materials surveys before demolition or renovation work begins. The survey shall include all of the following: A visual inspection of a facility or a portion thereof for suspect materials and sampling and laboratory analysis of any suspect materials found for the presence of asbestos or lead. The survey will also furnish a written report that includes: a description of the area(s) visually inspected, a detailed description of any suspect material sampled, the results of any laboratory analysis of suspect materials, the method of analysis, and the total amount of asbestos containing material. Typically a floor or roof plan is included with the report to reference the written information visually.

The person conducting the survey must be certified pursuant to OSHA and/or EPA regulations. The survey may be performed by a certified Site Surveillance Technician (SST) under the supervision of a licensed consultant. The survey may be performed by a certified Site Surveillance Technician (SST) under the supervision of a licensed consultant. The survey needs to be kept in a project file so that it can be accessed when working on future projects.

If lead or asbestos have been confirmed to be present employees and subcontractors must follow Unger Constructions Lead and/or Asbestos program. If hazards such as asbestos or lead will be disturbed during remediation, a properly licensed professional must perform the work and follow appropriate regulations.

Overview

Studies show that construction work tasks involving sanding, drilling, chipping, grinding, cutting, sawing, sweeping, jack hammering, concrete mixing, concrete drilling, brick and concrete block cutting/sawing, tuck pointing, drywall finishing, and sweeping generate respirable dust and silica dust levels well in excess of safe levels. Unger Construction is committed to being diligent in our efforts to select the most effective control technologies available, and to ensure that the best practices, as described in this policy, are followed at our worksites. Several effective controls are available to protect workers from harmful exposure. A combination of control measures will be required to achieve this objective. Effective engineering controls such as High Efficiency Particulate Air (HEPA) vacuum attachments and wetting methods, which control respirable and silica dust at the source. These controls have been proven to reduce airborne dust levels significantly when selected and operated in accordance with best practices. Engineering controls alone do not reduce respirable dust or silica dust to safe levels; so in most cases other control measures, including respiratory protection, will be necessary.

Workers need to recognize the importance of planning the work in order to minimize the amount of respirable and silica dust generated. During the project planning phase, we advocate the use of methods that reduce the need for cutting, grinding, or drilling of concrete surfaces (e.g., formwork planning). Whenever possible, we will schedule work when concrete is still wet, because we know that much less dust is released at that time.

Respirable Dust and Silica Dust Generating Activities

Unprotected workers performing these activities, or working in the vicinity, can be exposed to harmful levels of respirable dust and silica dust. Respirable dust and silica dust generating activities include but are not limited to:

Cutting, Drilling, Coring of: Concrete, roof tile, brick, block, granite, tile backer board.
Grinding: Tuck point grinding, sack/patch, scabbling/scarifying, and handheld surface grinding.
Sanding of: joint compound and drywall products.
Sand Blasting of: Concrete or masonry products.
Pulverizing: concrete demolition, jack hammers, chipping hammers.
Mixing/dumping bags of raw material: Cement, plaster, grout and/or mortar.
Housekeeping/Cleaning up: Dry sweeping, blowers, emptying vacuum cleaners.

Each jobsite where the aforementioned activities occur must have a Site-specific respirable dust and silica dust exposure control plan. This plan would be based upon the corporate policy and would include the following: Scope of work and list of tasks, Site-specific hazards and risk assessment, Dust (and other) control procedures and equipment, Safe work procedures, Proof of Worker training. The Site-specific respirable dust and silica dust exposure control plan includes but is not limited to:

a) Job hazard analysis to determine safe work practices, equipment, tools and appropriate PPE.
b) Engineering controls (containments and managed airflow)
c) Contamination control
d) Floor covering materials (carpet, hardwood, resilient, ceramic).
e) Ceiling and walls.
f) Affected contents and furnishings (fabrics, furniture, appliances, electronics)
g) Heating Ventilating Air Conditioning ductwork.
h) Electrical, fixtures, outlets, switches, lights, sensors, controllers, wiring, cabling.

Visible and Respirable Dust

Most dust generating activities produce a mixture of visible and respirable dust particles. Visible dust contains large particles that are easy to see. Respirable dusts are tiny and are not visible to the naked eye. Visible dust can be used as a guide for improving dust suppression efforts. If you see visible dust being generated, the emission of respirable dust is likely to be over acceptable limits for exposure.

Measures that control dust at its source will reduce all types of particle emissions including respirable particles. Wet cutting and vacuum dust collection can significantly reduce respirable dust levels but may not reliably keep them below 50 micrograma/m3 as an 8 hour time weighted average therefore it is common to use respiratory protection
Even when dust does not contain silica workers performing dusty jobs may be at risk. Sanding drywall joint compounds that contain little or no silica (silica free) creates a substantial amount of airborne dust. Exposure to high levels of dust whether it contains silica or not can also be harmful. CAL/OSHA's permissible exposure limit for respirable dust is 5.0 mg/m3. Drywall finishers must reduce their dust exposure by using vacuum dust collection equipment or wet sanding methods in combination with engineering controls and personal protective equipment (PPE) which are discussed in detail throughout this policy.

Figure 1 Visible and Invisible Dust

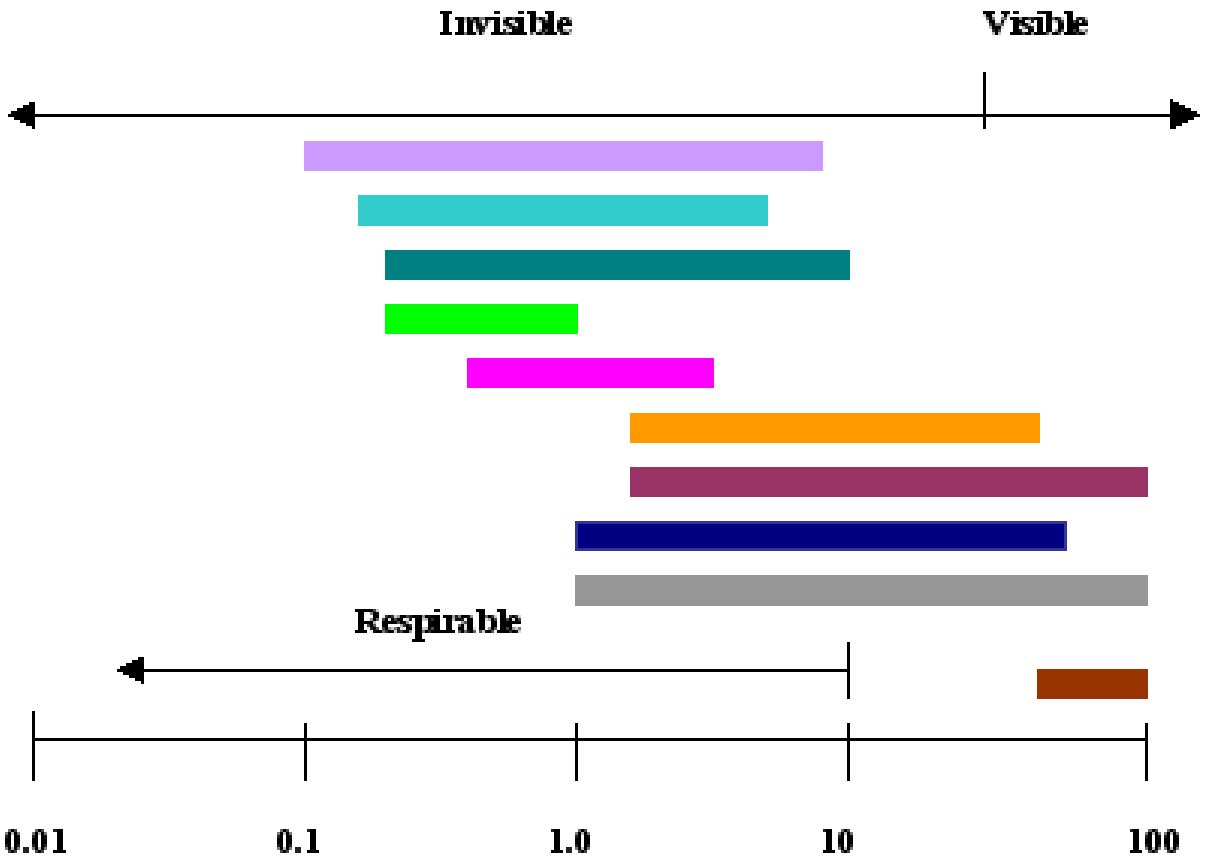
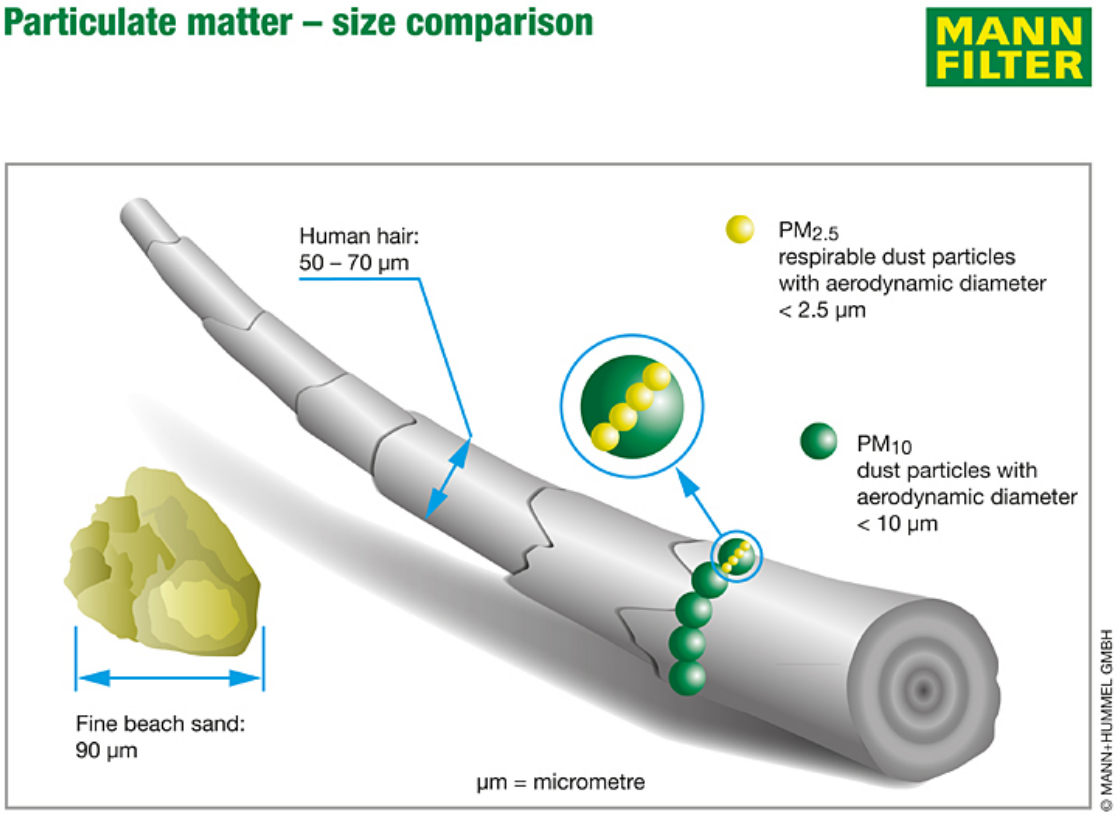


Figure 2 Particle Size Comparisons



What is Silica?

Silica is the second most common mineral on earth and makes up nearly all of what we call “sand” and “rock.” Silica exists in many forms—one of these, “crystalline” silica (including quartz), is the most abundant and poses the greatest concern for human health. Some common materials that contain silica include: rock, sand, concrete, cement, mortar, masonry, brick, tile, and fibrous-cement board.

Health Hazards

Long-term or heavy short-term exposures to respirable dust and silica dust can cause a disabling, sometimes fatal lung disease called silicosis. There is no cure for silicosis. The fine particles are deposited in the lungs, causing thickening and scarring of the lung tissue. The scar tissue restricts the lungs’ ability to extract oxygen from the air. This damage is permanent, but symptoms of the disease may not appear for many years. Generally speaking silicosis occurs after 15-20 years of exposure. Crystalline silica dust (e.g., quartz dust) is also a carcinogen.

Symptoms

Initially, workers with silicosis may have no symptoms; however, as the disease progresses, a worker may experience: Shortness of breath, severe cough or weakness. These symptoms can worsen over time and lead to death. Exposure to silica has also been linked to other diseases, including bronchitis, tuberculosis, and lung cancer.

Safe Work Procedures

Safe work procedures and hygiene practices are on-the-job activities that reduce the exposure potential from contaminated surfaces and work areas. Respirable dust and silica dust can also accumulate on the hands and clothing. From there it can be disturbed, re-suspended in air, and inhaled. There should be no smoking, eating, or drinking in contaminated areas, and lunches should be stored in an uncontaminated area. It is important to follow safe work and hygiene practices whenever respirable and silica dust is present.

Due to the risk posed by respirable and silica dust it is critical that all personnel involved in activities that could potentially create respirable and silica dust take specific actions to ensure that, as much as possible, a hazard is not created.

Ensure that all the tools, equipment, PPE and materials necessary are available and in good working condition prior to starting work activities. Coordinate your work activities with others working in the area; implement the controls necessary to protect them.

Potential exposure levels will depend on the concentration of silica in the materials, the work environment (enclosed, open spaces) single or multiple operations generating dust, environmental conditions wind speed and direction. CAL/OSHA has established an 8 hour average permissible exposure level (PEL) of 50 micrograms per cubic meter for silica dust and 5.0 milligrams per cubic meter for respirable dust.

For housekeeping or clean up tasks take steps to limit the amount of dry sweeping. Reduce the quantity of debris, smaller piles, frequent trash runs. Mop rather than sweep, damp mopping creates far less dust than sweeping. Use floor sweep compounds, floor sweep compounds dramatically reduce dust when compared to dry sweeping. HEPA vacuums also are recommended for cleanup of dust that may have settled on surfaces and for final cleanup. Care must be taken to assure that the filter is properly seated in the vacuum so that all the air passes through the filter. When changing the vacuum filter, workers should wear respirators, appropriate personal protective clothing, gloves, and eye protection to prevent exposure. The filter and contents of the HEPA vacuum must be disposed of in impermeable bags or containers in such a way as to prevent release of the debris.

Hierarchy of Risk Control Options

Effective control options must be used to eliminate or reduce the risk to workers from the hazards of respirable and silica dust exposure. The following hierarchy of control measures must be followed: Engineering controls (water, local exhaust ventilation, enclosure) Administrative controls (worker rotation, tape barrier isolation, coordination of tasks with subcontractors, signage). Personal protective equipment (respiratory protection, coveralls, gloves)

Engineering Controls

Engineering controls aim to control or otherwise minimize the release of silica dust. The two most common methods are local exhaust ventilation (LEV) and wet dust suppression (WDS). These methods have been integrated into tools commonly used in construction and are readily available. Containment or enclosure systems and ventilation fans are also engineering controls. Examples of engineering controls for common tasks are located on pages 16-19, Table 1.

Selecting an appropriate engineering control method for respirable and silica dust depends on the specifics of the operation. In some cases, local exhaust ventilation (LEV) is more effective at controlling exposure (during grinding operations) than wetting methods. For other tasks, wetting may be more effective (during cutting operations) than LEV. When evaluating the best method you should consider all phases of the operation and the collateral impacts of each method. For example the clean-up operation when the work is complete; using LEV may reduce the amount of final

cleaning required, as the silica dust is captured at the source. Wet methods can produce slurry that if not cleaned up when it is still wet will generate silica dust. Additionally, wet methods can create slip hazards and concerns over electrical shock. Quite often no single engineering control is completely effective therefore a combined approach is typical.

Local Exhaust Ventilation (LEV)

LEV systems are readily available for a number of tools; make certain to request them from the rental yard, tool supplier. LEV systems are generally compromised of a shroud assembly, a hose attachment and a vacuum. Dust laden air is collected within the shroud, drawn into the hose attachment and conveyed to the vacuum where it is filtered (trapped) within the HEPA filter. This method is very effective because it collects the dust particles at the source, before they can spread. The HEPA vacuum units should be capable of creating target airflow of at least 70 cfm. This should achieve a face velocity at the shroud of about 260 feet per minute. The higher the face velocity, the more dust captured at source. Choose a vacuum with the appropriate capacity for respirable dust collection. The vacuum hose should have a diameter of 1-1/2 inches to 2 inches. Airflow resistance increase with the length of hose, avoid using hoses more than 15 feet in length. Keep the vacuum hose clear and free of debris, kinks and tight bends. The HEPA filters should be cleaned throughout the work day to ensure they are effectively capturing dust and achieving the proper flow rate.

Wet Dust Suppression (WDS)

WDS systems are readily available for a number of tools make certain to request them from the rental yard or the subcontractor. Wetting is very effective at reducing dust release at the source and, in fact, may be more effective than local exhaust ventilation for slab and masonry cutting. A drawback to this method of dust control is that the dust is not collected; the wet slurry must be cleaned up so that the dust does not dry and become airborne. Wet slurry will be cleaned from work surfaces when the work is completed, using a wet vacuum or wet sweeping. If a WDS system is not available similar results can be achieved by manually wetting the point of work with a Hudson sprayer or a garden hose. Wet particles are heavier and more likely to stick together than dry particles. Water can create additional hazards. The ideal method of dust control uses the minimum amount of water to get the maximum result. Water applied at 0.1 gallon per minute to the point of work will dramatically reduce the release of respirable dust. Periodically spraying is not effective, pre-wetting the surface is ineffective. To be effective the water application must be continuous and directed at the point of work.

Use of water spray controls presents potential safety hazards, which include electrocution, slipping, and potentially hypothermia. When working with electrically powered tools ensure the tool is specifically designed for this purpose (water tight, sealable connectors) and that it is connected to a GFCI. Water can also create slip hazards. Slurry should be cleaned from surfaces as soon as the work is complete, before it dries and itself becomes a respirable dust concern. Use a wet/dry vacuum for slurry removal and remove the slurry when it is wet.

Water spray can effectively reduce exposure levels but is not feasible in many applications (tuck point grinding and cutting fibrous cement board) because water can result in material discoloration, expansion, and building damage.

Cross Contamination Control

Cross contamination control (not allowing respirable or silica dust to spread) by isolating contaminated areas, erecting containment or enclosure systems, isolating HVAC systems, using supplemental air movers exhausted outside and employing safe work practices. Respirable dust contaminants can be tracked on feet, or spread by wheels that come in contact with the dust. Respirable dust can be spread by natural circulation, HVAC systems or by using air moving equipment (air movers, scrubbers, negative air systems).The most effective way to ensure that respirable dust contaminants do not spread is to isolate work areas by erecting containment or enclosure systems.

Cross contamination control is achieved by engineering and administrative controls that ensure respirable dusts do not spread to non-contaminated areas via foot traffic, the movement of contaminated materials or equipment and through air movement.

Cross containment control systems includes physical barriers (rolled plastic or plastic sheeting), pressure isolation (depressurization techniques via negative air pressure machines to maintain a pressure differential of 0.01- 0.03 inches water column, separation and protection of HVAC systems (separating the HVAC system from remediation areas and non-contaminated spaces), dust suppression methods (Kett saws, damp wiping and HEPA vacuum cleaning), decontamination procedures (ante rooms) and waste disposal (materials will be enclosed in plastic and removed from the building using the shortest direct route leading to the outside of the building).

Site supervision will determine the type and design of barrier or enclosure (based on the work activity and the work area) and ensure it is constructed in accordance with this policy.

Containment or Enclosures Systems

Enclosures can contain a dusty atmosphere. They can consist of a partial structure (poly draping or partial plywood boarding) or a full enclosure equipped with some capacity for maintaining a lower than ambient pressure inside (negative pressure). For partial enclosures, airflow in the enclosure could be created by setting up a ventilating (blower) fan where the dusty air would be discharged to an unoccupied outdoor location. This option should only be used when dust levels are low or to supplement LEV or wet methods such as in stairwells.

Full enclosures can be fitted with a negative air unit that pumps air from inside the structure. Negative air units draw dusty air through a large HEPA filter panel before the air is discharged outside the enclosure. Another option to create airflow in the enclosure is to set up ventilating (blower) fans where the dusty air can be discharged to an unoccupied outdoor location.

The primary objectives of containment are to prevent exposure to nearby workers and to limit the amount of dust released into the air and surrounding areas. Containment systems are generally separated in 3 basic types. Source, limited, and full scale containment. For all containment systems fire retardant materials with a minimum flame spread rating of 25 shall be used. In general, the size of the area helps determine the level of containment.

Source Containment

Source containment is generally recommended for areas that are less than 25 square feet. The enclosure around the contaminated area should consist of a single layer of 6-mil, fire-retardant polyethylene film (visqueen). The containment should have a slit entry and covering flap on the outside of the containment area. The polyethylene film can be affixed to floors, walls and ceilings with tape.

Limited Containment

Limited containment is generally recommended for areas that are less than 100 square feet. The enclosure around the work area should consist of a single layer of 6-mil, fire-retardant polyethylene film (visqueen). The containment should have a slit entry and covering flap on the outside of the containment area. Zip poles or metal stud frame can be erected and polyethylene film attached to it. All supply and air vents, doors, chases, and risers within the containment area must be sealed to minimize the migration of contaminants to other parts of the building. Removal of ceiling materials (tiles or drywall) may impact HVAC systems and the effectiveness of the containment system if the space above the ceiling is used as a return air plenum. In this case, containment should be installed from the floor to the ceiling deck. The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside of

the building. Prevent the remediation area from becoming positively pressurized. Cease all work if negative pressure has been lost, don't restart until appropriate pressure differential is re-established.

Pressure Isolation

Airflow should be from the non-contaminated areas (clean area) to the contaminated area. When using limited or full scale containment HEPA filtered negative air machines are required to create pressure differential in relation to surrounding areas. Generally speaking the pressure in the dust area will be between 0.01-0.03 inches of water less than the surrounding areas. Pressure differential can be measured or monitored by analog or digital manometers, smoke tubes or pencils, or visual inspection (plastic sheeting, billows inwards into the remediation area) Based on the scope of work the airflow exchange rate will need to be modified. For low dust producing tasks the airflow exchange rate should be 6 times per hour, for moderate dust producing the exchange rate is 8 times and for high dust producing the exchange rate is 12 times per hour.

Ante Room/Decontamination Chamber

Ante rooms or decontamination chambers are designed to prevent cross contamination by acting as a transition space between the dust area and the surrounding clean areas. Ante rooms should be large enough to move materials into the contaminated area without requiring both doors to be open at the same time. Opening both doors at the same time defeats the purpose of pressure isolation and will lead to cross contamination. The ante room shall have a waste container(s) and HEPA a vacuum to clean tools, materials and personnel as they exit the contaminated space. Waste containers shall be large enough to place all contaminated PPE and protective clothing. Ante rooms shall be under negative pressure. The ante room shall be configured such that protective clothing (coverall, hoods, booties) shall be donned and doffed in this space. Contaminated materials (demolition debris) shall be bagged, wrapped or sealed before entering the ante room, from the contaminated space. Before contaminated materials (demolition debris) are moved from the ante room the clean space all outer surfaces shall be HEPA vacuumed and damp wiped. Respirators should be worn until workers are prepared to step outside the decontamination chamber and into the clean space. Respirators should be doffed and placed in a sealed bag while in the ante room. Tack mats shall be used to prevent tracking.

Point Containment

When using a rotor hammers or similar tools to drill a few small diameter holes in concrete, brick, masonry block, tile and similar materials you might consider using a point of use dust barrier method as a source control. This method involves inserting the drill bit though a barrier, which is then pressed against the working surface during drilling. This method evolved from the asbestos abatement industry. For shallow holes use a damp sponge that is held or taped in place to ensure a tight seal against the surface. Puncture the sponge with just enough clearance to allow the drill bit to pass through without contacting the sponge. For deeper holes you can fill a waxed cut with shaving cream and drill though the bottom of the waxed cup. Ensure the cup it held firmly against the surface being drilled. It is important to use a waxed cup and not a Styrofoam cup. Waxed cups will compress under pressure, Styrofoam will crack. Do not allow the barrier to become overloaded. Periodically check the barrier as it may be necessary to empty it or replenish the shaving cream. For deeper holes this process may need to be repeated several times.

<u>Ventilation Systems</u>

Ventilation systems (fans, air moving equipment (air movers, scrubbers, negative air systems) are not effective for dust control when used alone and should not be the primary method of managing dust. Fans can be useful as a supplement to other control methods such as enclosed areas where dust would build up due to poor air circulation. Fans can be set up in a push pull manner to displace the dust outside of the workers breathing zone to the captured away from the worker. Typically the flow rate, across the workers face, needs to be greater than 250 feet per minute. The distance of the worker from the fan is critical. The fans capture efficiency when used in the pull mode (exhaust) drops off quickly. Here's an example of a four foot square fan exhausting through a window to outside. The strongest capture rate is

directly in front of the fan. At two feet away from the fan the capture rate drops by 50%, at four feet the capture rate is 7%.

Administrative Controls

Administrative controls are those that aim to control or otherwise minimize the release of respirable dust through the use of work procedures rather than by affecting the actual physical work. Examples of administrative controls are training, written policies, posting warning signs, relocating unprotected workers, scheduling/coordination with others in the work area, worker/task rotation.

Tape or Ribbon Barriers

Tape barriers (may be simple hazard-flagging ribbon) are used to isolate the work area from the rest of the project and to prevent entry by unauthorized workers. They do not prevent dust drift and should only be used where natural ventilation is sufficient and dust release is controlled. Tape barriers will be constructed to notify other workers that respirable dust generating work is underway and access to the immediate work zone is restricted to authorized personnel.

Worker Rotation

In addition to identifying the specific activities where workers could be exposed to respirable dust the amount of the exposure and the duration of the exposure should be considered. Worker rotation keeping their exposure to less than 4 hours is an effective administration control.

Planning and Documentation

Planning and documentation are critical elements in reducing exposure to respirable and silica dust. Job hazard assessments will be performed for each task that generates respirable or silica dust. JHA's can be found on pages 20-24. Each jobsite will have a site specific respirable and silica dust control plan. A template can be found on page 25.

Personal Protective Equipment (PPE)

Hearing protection and eye protection are required for all respirable and silica dust generating tasks. When used in conjunction with engineering and administrative controls respirators and protective clothing can further reduce workers exposure to respirable dust. An air purifying respirator fitted with HEPA cartridges is the most common piece of PPE that would be used to minimize the exposure to respirable dust. In the majority of situations a ½ face piece respirator (with a rating of P100) would be used. However, high dust creating tasks or areas with poor ventilation a full face respirator may be required. Both of these respirators are seal dependent thus the users must be fit tested for the specific respirators and clean shaven where the respirator seals to the face. See our respirator policy for more requirements. In addition to the respirator in high dust producing tasks protective clothing (disposable coveralls) may be worn to protect the workers personnel clothing.

Respirators

Respirators should not be relied on as a primary means of preventing or minimizing exposure to respirable or silica dust. Select respiratory protective equipment (RPE) very carefully, as different types can give widely varying levels of protection. Several research reports indicate that when effective engineering controls (LEV and wet methods) are used, a half-face air purifying respirator is adequate to protect workers from harmful exposure to respirable and silica dust. When engineering controls are not feasible, it is likely that powered air purifying or air-line respirators will be required. Other workers in close proximity to the dust generation will also need respiratory protection if they are exposed to the dust trail. Containment systems, barriers and fans can reduce the need for respiratory protection for nearby workers. Workers who wear respirators will do so in adherence with Unger Constructions respirator program. Workers who wear respirators will be clean-shaven. Respirators give little or no protection to workers with beards, and even a minor

growth of stubble can severely reduce the effectiveness of respiratory protection. All workers who wear respirators will be fit-tested and have a current annual medical evaluation.

Protective clothing

Workers will wear protective clothing as specified in our task-specific safe work procedures to prevent contamination of worker clothing. Workers will not use compressed air to clean themselves, their clothing, or their equipment.

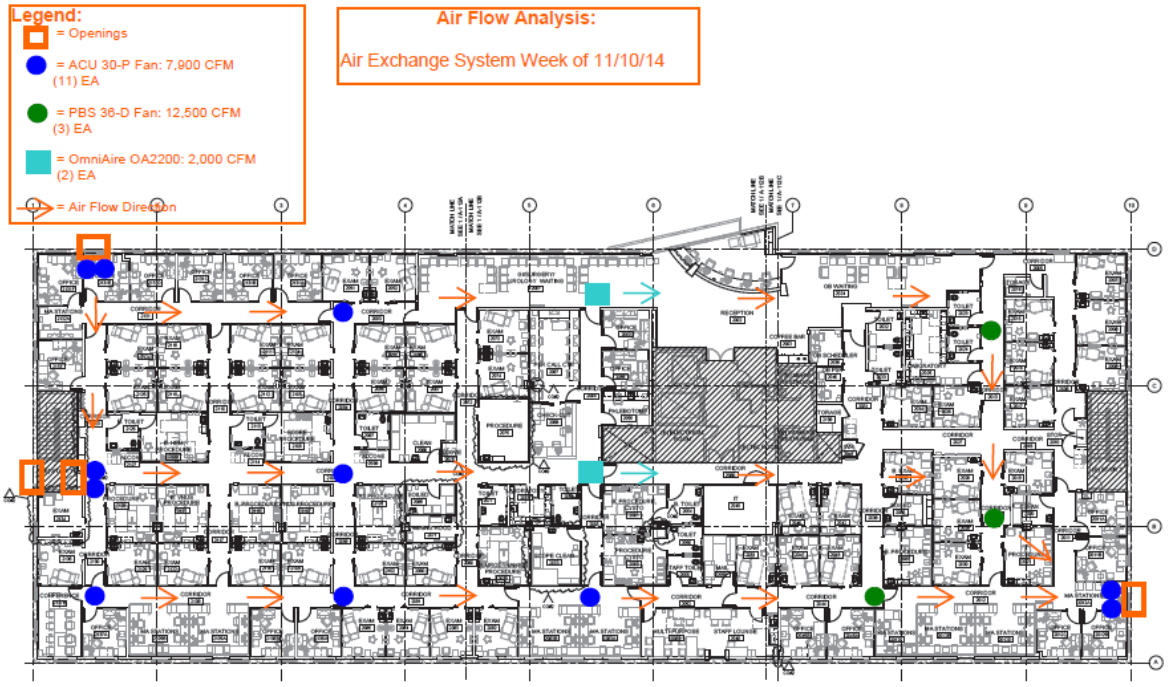
Job Hazard Assessment (Safe Work Plan)

Unger Construction utilizes JHA's as our means of hazard assessment and establishing a safe work plan. JHA's are performed by supervisors and/or workers. Our library of hazard assessments is maintained on the "S" drive. Before beginning a new task refer to the JHA library, generally speaking all scopes of our work are covered. For situations that have not yet been covered select one that is substantially similar and use it as a baseline. JHA's on the "S" drive are organized by work area and job description. JHA's include strategies for elimination, substitution, engineering and administrative controls. After applying all appropriate reduction and elimination technique, the remaining hazards will be analyzed and the proper PPE to reduce the hazards will be selected. PPE will be identified for hazards that are in the process of being reduced or eliminated and/or when hazard-reduction efforts are not 100% effective in eliminating the hazards.

For complex or moderate to high hazard tasks, tasks where an additional level of safety planning is needed, the safety director will perform the JHA with the supervisor and workers. Pages (20-24) are JHA's for common respirable and silica dust generating tasks.

Airflow Analysis

Some tasks have the potential to generate a fair amount of dust, such as drywall finishing, when this occurs on a large scale an air flow analysis is required. The air flow analysis determines the amount of negative air machines, placement of pedestal fans and the amount of fresh air make up to ensure dust is managed to an acceptable level. Below is an example of an air flow analysis



Calculation II

2F Cubic Feet: 25,000 sf x 14' ceiling ht = 350,000 CF
Stairwell CF: 30 sf x 41' ceiling ht = 1,260 CF
Total CF: = 351,260 CF

Fresh Air
ACU 30-P Fan: 7,900 CFM x (4) EA = **31,600 CFM of Fresh Air** is brought into SPMF

60 Min / 1 HR x 31,600 CF / 1 Min = **1,896,000 CF per Hour of Fresh Air** is brought into SPMF 2F

351,260 CF / X Min x 1 Min / 31,600 CFM = **11.12 Min Fresh air** is exchanged through the 351,260 sf of the SPMF 2F TI

60 Min / 1 Hr x X Hr / 11.12 AC Min = 5.4 air changes in 1 Hour or **5.4 ACH of Fresh Air**

Scrubbed Air
OmniAire OA2200: 2,000 CFM x (2) EA = **4,000 CFM** of air is **Scrubbed** in SPMF 2F

60 Min / 1 HR x 4,000 CF / 1 Min = **240,000 CF per Hour** of air is **Scrubbed** in SPMF 2F

351,260 CF / X Min x 1 Min / 4,000 CFM = **87.8 Min** air is **Scrubbed** through the 351,260 sf of the SPMF 2F TI

60 Min / 1 Hr x X Hr / 87.8 AC Min = 0.7 air changes in 1 Hour or **0.7 ACH of Scrubbed Air**

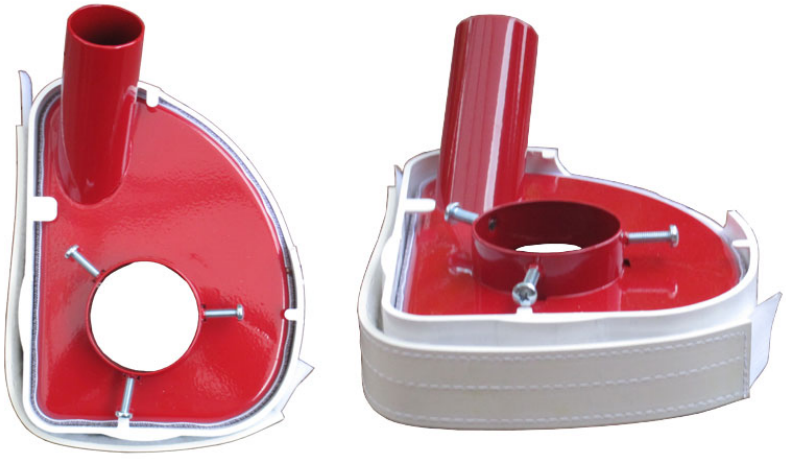
5.4 ACH + 0.7 ACH = **6.1 ACH of Clean Air**

Dust Control Systems

Due to the regulations becoming much more restrictive with respect to respirable and silica dust exposure all of the common tool manufacturers have develop dust control systems. Here are some examples of dust control systems that use vacuum as the primary engineering control. The options are nearly limitless, which should eliminate excuses.

1-3/8" BitBuddie

1-4" BitBuddie



How can silica exposures be controlled in order to keep exposure at or below the PEL?

Employers must use engineering controls and work practices as the primary way to keep exposures at or below the PEL. Engineering controls include wetting down work operations or using local exhaust ventilation (such as vacuums) to keep silica-containing dust out of the air and out of workers' lungs. Another control method that may work well is enclosing an operation ("process isolation").

Examples of work practices to control silica exposures include wetting down dust before sweeping it up or using the water flow rate recommended by the manufacturer for a tool with water controls.

Table 1 "Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica"

Table 1 is a flexible compliance option that effectively protects workers from silica exposures. It identifies 18 common construction tasks that generate high exposures to respirable crystalline silica, and, for each task, specifies engineering controls, work practices and respiratory protection that effectively protect workers. Employers that fully and properly implement the engineering controls, work practices and respiratory protection specified for a task on Table 1 are not required to measure respirable crystalline silica exposures to verify that levels are at or below the PEL for workers engaged in the Table 1 task.

OSHA developed Table 1 in response to stakeholders in the construction industry, who indicated the need for guidance and a standard that is different than a standard for general industry. Among the concerns of construction industry stakeholders were the impracticality of exposure monitoring based on the short duration of tasks and constantly changing conditions, such as weather, job sites and materials. For construction, the standard includes Table 1, a list of common construction tasks along with exposure control methods and work practices that work well for those tasks and that can be used to comply with the requirements of the standard.

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TABLE 1: SPECIFIED EXPOSURE CONTROL METHODS

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
Stationary masonry saws	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
Handheld power saws *(any blade diameter)*	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	• Outdoors: None • Indoors/Enclosed area: **APF 10**	• Outdoors: APF 10 • Indoors/Enclosed area: **APF 10**
Handheld power saws *(for cutting fiber-cement board, with a blade diameter of 8 inches or less)*	For tasks performed outdoors only: • Use saw equipped with commercially available dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency.	None	None
Walk-behind saws	• Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	• Outdoors: None • Indoors/Enclosed area: **APF 10**	• Outdoors: **APF 10** • Indoors/Enclosed area: **APF 10**
Drivable saws	For tasks performed outdoors only: • Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
Rig-mounted core saws or drills	• Use tool equipped with integrated water delivery system that supplies water to cutting surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
Handheld and stand-mounted drills *(including impact and rotary hammer drills)*	• Use drill equipped with commercially available shroud or cowling with dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.	None	None

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
Dowel drilling rigs for concrete	For tasks performed outdoors only: • Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.	**APF 10**	**APF 10**
Vehicle-mounted drilling rigs for rock and concrete	• Use dust collection system with close capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector. **OR** • Operate from within an enclosed cab and use water for dust suppression on drill bit.	None	None
Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact. • When used outdoors. • When used indoors or in an enclosed area. **OR** • Use tool equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism.	• Outdoors: None • Indoors/Enclosed area: **APF 10**	• Outdoors: APF 10 • Indoors/Enclosed area: **APF 10**
Handheld grinders for mortar removal *(i.e., tuckpointing)*	• Use grinder equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99 percent or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	**APF 10**	**APF 25**

Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: • Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. **OR** • Use grinder equipped with commercially available shroud and dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide 25 cfm or greater of airflow per inch of wheel diameter and have a filter with 99 percent or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	None • Outdoors: None • Indoors/Enclosed area: None	None • Outdoors: None • Indoors/Enclosed area: **APF 10**
Walk-behind milling machines and floor grinders	• Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. **OR** • Use machine equipped with dust collection system recommended by the manufacturer. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. • When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None	None
Small drivable milling machines *(less than half-lane)*	• Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant. • Operate and maintain machine to minimize dust emissions.	None	None
Large drivable milling machines *(half-lane and larger)*	For cuts of any depth on asphalt only: • Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. • Operate and maintain machine to minimize dust emissions. • For cuts of 4 inches in depth or less on any substrate: • Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. • Operate and maintain machine to minimize dust	None	None

	emissions. **OR** • Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant. • Operate and maintain machine to minimize dust emissions.		
Crushing machines	• Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points). • Operate and maintain machine in accordance with manufacturer's instructions to minimize dust emissions. • Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.	None	None
Heavy equipment and utility vehicles used: • To abrade or fracture silica-containing materials *(e.g., hoe-ramming, rock ripping)* OR • During demolition activities involving silica-containing materials	• Operate equipment from within an enclosed cab. • When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.	None	None
Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing, abrading, or fracturing silica-containing materials	• Apply water and/or dust suppressants as necessary to minimize dust emissions. OR • When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.	None	None

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Task		Control methods	Personal protective equipment	Comments
Grinding	Concrete interior/exterior walls, ceilings, and other flat surfaces	• Barrier or enclosure systems are required to restrict access to the work area. • Local exhaust ventilation (LEV)—use concrete grinders with HEPA vacuum attachments. • Grinding using wet method of dust control may be an option for specific circumstances. • Personal protective equipment.	• Half-mask air purifying respirator equipped with P100 series HEPA filters. • Full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, when heavy work and poor dilution ventilation in work area. • Disposable coveralls are recommended for grinding work and are required for grinding operations in small enclosed spaces. • Eye protection should be worn when using a half-face respirator. • Hearing protection and gloves should be worn.	• Vacuum systems equipped with HEPA filtration are the best control options for flat surface grinding. Ensure they are well designed for this type of work. A variety of suitable systems are readily available. • Very little visible dust should be present in the air. • Inspect the LEV unit frequently to ensure it is operating properly and the filters are not overloaded. • When LEV and wet grinding systems cannot be used, dry grinding is permitted, provided a full enclosure system is constructed. Workers should wear respirators and disposable coveralls.
	Window casements and other working areas with space or other constraints	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation (LEV) should be used when practical and effective. • Wetting methods of control can be used to supplement LEV or when LEV methods are not practical or effective. • Personal protective equipment.	• Half-face or full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator. • Hearing protection and gloves should be worn.	• Due to space constraints, it may not be possible to use an LEV-equipped grinder. • Water flow and the rpm of the grinder should be properly adjusted for the material being worked on. • Caution—water may produce a slipping hazard. • Electric shock hazards need to be assessed and controlled when using wet methods (pneumatic grinders may be a another option).

Task		Control methods	Personal protective equipment	Comments
Grinding	Tuck point grinding	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation (LEV)—use specially designed tuck point grinders with HEPA vacuum attachments. • A specially designed oscillating tool is available for mortar removal. The tool can be purchased with an LEV attachment. • When LEV cannot be used, construct an enclosure including a negative air unit for dilution ventilation. • Personal protective equipment.	• Half-face air purifying respirator equipped with P100 series HEPA filters. • For challenging jobs where LEV or wetting control cannot be used, full-face supplied-air respirators operated in pressure-demand mode or full-face supplied air respirators operated in continuous-flow mode will be required. • Disposable coveralls should be worn for tuck point grinding work. • Hearing and Eye protection.	• Due to space constraints, it may not be possible to use an LEV-equipped grinder. • Water flow and the rpm of the grinder should be properly adjusted for the material being worked on. • Caution—water may produce a slipping hazard. • Electric shock hazards need to be assessed and controlled when using wet methods (pneumatic grinders may be a another option).
	Enclosed areas (e.g., stairwells, elevator shafts)	• Full enclosure systems are required to restrict access to and contain the work area. • LEV—use concrete grinders with HEPA vacuum attachments. • Have dedicated grinders available with corner and flat-end shrouds. • Some wet grinding may be acceptable • Personal protective equipment.	• Half-face air purifying respirator equipped with P100 series HEPA filters. • If effective dilution ventilation within the work area enclosure cannot be established, then full-face piece supplied-air respirators is required. • Disposable coveralls must be worn • Hearing and Eye protection. •	• LEV attachments for concrete grinders are not effective for corners or interfaces with objects on another plane. • HEPA filters should be checked routinely throughout the work shift to ensure they are not clogged with silica dust.
	Floor grinding	• Barrier or enclosure systems are required to restrict access to and contain the work area. • Local exhaust ventilation—a variety of specially designed floor grinding systems are available equipped with HEPA filtration. These systems should be used when practical. • Wet grinding may be an option, provided acceptable slurry cleanup procedures are documented and followed. • Personal protective equipment.	• Half-face air purifying respirator equipped with P100 series HEPA filters. • Full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, when working in an enclosed area and visible dust is observed. • Disposable coveralls should be considered. • Eye protection. • Hearing protection should be considered when using powered equipment.	• Portable shot blaster (floor smoothing) systems equipped with dust controls are available for floor grinding. • When large amounts of concrete are to be removed, filter systems should be more substantial (e.g., two vacuums connected in series—one large course filter system followed by a finer filter system). This will improve efficiency of the overall unit. • Vacuum systems will likely need to be cleaned and inspected frequently.

Task		Control methods	Personal protective equipment	Comments
Drilling	Walls, floors, and ceilings	• Barriers to restrict access to the work area. • Dust capture tool (e.g., a dust cap, LEV, or wetting method). • Personal protective equipment.	• Half-mask air purifying respirator equipped with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator. • Waterproof equipment where appropriate. • Hearing protection should be considered when using powered equipment.	• Hammer drills (variety of sizes) are available. Some units are equipped with local exhaust ventilation attachments (with HEPA filters). • A "dust cap" is a dust-capturing device that fits between the drill and the working surface (on the end of the drill). This is useful for overhead ceiling and wall drilling. A few different types are available. • When water is used as a dust control, the slipping hazard must be considered and managed. • Large concrete drills can be purchased that are equipped with a water spray attachment. Any wet slurry must be cleaned up when the work is completed.
		•	•	•
Chipping and Jackhammering	Walls, floors, and ceilings	• Barriers must routinely be established to restrict access to these work areas. Enclosure systems must be constructed when controls are not effective at reducing visible airborne dust. • Local exhaust ventilation when practical. • Wet methods can be used and are often very effective for floor hammering. • Personal protective equipment.	• Half-face or full-face air purifying respirator or powered air purifying respirator (PAPR) with P100 series HEPA filters, depending on the effectiveness of the controls. • Disposable coveralls should be worn when using full-face respirators. Waterproof PPE (and clothing) required when wetting methods are used. • Eye protection should be worn when using a half-face respirator. • Hearing protection.	• LEV could include a negative air unit or HEPA vacuum positioned near the working surface. These controls may be practical when chip hammering walls or other vertical surfaces or locations where water cannot be used. • Wet methods could include a portable airless sprayer, air mister, or hose sprayer. Slurry should be cleaned up when the work is completed to avoid secondary dust exposure hazard. • Caution—water may produce electrocution and slipping hazards.

Task		Control methods	Personal protective equipment	Comments
Cutting of concrete slab and concrete masonry products		• Barrier or enclosure systems are required to restrict access to and contain the work area. • Wetting methods of control can be very effective and should be used as a first choice when saw cutting concrete or concrete products. • LEV systems for concrete saws must be considered as a dust control when wet methods cannot be used. • Personal protective equipment.	• Half-face or full-face air purifying respirator with P100 series HEPA filters when wet or LEV controls used. • Disposable coveralls should be worn when using full-face respirators. • Eye protection should be worn when using a half-face respirator. • Hearing protection.	• A water flow rate of (0.10 gallons/minute) is the recommended minimum for saws equipped with wetting controls. • Caution—water may produce electrocution and slipping hazards. • Slurry cleanup must be part of the work plan.
Abrasive blasting of concrete surfaces	Exterior and interior concrete surfaces	• Barrier tape is required when dust can be controlled at the source. • Containment system is required when source control of dust cannot be established • Blasting units that capture the dust (e.g., shot recycle systems) should be used when practical. • Blast systems that discharge a wet slurry shot should be used when practical. • Personal protective equipment.	• Full-face supplied-air helmet or hood respirator with a neck shroud, operated in continuous-flow mode. • Heavy waterproof protective clothing should be worn. • Hearing protection should be considered when using powered equipment.	• Caution—water may produce electrocution and slipping hazards. • Slurry cleanup must be part of the work plan.
Cleanup	General cleanup	• Barrier tape to restrict access to and contain the work area. • Full enclosure systems can be used in dust-sensitive areas or when unprotected workers cannot be restricted from entering cleanup work areas. • Use vacuum (HEPA-equipped) when practical. • Wetting of dust prior to sweeping/scooping to be used when practical. • Planning for bulk/coarse debris cleanup followed by fine-dust cleanup can reduce the amount of dry sweeping. • Dust suppressants (sweep compound) should be used if dry sweeping is the only practical option.	• Half-face air purifying respirator when vacuum systems or wet sweeping methods are used. • Eye protection should be worn when using a half-face respirator. • Hearing protection should be considered when using powered equipment.	• Dust-suppressing agents or absorbents are only marginally effective in minimizing airborne dust during sweeping. • Safe work procedures must be followed. • Rolling a seam of dust suppressant into fine, settled dust is reported to work better than a wide-spread scattering.

Task		Control methods	Personal protective equipment	Comments
Cleanup	Vacuum bag/filter changing and maintenance of LEV	• Barrier tape to restrict access to the work area. Signage marking an area removed from other workers may be adequate.	• Half-face air purifying respirator with P100 series HEPA filters. • Eye protection should be worn when using a half-face respirator.	• Safe work procedures must be established and followed. • Many vacuums are designed to collect the dust in a bag (rather than loose in the canister) that can be tied and disposed without generating airborne dust. Any new vacuum systems purchased should have this design feature.
Cutting fibrous cement board		• A variety of dust control options are acceptable: o Fiber cement shears o Score and snap knife o Dust-reducing saws (circular and jig) equipped with HEPA vacuum o Wetting method if practical	• Half-face air-purifying respirator with P100 series HEPA filters when using saws. • P95 dust mask when using fiber cement shears indoors.	• A number of equipment manufacturers make saws (and saw blades) specially designed for cutting fiber cement board that can be purchased with HEPA. • Carbide score and snap knives have been shown to be an efficient and productive means of cutting fibrous cement board.

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Site-specific Respirable and Silica Dust Exposure Control Plan

Location: _____ Date: _____

Work description:

Respirable and Silica dust control options

Engineering Controls

LEV: _____
Wetting: _____
Ventilation: _____
Isolation: _____
Other means: _____

Administration Controls

Barrier Tape: _____
Work schedule: _____
Other means: signage _____

Personal Protective Equipment

Half-mask respirators: Cartridge type: Fit tests confirmed:
Full-face respirators: Cartridge type: Fit tests confirmed:
Supplied air units:
Coveralls required:
Hearing protection:

Safe work procedures and other details: _____

_____

_____

_____

Ventilation plan (sketch)

Crew (Read and Understood)

Print_____ Initials_____	Print_____ Initials_____
Print_____ Initials_____	Print_____ Initials_____
Print_____ Initials_____	Print_____ Initials_____
Print_____ Initials_____	Print_____ Initials_____
Print_____ Initials_____	Print_____ Initials_____