

## **Scope of Work - Oxford Valley Elementary School – C-Wing Basement and Crawlspace – Clean-up and Mold Remediation** (prepared 2/19/21)

### **Background**

The Pennsbury School District (PSD) Facility Department noted that there were significant musty, moldy odors in the C-wing basement/crawlspace of the Oxford Valley Elementary School (OVES). The C-wing basement/crawlspace is located under the C-wing of the OVES at the southeast corner of the building and is entered through a pull-up garage type door at the southeast corner of the C-wing. The basement/crawlspace consists of three parallel “bays”, one under each row of classrooms and a narrower one under the hallway. The “bays” are separated by cement walls with several openings (crossovers) between them. The C-wing basement consists of a cement floored basement area (approx. 23 ft. wide and 42 ft. long) directly inside the garage door entry and the crawlspace extends an additional approx. 162 feet past the low wall at the end of the basement (as dirt floored crawlspace) and remains approx. 23 ft. wide. This 1<sup>st</sup> section is under classrooms (C-16 through C-20) on the south side of the wing. There is a 2<sup>nd</sup> “bay” that runs parallel to the 1<sup>st</sup> bay and is under the C-wing hallway (dimensions – approx. 204 ft. long and 9.5 ft. wide) and is dirt floored. The 3<sup>rd</sup> “bay” is parallel to the first two bays and is under classrooms (C-21 through C-26) on the north side of the wing (dimensions – approx. 204 ft. long and 24 ft. wide) and also dirt floored. Ceiling heights range from approx. 9 ft. in the basement area to as little as 4 to 3 feet in some portions of the crawlspaces. There is a normal amount of fiberglass insulated HVAC system and sanitary plumbing in the crawlspaces (all asbestos pipe insulation was abated several years ago).

Due to the musty, moldy odors, Element Environmental Solutions, Inc. (E2S) was requested to perform a limited Indoor Air Quality (IAQ) evaluation which initially included two samples for total airborne mold spores collected in the basement area of the C-Wing combined basement/crawlspace and compared to an outside sample. The airborne mold spore samples indicated very high counts of three types of mold (**see attached Lab Report**) that were most predominant in the Basement Crawlspace, Basidiospores (includes mushrooms and shelf fungi), Aspergillus/Penicillium and Ascotracha/Dicyma (two phases of the same mold, Ascotracha grows on wood and cellulose, and Dicyma prefers more easily “digested” cellulose). Tape lift surface samples were collected from some of the basement area contents and found High spore densities (but only moderate areas of growth) for Aspergillus, Penicillium and Ascotracha/Dicyma. The amount of growth in the basement area did not appear sufficient to produce the high airborne spore counts and no Basidiospores growth was indicated in the 4 locations (old wooden furniture) sampled. Consequently, the Basidiospores growth and additional amounts of the mold genera found in the basement are expected to be on the wood, cardboard and other debris in the crawlspaces and possibly on wall, ceiling or dirt floor surfaces. The airborne mold spore counts measured here were significant potential health concerns and could easily produce asthma and allergy symptoms for anyone entering the basement/crawlspace area and more serious symptoms for susceptible individuals. Until corrective actions are completed, E2S recommended that access to the basement/crawlspace areas should be restricted. It should be noted that sampling performed in the normally occupied spaces of the school did not indicate any significant intrusion of airborne mold spores from the basement/crawlspace into the occupied spaces (except for one sample collected at a floor access trap door from the library into the crawlspace, which was recommended immediately by E2S to be better sealed).

Based on observations during the initial evaluation, the **basement area** has cardboard and old wood furniture and other items stored long term, and the adjacent large crawlspace area has large quantities of old wood and framing on the dirt crawlspace floor. The crawlspace has a number of vent grills to the outside around the perimeter which would allow humidity and airborne mold spores from outside to enter easily, the dirt floor would also allow substantial amounts of moisture from the ground to evaporate into the basement/crawlspace air and further increasing the humidity. Additional observations indicated wood and cardboard and other common debris were present in the other two bays and the additional observations found standing water primarily along the north wall of the 3<sup>rd</sup> bay and some active water intrusion in that section as well. **Contractors bidding on this project are strongly recommended to visit the crawlspace.**

## Corrective Actions

There are several different issues that need to be addressed, **the 1<sup>st</sup> will be addressed by the Remediation Contractor**, for the 2<sup>nd</sup>, the District will be making arrangements with their chosen engineering firm:

- 1.) The airborne mold spore counts in the basement/crawlspace must be reduced substantially (this will require removal and disposal of all moldy contents and debris and junk). Most of the stored items in the basement appear to have some surface mold and most of the contents should be disposed of. The metal, or plastic items can probably be cleaned and sanitized if they are worth salvaging, but wood, cardboard, paper and fabric items should be disposed of along with any other object in the basement that is not worth salvaging. **The District will determine if any items are worth salvaging and the Remediation Contractor should provide a price for cleaning and sanitization any items chosen by the District as this may affect a final decision.** In the main portion of the basement crawlspace area, there are piles of lumber (source unknown) laying directly on the dirt floor. This wood appears to be damaged and is also very likely to have heavy surface mold growth (it is a likely source for any of the three predominant mold genera). This wood should be disposed of. A careful visual inspection should be performed in the rest of the crawlspace bays for additional substrate for mold growth (cardboard, paper, wood), most likely laying on the dirt floor and all should be disposed of. This effort will also include additional cleaning and sanitization and will be detailed in the **Scope of Work** section below.
- 2.) Until such time as the humidity can be controlled and most of the mold eliminated, an exhaust system should be installed in the basement/crawlspace. This exhaust unit should be sized to accomplish the following: 1<sup>st</sup>) to create some negative pressure in the basement/crawlspace and prevent air movement from the basement crawlspace into the occupied space (classrooms/library/etc. above), this exhaust unit should be HEPA filtered so that the vast majority of mold spores that are being removed by the exhaust system will be trapped and removed and not have the potential to affect any one outside near the exhaust or in or near the school if the exhausted air blows back towards the school; 2<sup>nd</sup>) to reduce the spore count numbers in the basement/crawlspace, and to help control humidity and to help keep the dirt floor dry. There are also possibilities that dehumidification could help, but the space is large to attempt dehumidification and intrusion is not effectively controlled by dehumidification. The wettest areas (where water intrusion is occurring) may need a drainage system to a sump for collection and discharge and there may be a need for some outside surface water drainage and/or foundation sealing. In some areas of the crawlspace, there may be some improvement from sealing the dirt floor with plastic sheeting to reduce evaporation from the soil, but this would tend to increase humidity under the plastic and could lead to isolated mold growth (which would be under the plastic and not easily released into the air).

## Requirements

**The workers involved in the cleaning and sanitization should be experienced and have supervisors experienced with mold remediation procedures.** All personnel entering and working inside the basement/crawlspace must wear appropriate **personal protective equipment** for the phase or current activity of the remediation.

## PPE

Appropriate personal protective equipment (PPE) should be worn for the stage of work or the activity being performed. Safety shoes and appropriate gloves (work gloves for handling and throwing away contents or bagging debris should be worn, and nitrile rubber gloves when cleaning with solutions) are essential to prevent injury or exposure. With dusty items (mold spores, etc.) and aggressive cleaning and spraying of cleaners, eye protection is warranted. Respiratory protection should be P100 HEPA half face respirators and all users should be trained and medically authorized to use them. Tyvek® overalls are recommended but spun poly overalls at a minimum are required and a torn suit should be replaced immediately. Hard hats are also required as there is strong potential for contact with overhead obstructions (pipes, support structure for the classroom floor above, etc. All appropriate OSHA requirements that apply, must be met.

## **SCOPE OF WORK**

### Preparation

Access to the work area (the basement/crawlspace under the C-wing) during the remediation, **should only** be through the garage type entry door at the east end of the C-wing at the southeast corner, and no access doors or hatches inside the school

building shall be used for entry to the crawlspace. There are several small outside access doors (in window wells with the opening covered with plexiglass) that access the crawlspaces and there is reportedly at least one of these openings into the C-wing. This could be a potentially useful point to have the required HEPA negative pressure air filter unit installed. This should be a large unit (~2000 cfm) and it may be appropriate to **use more than one** as the basement/crawlspace is approximately 70,000 to 80,000 cubic feet of volume. It is important to isolate the work area by utilizing HEPA filtered negative pressure systems (appropriately sized for the large volume of the workspace) and poly barriers to help prevent mold release into occupied areas of the school located above the crawlspace and additional adjacent crawlspace areas under other wings of the building (this project is limited at this time to the C-wing crawlspace). Isolation of the C-wing is also critical to prevent mold spores that may be present in the adjacent wings from entering the C-wing during the cleaning and sanitization.

There are also some smaller vent grills to the outside around the perimeter of the C-wing (and the other crawlspaces) that should be covered (C-wing vent grills and **from the outside**) during the clean-up but may be opened later to help ventilate the space faster for airborne particulate reduction (dust and mold spores), as the outside airborne spore counts were currently very low due to snow cover. Any floor hatches in the occupied areas of the C-wing that open into the work area, should be sealed with wide plastic tape inside the school and shall be covered (inside the crawlspace) with 2 layers of 6 mil polyethylene sheeting and sealed with tape and/or spray glue (used inside the crawlspace only). Two examples of this kind of hatch are found in the Library but these two do not appear to enter the C-wing crawlspace. Any openings and/or passageways from the C-wing crawlspace into adjacent crawlspaces other than the C-wing crawlspace shall be covered with 2 layers of 6 mil polyethylene sheeting and sealed with tape and/or spray glue (used inside the crawlspace only). It may be necessary to use some wood framing to support the poly sheeting against the pull of negative air pressure and the passages and openings may be sealed more effectively by placing the framing on the “upwind” side of the opening and attaching the poly to the frame instead of trying to stick it to the cold damp cement perimeter of the wall opening and the placement of cross member supports at the opening should also help support the poly. The entryway preparation at the C-wing garage door should have a decon (pop-up) where workers can HEPA vacuum off dust and debris from their Tyvek overalls before removing them and exiting the work area to the outside. Remediation workers should not be seen walking around outside the crawlspace with used coveralls on. As the entry door is fairly wide, a flap entryway can also be in place for removal of bagged smaller debris items and for larger furniture, boxes and the damaged contaminated lumber as well as other debris found in the crawlspace bays. As the HEPA negative air systems are recommended to be routed through a “window” in the crawlspace, it should be possible at the end of the workday, to move the decon into the basement and the poly on the doorway and close and lock the garage door. The HEPA negative air equipment installed in the work area should continue to run after hours.

Covered dumpsters should be placed in the parking lot closest to the C-wing entrance and smaller wheeled covered dumpsters can be used to transport the debris past the B-wing to the parking lot dumpsters. The distance from the C wing access door to a sidewalk alongside the B-wing is approx. 220 feet of snow covered grass that will become mud quickly. Placement of a series of plywood sheets (4 X 8) from the C-wing entrance to the B-wing side would make transporting equipment significantly easier. While there are some electrical outlets inside the basement area, it is doubtful there are enough to operate all the necessary equipment so additional power connections will be needed.

## **Mold Remediation - Contents and Debris Removal followed by selected Cleaning and Sanitization**

### **Cleaning and Debris Removal**

All contents of the C-wing basement and crawlspace will be removed for disposal to the covered dumpsters, (unless otherwise specified prior to the start of the remediation), including but not limited to old wooden desks and chairs, tables, other furniture, boxes, cardboard, etc. The cement floored basement area can then be HEPA vacuumed (more cleaning will be done here at the end of the cleaning phase). Any debris on the ground or hanging loose in the entire C-wing crawlspace (specifically a large pile of wood boards just beyond the low wall in the basement, also chunks of wood, individual boards, cardboard, bags, insulation, and what appeared to be pieces of pipe and any other debris, whether it is currently moldy or not, scattered throughout the C-wing crawlspace, should also be collected and disposed of. Any mushrooms growing on the ground (alive or dead) or mushrooms or mushroom-like growths on any of the debris should be carefully bagged for removal. The cement floored basement area will receive additional cleaning when all of the other cleaning is completed in the

crawlspace. During the clean-up of debris, the location of any suspected mold growth on walls, ceilings or fiberglass pipe insulation should be noted.

### **Spot Cleaning and Spot Sanitization**

After the debris removal is completed follow-up cleaning using HEPA vacs with brush attachments can be used to clean suspected mold on the exterior of fiberglass pipe insulation and other surface locations where it was observed (**this is not a vacuuming of all wall and ceiling surfaces**, just the apparent growth). An initial application of sanitization agent on these suspected mold spots (pipe insulation, etc.) shall be applied with a pump-up sprayer immediately after the HEPA/brush vacuuming. A visual inspection should be performed at this point by E2S and if debris removal and spot cleaning were acceptably completed, the general scan then be scheduled.

### **Pre-Sanitization Air Flush**

After the Spot Cleaning and Spot Sanitization, there should be an approx. 24 hour “flush” of the basement/crawlspace with the HEPA negative air filtration operating prior to the main sanitization. If there is still snow cover (which would generally mean low airborne mold spore counts outside), the small foundation vent grills to the outside around the perimeter of the C-wing, which were mentioned in the Preparation section as being sealed or covered, could be opened to increase the air exchange rate. After the 24 hour flush, the main sanitization can proceed with air-less sprayers and/or foggers (using Sporidicin® or equivalent, or Vital Oxide® would also be acceptable at this stage, the sanitizer to be used by the contractor, should be discussed with the District Facilities Department and with E2S).

### **Sanitization**

Starting at the far end of each bay, the overhead, the walls, the floor and any pipes (insulated or not) shall be well sprayed with sanitizer solution (all surfaces), with as close to 100% coverage as possible (it is better to get too much sanitizer on the surface than too little). The ceiling (overhead) and walls should be sprayed/fogged first and then the dirt floor sprayed/fogged by starting all the way in a section and backing up as the dirt floor spraying proceeds (do not walk on the sprayed areas at this time) and the sprayed dirt floor areas should be visibly wet with the sanitizer. **Note: All surfaces must remain wet with the sanitizer for at a minimum, the full contact time specified for the sanitization agent and the documented types of mold found in the basement/crawlspace, but longer is better.** The basement area (ceiling (overhead), walls and floors) near the entry door will be the last area sprayed. The HEPA negative air system will be off during the spraying so that there is minimal air movement to prevent the spray/fog from going where it is directed. After the acceptable contact time (plus some additional extra time to maximize sanitizer effect) for the sanitizer to kill mold spores and/or growth, the HEPA negative air unit(s) can be turned back on until the additional recirculating HEPA units and the dehumidifiers are operational, then it should be turned off or disconnected from the discharge hose and also operated as recirculating. Additional HEPA units (these may be supplied by the District and should be ~2000 CFM capacity) should be operated inside the workspace in recirculation mode (drawing the basement/crawlspace room air in and returning it to the room HEPA filtered, not discharging from the building) to reduce and/or remove any residual mold spores in the air and ideally, several large high-capacity **desiccant dehumidifiers** should be also operational to remove the excess moisture added to the crawlspace by the sanitization procedure. Ideally, one large HEPA unit should be placed in each bay (see above) with the filtered discharge of each unit aimed down the bay for maximum distribution and mixing and at a slight up angle, to minimize the blowing dirt from the dirt floor around. The large dehumidifiers should be paired with a HEPA recirculating filter unit to maximize distribution and mixing of the filtered, **dehumidified** air. The dehumidifiers should remain on until the humidity has dropped sufficiently, E2S will evaluate the conditions in the crawlspace and when it has dried enough, the dehumidifiers can be turned off and removed, however, the HEPA units should continue to operate. Relative humidity (% RH) readings will be taken in the basement/crawlspace and compared to outside % RH, temperatures in both areas will also be compared as ambient temperatures control % RH and results will be compared to appropriate guidelines for crawlspaces (if any).

### **Satisfactory Completion Evaluation**

When the observed and measured conditions (% RH) following completion of the cleaning and sanitization procedures are acceptable, a Satisfactory Completion inspection/evaluation is recommended, which includes a visual inspection and appropriate sampling. Satisfactory Completion sampling includes a series of airborne mold spore samples collected at representative locations in the remediated space and comparison to previous pre-remediation sampling results, current outside conditions and current adjacent accessible spaces. The airborne mold spore samples will be analyzed by an AIHA certified microbiology lab (EMSL Analytical, Inc.). If the inspection findings/samples are found to be acceptable, the

remediation is considered to be **Satisfactorily Completed**. If it is considered to have failed, additional corrective actions may be recommended and follow up sampling performed after the recommended corrective actions are completed. This may be as simple as the HEPA recirculating filters continuing to run (for an additional day(s)) until the airborne mold spore counts drop to an acceptable level. It is important to understand that a dirt floored crawlspace is **very unlikely** to have the same comparatively low airborne spore count level of a cement floored crawlspace, in addition, the very high initial spore counts are a starting point and a Satisfactory Completion of a dirt floored crawlspace that previously had a very high airborne spore counts is likely to have some residual remaining airborne spores. See additional discussion of Satisfactory Completion Evaluations below.

#### **Additional Discussion of Satisfactory Completion Evaluation**

In buildings with substantial mold contamination, especially those with larger populations (schools, office buildings, hospitals and apartment buildings), E2S recommends a Satisfactory Completion Evaluation (SCE) which includes a visual inspection and limited mold sampling to confirm the project was effectively completed and any mold contamination has been reduced to acceptable levels. This evaluation would be performed after all removal, cleaning and sanitization procedures are completed, but critical barriers and HEPA filtration should still be in place and additional HEPA air scrubbers could be added at this time to maximize air filtration prior to any clearance sampling. The SCE will be performed by a Certified Industrial Hygienist (CIH) with extensive IAQ/IEQ evaluation and mold remediation experience. The SCE will include a visual inspection of the work area and collection of appropriate airborne mold spore samples (from the work area, from the adjacent basement area and from outside near a location where outside air is entering the basement/crawlspace). The interior (work area) samples will be compared to an accessible adjacent basement or crawlspace sample and an outside sample. It is not a requirement that no airborne mold spores be present in the work area at completion, however, interior work area counts are expected to be lower than either the outside (warm weather, not winter with snow cover) or the accessible adjacent basement or crawlspace sample area spore counts and mold genera known to indicate water damage mold growth should be at very low counts or even none detected and mold genera found outside and/or in the adjacent basement area may be present but should be at lower counts than were present in the source areas (adjacent basement or outside). Up to five surface mold samples will also be collected to identify potential suspected remaining surface mold, and the confirmed presence of remaining surface mold may require additional cleaning depending on observed amounts **but may not** indicate a failure of the SCE if airborne counts of the identified remaining mold are low or none detected in the air samples. A failed SCE will indicate a need for additional cleaning and/or sanitization.

Questions about this Scope of Work should be directed to Robert Pfromm, CIH, Technical Manager, IAQ, Element Environmental Solutions, (email: [bob@e2s.us](mailto:bob@e2s.us) or Text/Call 610-413-0911).