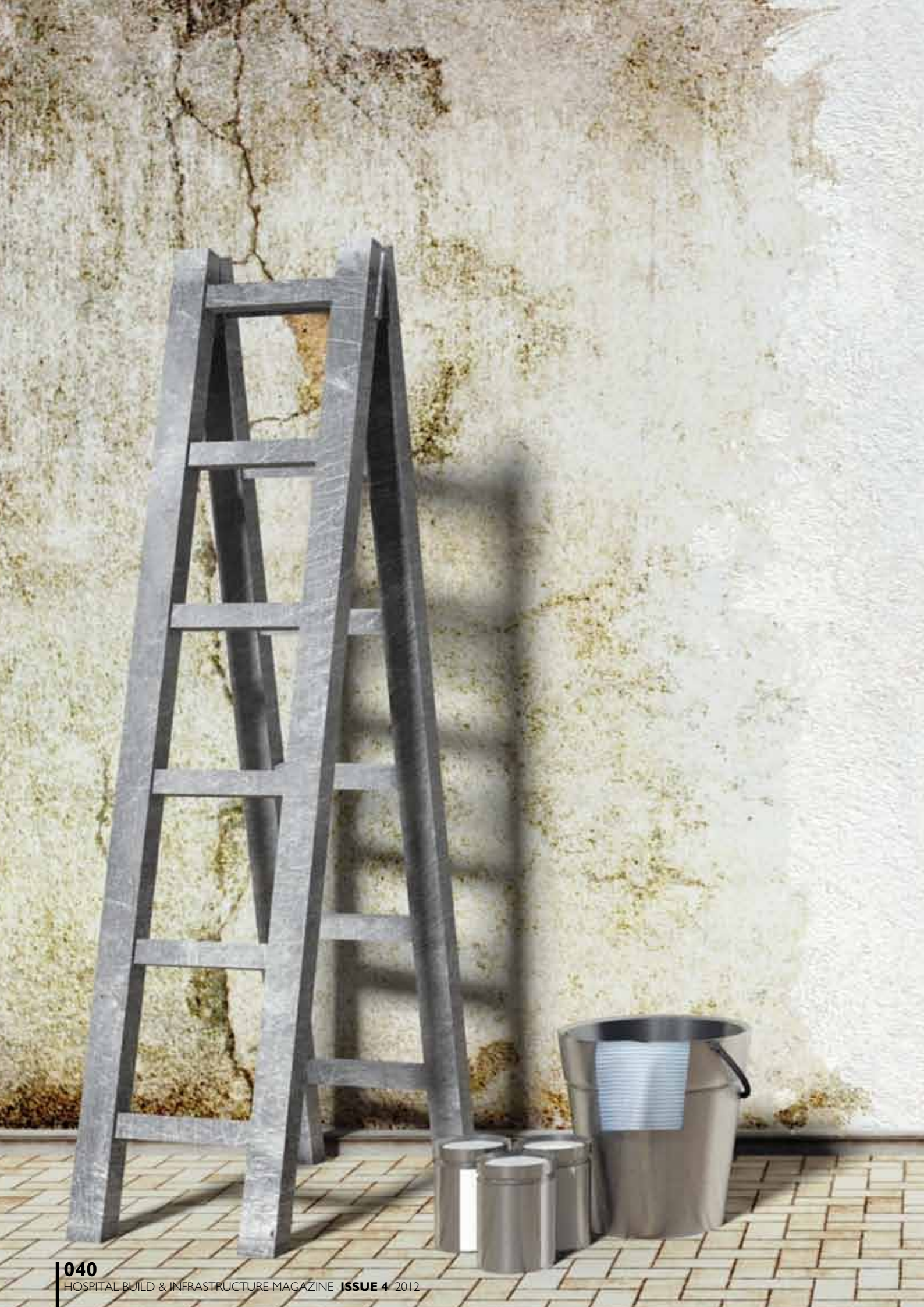


PATIENT SAFETY DURING CONSTRUCTION AND RENOVATION

TAKING ENVIRONMENTAL INFECTION CONTROL TO THE PATIENT

By: Michael Rollins, Independent Healthcare Environmental Hygiene and Infection Prevention specialist, UK and Kingdom of Saudi Arabia

Construction related indoor fungal aerosol pollution could create a significant health risk to susceptible patients. The source of such aerosols can originate from both building exterior and interior activity, which causes the disturbance of settled spores or disruption of contaminated materials within the building envelope.

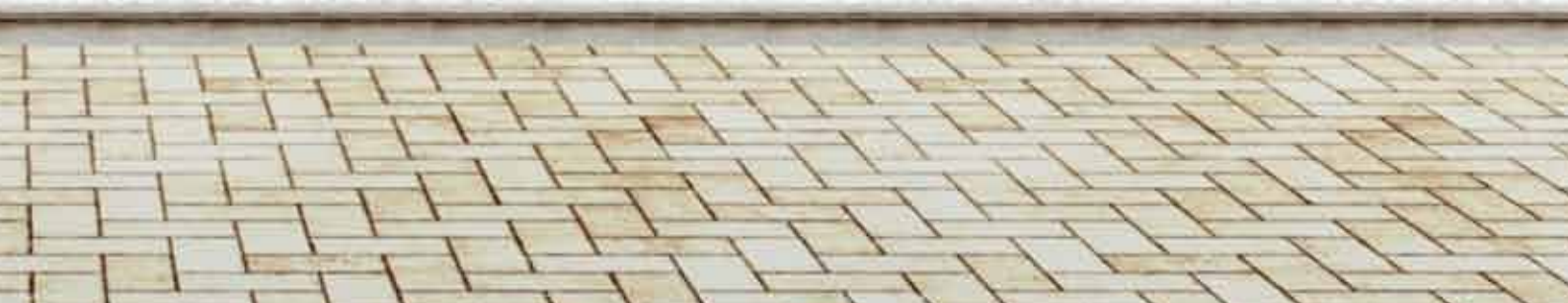
Demolition, construction, renovation, including installation of services to the build structure can result in the generation of fungal aerosol pollution, typically of the *Aspergillus* species. Without appropriate environmental controls these activities can result in increased incidence of invasive Aspergillosis; a condition where pneumonia caused by inhalation of Aspergillus spores is established and the fungus disseminated to other organs. Because of the high mortality rate associated with invasive Aspergillosis, it is vital to assess and manage the risk to patients. Critically, 5% of healthcare associated infections are construction and maintenance related (CDC/ASHE).

The Infection Control Risk Assessment (ICRA) is the standard evaluation tool. This includes a six step process to review the planned construction /renovation project:

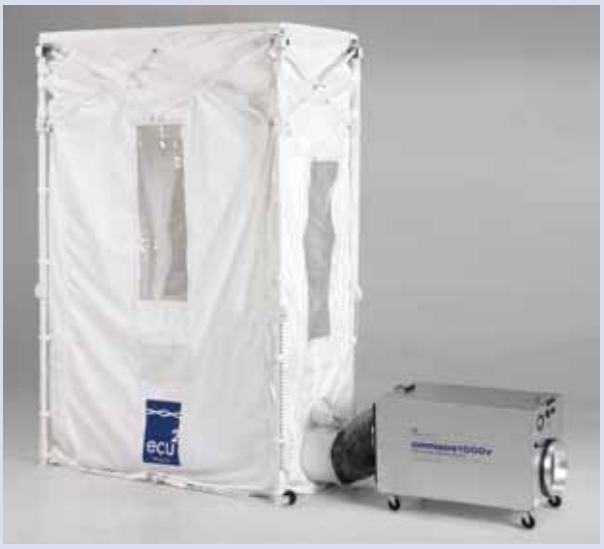
- Identification of risk
- Assessment of risk
- Classification of precautions
- Project staff and worker training
- Project permit issued
- Verification of compliance with project scope and precautions.

Before any project involving construction, renovation, maintenance, demolition or repair, an ICRA assessment should be conducted to define the scope of the activity and need for protective measures. It is important to establish collaborative policies of the facilities management and engineering departments and all out-sourced contractors and their construction workers.

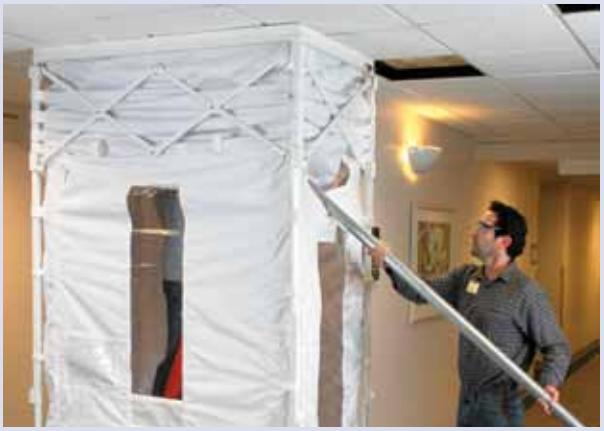
A key element in the protective measures is the isolation and barrier containment of the work area. This is a critical patient protection and safety measure. Typical dust containment methods rely on physical barriers, either by constructed temporary walls or with sheet film, poles and tape to secure the migration of particulate material from the worksite. Such methods alone do not provide secure containment and present an infection risk. Physical barriers must be airtight and incorporate negative-pressure ventilation in the construction area through a negative air machine (NAM) fitted with pre-filter and High Efficiency Particulate Air (HEPA) filters if the discharge air is released within the healthcare environment. Other measures include the isolation and sealing of all air intake and exhaust vents in the construction zone, capping the open ends of ventilation ducts within the work zone, control of access to ▶



▼IMAGE 5: Environmental Containment Unit with NAM and HEPA filtration



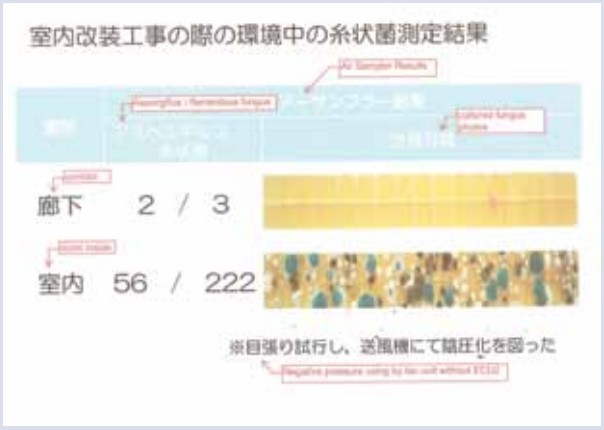
▼IMAGE 6: Access to the plenum area for cabling, filter and light changes. Worker is contained within the ECU2. Materials and power tool leads can be inserted through envelope access points



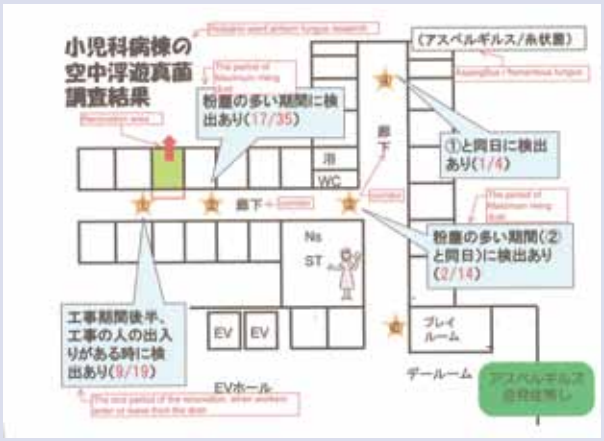
▼IMAGE 7: ECU2 containment. Disposable envelopes can be used on the frame and modified to seal off the work area within the ECU2 envelope

▼IMAGE 8: ECU corridor isolation

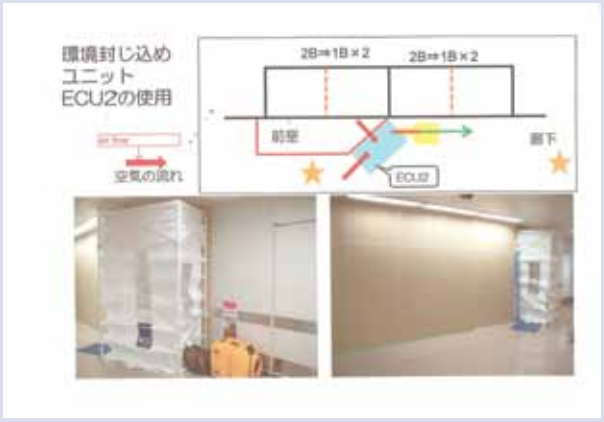
▼IMAGE 1: Exhaust to outside air samples



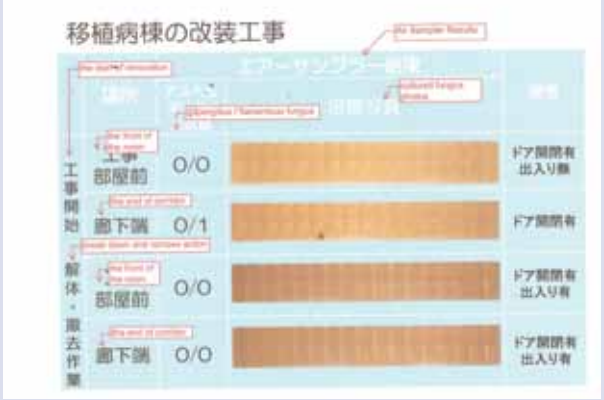
▼IMAGE 2: Osaka 2: Exhaust to outside location floor plan



▼IMAGE 3: ECU installed floor plan



▼IMAGE 4: ECU installed air samples



the work zone away from patient areas, regular and controlled removal of construction debris in sealed containers, the use of tack mats to the floor and damp cleaning.

Centres for Disease Control and Prevention (CDC) Guidance recommend: "Before the project gets underway, perform the ICRA to define the scope of the activity and the need for barrier measures. Create and maintain negative air pressure in work zones adjacent to the patient-care areas and ensure that engineering controls are maintained".

WE MUST PRACTICE WHAT WE PLAN...

The prevention of healthcare associated infection is everyone's responsibility, including construction workers. It is not uncommon to go through the ICRA process, establish the precautions and then observe non-compliance on inspection, once the project is underway. Project staff training is important to ensure that the purpose of the precautions is clearly understood by each individual and their responsibility to patient safety recognised.

Temporary barriers constructed with film and adhesive tape does not provide a robust protective environment for extended projects and cannot withstand the rigours of worker entry/exit, delivery of materials, removal of waste etc. A constructed barrier should be fit for purpose and incorporate negative pressure air controls with 12+ air changes per hour.

REFERENCES

References available on request (magazine@informa.com)

AUTHOR INFO

Michael Rollins is an Independent Healthcare Environmental Hygiene and Infection Prevention specialist. Prior to establishing an independent consultancy, Michael was the Projects Manager for Environmental research at University College London Hospitals. Michael works in the UK and KSA in the implementation of enhanced hygiene and environmental Infection prevention quality improvement programmes. He is a regular speaker at International Infection Prevention Conferences. Michael is also a Patron for the Association of Healthcare Cleaning Professionals Organisation in the UK.

CASE STUDY

A COMPARATIVE STUDY OF ENVIRONMENT CONTAINMENT METHODS

OSAKA UNIVERSITY HOSPITAL

A recent presentation at the Japanese Society for Environmental Infection evaluated three methods of construction containment during renovations at the Osaka University Hospital. During the construction of Osaka University Hospital the infection control department monitored environmental contamination in three work sites each using varied containment methods. A built dry-wall barrier contained each site.

Site 1: Used an exhaust fan to the building exterior

Site 2: Installed Negative Air HEPA filtration system directly to the partition wall

Site 3: Installed mobile anteroom system (ECU with negative air HEPA filtration).

METHODS

Periodic air sampling was conducted during construction, and at the end of the work period on exit of workers from the site. Samples were also taken at times of known high levels of dust generation. The air samples were taken within the work site, immediately outside of the access point to the worksite and at several remote points in adjacent corridors. Microbiological cultures were enumerated for Aspergillus and filamentous fungi.

RESULTS

High levels of Aspergillus and filamentous fungi were detected within the work zone. Negative air pressure applied to the work zone reduced contamination levels substantially. However viable spores were not totally controlled by exhaust to the exterior (site 1) or through a wall mounted HEPA filter (site 2). Aspergillus spores were detected immediately outside the work zone and also in remote areas of adjacent corridors. The physical barrier even when negatively pressurised failed to contain dispersion

In comparison, the partition method when installed with the mobile anteroom ECU with a negative air and HEPA filtration system installed, (site 3), the air samples taken in each area outside of the work zone were negative. No Aspergillus spores were detected.

CONCLUSION

Construction/renovation projects should take isolation precautions to comply with the Infection Control Risk Assessment (ICRA) CDC HICPAC Guidelines. Environmental containment and air controls provided by the mobile ECU + HEPA system has proved to be useful in reducing the risk of exposure to Aspergillus and filamentous fungi contamination of the healthcare environment.

The Environmental Containment Unit (ECU) used in this study is a mobile system made up of a collapsible steel frame with a woven polyfabric envelope with 0.03 micron containment rating, attached to the NAM and HEPA system. The ECU is a self-contained anteroom, which provides access via all sides and ceiling panel. This system allows for the controlled and safe entry and exit to the worksite. When the doors or ceiling panel are open for access, the negative air pressure within the ECU creates a secure, controlled airflow of airborne particulate and filtration via the NAM/HEPA and prevents dispersion to the protected patient area.

The system can be used to isolate a single door entry or be deployed in combination with a corridor flange, to isolate a full corridor, or corridor section.

The deployment of the ECU system provides a robust method for particulate containment and protective environment during construction. Negative air pressure and controlled airflow through the negative air machine and HEPA filter provides the required air changes per hour, reducing particulate aerosol within the work area and prevents dispersal to the exterior patient environment. Visual real time monitoring of the HEPA filtration controls and pressure gauge monitor and alarm provides for ICRA validation.