



# Safety Considerations in Performing Ductwork Decontamination in an Animal Facility

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**Abstract** To describe the safety concerns and steps taken to mitigate them in a project to decontaminate ductwork servicing animal quarantine rooms in a research and teaching facility prior to removing and replacing the ducts.

**Methods/Implementation:** Prior to demolition of ductwork servicing two rooms which have been used for animal quarantine, it was decided the ducts should be decontaminated using chlorine dioxide. A contractor was selected to do the project. Through collaborative work with Laboratory Animal Medicine, Facilities Planning and Construction, and Environmental Health and Safety, safety concerns were identified due to the size of the building and ducts, the occupied status of the animal facility, and the use of the building for research and teaching labs, classrooms, offices, and a physical therapy clinic.

**Results/Discussion:** Through collaborative work, it was decided to do the project after normal business hours on a Friday and to close the building early in order to decontaminate in the evening. Notifications were made and staff was in place to ensure occupancy. The decontamination was run with the ductwork under negative pressure to ensure containment of these areas. A test was performed first to determine whether there were any leaks. Sampling was performed to validate the decontamination to ensure safety for the animals and staff performing the decontamination.

**Conclusion:** Through planning and teamwork an effective decontamination took place while ensuring the safety of the animals still in the facility and the staff performing the decontamination. There was minimal interruption to the function of the building and to occupants, and all concerns were mitigated when the building was reoccupied as scheduled the following day. The demolition work was able to start on schedule without concerns for exposure to pathogens for the construction workers.



## The Project

An exhaust fan and ductwork servicing rooms in an animal facility located in the basement of a research and teaching building were to be demolished and replaced. Because the system serviced animal rooms which had originally been designed as the quarantine rooms, and the location pre-existed any current staff, we could not verify whether infectious or hazardous materials had been used in the rooms. Currently the rooms are used to isolate newly arrived animals to ensure their health before entry into the colonies. The old ductwork and exhaust fan were to be demolished by a general contractor and replaced with new equipment. Environmental Health and Safety (EHS), Facilities Planning and Construction (FP&C), and the Lab Animal Medicine (LAM) manager determined it would be best to decontaminate the ductwork prior to demolition.

Because the building is over 30 years old, we could not be sure that the ductwork did not have leaks. The rest of the animal facility was still occupied. The building is occupied by the animal facility, a physical therapy clinic, classrooms and offices, teaching and research labs, and is connected to another building as well.

## Concerns

- Physical Therapy clinic treating patients from 8am until 8pm Mon-Fri.
- Classes and student labs run from 8am until 10pm.
- Research labs and offices which could be occupied at any/all times by at least 4 different departments.
- Animals were located as close as 2 doors away from the rooms serviced by the ductwork of concern and in the rest of the facility.
- Ductwork to be decontaminated ran about 350 feet through the basement, up 3 floors, then into a rooftop mechanical room.
- Unsure of condition of ductwork- would it leak and allow decontamination agent out to other areas of the building?
- Because a closed-loop system is needed for chlorine dioxide, the hose would have to be dropped down the side of the building, enter the building, and run down a hall, leaving the exterior building door and the animal facility entrance propped open and unsecured.
- Chlorine dioxide is still a hazardous material! Safety for personnel involved.

## Why Chlorine Dioxide?

- Chlorine dioxide was chosen because of the comfort level with the safety of the process.
- Detectability of the agent.
- Use in other projects at other institutions with which we were familiar.
- Use chlorine dioxide in animal facility applications already.
- Chose a company and contractor to do the project.



## Planning Process

Started planning far in advance (several months). Worked with FP&C, LAM, building manager, and the PT clinic director to minimize the impact on all groups affected. Decided to do the decontamination with minimal number of people in the building. Best chance of this was on a Friday evening. Could do setup during afternoon and wait to do the decontamination until occupants had left. Contacted PT clinic- they agreed to cancel patients after 6pm that night. E-mail notification was sent out weeks in advance to all building occupants explaining the project and stating that the building would be closed after 6pm. Decided to run the decontamination with the ductwork under negative pressure, and to do a leak test with isoamyl acetate (banana oil) first to see how bad the leakage might be, and where it would occur. Decided to have EHS and LAM staff on-site during decontamination.

## The Decontamination

Contractor arrived in the morning to set up. There were able to run hoses within the duct chase rather than down the side of the building, eliminating the need to leave the exterior door propped open and unsecured. Animals were moved from the immediate area, but were still several doors down. Ran a test with isoamyl acetate (banana oil) in mid-afternoon. Found several minor leaks in recirculation tubing which were corrected. Signs were posted on all building entrances stating the building was closed. Building was locked by Security prior to start of decontamination. EHS and Building Manager walked through the building at 5:45pm before the start to ask several stragglers to leave; went through again at 6pm and the building was vacant except for the decontamination staff. LAM staff on site to ensure security of facility since the door had to remain open and contractors were in the facility and to help move animals if a need arose. EHS and contractors had PPE available- SCBA, PAPR, and full face respirators. Monitoring performed throughout process: spectrophotometer in corridor to monitor chlorine dioxide concentration and handheld electrochemical portable detector was used. Plan established for gross and uncontrollable leakage: cease gas generation and turn on exhaust fan. PPE available for use during this. Buffer zone established in the dirty corridor in facility and hallway exterior to the facility. All extra personnel stayed outside buffer zone during gas generation.

## Results

Had some leakage initially at the generator, so it was moved to a room with negative pressure and exhaust to the outside. Had difficulty generating sufficient concentration to ensure kill- after troubleshooting decided the first gas tank used had a bad chlorine/nitrogen mixture. When tank was replaced a sufficient concentration for decontamination was quickly achieved. 2-Bacillus atrophaeus biological indicators were tested and showed acceptable kill levels had been achieved. During the process the team periodically walked through the building and no detectable levels of chlorine dioxide were detected outside of the room containing the generator. The building was reoccupied the following morning, though occupants were permitted to re-enter at midlight upon completion of the decontamination. All occupants were very satisfied that there were no indications the next day that the decontamination had even taken place. None of the animals were disturbed by the process. Because the decontamination went smoothly, construction was able to proceed on schedule with minimal impact to occupants.

## Lessons Learned

Plan, plan, plan  
-Work with all occupants that will be impacted well in advance. No one was caught by surprise or unaware this would take place, impacting their work.  
-Notify occupants using multiple means- email, signs, verbal notification. 1 method is not enough to ensure the message is disseminated in a multi-use and multi-user facility.  
-Even a building that may be occupied 24/7 can be emptied (or people) with enough planning.  
-Testing early with a safe substitute can identify problems and prevent difficulties later.  
-Work together to troubleshoot and solve problems. Everyone brings different experience and expertise to the table.  
-Have monitoring equipment and PPE available.

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