DRAFT

UNR
Indoor Air Quality
Program

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SCOPE AND APPLICATION

Potential indoor air contaminants include volatile organic compounds from solvents, paints, or sprays; microbial agents; carbon monoxide from idling vehicles, generators, and other incomplete combustion sources; dusts from cutting or grinding activities; formaldehyde; pollen; environmental tobacco smoke and other agents that may cause discomfort or illness.

The procedures outlined in this program reflect the University's commitment to improve air quality and minimize discomfort and illness related to indoor air contaminants. This program applies to all University of Nevada, Reno (UNR) facilities.

ROLES AND RESPONSIBILITIES

Facilities Services Department

1. Notifies contractors and Facilities Services Department personnel of responsibility to minimize generation of airborne contaminants during maintenance, renovation, or construction activities.

2. Requires contractors and Facilities Services Department personnel to implement controls such as ventilation, dust suppression, and containment to minimize the production of airborne contaminants.

3. Notifies EH&S when work will be performed that may generate air contaminants which may be odorous, irritating, or toxic.

4. Does not generate air contaminants in excess of American Conference of Governmental Industrial Hygienist (ACGIH) threshold limit values (TLVs) or OSHA permissible exposure levels (PELs), whichever is lower.

5. Maintains readily accessible material safety data sheets (MSDSs) for any chemical(s) used during construction/maintenance activities.

6. Provides contractor safety plans to EH&S for review prior to work commencement.

7. Provides indoor ventilation rates at UNR facilities in accordance with ANSI/ASHRAE 62-1999 "Ventilation for Acceptable Indoor Air Quality".

Contractors

1. Provides up to date contractor safety plans to the Facilities Serviced Department.

2. Notifies Facilities Services Department when performing work that may generate any air contaminant which may be odorous, irritating, or toxic.

3. Implements controls such as ventilation, dust suppression, and containment to minimize the production of airborne contaminants.

4. Does not generate air contaminants in excess of American Conference of Governmental Industrial Hygienist (ACGIH) threshold limit values (TLVs) or OSHA permissible exposure levels (PELs), whichever is lower.

5. Maintains on-site material safety data sheets (MSDSs) for any chemical(s) used during construction/maintenance activities.

Academic Departments

1. Notifies EH&S when performing academic or research activities that may generate air contaminants which may be odorous, irritating, or toxic.

2. Implements controls such as ventilation, dust suppression, and containment to minimize the production of airborne contaminants.

3. Does not generate air contaminants in excess of American Conference of Governmental Industrial Hygienist (ACGIH) threshold limit values (TLVs) or OSHA permissible exposure levels (PELs), whichever is lower.

4. Maintains on-site material safety data sheets (MSDSs) for any chemical(s) used during academic and research activities.

Environmental Health and Safety Department (EH&S)

1. Develops and implements written indoor air quality program.

2. Performs review of processes and materials used in maintenance, renovation, and/or construction activities.

3. Reviews contractor safety plans as submitted by Facilities Services Department.

4. Conducts monitoring to determine airborne contaminant concentrations.

5. Recommends corrective action(s) and methods to control air contaminants in UNR facilities.

6. Performs routine indoor air quality assessments of UNR facilities.

PROCEDURES

Facilities Services Department

Every effort to prevent the migration of construction/maintenance generated contaminants into occupied areas must be made. This may include implementation of one or more of the following methods:

1. Contain construction/maintenance generated contaminants by sealing doors, HVAC supply & return grills, and any openings in floors or ceilings where contaminants can migrate from the construction zone to occupied areas.

2. Provide a means of exhausting construction/maintenance contaminants out of the building, ensuring that the exhaust is not contaminating occupied areas through open doors, windows, or fresh air intakes.

3. Provide containment vestibule(s) into the construction/maintenance zone to allow ingress and egress while controlling the exposure of contaminants to areas outside of the construction zone.

4. When construction activities require roto-hammer, drilling into, or hammering against the structure thereby creating structure-borne noise, coordinate with the scheduling office to ensure that these operations do not conflict with classroom instruction.

5. Clean equipment outside of the building where vapors from solvents, degreasers, or other chemical solutions will not contaminate occupied areas. Cleaning operations shall not stain exterior surfaces, harm existing landscape vegetation, or pollute drainage systems.

6. Keep gas-powered equipment outside of the building. Prevent exhaust from entering the building through open doors, windows, or fresh air intake vents.

7. If the above requirements cannot be met, contact EH&S for additional solutions to control construction/maintenance generated contaminants.

Contractors

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7. The University of Nevada, Reno expects contractors to understand that construction activities, while vital to our continued growth, must be performed in a manner which minimize exposures to staff and students. If any of the above requirements cannot be met the Contractor must provide a written explanation to the UNR project representative and propose a solution that will appropriately minimize contaminants. No work shall occur until a solution has been approved by the UNR project representative.

Academic Departments

1. Create standard operating procedures (SOPs) which specify controls to minimize the generation of indoor air quality contaminants.

2. Utilize laboratory hoods and other local exhaust ventilation when generating contaminants that may be odorous, irritating, or toxic.

Environmental Health & Safety Department

Routine indoor air quality surveys shall be conducted by the Environmental Health & Safety Department which include:

1. Building walkthroughs to assess building odors, moisture/drainage concerns, and contaminant sources;

2. Inspection of heating, ventilation, and air conditioning system to assess air intakes, filters, coils/drain pans, and accessible ductwork for potential contaminant sources;

3. Completion and maintenance of UNR Facility IAQ Assessment forms in the UNR EH&S Building Files.

Annual ventilation surveys shall be conducted by the Environmental Health & Safety Department on UNR laboratory hoods and local exhaust ventilation systems designed to control emission of indoor air contaminants and should include:

1. Quantitative assessment of average inward air velocities;

2. Visual assessment of containment using smoke and/or appropriate tracers;

3. System performance labeling;

4. Recommendations, as necessary, to Facilities Services Department for exhaust system improvements.

DEFINITIONS

Asbestos Containing Materials: All materials containing greater than 1% asbestos by weight.

Construction/Maintenance Activities: Those activities which are performed to maintain and/or construct equipment, facilities, or grounds on University of Nevada properties. These may include parts/equipment cleaning; disturbing materials which may be asbestos containing; painting/coating activities; sanding or cutting; welding, soldering, and/or torch-cutting.

Construction/Maintenance Generated Contaminants: Construction and/or maintenance generated contaminants are defined, but not necessarily limited to, the following: dust (from cutting and sanding operations); atomized sprays (from painting or sealing operations); vapors (from coating, chemical applications, or cleaning activities); odors (from coating, chemical applications, or cleaning activities); gases (from internal combustion equipment); and noises (from hammering, drilling, sawing, etc.).

HEPA: A pleated filter media (high efficiency particulate arrestor) capable of filtering 99.97% of particulates 0.3 um in size.

HVAC: Heating, ventilating, and air conditioning systems that provide fresh tempered air to occupants of indoor environments.

Indoor Air Quality: Indoor air quality is a term used to characterize the acceptability of the indoor air and is defined as: "The nature of air that affects the health and well-being of occupants." Acceptable indoor air quality is defined by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) as: "Air in which there are no known contaminants at harmful concentrations and with which a substantial majority of the people exposed do not express dissatisfaction."

Material Safety Data Sheet (MSDS): Written or printed material concerning a hazardous chemical which contains the chemical's identity, constituents, physical and chemical characteristics, physical hazards, health hazards, primary routes of entry, exposure limits, carcinogen status, safe handling methods, control methods, emergency and first aid procedures, date of preparation, and the name, address, and telephone number of the chemical manufacturer or distributor.

Permissible Exposure Limit (PEL): Maximum airborne concentrations of substances and conditions that workers may be legally exposed to.

Threshold Limit Value (TLV): Airborne concentrations of substances and conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects.

REFERENCES

American Conference of Industrial Hygienists (ACGIH): Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (Latest Version).

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) 62-1999 "Ventilation for Acceptable Indoor Air Quality".

American Society for Testing and Materials (ASTM) D6245-98 "Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation".

Indoor Air Quality and HVAC Workbook, Burton, J.D., 2000.

Occupational Safety and Health Administration (OSHA) Code of Federal Regulations 29 CFR 1910.1000 "Air Contaminants".

University of Nevada Contract Documents and Construction Specifications for Contractors.

UNR EH&S Facility IAQ Assessment

Building:_____

Date:_____

HVAC Inspection

Outside air intakes clean & free of blockage. Y/N

Outside air intakes free of potential vehicle emissions from loading docks? Y/N

Outside air intakes free of contaminants from garbage dumpsters? Y/N

Outside air intakes free of re-entrainment from nearby building exhaust(s)? Y/N

Outside air intakes free of debris (leaves, bird excrement, etc.)? Y/N

Outside air intakes free from large pollinating foliage (trees, evergreens)? Y/N

Outside air intakes free of other contaminant sources? Y/N

Intake filters clean? Y/N

Intake filters properly fitted? Y/N

Coils & drain pans clean and free of biological growth? Y/N

Visible return air ductwork clean and free of biological growth? Y/N

Potential for combustion gases to enter return air (direct fire, boilers, etc.)? Y/N

Building Walkthrough

Good site drainage away from building? Y/N

Building free of objectionable odors? Y/N

Building free of excess visible moisture and/or standing water? Y/N

- -rooftop
- -crawlspace
- -occupied rooms
- -mechanical/equipment rooms
- -other_____

Evidence of roof or plumbing leaks? Y/N

Building free of visible mold growth? Y/N

Potential contamination/pollutant sources controlled? Y/N
- -building operations/sources
- -maintenance/contractor operations
- -air intake near contaminant source
- -dry traps (drains in sinks, floors, cupboards, hoods, etc.)
- -rodents/fowl
- -other_____

Required Sampling (for routine assessments)

-TSI Q-Trak (CO, CO_2, %RH, temperature)

If CO in any area exceeds 3 ppm, locate source and assess risk.

_____ ppm CO

If CO_2 in any area averages > 1000 ppm then:

1. Measure quantity of supply air in affected area with Alnor Balometer
2. Measure and calculate minimum percent outside air using CO_2 (ASTM D 6245-98) or Temperature methods.
3. Calculate quantity of fresh air/person (should have >20 cfm fresh outdoor air/person per ASHRAE ANSI/ASHRAE 62-1999).

_____ ppm CO_2

_____ $^{?}F$

_____ %RH

-MiniRAE 2000 PID (VOCs)

If reading is above background, locate source and assess risk.

_____ ppm VOC

Additional Sampling (specific complaints/incident response)

-TSI P-Trak (ultrafine particulate concentrations)

1. Measure outdoor ultrafine particulate levels.
2. Measure indoor and supply diffuser ultrafine particulate levels in affected area(s).
3. Measure particulate levels from potential sources such as copy/fax machines, boilers, & building processes
4. Calculate % indoor reduction (should be lower indoors with active building AHU filtration; if reading is significantly above outdoors, locate source and assess risk.)

_____ pt/cc UFP (outdoors)

_____ pt/cc UFP (indoors)

-RAE MultiRAE Gas Monitor (VOCs, CO, LEL, O_2, H2S, Cl)

If H_2S is above 1 ppm, locate source and assess risk.

_____ ppm H_2S

If Cl is above 0.1 ppm, locate source and assess risk.

_____ ppm Cl

If LEL is above 1%, locate source and assess risk.

_____ %LEL

If O_2 is <19.5% or greater than 23%, locate source and assess risk.

_____ %O_2

-TSI Dust-Trak (particulate concentrations)

If reading averages >0.15 mg/m^3, locate source and assess risk

_____ mg/m^3 Total Dust

Outdoor Air & Ventilation Rate Calculations

Outdoor Air Calculations

The approximate percentage of outdoor air (%OA) in the supply air stream of an air handler may be determined by the following methods:

1. Directly measuring the ratio of outdoor air intake volumetric air flow (Q_{oa}) to supply air volumetric air flow (Q_{sa}) where:

   $$\%OA = Q_{oa} / Q_{sa} \text{ X } 100$$

2. Using CO_2 as a tracer gas, measuring CO_2 concentration in the return airflow (C_{ra}), supply airflow (C_{sa}), and outdoors (C_{oa}) where:

   $$\%OA = [(C_{ra} - C_{sa}) / (C_{ra} - C_{oa})] \text{ X } 100$$

3. Measuring the dry bulb temperature of the return air (T_{ra}), mixed return & outside air (T_{ma}), and the outside air (T_{oa}) where:

   $$\%OA = [(T_{ra} - T_{ma}) / (T_{ra} - T_{oa})] \text{ X } 100$$

Outdoor Air Ventilation Rate

The total outdoor air supply volume per person ($Q_{out/person}$) may be calculated by multiplying the percent outside air (%OA) by the total supply volume from air diffusers in the area (Q_{sd}) and dividing by the number of persons normally present in the area.

$$Q_{out/person} = (\%OA \text{ X } Q_{sd}) / (\# \text{ persons})$$