

**Gulf**of**Mexico**



**Operations: HSE**

**Health and Industrial Hygiene**

**Indoor Air Quality**



## TABLE OF CONTENTS

<b>1</b>	<b>Introduction</b> .....	<b>4</b>
<b>2</b>	<b>Scope</b> .....	<b>4</b>
<b>3</b>	<b>Key Responsibilities</b> .....	<b>5</b>
3.1	Offshore Installation Manager (OIM) and Onshore Facility Manager .....	5
3.2	Health & Safety Site Lead.....	5
3.3	Medic.....	5
3.4	Health and Industrial Team .....	6
<b>4</b>	<b>General Requirements</b> .....	<b>6</b>
4.1	Heating, Ventilation, and Air Conditioning (HVAC) Operation and Maintenance.....	6
4.2	Preventing Duct and HVAC System Contamination <b>Error! Bookmark not defined.</b>	
4.3	Moisture Control for Ductwork Systems .....	7
4.4	Housekeeping.....	8
4.5	Record Keeping .....	9
<b>5</b>	<b>Process</b> .....	<b>10</b>
5.1	Indoor Air Quality Assessments .....	10
5.2	Duct Sanitization and Cleaning.....	8
5.3	Mold Remediation/Cleanup Methods .....	9
<b>6</b>	<b>Definitions/Acronyms</b> .....	<b>13</b>
<b>7</b>	<b>Key Documents/Tools/References</b> .....	<b>13</b>

## **1 Introduction**

The purpose of this Indoor Air Quality guideline is to minimize the potential for workforce discomfort and illness as a result of air quality in the work and living environment. This guideline is aligned to meet American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and American Conference of Governmental Industrial Hygienists (ACGIH) regulations and guidelines and conforms to OMS 3.4 Health and Industrial Hygiene.

## **2 Scope**

This Practice is intended to be applied to GoM onshore and offshore facilities and covers the following:

- 2.1.1 Heating, Ventilation, and Air Conditioning System Maintenance and Cleaning
- 2.1.2 Indoor Air Quality Assessments
- 2.1.3 Mold and Other Remediation Work

### **3 Key Responsibilities**

#### **3.1 Offshore Installation Manager (OIM) and Onshore Facility Manager**

- 3.1.1 Address indoor air quality recommendations from industrial hygiene and external inspections.
- 3.1.2 Communicate indoor air quality concerns to the Health & Industrial Hygiene Team.
- 3.1.3 Inform the Health and Industrial Hygiene Team of changes to existing processes, controls, or procedures that have the potential to impact facility air quality and ventilation.

#### **3.2 Health & Safety Site Lead**

- 3.2.1 Document indoor air quality incidents in Tr@ction.
- 3.2.2 Assist with communicating results and recommendations related to indoor air quality assessments.

#### **3.3 Medic**

- 3.3.1 Track personnel complaints/concerns and notify Health and Industrial Hygiene Team to determine whether an indoor air quality assessment is needed.
- 3.3.2 Assist with communicating results and recommendations related to indoor air quality assessments.
- 3.3.3 Inform the Health & Safety Site Lead of indoor air quality concerns and incidents for documentation in Tr@ction.

### **3.4 Health and Industrial Team**

- 3.4.1 Provide technical support as requested and conduct and assist with arranging an indoor air quality or heating, ventilation, and air conditioning (HVAC) assessment.
- 3.4.2 Investigate health complaints/concerns related to indoor air quality issues.
- 3.4.3 Review and update this Practice every 5 years or sooner if regulations or guidelines change.

## **4 General Requirements**

### **4.1 Heating, Ventilation, and Air Conditioning (HVAC) Operation and Maintenance**

- 4.1.1 HVAC system maintenance and correct operation are critical to providing a comfortable indoor environment for occupants. ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality, contains specific ventilation system components to be maintained, what tasks to be performed, and the minimum frequency for performing tasks.
- 4.1.2 Fungal (mold), bacterial and dust mite growth can be minimized by controlling temperatures, humidity, water intrusion, condensation, etc. in HVAC systems.
- 4.1.3 Supplied outdoor air and air exchange rates in HVAC systems can assist with maintaining indoor air quality. ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality, specifies minimum ventilation rates for indoor air quality to minimize the potential for adverse health effects.
- 4.1.4 Dust in ducts/HVAC systems act as a reservoir for microbial growth including fungi (mold), bacteria and dust mites. Use the highest efficiency air filter recommended by the manufacturer of the HVAC system.
- 4.1.5 Change filters on a routine schedule. If filters are clogged, increase the change-out frequency.
- 4.1.6 Check for missing filters and for air gaps around the filter/filter holder.

- 4.1.7 Keep cooling coils clean.
- 4.1.8 Do not allow standing water in drain pans. Consult with the Health and Industrial Hygiene Team prior to adding algaecides or other slime prevention chemicals to the drain pans or the HVAC system.
- 4.1.9 Seal off supply and return registers and do not operate the HVAC system during construction or until dust is cleaned up.
- 4.1.10 If the heating system includes in-duct humidification equipment, be sure to operate and maintain the humidifier as recommended by the manufacturer.

## **4.2 Moisture Control for HVAC Systems**

- 4.2.1 Moisture control is critical to controlling mold and fungal growth. Any water infiltration should be stopped and cleaned promptly. A prompt response (within 24-48 hours) and thorough clean-up, drying, and/or removal of water-damaged materials will prevent or limit mold growth.
- 4.2.2 Cooling coils are designed to remove water from the air and can be a major source of moisture contamination of the system and can lead to mold growth. Verify that condensate pan drains properly. The presence of substantial standing water and/or debris indicates a problem requiring immediate attention. Check any insulation near cooling coils for wet spots.
- 4.2.3 The heating and cooling system should be properly insulated on the outside of ductwork instead of inside the ductwork to prevent water condensation.
- 4.2.4 Perform regularly scheduled building/ HVAC inspections and maintenance, including filter changes.
- 4.2.5 Maintain indoor relative humidity below 70% (25 - 60%, if possible).
- 4.2.6 Vent moisture-generating appliances, such as dryers, to the outdoors where possible.
- 4.2.7 Vent kitchens (cooking areas) and bathrooms to the outside.

4.2.8 Protect air intakes from water intrusion.

### 4.3 Duct Sanitization and Cleaning

4.3.1 Duct cleaning refers to the cleaning of various heating and cooling system components of forced air systems, including the supply and return air ducts and registers, grilles and diffusers, heat exchangers heating and cooling coils, condensate drain pans (drip pans), fan motor and fan housing, and the air handling unit housing. This type of process is often applied on a monthly or quarterly basis based on recommendations and advice from the manufacturer and Health and Industrial Hygiene Team. Air ducts should be cleaned if:

- A. There is substantial visible mold growth inside ducts or on other components of HVAC system.
- B. If the insulated air ducts and the insulation gets wet or moldy it cannot be effectively cleaned and should be removed and replaced. Note: If the conditions causing the mold growth in the first place are not corrected, mold growth will recur.
- C. Ducts are infested with vermin, e.g. (rodents or insects).

4.3.2 Duct sanitization is a preventive measure taken to ensure that growth of mold and other contaminants do not build up in the air ducts. It involves the use of an industrial fogger machine and liquid sanitizer applied to the internal air supply system. This type of process is often applied on a monthly or quarterly basis based on recommendations and advice from the manufacturer and Health and Industrial Hygiene Team.

4.3.3 Cleaning and sanitizing HVAC systems requires removing the sources of contamination by hand-brushing or contact vacuuming. During cleaning, the entire HVAC system is placed under continuous negative pressure (vacuum) to prevent the spread of contaminants (depending on the size of the remediation). Continuous negative pressure allows very fine particles to be removed from the system as they become airborne, ensuring that these particles are not released into the living space when the system is turned on after cleaning.

## **4.4 Mold Remediation/Cleanup Methods**

- 4.4.1 Contact the Health and Industrial Hygiene Team for mold and other remediation projects to determine procedures and personnel protection requirements.
- 4.4.2 Mold remediation methods may include use of wet vacuum, damp wipes, HEPA vacuum.
- 4.4.3 Building materials and furnishings contaminated with mold growth that are not salvageable should be placed in sealed impermeable bags or closed containers to minimize dispersion of mold spores. These materials can usually be discarded as ordinary construction waste.

## **4.5 Housekeeping**

- 4.5.1 Use high efficiency particulate air (HEPA) filters in vacuum cleaners, as needed, to reduce escape of dust and other air contaminants through the exhausted vacuum air.
- 4.5.2 Clean up water leaks promptly. Contact the Housekeeping and Maintenance Staff to clean up and fix the leak.
- 4.5.3 Promptly wet-vacuum carpets or other soft surfaces if wet. Use fans to dry the surfaces. If the surfaces show signs of mold or odor, remove and discard the contaminated item. Consult with the Health and Industrial Hygiene Team for personal protective equipment (PPE) and procedures to minimize the spread of contamination prior to removing contaminated items.
- 4.5.4 Dust with electrostatic wipes.
- 4.5.5 If excessive visible dust accumulates on air registers and vent covers, inform the Maintenance Team to check for filter blow out or leakage.

## **4.6 Record Keeping**

- 4.6.1 Indoor Air Quality assessment records, including testing, evaluations, and reports, shall be maintained in the document repository system.

4.6.2 HVAC system evaluations and operations and maintenance records (including filter changes and duct cleaning) shall be maintained.

## **5 Process**

### **5.1 Indoor Air Quality Assessments**

5.1.1 In the event that personnel express concern regarding the indoor air quality, or the Medic notices an increase in occupant symptoms (flu-like or allergy type symptoms), contact the Health and Safety Site Lead and the Health and Industrial Hygiene Team for an indoor air quality assessment. The assessment may comprise of the following:

- A. An informal interview to understand symptoms, time/location related issues, allergies, and how wide spread the issue is. A symptom survey may also be used to assess personnel using the Appendix - Indoor Air Quality Health Questionnaire.
- B. Facility walkthrough that will include a review of:
  - 1. Visible signs of water damage, lack of hygiene, fungal (mold) growth
  - 2. Check for housekeeping issues (excessive dust on air returns, etc.)
  - 3. Check chemical storage (near the air intakes, in mixing chambers)
  - 4. Check for leaks, drainage issues, condensation in or on ductwork
  - 5. Check for the use of biocides (bactericides, algacides)
  - 6. Check HVAC system (filters, drain pans, air flow, air intakes, return air, etc.)
  - 7. Check HVAC maintenance, operation, filter change-out schedules
- C. Monitoring for the following contaminants and/or parameters depending on personnel concerns, symptoms, and visual assessment/facility walkthrough will also be completed. All samples will be sent to accredited laboratories for analysis.

1. Carbon monoxide, carbon dioxide, ozone, formaldehyde, nitrogen oxides, volatile organics, and other chemical contaminants
  2. Air monitoring for fungal and other biological contaminants (indoor vs. outdoor levels)
  3. Temperature, humidity, moisture
  4. Air flow
  5. Bulk samples of contaminated materials or tape/swab surface sampling
- 5.1.2 Corrective actions and/ or remediation may also be required depending on the level of contamination and results from the indoor air quality assessment. Contact the Health and Industrial Hygiene Team for approved contractors and remediation/cleaning procedures based on size of project.
- A. Consult with the Health and Industrial Hygiene Team for PPE and procedures to minimize the spread of contamination prior to removing contaminated items.
  - B. Use a licensed remediation contractor for large projects.
  - C. For small jobs, remove visibly contaminated materials (ceiling tiles, insulation, porous surfaces). Procedures will include the use of a 10:1 water bleach solution or approved disinfectant/sanitizer. Utilize PPE per the safety data sheet (SDS).

5.1.3 Indoor Air Acceptable Concentration Standards and Parameters

<b>Parameter</b>	<b>Acceptable Concentration*</b>
Carbon Dioxide	250-350 ppm normal outdoor level 600 ppm, possible occupant complaints
Carbon Dioxide	<1000 ppm
Carbon Monoxide	0 -1 ppm
Carbon Monoxide - Outdoors	9 ppm (8 hour average concentration) 35 ppm (1 hour average concentration)

Nitrogen dioxide - Outdoors	0.053 ppm (annual)
Ozone - Outdoors	0.075 ppm (8 hour average concentration)
Particulate 10 microns - Outdoors	150 µg/m <sup>3</sup> (24 hour average concentration)
Particulate 2.5 microns - Outdoors	35 µg/m <sup>3</sup> (24 hour average concentration)
Formaldehyde	<0.1 ppm
Radon	< 4 pCi/L
Temperature	68-76° F
Relative Humidity	20%-60%
Ventilation Rate	Minimum 15 cfm of outdoor air per person for office reception areas Minimum 20 cfm per person for general office space 60 cfm per person for smoking lounges with local mechanical exhaust ventilation and no air recirculation
Fungal Spores Outdoors	1,000 to 100,000 cfu/m <sup>3</sup> of air, where: <ul style="list-style-type: none"> <li>• 1,000 viable colony-forming units in a cubic meter of air</li> <li>• 1,000,000 fungi per gram of dust or material</li> <li>• 100,000 bacteria or fungi per milliliter of stagnant water or slime</li> </ul>
Volatile Organic Compounds	Compare to Non-complaint area
Ammonia	Compare to Non-complaint area
Hydrogen Sulfide	Compare to Non-complaint area
Sulfur Dioxide	Compare to Non-complaint area
<p><b>*parts per million = ppm</b>  <b>*µg/m<sup>3</sup> = micrograms per cubic meter</b>  <b>*pCi/L - picoCuries per liter</b></p>	

## **6 Definitions/Acronyms**

## **7 Key Documents/Tools/References**

- 7.1.1 ASHRAE Standard 62.1-2013, Ventilation for Acceptable Indoor Air Quality
- 7.1.2 ASHRAE Standard 55-2013, Thermal Environmental Conditions for Human Occupancy, ACGIH, 1999, Bioaerosols Assessment and Control
- 7.1.3 DWGOM-GP 44-1502 Living Quarters Design Guideline
- 7.1.4 Appendix - Indoor Air Quality Health Questionnaire

## Appendix - Indoor Air Quality Health Questionnaire

<b>Location/Facility</b>	
<b>Date</b>	
<b>QUESTION</b>	<b>ANSWER/RESPONSE</b>
<p><b>List complaints</b></p> <p>Temperature too hot or cold, air circulation (stuffy feeling), noticeable odors, dust in air?</p>	
<p><b>Health Problems or Symptoms</b></p> <p>Describe in <u>three words or less</u> each symptom of adverse health effect you experience <u>more than two times</u> per week (i.e., runny nose)</p>	
<p><b>Symptom occurrence</b></p> <p>Living Quarter or Work Area/Office?</p> <p>Morning, Afternoon, All day, No Noticeable Trend?</p> <p>Do the above symptoms clear up within 1 hour after leaving the Living Quarters or Work Area/Office (if No, describe)?</p>	
<p><b>Do you have any health problems or allergies which might account for any of the above symptoms?</b></p> <p>Yes or No (if Yes, describe)</p>	

<p><b>Do you wear contact lenses?</b></p> <p>Yes or No</p>	
<p><b>Do you operate video display terminals at least 10% of the work day, operate photocopier machines at least 10% of the work day, use or operate other special office machines or equipment</b></p> <p>Yes or No (if Yes, describe)</p>	
<p><b>Are you currently taking medications?</b></p> <p>Yes or No (if Yes, the Health Team may contact you)</p>	
<p><b>Do you smoke? Or, do others in your work area smoke?</b></p> <p>Yes or No</p>	
<p><b>Provide your Living Quarter number or your work area/office location</b></p>	
<p><b>Your job title or position and primary task/s</b></p>	
<p><b>Any other comments or observations concerning your work/office environment</b></p>	