



Forms

Contact List

BWS Instructions

Help Desk

Find Subject Areas:

Index



Categories



Alpha



Show Side Menu

Search Subject Areas &amp; Legacy Documents:

## Contents: Indoor Air Quality

Effective Date: July 2003

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

Section	Overview of Content (see section for full process)
<a href="#">Introduction</a>	
<a href="#">1. Assessing Need for Indoor Air Quality Evaluation</a>	<ul style="list-style-type: none"> <li>• Report symptoms.</li> <li>• Arrange for IAQ evaluation.</li> </ul>
<a href="#">2. Maintaining Indoor Air Quality in Routine Building Operations</a>	<ul style="list-style-type: none"> <li>• Implement control measures.</li> </ul>
<a href="#">3. Building Renovations &amp; Remodeling: Controlling the Impact on Indoor Air Quality</a>	<ul style="list-style-type: none"> <li>• Consider IAQ in design phase.</li> <li>• Ensure procedures and controls are incorporated.</li> <li>• Develop and implement a work plan.</li> <li>• Notify occupants when work may introduce air contaminants in work area.</li> </ul>
<a href="#">4. Conducting an Indoor Air Quality Investigation</a>	<ul style="list-style-type: none"> <li>• Document symptoms.</li> <li>• Conduct walk through to determine potential sources of contamination.</li> <li>• Record findings.</li> <li>• Arrange for measurements of contaminants, comfort parameters, and ventilation indicators.</li> <li>• Maintain documentation.</li> <li>• Arrange for follow-up from occupants.</li> </ul>
<a href="#">Definitions</a>	
<b>Exhibits</b>	
<a href="#">BNL Building-specific IAQ Compliance Programs</a>	
<a href="#">General Guidance on Building Ventilation, Operations and Maintenance Controls</a>	
<b>Forms</b>	
<a href="#">Initial Indoor Air Quality Investigation Record</a>	

[Initial Indoor Air Quality Investigation Record](#)

## Training Requirements and Reporting Obligations

This subject area does not contain training requirements.

This subject area does not contain reporting obligations.

## References

ANSI/ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy

ANSI/ASHRAE Standard 62: Ventilation for Acceptable Indoor Air Quality

[Asbestos](#) Subject Area

[BNL Smoking Policy](#)

[Environment, Safety, Health and Quality \(Tier I\) Inspections](#) Subject Area

[Indoor Air Quality Subject Matter](#), [Safety & Health Services Industrial Hygiene](#) Web site

[Lead](#) Subject Area

[Work Planning and Control for Experiments and Operations](#) Subject Area

[Working with Chemicals](#) Subject Area

## Standards of Performance

All staff and guests shall comply with applicable Laboratory policies, standards, and procedures, unless a formal variance is obtained.

All staff and users shall identify, evaluate, and control hazards in order to ensure that work is conducted safely and in a manner that protects the environment and the public.

## Management System

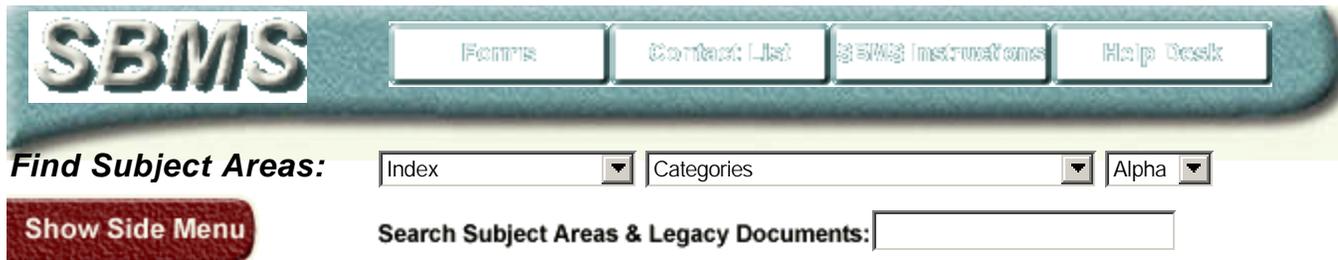
This subject area belongs to the **Worker Safety and Health** management system.

[Back to Top](#)

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**SBMS**    [Forms](#)    [Contact List](#)    [SBMS Instructions](#)    [Help Desk](#)

**Find Subject Areas:**    Index    Categories    Alpha

[Show Side Menu](#)    **Search Subject Areas & Legacy Documents:**

---

## Introduction: Indoor Air Quality

Effective Date: **July 2003**

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

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Indoor Air Quality (IAQ) refers to the composition of air within occupied areas of a building. It includes such factors as relative humidity, temperature, microbial contamination, and toxic air constituents not related to process equipment and operations conducted in the work area. An example of a toxic IAQ concern would be carbon monoxide infiltration into a building from motor vehicles outdoors or off-gassing of chemicals from new carpeting, paint, or furniture. Occupants may become ill or experience extreme discomfort when in a building with poor IAQ due to unacceptable breathing air. In some cases where air quality is otherwise acceptable, certain individuals may have a higher degree of sensitivity to specific contaminants and display potentially extreme reactions at very low levels, while others appear to be unaffected. Occupants with specific sensitivities should work closely with their ES&H Coordinators to minimize potential exposures.

This subject area will help individuals become aware of the causes of poor IAQ and how to prevent them. It also provides information to determine if an IAQ specialist is needed for assistance in evaluating potentially hazardous work areas.

The evaluation of fugitive emissions from chemical use in industrial or laboratory work areas is not covered by this subject area. These situations are covered by the [Working with Chemicals](#) Subject Area. Examples of this type of toxic air contaminant scenario would be solvent vapors from PVC-pipe installation, vapors from photo-developing equipment, and laboratory handling of chemicals outside of a hood. Outdoor environmental exposures are not considered under this subject area unless they infiltrate a building envelope and cause health concerns indoors.

Indoor air quality problems can occur in all types and ages of buildings; in newly constructed buildings, in renovated or remodeled buildings, and in old buildings. Problems in new, clean buildings are often not related to microbial growth, since the physical structures are new. Older buildings that have not been adequately maintained and operated may have problems with bioaerosols if parts of the building have been allowed to become reservoirs for microbial growth. If inadequate outside air is provided, regardless of the age of the building, chemical and biological contaminants may build up to levels that can cause health effects in some workers. Other physical factors such as lack of windows, noise, and inadequate lighting, and ergonomic factors involving uncomfortable furniture and intensive use of video display units, will cause discomfort in occupants that may be inaccurately attributed to poor IAQ.

IAQ complaints are often categorized as Sick Building Syndrome (SBS) or Building-related Illnesses (BRI). SBS is attributed when there is no well-defined disease or cause. It appears to be a reaction at least in part due to stimulation by a variety of chemical, physical and/or

to be a reaction, at least in part due to stimulation by a variety of chemical, physical and/or biological stimuli. BRIs are typically specific medical conditions of known etiology, which can be documented by physical signs and laboratory findings.

[Back to Top](#)

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[Show Side Menu](#)

Subject Area: *Indoor Air Quality*

# 1. Assessing Need for Indoor Air Quality Evaluation

Effective Date: **July 2003**

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

## Applicability

This information applies to BNL staff who assess the need for an Indoor Air Quality Evaluation.

## Required Procedure

<b>Step 1</b>	<p>Staff contact their Supervisor or <a href="#">ESH Coordinator</a> when they exhibit symptoms, such as</p> <ul style="list-style-type: none"> <li>≅ Runny nose;</li> <li>≅ Itchy or burning eyes;</li> <li>≅ Throat irritation;</li> <li>≅ Nasal congestion;</li> <li>≅ Headaches.</li> </ul> <p><b>Note:</b> As many of these symptoms are also associated with the common cold or flu, Indoor Air Quality (IAQ) evaluations should be done when multiple occupants have symptoms for long periods (at least a month), or when a temporary medical condition or illness is not the cause of symptoms. A good determinant of Building-related Illness (BRI) is a distinct link between symptoms that end when the occupant is not in the building (such as weekends and evenings for office workers).</p>
<b>Step 2</b>	<p>The ESH Coordinator contacts the Industrial Hygiene Representative to arrange for an IAQ evaluation, when necessary.</p>
<b>Step 3</b>	<p>Staff with symptoms that decrease their ability to perform assigned tasks or with discomfort that persists when at BNL, report the problem to their Supervisor. The Supervisor assists the worker in obtaining medical attention from the Occupational Medicine Clinic (OMC) and other Safety &amp; Health Services Division (SHSD) professionals. Staff may also go directly to the OMC to report signs and</p>

symptoms.

## Guidelines

Advice for staff, ESH Coordinators, and those affected by poor IAQ is available through the [Indoor Air Quality Subject Matter](#), [Safety & Health Services Industrial Hygiene](#) Web site.

## References

[Indoor Air Quality Subject Matter](#), [Safety & Health Services Industrial Hygiene](#) Web site

| [Continue to Next Page](#) |

[Back to Top](#)

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Forms
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Help Desk

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[Show Side Menu](#)      Search Subject Areas & Legacy Documents:

Subject Area: *Indoor Air Quality*

## 2. Maintaining Indoor Air Quality in Routine Building Operations

Effective Date: July 2003

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

### Applicability

This information applies to BNL staff and non-BNL staff who plan or perform work with the potential to impact indoor air quality.

### Required Procedure

BNL staff and non-BNL staff must follow these procedures when planning or performing routine work.

<b>Step 1</b>	<p>Line Management ensures all appropriate personnel are knowledgeable in</p> <ul style="list-style-type: none"> <li>⚡ How to maintain adequate ventilation to minimize concentration of air contaminants generated during work;</li> <li>⚡ How to minimize adverse effects on indoor air quality during the use and storage of chemicals and other agents.</li> </ul>
<b>Step 2</b>	<p>The Supervisor implements control measures, such as local-source-capture exhaust ventilation or substitution, when general ventilation is inadequate to control air contaminants emitted from point sources within workspaces.</p> <p>To eliminate or provide controls for industrial process sources or tasks that can emit chemical vapors, mists, fumes or particulates, see the <a href="#">Working With Chemicals</a> Subject Area, and the <a href="#">Lead</a> and <a href="#">Asbestos</a> Subject Areas for control requirements.</p> <p>Ensure the BNL Smoking Policy is followed. See the <a href="#">BNL Smoking Policy</a>.</p> <p>See the exhibit <a href="#">General Guidance on Building Ventilation, Operations, and Maintenance Controls</a> for recommendations to follow to prevent the degradation of</p>

[Maintenance Controls](#) for good practices to follow to prevent the degradation of building-specific IAQ.

## Guidelines

Building ventilation and occupancy condition should meet the following:

- ✦ The NYS Building Code - International Building Code (IBC) general design parameters;
- ✦ ANSI/ASHRAE Standard 62: Ventilation for Acceptable Indoor Air Quality;
- ✦ ANSI/ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy.

See the exhibits [BNL Building-specific IAQ Compliance Programs](#) and [General Guidance on Building Ventilation, Operations, and Maintenance Controls](#).

## References

ANSI/ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy

ANSI/ASHRAE Standard 62: Ventilation for Acceptable Indoor Air Quality

[Asbestos](#) Subject Area

[BNL Smoking Policy](#)

[Lead](#) Subject Area

[Working With Chemicals](#) Subject Area

| [Go to Previous Page](#) | [Continue to Next Page](#) |

[Back to Top](#)

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Subject Area: *Indoor Air Quality*

## 3. Building Renovations & Remodeling: Controlling the Impact on Indoor Air Quality

Effective Date: July 2003

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

### Applicability

This information applies to BNL staff who plan and perform building renovation and remodeling activities.

### Required Procedure

BNL staff must follow these procedures when planning or performing renovation and remodeling work.

<b>Step 1</b>	The Design/Project Manager includes Indoor Air Quality (IAQ) considerations in the design phase to eliminate degradation.
<b>Step 2</b>	Work Control Managers/Coordinators (WCM/WCC) ensure procedures and appropriate controls are incorporated to minimize degradation of the IAQ for staff performing renovation and remodeling, as well as staff in other areas of the building.
<b>Step 3</b>	<p>In accordance with the requirements of the <a href="#">Work Planning and Control for Experiments and Operations</a> Subject Area, WCMs/WCCs meet with the contractor or individual(s) performing the work to develop and implement a work plan, considering the following:</p> <ul style="list-style-type: none"> <li>⚡ Means to ensure HVAC systems continue to function effectively during remodeling and renovation;</li> <li>⚡ Controls to prevent air contaminant entry into the HVAC air distribution system;</li> <li>⚡ Isolation or containment of work areas and appropriate negative pressure containment;</li> <li>⚡ Air contaminant suppression controls or auxiliary air filtration/cleaning.</li> </ul> <p>See the <a href="#">Work Planning and Control for Experiments and Operations</a> Subject Area for information on work planning.</p>

<b>Step 4</b>	<p>Line Management ensures workers involved in building renovations and remodeling are knowledgeable in the following:</p> <ul style="list-style-type: none"> <li>⚡ How to maintain adequate ventilation to minimize concentration of air contaminants generated during these operations;</li> <li>⚡ How to minimize adverse effects on indoor air quality during the use and disposal of chemicals and other agents.</li> </ul>

## Guidelines

Building Managers should notify occupants of scheduled renovations and activities such as roofing work. Occupants, who know they may be sensitive to factors generated as part of this work, should contact their Supervisor and ESH Coordinator for evaluation and possible temporary work accommodations, including relocation, as necessary. Supervisors should make all necessary adjustments to ensure adequate measures are invoked for occupant protection.

## References

[Work Planning and Control for Experiments and Operations](#) Subject Area

| [Go to Previous Page](#) | [Continue to Next Page](#) |

[Back to Top](#)

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Forms
Contact List
SBMS Instructions
Help Desk

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[Show Side Menu](#)      Search Subject Areas & Legacy Documents:

Subject Area: *Indoor Air Quality*

## 4. Conducting an Indoor Air Quality Investigation

Effective Date: July 2003

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

### Applicability

This information applies to BNL staff who evaluate employee complaints of IAQ concerns.

### Required Procedure

<b>Step 1</b>	<p>The ESH Coordinator conducts or coordinates interviews of employees with the Industrial Hygiene Representative to document the employees' symptoms in relation to occupancy of the building. This is to determine a correlation between symptoms and exposure, especially in relationship to occupancy of any particular area or a temporal relationship (time of day, week, or season).</p> <p>Include discussion of any activities done by employees outside BNL (such as sports, woodworking, painting, yard work) that may result in IAQ stressors. Non-BNL activities may be the initiator of IAQ symptoms or aggravate existing conditions.</p>
<b>Step 2</b>	<p>The ESH Coordinator conducts a walk through of the area in question to determine potential sources of contamination. This walk through may be in conjunction with the Industrial Hygiene Representative. Check for the following:</p> <ul style="list-style-type: none"> <li>≠ Water leaks;</li> <li>≠ Chemical storage;</li> <li>≠ Fungal growth and water damage;</li> <li>≠ Animal or insect infestation;</li> <li>≠ Hygiene issues.</li> </ul> <p>Observe the local heating and cooling system equipment for signs of contamination (dust patterns by grills, clogged room A/C filters, improper setting of room A/C vent, etc.).</p> <p>Ensure the BNL Smoking Policy is followed. See the <a href="#">BNL Smoking Policy</a>.</p>
<b>Step 3</b>	<p>Include mechanical rooms and systems that service the area, if appropriate. Check for the following:</p>

	<p>Check for the following.</p> <ul style="list-style-type: none"> <li>⚡ Condensation in HVAC drain pans;</li> <li>⚡ Integrity of HVAC filters;</li> <li>⚡ Sources of contaminants into the HVAC;</li> <li>⚡ Condition and settings of exhaust and intakes for the HVAC;</li> <li>⚡ Leaks in the steam coils, etc.</li> </ul>
<b>Step 4</b>	<p>Record findings using the <a href="#">Initial Indoor Air Quality Investigation Record</a> or equivalent.</p> <p><b>Note:</b> The Industrial Hygiene Group developed a procedure for coordinated activities when the scope of the investigation indicates multi-jurisdictional efforts to identify or remediate the concerns. See the <a href="#">Indoor Air Quality Subject Matter</a> for information.</p>
<b>Step 5</b>	<p>If applicable, arrange for measurements of airborne contaminants, comfort parameters (temperature/relative humidity) and/or ventilation indicators (e.g., carbon dioxide). See the exhibit <a href="#">General Guidance on Building Ventilation, Operations and Maintenance Controls</a> for information.</p>
<b>Step 6</b>	<p>Maintain documentation of any formal report provided by the Industrial Hygiene Representative. The report should describe environmental conditions, symptoms, exposure monitoring results, and recommended remediation, if appropriate. Send a copy to the worker and his/her management, Occupational Medicine Clinic, the Building Manager, and the Industrial Hygiene Group.</p>
<b>Step 7</b>	<p>Arrange for a follow-up or feedback from occupants to determine if changes were effective and if further improvements are required.</p>

## References

[BNL Smoking Policy](#)

| [Go to Previous Page](#) |

[Back to Top](#)

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[Forms](#)[Contact List](#)[SBMS Instructions](#)[Help Desk](#)**Find Subject Areas:**

Index



Categories



Alpha

[Show Side Menu](#)Search Subject Areas & Legacy Documents: 

---

Subject Area: *Indoor Air Quality*

## BNL Building-specific IAQ Compliance Programs

Effective Date: **July 2003**Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

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The BNL Building-specific IAQ Compliance Programs is provided as a [Word](#) file.

[Back to Top](#)

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## BNL Building-specific IAQ Compliance Programs

Element	Description	Location/Reference
Responsibility	BNL management identifies a <i>designated person</i> who is given the responsibility for implementation of the IAQ compliance program in the building.	Building Manager or ESH Coordinator
Elements of the Compliance Program	Description of the facility building systems, which may include: <ul style="list-style-type: none"> <li>• Work</li> <li>• Number of employees and visitors</li> <li>• Hours of operation</li> <li>• Weekend use</li> <li>• Tenant requirements</li> <li>• Known air contaminants released in the space.</li> </ul>	Facility Use Agreement
	Single-line schematics or as-built construction documents which locate major building system equipment and the areas that they serve	Plant Engineering Documents
	Information for the daily operation and management of the building systems, which must include <ul style="list-style-type: none"> <li>• Description of normal operating procedures,</li> <li>• Special procedures such as seasonal start-ups and shutdowns, and</li> <li>• List of operating performance criteria including minimum outside air ventilation rates, potable hot water storage and delivery temperatures, range of space relative humidity levels, and any space pressurization requirements</li> </ul>	Plant Engineering Documents
	Programs for the preventive maintenance of building systems that reflect equipment manufacturer's recommendations. The maintenance program describes the equipment to be maintained and established maintenance procedures and frequency of performance	Plant Engineering Documents
	Visual inspection of building systems	Tier 1 Inspection protocol/reports. See the <a href="#">Environment, Safety, Health and Quality (Tier I) Inspections</a> Subject Area.

Engineering System Records	<p>If available, retain the following information to assist in potential indoor air quality evaluations:</p> <ul style="list-style-type: none"> <li>• As-built construction documents</li> <li>• HVAC system commissioning reports</li> <li>• HVAC systems testing, adjusting and balancing reports</li> <li>• Operations and maintenance manuals</li> <li>• Operator training materials.</li> </ul>	Plant Engineering Documents
Employee Complaint Records	<p>Establish a written record of employee complaints of signs or symptoms that may be related to building-related illness to include:</p> <ul style="list-style-type: none"> <li>• Information on the nature of the illness reported</li> <li>• Date of employee complaint</li> <li>• Remedial action, if any, taken to correct the source of the problem.</li> </ul>	ESH Coordinator
Maintenance records	<p>Maintain inspection and maintenance records, including:</p> <ul style="list-style-type: none"> <li>• Specific remedial or maintenance actions taken</li> <li>• Date of the inspection or maintenance activity.</li> </ul>	Plant Engineering Documents



Forms
Contact List
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---

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Subject Area: **Indoor Air Quality**

## General Guidance on Building Ventilation, Operations, and Maintenance Controls

Effective Date: **July 2003**

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

The following guidelines are presented as good practices to prevent degradation of building-specific Indoor Air Quality.

- ✧ Periodically inspect building systems.
- ✧ Establish a written record of building system inspections and maintenance.
- ✧ Ensure hallways and offices are positively pressurized relative to chemical use areas, such as shops and laboratories. Maintain the balance by increasing the exhaust airflow in the area of chemical use via local (lab hoods, elephant trunk systems) and general dilution systems.
- ✧ Locate air intakes on HVAC systems to eliminate the potential for re-entrainment of building exhaust, local exhaust ventilation systems, and intake of exhaust from motor vehicles. Post areas where vehicles should not idle.  
Implement measures, where necessary to relocate air intakes and other building openings to prevent entry of outdoor air contaminants.
- ✧ Determine if the building has adequate ventilation for the number of building occupants in each area. Guidance is provided in ASHRAE Standard 62: Ventilation for Acceptable IAQ.
- ✧ Determine that the building has appropriate heating and cooling capacity for the number of building occupants. The comfort zone for temperature is typically: Winter: 67 - 73.4°F (19.5 - 23°C); Summer: 72.7 - 78.8°F (22.6 - 26°C). Also determine the temperature ranges required for office/experimental equipment before making temperature adjustments. Guidance is provided in ASHRAE Standard 55: Thermal Environmental Conditions for Human Occupancy.
- ✧ Identify the type of humidification/dehumidification system and determine that the building has adequate capacity for the building design. Acceptable range for relative humidity is 15 -70 %. Optimum to prevent microbial growth is <60%. Below 15% humidity, nasal and upper respiratory tract dryness, irritation, and congestion may occur.
- ✧ Control routine sources of occupant-derived odors. Example: provide dilution ventilation for areas where cooking odors occur and ventilate bathrooms and janitor closets with continuous or intermittent fans.
- ✧ Inform occupants in areas to be treated with chemicals (e.g., floor strippers and pesticide spraying) before application. Use and apply the chemicals according to manufacturers' recommendations.

- ⌘ Maintain and operate the HVAC system within design specifications and provide at least the minimum outside air ventilation rate as detailed in design specifications.
- ⌘ Control microbial contamination in the building by
  - ⌘ Routinely inspecting for, and promptly repairing, water leaks that can promote growth of biologic agents.
  - ⌘ Promptly drying, replacing, or removing damp/wet materials.
  - ⌘ Repairing or removing significant visible microbial contamination in ductwork, humidifiers, other HVAC and building system components, or on building surfaces when found during regular or emergency maintenance activities, or during any visual inspection.
- ⌘ Maintain operable windows, doors, vents, stacks, and other portals designed or used for natural ventilation in buildings without mechanical ventilation.
- ⌘ Maintain mechanical equipment rooms and any nonducted air plenums or chases that transport air in a clean condition. Do not store chemicals or janitorial equipment/supplies in these areas.

[Back to Top](#)

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# Initial Indoor Air Quality Investigation Record



<b>Name:</b>	<b>BNL#:</b>	<b>Date:</b>
<b>Department:</b>	<b>Building:</b>	<b>Room/Area:</b>
<b>Description of Area:</b>	<b>Number of Employees Affected:</b>	<b>Investigator(s):</b>

## Symptoms

<b>Physical</b>	Eyes, nose, throat, pain, sneezing, irritation, burning	
<b>Sensory</b>	Odor, temperature, comfort, noise	
<b>Pattern/ Frequency</b>	Time of day, weekends vs. weekdays, seasonal, persons affected- all or specific people	

## Potential Causal Agents

<b>Microbial</b>	Sign of water damage, excess paper storage, accumulated dust, carpet, type of wall material, etc.	
<b>VOCs</b>	Odors, chemical sources, age of carpet and furniture, vehicle intake, photocopiers, etc.	
<b>Ventilation</b>	Central HVAC versus room, humidifier, duct cleanliness, make-up air quantity and pattern, air change-rate, source & pattern, blocked air vents or grills	
<b>Lighting</b>	Type of lamps, intensity, distribution, glare, task lighting, computer use	

## Additional Investigation Needs

<b>Agents</b>	Microbial, VOCs, Ventilation, Lighting, Noise	
<b>Medical Exam</b>	Refer to OMC	

**Additional Comments:**

Send a copy to the worker and his/her management, Occupational Medicine Clinic, and the Industrial Hygiene Group.



Forms
Contact List
SBMS Instructions
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## Definitions: Indoor Air Quality

Effective Date: **July 2003**

Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

Term	Definition
air contaminants	Substances contained in the vapors from paint, cleaning chemicals, pesticides, and solvents; particulates; outdoor air pollutants; and other airborne substances, which together may cause material impairment to employees working within the nonindustrial environment.
Building-related Illness (BRI)	Diagnosable illness whose symptoms can be identified and whose cause can be directly attributed to airborne building pollutants (e.g., Legionnaire's disease, hypersensitivity pneumonitis).
building systems	The heating, ventilation and air-conditioning (HVAC) system, the potable water systems, the energy management system, and all other systems in a facility that may impact indoor air quality.
designated person	A person who has been given the responsibility to take necessary measures to ensure compliance with IAQ guidelines accepted by BNL, and is knowledgeable in the requirements of the specific building systems servicing the affected building or office.
HVAC	Heating, Ventilation and Air Conditioning equipment used to maintain the ambient conditions within a building. This includes air-handling ducts, heating and cooling equipment and fans, filters and frames, cooling-coil condensate drip pans and drainage piping, outside air dampers and actuators, humidifiers, air distribution ductwork, automatic temperature controls, and cooling towers. This also includes individual room HVAC systems.
nonindustrial work environment	An indoor or enclosed work space such as offices, educational facilities, commercial establishments, and healthcare facilities, and office areas, cafeterias, kitchens and break rooms located in labs, shops and other facilities used by employees. Nonindustrial work environments do not include manufacturing and production facilities, residences, vehicles, and agricultural operations.
renovation and remodeling	Building modification involving activities that include removal or replacement of walls, ceilings, floors, carpet, and components such as moldings, cabinets, doors, and windows; painting, decorating, demolition, surface refinishing, removal or cleaning of ventilation

	ducts.
Sick Building Syndrome (SBS)	Term sometimes used to describe situations in which building occupants experience acute health and/or comfort effects that appear to be linked to time spent in a particular building, but where no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be spread throughout the building.

[Back to Top](#)

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## Revision History: Indoor Air Quality

 Point of Contact: [Indoor Air Quality Subject Matter Expert](#)

### Revision History of this Subject Area

Date	Description	Management System
August 2004 -- Minor Rev. 1.1	The <a href="#">Environment, Safety, Health and Quality (Tier I) Inspections</a> Subject Area replaces ES&H Standard 1.2.0, Departmental Environment, Safety & Health Inspections.	Worker Safety and Health
July 2003	<p>Indoor Air Quality (IAQ) refers to the composition of air within occupied areas of a building. It includes such factors as relative humidity, temperature, microbial contamination, and toxic air constituents not related to process equipment and operations conducted in the work area. An example of a toxic IAQ concern would be carbon monoxide infiltration into a building from motor vehicles outdoors or off-gassing of chemicals from new carpeting, paint, or furniture. In IAQ problems, workers may become ill or experience extreme discomfort when in a building because of unacceptable breathing air.</p> <p>This subject area will help individuals become aware of the causes of poor IAQ and how to prevent them. It also provides information to determine if an IAQ specialist is needed for assistance in evaluating potentially hazardous work areas.</p>	Worker Safety and Health

[Back to Top](#)

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1.1-082004/standard/1n/1n00a011.htm

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