

BC Buildings Corporation

Mandatory Indoor Air Quality (IAQ) Complaint Investigation Standard

To Meet Section 4.79 of the WCB OH & S Regulation

Prepared by
BCBC WCB-IAQ Steering Committee



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Mandatory Indoor Air Quality (IAQ) Complaint Investigation Standard To Meet Section 4.79 of the WCB OH & S Regulation

INTRODUCTION

This is a mandatory standard for investigating IAQ complaints in BCBC-managed buildings. The revised WCB Occupational Health and Safety (OH & S) Regulation, which came into effect on April 15, 1998, contain provisions pertaining to indoor air quality (IAQ) in all spaces occupied by workers, including spaces in commercial and institutional occupancies. Section 4.79 requires employers to ensure that IAQ complaints are investigated, and that records of complaints, the findings of the investigation, and all corrective actions taken are kept.

The purpose of this standard is to establish a consistent approach for clients of BCBC, BCBC Property Management staff, and others as appropriate, to use in receiving IAQ complaints, carrying out IAQ investigations and corrective actions, and documenting all aspects of the process.

DISCLAIMER

This IAQ Complaint Investigation Standard is intended for the use of the British Columbia Buildings Corporation and its Clients (Ministries and Agencies of government).

Copies of this standard may be provided, upon request, to Landlords from whom the Corporation is leasing space. However, this standard is **NOT** intended to direct any Landlord as to their compliance with any aspect of the WCB OH & S Regulation.

EMPLOYER and BCBC RESPONSIBILITIES

Employer Responsibilities

Section 4.79 of the WCB OH & S Regulation states:

“4.79 (1) The employer must ensure that the indoor air quality is investigated when:

- (a) complaints are reported,
- (b) occupancy in the space changes substantially, or
- (c) renovations involving significant changes to the ventilation system occur.”

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Under the WCB Regulation, the “employer” is the organization which employs the workers who occupy the building or space in question. In other words, the client ministry or agency which directly employs the workers occupying the space is considered to be the “employer”, and as such has the primary responsibility for meeting the requirements of the WCB Regulation. This IAQ Complaint Investigation standard recognizes these basic employer responsibilities which include the following:

- receiving and logging IAQ complaints,
- obtaining data concerning each complaint and documenting it,
- ensuring complaints are investigated,
- ensuring corrective action is taken when required, and
- ensuring the investigation done and action taken are documented.

The employer’s responsibilities also encompass ensuring that the space occupied meets the relevant requirements of the Regulation. Often tenant improvements (TI’s) are required to make the space suitable for the client’s specific occupancy. It is critical to remember that TI’s must include all modifications to building services (HVAC, plumbing, electrical, etc.) required to make the space comply with the WCB Regulation. Building services modifications are most likely when the intended occupancy involves any of the following:

- a requirement for new or relocated partitions,
- a change in the use of the space (e.g. if storage space is being upgraded for office use, significant ventilation and lighting upgrades may be needed),
- meeting, conference, or board rooms are being created where none existed before, or
- there will be an increase in worker occupancy and/or the usage of heat emitting equipment (e.g. electronic equipment such as computers, printers, photocopiers, etc.).

Sometimes, the capital costs of such modifications can be significant. In such cases, it is important to evaluate alternatives in order to arrive at an optimum solution. In some cases, occupancy of one specific building is deemed by the client ministry to be of overriding importance due to location, proximity to other resources, or some other valid reasons. If the building requires costly TI’s, that is a factor which needs to be considered before it is selected. In other cases, it is anticipated that a premises will only be occupied temporarily, until more permanent accommodation is available. Unfortunately, the WCB Regulation must be met, even for temporary accommodation, and even if required renovation or upgrade work is extensive.

Generally speaking, BCBC will be delegated the task of managing the design and construction of any required TI’s. Provided the Corporation’s recommended TI’s are installed, and the client’s continued occupancy is according to the information on which the TI design was based, then the Corporation would be

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responsible for dealing with any corrective action required to meet IAQ requirements. The client may object to the cost of work recommended by BCBC as necessary to meet the WCB Regulation, and refuse to authorize the necessary costs. Provided the work meets the requirements of the Building Code, BCBC may agree to proceed with a scope of work which, in its judgment, does not meet the WCB Regulation. However, in such a case, the client will be required to sign a letter absolving BCBC of the costs of any future renovations or upgrade which may be required to correct IAQ problems related to its occupancy of the premises in question.

If the client has occupied space prior to 1999, and the TI's carried out were not according to the Corporation's recommendations, then in the event of an IAQ complaint, the client will probably be responsible for the costs of any required upgrade to meet the current Regulation. In addition, if the client's intensity of use of the space, or the nature of that use, has changed in a way to put additional demands on the building systems, then IAQ problems and complaints could arise. If the investigation determines that the cause of the problem is client's use of the space, then the client will be responsible for any required upgrade costs.

In the event the client carries out TI work which does not meet Building Code, or WCB or other Regulatory requirements, and the Corporation was not aware of the activity, then the client would have full responsibility for funding the Corporation to carry out any necessary corrective action. TI work done by a client could include installation or relocation of furniture and screens, particularly interlocked "systems" furniture, if it interferes with air flows, heating elements, access for maintenance, etc.

BCBC Responsibilities

From our clients' point of view, the Corporation has responsibility for building operations and maintenance services in all buildings. Therefore, the Corporation has, in effect, the delegated responsibility for required actions which are under its control, and not under the control of its clients. Therefore, when a pattern of IAQ complaints has developed (or a single complaint of a serious or acute nature) which appears to involve the building or its systems, the Corporation will work with the client ministry in carrying out the investigation and recommending any corrective action necessary.

When the Corporation carries out tenant improvement work for the client, it is required to ensure such work meets the Building Code, WCB and all other applicable Regulations. As the client's activities and use of the space can have a significant bearing on any required TI design, it is important that occupancy and usage criteria, along with any required environmental criteria for processes, be obtained from the client and incorporated into the design. In addition, the Corporation **must** be prepared to provide design drawings and specifications to an WCB Officer upon request, according to Section 4.71 of the WCB Regulation.

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When there is an IAQ complaint in a corporate-owned building, the initial walk-through inspection (see Part 'B', Step 2 on page 7) will be carried out by BCBC as part of its standard services. If a detailed or consultant inspection is required, this work is considered extra services to be paid for by the Client (covered by an up-front RFS). If the cause of the complaint turns out to be something within Corporation control, then the costs would revert to the Corporation. The costs of all action (repairs, replacements, modifications, upgrades) required to correct the cause of an IAQ problem will be borne:

- by the Corporation if the cause of the problem is within the Corporation's control, or
- by the Client if their actions or decisions have given rise to the problem.

In the event of an IAQ complaint in a maintained-only building, the Corporation would typically carry out a walk-through inspection at no additional cost. However, the client would pay for any additional investigative work needed (detailed and/or consultant investigations plus all corrective actions required) over and above work which is already covered by the maintenance agreement BCBC has with the specific Client. The decision as to whether the Client or the Corporation manages the investigation and resolution of an IAQ complaint will typically be made on a case-by-case basis.

In a building leased by the Corporation from a Landlord, either the Landlord will carry out any tenant improvement work on behalf of the Corporation, or the Landlord must give approval, prior to the work commencing, to all tenant improvements carried out by the Corporation (including contractors retained by the Corporation). The Client Request costs quoted will include all work required to meet all Code and Regulatory requirements. For further information related to leased buildings, refer to "Lease Management Issues" under Step 5 in Part 'B' of this standard.

IAQ COMPLAINT INVESTIGATION STANDARD

The flowchart on the next page shows all the necessary steps in summary form.

Part 'A' shows those actions required by the Corporation's clients, as the direct employer (as defined in the WCB Regulation).

Part 'B' shows the actions required of BCBC when acting as the agent of their clients with respect to physical accommodations. The actions required in each of the nine steps in Part 'B' of the chart are described in more detail on pages 6 through 13 of this document.

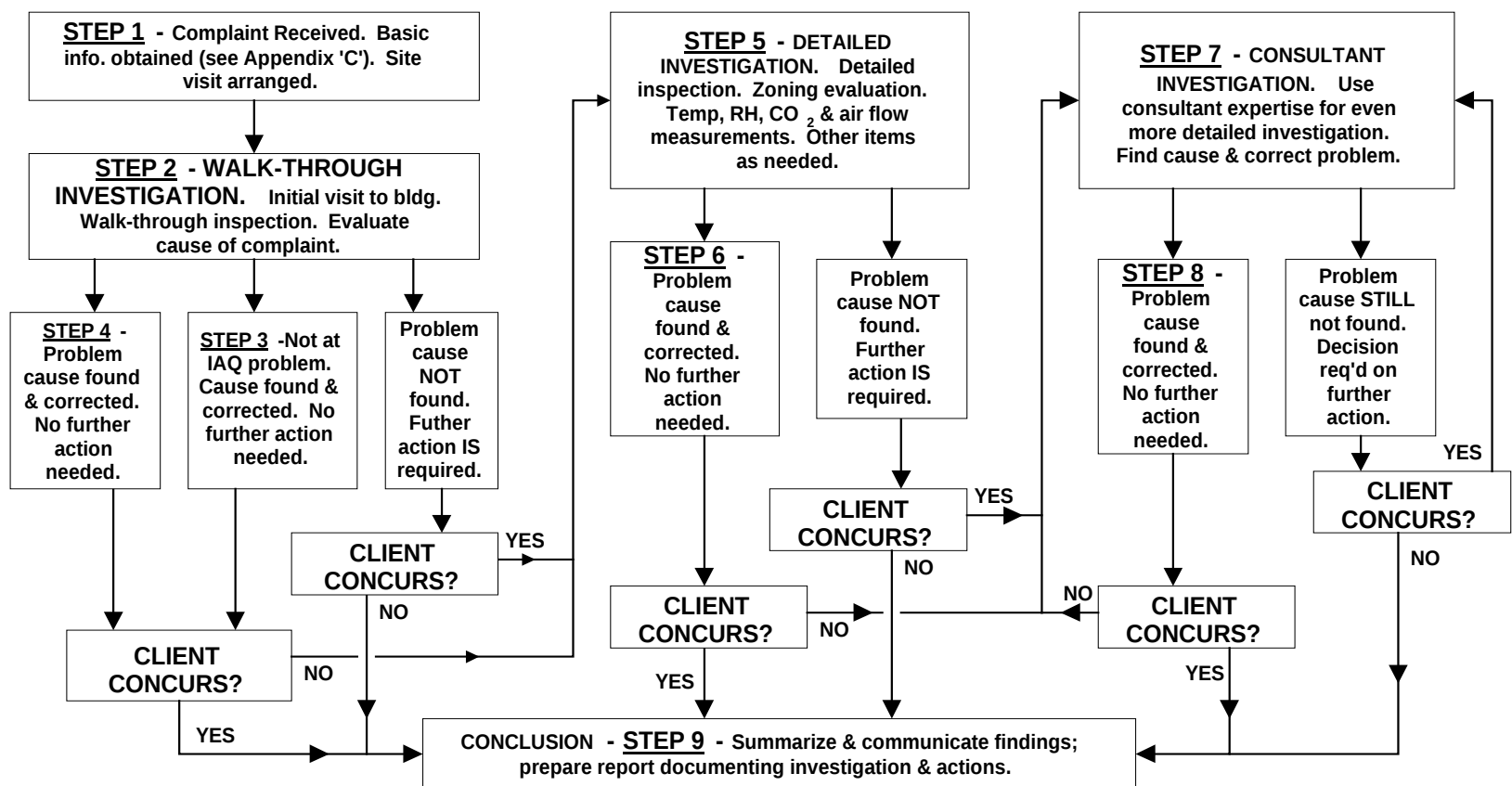
Flowchart - IAQ Complaint and Investigation

INDOOR AIR QUALITY COMPLAINT & INVESTIGATION FLOWCHART

ACTIONS BY CLIENT - Part A :

1. Maintain a log of IAQ complaints (see Appendix 'A'). Keep with the building's log book or as agreed with BCBC.
2. If the log indicates a "pattern" of IAQ complaints, or if there is a single complaint of an acute nature, investigate to determine cause. If help is needed, then submit IAQ Investigation Request form (see Appendix 'B') to BCBC.

REQUIRED ACTIONS BY BCBC : See Part B for details of actions to be taken at each step.



PART 'A' - ACTIONS BY CLIENT

1. The client ministries or agencies which occupy BCBC space, under either the Accommodation Agreement or some other form of agreement, are the “employers” under the WCB Occupational Health and Safety (OH & S) Regulation. With respect to IAQ, client ministries and agencies are responsible for ensuring that IAQ complaints are:
 - recorded,
 - investigated in accordance with the WCB Regulation, and
 - corrective action taken to alleviate unacceptable conditions.
2. Each client has a responsibility to have someone to whom IAQ complaints (or any other type of complaints about the space) are to be sent. Where there are a number of staff at a given premises, there would normally be someone resident in that premises who is assigned that role. Most commonly it would be whoever is Property Management’s liaison person for that client in that premises. If there are very few client staff in a specific premises, then someone in a more central office might be assigned the complaint reception role.
3. The client would have the responsibility of maintaining a log of IAQ complaints received. In addition, obtaining as much information from on-site observations as early as possible is a very important client responsibility. The more information available, the faster, and more certain the diagnosis will be. It is important to consider whether the complaint is purely one related to discomfort or whether it relates to an IAQ problem covered by the WCB Regulation; comfort complaints may not indicate IAQ problems.

Comfort is important, and comfort complaints can, and will, be responded to by BCBC. But they should not be used to generate a formal IAQ complaint unless there is some indication of an IAQ problem.

4. The exact physical nature of the IAQ complaint log is the responsibility of the client. Complaint documentation should be retained for at least seven (7) years, and be kept accessible so that it can be produced if requested by a WCB Officer. Appendix ‘A’ contains one possible IAQ Complaint Log format. But other options may be used provided the basic information indicated is available.
5. When the IAQ Complaint Log indicates a pattern of IAQ complaints, or if there is a complaint or problem which is clearly of a serious or acute nature, the client should investigate, try to determine the cause, and if it involves the client’s own operation to undertake corrective action whenever possible. If technical expertise is required for diagnosis, the client should contact BCBC Property Management for assistance. In such cases, an IAQ Investigation Request form, see Appendix ‘B’, should be completed and forwarded by facsimile, along with any information already gathered, to the appropriate BCBC Property Management liaison person.

PART 'B' - ACTIONS BY BCBC PROPERTY MANAGEMENT STAFF

STEP 1 - IAQ Complaint Received by BCBC

When an IAQ Investigation Request has been received by BCBC from a client (see preceding Part A), it should be acknowledged as quickly as possible.

Whoever is responding to the complaint should endeavor to get as much information concerning its nature as possible. The use of an IAQ Investigation Record Form (see Appendix 'C'), to assist in organizing and documenting the information collected is mandatory. In some cases it may be possible to resolve the complaint without a site visit. If this is the case, the resolution must be documented as required by WCB Section 4.79, and kept with the building file.

In most cases, it is anticipated that a site visit will be needed. Some follow-up by telephone may well be needed by whoever is assigned to start the investigation. At the same time, arrangements should be made for the initial site visit related to the complaint.

STEP 2 - Walk-Through Investigation

(a) Process

If the cause of the complaint has not been determined at step 1, then a visit to the site is important for 2 reasons:

- It shows the Corporation takes legitimate IAQ complaints seriously, and
- The IAQ investigation process requires on-site observation and direct contact with the complainant(s) in order to obtain reliable, first-hand information.

The walk-through investigation is intended to be as streamlined as possible while still obtaining significant information and, hopefully, enough to diagnose the cause of the problem and identify the corrective action needed.

A walk-through inspection should be done by a BCBC representative, with an emphasis on the area from which the complaint has come and the HVAC system(s) serving that area. Unless the specific cause of the complaint is identified immediately, the use of the Corporation's walk-through IAQ Inspection Checklist is mandatory. This checklist will act as a reminder of what to inspect, and will provide a convenient means of documenting observations and other information. If the nature of the complaint suggests they might provide useful information, snapshot measurements of relevant environmental conditions may assist in the diagnosis (examples of measurements would be temperature, relative humidity, or CO₂ concentrations).

BCBC will carry out a walk-through inspection for all IAQ complaints referred to it, in both owned and leased buildings. In leased buildings, the building owner

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must be made aware of the IAQ complaint, and invited to participate in the walk-through inspection.

There are several possible outcomes from the walk-through inspection.

- First, there could be no evidence at all to support the complaint, and the conditions which gave rise to it seem to have gone away.
- Second, the walk-through inspection could identify an obvious cause which has a clearly defined solution. Problem solved once corrective action is taken.
- Third, the walk-through inspection could identify one or more possible causes for an IAQ problem. The walk-through inspection has done its job; it has narrowed the search for a cause. In this case, a more detailed investigation of the identified causes is needed to either confirm or deny the suspicion identified in the walk-through. Use of related items in the detailed inspection checklist, undertaking some specific measurements, getting access to hidden areas for more detailed observations, or retaining a consultant or contractor with expertise related to the possible problem cause, may be in order. The goal is to identify the cause of the problem (if there is a problem) and determine the appropriate corrective action.
- Fourth, the walk-through inspection might not identify any probable cause, or even any possible causes. If the condition which gave rise to the original complaint still exist, then in this case it will be necessary to proceed to a detailed investigation of the IAQ complaint.

To summarize, at the conclusion of this step the following choices exist:

- If the cause of the complaint has been discovered, and it is **NOT** IAQ-related, go to Step 3.
- If the cause of the complaint has been discovered, and it **IS** IAQ-related, go to Step 4.
- If the cause of the complaint has **NOT** been discovered then, if the client concurs, go to Step 5, which outlines the Detailed Investigation process.

(b) Lease Management Issues

If the walk-through inspection either identifies an obvious cause, or identifies possible causes which require more detailed investigation, then it is critical that the Corporation respect the provisions of the Lease Agreement. Refer to the guidance provided under “Lease Management Issues” in Step 5.

STEP 3 - Complaint not IAQ related

(a) Process

If the cause of the complaint is determined in Step 2, and it is not IAQ-related, then any corrective action required should be taken. However, if IAQ is not at issue, this procedure is not strictly applicable. If the Client concurs, then proceed to Step 9.

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If there appears to be no basis for an IAQ complaint, but the Client continues to insist there is, then BCBC could carry out (or, in a leased building, have the Landlord carry out) a more detailed IAQ investigation, including testing for the presence of contaminants if the Client insists on it. Any additional investigation carried out under such circumstances should only be done if the Client agrees to the scope of the investigation and agrees, ahead of time, to pay the cost of it.

(b) Lease Management Issues

When any action, beyond the walk-through inspection, is required in a leased building, then it is critical that the Corporation respect the provisions of the Lease Agreement. Refer to the guidance provided under “Lease Management Issues” in Step 5.

STEP 4 - Cause of problem found to be IAQ-related

(a) Process

If the cause of the complaint is determined in Step 2, and it is IAQ-related, then take action to correct the problem. If the Client concurs the problem has been resolved, then proceed to Step 9.

(b) Lease Management Issues

If the Corporation has leased the space from a Landlord, the Landlord should be required to take corrective action according to the terms of the lease. Refer to the guidance provided under “Lease Management Issues” in Step 5.

STEP 5 - Detailed Investigation

(a) Process

If the walk-through investigation does not identify the cause of the complaint, then a more detailed investigation will be needed. The District Office may be able to undertake this investigation with its own staff. But time demands, geographic distance, the possible need for additional expertise, and/or the need for an independent opinion may suggest the use of external resources (e.g. an HVAC consultant, a trusted controls/balancing/commissioning agency, or a knowledgeable contractor).

As with the walk-through investigation, the detailed investigation should focus on the area from which the complaint originated. All documentation from the walk-through investigation must be reviewed. Both the walk-through and detailed IAQ Inspection checklists must be used as appropriate. However, the inspection will need to be much more detailed than in the walk-through investigation. Measurements, taking trendlogs, testing controls or other functions, obtaining access to equipment or into walls or ceilings, and other investigative actions may be needed.

If the inspection indicates there may be a ventilation system zoning problem, then someone with HVAC design expertise should undertake a specific

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examination of both thermal and ventilation zoning of the spaces in question. Trendlogs of temperatures, humidity, CO₂ and possibly other parameters may be needed in this evaluation. Airflow measurements may also be required to obtain necessary data. The following questions will likely be relevant:

- Is each zone comprised of all interior space, or all perimeter space having a single exterior orientation?
- Do all partitioned rooms or spaces in each zone have similar occupancy patterns?
- Does the outside air ventilation provided to each room or space match up with the design peak occupancy?
- If heating and/or cooling is provided by the ventilation system, do the heating and cooling capacities match the design heating and cooling loads in each room or space?

If the answer to any one of these questions is “NO”, then some modification of HVAC system zoning may be needed.

Finally, if there is any indication the cause could be chemical, biological or particulate contaminants of some sort, then a recognized occupational hygiene consultant should be retained - refer to Step 7, Consultant Investigation.

If the cause of the problem is found, then go to step 6. Even if no specific cause is found, sometimes the actions taken to try and resolve it actually see the symptoms disappear. However, if the detailed investigation still does not identify the cause of the problem, and the symptoms which caused the complaint are still evident, then it will be necessary to proceed to step 7, the Consultant investigation.

(b) Lease Management Issues

If the IAQ complaint is from a leased building, it is imperative that the Landlord be made aware of the complaint. This applies to **ALL** leases. In most cases, the Landlord will have the responsibility of carrying out the IAQ investigation at this, and all following stages of the process. In some cases, there may be doubt concerning responsibility, or the Landlord may disclaim responsibility or delay unreasonably. If such issues are not resolved quickly, Property Management staff are urged to consult with Leasing, and to work out a suitable course of action which is both consistent with the Lease Agreement and protects the Corporation's interests. If resolution cannot be achieved otherwise, then as a last resort the Corporation has the right to invoke the formal “72 hour notice” clause in the Lease Agreement. This should only be done with the approval of the District Director or higher management. However, it will allow the Corporation to take action (e.g. carry out a detailed IAQ investigation and, if necessary, to take action to correct a severe problem) if the Landlord refuses to do so.

Generally speaking, the only time BCBC should carry out a detailed IAQ investigation in a leased building is when the Landlord has explicitly agreed to BCBC carrying out the investigation, the scope and cost have been agreed, and

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responsibility for the costs have also been agreed (normally, costs will lie with the Landlord).

If physical changes to building, systems or tenant improvements are required to correct an identified cause of an IAQ complaint from a leased building, the responsibility for that work will depend on the circumstances. In all cases, this document assumes the Lease Agreement requires the Landlord to meet all applicable Codes and Regulations (including the WCB Regulation). If base building fabric or systems changes are needed, the Landlord would be responsible. If tenant improvement changes are needed, and the Landlord designed and constructed the space, then the Landlord would be responsible. If tenant improvement changes are needed, and the Corporation had designed them (presumably with the Landlord's permission to do so), then the Corporation might well be responsible for costs of correction, regardless of who carried the work out.

The foregoing points out the importance of the Corporation's staff not inadvertently assuming some of the Landlord's responsibilities by undertaking either design or construction work in leased buildings. **The Corporation should never undertake such work unless there is a clear agreement with the Landlord for the Corporation to do so.** In addition, the Landlord should be required to review the designs for all such work, and be required to sign off that the work is designed in accordance with all Codes and Regulations. This may not be possible in all cases. Where it does not appear possible, Property Management staff are urged to consult with Leasing, and to work out a suitable course of action which will protect the Corporations interests in the event of later difficulties.

STEP 6 - Cause of problem found at step 5

(a) Process

If the cause of the complaint is determined in Step 5, then take action to correct the problem and proceed to Step 9 if the client concurs no further action is needed, or to Step 7 if the client does not concur.

(b) Lease Management Issues

As noted in Step 5, if the Corporation has leased the space from a Landlord, depending on the terms of the lease, responsibility for corrective action may lie with the Landlord. Regardless, the Landlord must either carry out the work or give prior approval to the Corporation carrying out the work (either directly or through a contractor). Refer to the guidance provided under "Lease Management Issues" in Step 5.

STEP 7 - Consultant Investigation

(a) Process

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If condition which gave rise to the complaint still exists, and no cause has been identified during the walk-through or detailed investigations, it may be necessary to proceed to a Consultant Investigation. A recognized occupational hygiene consultant and an expert HVAC consultant will both need to be retained for this work. All the previous data should be reviewed by the consultants, who may suggest some additional tests or measurements. In addition, the use of a recognized IAQ questionnaire, administered to all building occupants, should be considered in order to identify possible factors not heretofore apparent.

The investigation of an IAQ complaint or problem should not get to this stage unless the nature of the complaints, or previous testing, suggest a serious IAQ problem, and the complaint continues consistently from a number of occupants, not just a single individual.

If there is any indication the cause could be chemical, biological or particulate contaminants of some sort, then samples should be taken and tested at an independent laboratory expert in the particular type of measurements needed. The occupational hygiene consultant will need to determine what samples should be taken and ensure they are collected and analyzed properly. The results of these measurements will be compared to acceptable levels of the respective chemicals or contaminants.

Every problem reaching this stage will be unique. There is no standard checklist which can be suggested for use.

If the cause(s) of the IAQ complaint are determined, then proceed to Step 9.

If, even after all this effort, no probable cause has been identified, the next steps, if any, will be determined by the situation. By this time, building systems capacity, zoning, controls, operation, etc. will all have been examined in detail. If there is a systems problem, it should have been identified. If all the chemical and contaminant measurements show no elevated levels, then these would seem to be eliminated as a cause. In such a situation, it may not be possible for the Corporation to take any action because nothing appears to be wrong with the building. If the Client concurs that no further action is feasible, then proceed to Step 9. If the Client demands further action, then the Client and Corporation must agree on what that action should be, and what the responsibility for any costs will be.

(b) Lease Management Issues

If the Corporation has leased the space from a Landlord then, as noted under "Lease Management Issues" in Step 5, the Landlord will, in most cases, have responsibility for undertaking both the Consultant-level investigation and actions required to correct any problems identified as a result of it. The guidance provided in Step 5 should be followed.

STEP 8 - Correct Cause of Problem

(a) Process

If the cause of the IAQ complaint is determined, then corrective action must be taken.

(b) Lease Management Issues

If the Corporation has leased the space from a Landlord then, as noted under “Lease Management Issues” in Step 5, the Landlord will, in most cases, have responsibility for undertaking actions required to correct any problems identified. The guidance provided in Step 5 should be followed.

STEP 9 - Summarize and communicate findings

Regardless of the route taken to complete the IAQ investigation, it is necessary to document the complaint, the various investigative actions taken, the diagnosis, and any actions taken as a result. The primary responsibility for this, as noted in the “RESPONSIBILITY” section of this document, lies with the client as “the Employer”. However, to the extent BCBC becomes involved in any investigation and resulting corrective action, it is important for the Corporation to document its involvement in a report.

This report does not need to be a lengthy one, particularly if the cause is found and corrected at one of the early steps. But it does need to provide evidence of responsible actions, in accordance with the WCB Regulation. However, in the event resolution requires the process proceed to a detailed investigation or beyond, the length and scope of the report would be expected to increase significantly. For example, it would include copies of all inspection checklists used, all consultant reports received, all measurements or trendlogs taken, etc.

The report shall be sent to the client in support of any required response they may have to make to WCB. It shall also be filed in the building file and sent to appropriate BCBC staff.

APPENDIX 'A' - SUGGESTED FORM OF CLIENTS' IAQ COMPLAINT LOG

Building Name _____

Building Address _____

Client Liaison Person: _____

Information to obtain about each complaint:

1. A description of the complaint. What is wrong? What has been observed? Any other comments?
2. Has it occurred before? At any particular time(s) of day, or day(s) of week
3. Is anybody else affected? Who?
4. What are the weather conditions?

Date & Time	Complainant's Name	Location in Bldg.	Description of the Complaint

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APPENDIX 'A' (cont'd)

Date & Time	Complainant's Name	Location in Bldg.	Description of the Complaint

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APPENDIX 'B' - IAQ INVESTIGATION REQUEST to BCBC



NOTE: Use a separate form for each complaint.

Fax form to BCBC at:

Building Name _____

Client Liaison Person: _____

Building Address _____

Signature: _____

Date & Time Submitted: _____

Date & Time	Complainant's Name	Location in Bldg.	Description of the Complaint
<u>Comments Concerning the Complaint by Client Liaison Person:</u>			<u>BCBC Date Stamp</u>

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APPENDIX 'C' - BCBC IAQ INVESTIGATION RECORD FORM



Building Name _____ Client Liaison Person: _____

Building Address _____ Date Submitted: _____

BCBC Superintendent: _____ Date Acknowledged by BCBC: _____

BCBC Investigator: _____

Ensure IAQ Investigation Request Form, plus any other information received from Client is attached.

During initial client contact (by phone and/or during initial site visit), obtain further information about the complaint as seems desirable. Attempt to determine what symptoms or other observations the complainant may have had. Use the following table as a guide, asking only about symptoms which seem relevant.

Note observations below. Use more pages as needed. Attach copies of inspection checklists, etc. used.

Thermal Environment	Building Conditions	Personal Symptoms
☐ Temperature too hot	☐ There are odours. Source?	☐ Congestion
☐ Temperature too cold	☐ Space is too noisy. Source?	☐ Sore throat
☐ Air is too humid	☐ Dust in the air.	☐ Eye irritation, watering
☐ Air is too dry	☐	☐ Skin is itchy, dry, flaky
☐ Air is stuffy, stagnant.	☐	☐ Drowsiness
☐	☐	☐ Headache
☐	☐	☐ Nausea

APPENDIX 'D'

B.C. Buildings Corporation

Mandatory Indoor Air Quality (IAQ) Walk-Through Inspection Checklist

Building No.	
Building Name	
Inspected by (Name / Company)	
Date of Inspection	



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APPENDIX 'D' - MANDATORY IAQ WALK-THROUGH INSPECTION CHECKLIST

SECTION 1: PURPOSE

This checklist responds to the new WCB Regulation concerning Indoor Air Quality (Sections 4.70 through 4.80) which came into effect on April 15, 1998. This Walk-Through Checklist **must be used** in Step 2 of the IAQ Investigation process to gather information which can then be analyzed and evaluated in order to identify the causes of an IAQ complaint and suggest suitable corrective actions. Nothing in this standard precludes the use of additional forms, or limits the observations or measurements which may be made in order to identify possible legitimate causes for IAQ complaints.

There are two primary reasons for using a checklist. First, it may jog the investigator's memory concerning items which should be looked for. Second, the checklist document will be a convenient location to jot down notes as observations are made. Even if there is nothing untoward, merely noting down "no problem" or some similar note will indicate the item in question was looked at. If someone later questions "was such-and-such looked at?", the answer can be provided.

SECTION 2: ORGANIZATION

Section 3 contains information about weather conditions at the time of the inspection, and some general information about the building. Section 4 contains Base Building related items; Section 5 contains Tenant Improvement related items. Section 6 provides space for any observations which might be made, and which do not fit into any of the specific items found in the other sections.

Except for very small buildings, or relatively small tenancies within larger buildings, it is recommended that a separate set of forms be used for each wing, floor, or other convenient sub-division of the entire building. Another way to sub-divide a building is to use a set of forms for each area served by a single air-handling (ventilation and cooling) system.

In Sections 4, 5 and 6 the tables in which the checklist items are located, have six columns as follows:

- Col. 1: This column contains the checklist item number. It is included to ensure certainty in discussions subsequent to the inspection about which observation is being referred to.
- Col. 2: Contains the inspection item itself. Each item consists of two parts. The first part is usually framed in the form of a question, and is shown in **normal typeface**. It will require the investigator to make some observations in order to answer the question. The second part contains some ideas for the observations which might

Mandatory IAQ Walk-Through Inspection Checklist

be required or useful, and may include suggestions for corrective action if a shortcoming is identified or indicated. This part is in ***italic typeface*** and is enclosed in brackets.

- Col. 3: The column 3 heading is “Ans”. It is to be used to provide the “Yes” or “No” answer to the question, or questions, posed in the inspection item in column 2.
- Cols. 4 and 5: These two columns are contained within a header titled “Action Req’d?”. The intention is to indicate clearly, in either the “Yes” or “No” column, whether or not further action is indicated by the observations made in connection with each inspection item. Further action could be additional investigation activity, measurements, analysis, etc. which might be needed for a solid problem diagnosis. Or the further action could be carrying out the corrective measures required to deal with an IAQ problem cause which has already been identified.
- Col. 6: Column 6 is use to provide additional information concerning the observations made, plus any action which may be indicated or required. Use additional sheets if required, and make reference to this additional material in column 6.

Mandatory IAQ Walk-Through Inspection Checklist

SECTION 3: GENERAL ITEMS

Sub-Section 3.1: Weather Conditions

No.	Observation Item	Value	Comments
	Record weather conditions at the time of the inspection		
3.1.1	Dry-bulb Temperature		
3.1.2	Wet-bulb Temperature (or Relative Humidity)		
3.1.3	Wind (describe velocity and indicate direction)		
3.1.4	Precipitation (Is there any? If so, how heavy?)		
3.1.5	Any other weather observations.		

Sub-Section 3.2: Other General Building Data

No.	Inspection Item	Ans	Action Req'd?		Comments
		Y/N	Yes	No	
3.2.1	Is there a documented Preventive Maintenance Program in the building? <i>(If there is, the documentation should be reviewed, and an evaluation made as to whether it meets WCB requirements. If there is no PM program, then one must be established.)</i>				

SECTION 4: BASE BUILDING ITEMS

Sub-Section 4.1: Outside the Building

This part of the inspection focuses on the exterior of the building and on conditions in its vicinity. It also includes situations where activities within one part of the building could create IAQ problems elsewhere in the building.

	OUTSIDE AIR INLETS	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
4.1.1	Inspect all outside air inlets. Are any close to possible air contaminant sources? <i>(e.g. vehicle traffic, cooling towers, chimneys, or exhaust air outlets within 2 m.,. Evaluate possible contamination. Alterations to reduce contamination may be required.)</i>				
4.1.2	Are any outside air inlets subject to blockage (i.e. located close to ground level)? If so, are there any signs of outside air inlet blockage? <i>(Could leaves, snow, vegetation, etc. block the inlet? If so, ensure regular clearance is included in the preventive maintenance task list.)</i>				

	EXHAUST AIR DISCHARGES	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
4.1.3	Examine all exhaust air outlets. Are there any which are close to outside air inlets, where exhaust could be sucked into the inlet? <i>(Have qualified personnel evaluate the likelihood of a re-entrainment problem. Determine if revision to the exhaust outlet, or relocation of the air inlet is required.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

PARKING GARAGES		Ans Y/N	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
4.1.4	Can inward airflow, or odours, be sensed at bldg. entrances, stairs or elevators adjacent to enclosed parking garages? <i>(Ensure garage exhaust system is functioning properly and there is entrance lobby pressurization if needed. Correct / install as needed.)</i>				

Sub-Section 4.2: Within the Building

The questions in this part of the inspection focus on spaces within the building related to the base-building construction, not to tenant improvements.

MECHANICAL EQUIPMENT ROOMS		Ans Y/N	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.2.1	Is there any evidence of poor housekeeping? E.g. dust & dirt, stagnant water on floor, any mould growth, paint peeling. <i>(Take steps to clean entire space, eliminate water sources, clean & disinfect mouldy areas, etc. as needed. In a lease, such conditions could trigger a more detailed check on preventive maint. program, if any)</i>				
4.2.2	Is mechanical space used as storage space? <i>(It should not be. Arrange other locations for required storage.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

Sub-Section 4.3: Base Building Heating Systems

SYSTEM COMPONENTS		Action Req'd?		Comments	
No.	Inspection Item	Ans Y/N	Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.3.1	Is the boiler room under negative pressure? Are the boiler(s) venting properly? <i>(Check the combustion air intake; ensure it is not blocked. Clear if needed. Ensure ventilation system fan suctions are not affecting room pressure.)</i>				
4.3.2	Is there any fuel oil or natural gas odour, in the boiler room or elsewhere? <i>(There is potential DANGER! Consider EVACUATING THE BUILDING! Shut off fuel oil or gas supply. Check for leaks, both in piping and combustion appliances. For gas, consider asking the utility company to provide assistance.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

Sub-Section 4.4: Base Building Ventilation / Cooling Systems

SYSTEM COMPONENTS		Ans Y/N	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.4.1	Check replacement record of air filters, and check condition of filters currently installed. <i>(Ensure filters are properly installed [no gaps allowing air bypass]. Ensure there is an air filter replacement record attached to the unit [inside]. Use it, and the observed condition of filters to adjust filter replacement schedule if needed.)</i>				
4.4.2	Check base building (washroom) exhaust grilles. Do they show signs of excessive dust, lint or dirt build-up? <i>(Clean grilles. Check exhaust ductwork for cleanliness; clean as necessary.)</i>				

SECTION 5: TENANT IMPROVEMENT ITEMS

Sub-Section 5.1: Within the Building

The questions in this part of the inspection focus on spaces within the building. Sub-section 5.1 is to be used for all occupied spaces. Subsequent sub-sections will be used for the specific types of spaces indicated.

	ALL OCCUPIED SPACES	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
5.1.1	Are there any signs of moisture staining on any interior surfaces? <i>(This could indicate the presence of moisture, past or present, which could be a breeding ground for micro-organisms. The source of any moisture must be located and corrected. Then the areas affected must be cleaned, disinfected if necessary, and repaired.)</i>				
5.1.2	Are there any signs of paint peeling on any interior surfaces? <i>(This could indicate the presence of moisture, past or present, which could be a breeding ground for micro-organisms. The source of any moisture must be located and corrected. Then the areas affected must be cleaned, disinfected if necessary, and repaired.)</i>				
5.1.3	Is there any visible mould growth on any interior surface? <i>(Some moulds can release spores having unpleasant or toxic affects on occupants. Mould requires moisture for growth, so the moisture source must be located and corrected. Then the areas affected must be cleaned, disinfected, and repaired.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

ALL OCCUPIED SPACES (cont'd)		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
5.1.4	Are there any noticeable odours or stuffiness? <i>(Odours could come from debris [i.e. poor cleaning], dry floor drain traps, mould, etc. Stuffiness might indicate inadequate ventilation.)</i>				
5.1.5	Are there screens, furniture, or other obstructions blocking ventilation grilles, heating units or thermostats? <i>(Relocate or rearrange so ventilation and heating effectiveness is not impaired.)</i>				
5.1.6	Have there been any TI's carried out in this area in the past year (e.g. new or relocated partitions)? <i>(If TI's have been carried out, check whether any of the reported symptoms could result from this TI work.)</i>				
5.1.7	Have the number of occupants increased or the usage of the space (including new equipment) changed over the past year? <i>(If so, then check to ensure the ventilation & cooling capacity is still adequate.)</i>				
5.1.8	Are there any signs of inadequate cleaning? (eg. in corners, on window sills or bookshelves, around ventilation grilles). Are there any stains or residues? (eg. from improper use of cleaning agents). <i>(Ensure that janitorial staff clean effectively [thoroughness and perhaps frequency], are using the correct cleaning agents, and using them properly.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

ALL OCCUPIED SPACES (cont'd)		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
5.1.9	Does there appear to be little or no air delivery from ventilation supply diffusers or grilles? <i>(Check for air motion. If it seems insufficient, search for any duct or other blockages and remove. If there are no blockages, arrange for qualified personnel to estimate or measure outside and total air flow rates and compare against needs.)</i>				
5.1.10	Has effectiveness of supply diffusers or grilles been reduced by blockage (accidental or deliberate)? <i>(Determine reasons for blockage. Remove blockages and carry out adjustments or corrective measures to alleviate problems.)</i>				
5.1.11	Are there complaints the space is too hot or too cold? Are some spaces too hot while others are too cold? <i>(Check that thermostat settings are correct. Instruct occupants on correct settings if needed. If thermostats appear to be set correctly, check their calibration.)</i>				
5.1.12	Are thermostats exposed to drafts, direct sunlight, or blocked by furniture? Are they in representative locations? <i>(If so, adjust air flows, shield the thermostat, move furniture, etc. If there is no improvement, then consult a qualified person for assistance.)</i>				
5.1.13	Are there dust marks around ceiling diffusers or return air grilles? <i>(This may indicate particulates in the space - thus a need for better air filters and/or improved janitorial cleaning. Or maybe air filters are not being changed frequently enough.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

ALL OCCUPIED SPACES (cont'd)		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
5.1.14	Can occupants adjust thermostat setpoints? <i>(No occupant access to thermostats can lead to dissatisfaction. But improper settings can cause comfort problems. Education, good zoning & good air distribution all minimize complaints.)</i>				
5.1.15	If the thermostat has a fan control switch accessible to occupants, is the fan switch in the "on" position? <i>(If the switch is in the "off" or "auto" positions, continuous ventilation will not be provided.)</i>				
5.1.16	Are there any IAQ complaints which may be related to local office printers, fax machines or small photocopiers? <i>(This type of equipment can be a source of ozone and some volatile organic compounds. It usually does not need to be provided with direct exhaust to outside. But any IAQ effects can be minimized by locating it in alcoves and close to return air inlets so emissions do not enter the occupied space directly.)</i>				
5.1.17	Does lighting appear to be adequate (or excessive) for the tasks being done? <i>(At walk-through, this is a judgment call. It may lead to measurements of illumination levels & assessment of adequacy.)</i>				
5.1.18	Does sunlight create glare problems? <i>(Ensure drapes are adequate and there is sufficient lighting when drapes are closed. Correct as necessary.)</i>				
5.1.19	Is there noticeable or distracting noise from HVAC or electrical equipment? <i>(IAQ complaints can arise from such noise. If it is present AND excessive, some expert advice on possible remedies should be sought.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

ALL OCCUPIED SPACES (cont'd)		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
5.1.20	Do noises from occupant activities, including from office equipment used by occupants, seem loud? <i>(Such noise is beyond control of the property manager. But complaints attributed to poor IAQ may really be the result of noise.)</i>				

Sub-Section 5.2: Special Purpose Spaces

Complete a copy of the following questions related to Special Purpose spaces for each individual space which could be classified as such. What follows is not a complete list of possible spaces. Be alert for any characteristics of the particular type of space being inspected for items which should be checked and documented. Special Purpose spaces will be areas such as laboratories, specialized storage spaces, print rooms, high production photocopy rooms, shops, gymnasiums, drafting rooms, etc. which may contain equipment, processes or materials requiring special attention in order to avoid IAQ complaints or problems.

SPECIAL PURPOSE SPACES		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
	Identify the Special Purpose Space:				
5.2.1	Are chemicals or solvents being handled or stored in this space? If yes, what are they? <i>(There are regulations concerning what chemicals or solvents can be stored, what quantities are permitted, and how they are to be stored. Ensure someone with this knowledge reviews this storage, and indicates either compliance or any deficiencies.)</i>				
5.2.2	Does the space contain equipment which generates fumes, particulate or chemical contaminants, excessive heat, etc.? If so, is there adequate provision for exhausting air from the equipment? <i>(Applies to equipment such as large photocopiers, blueprint machines, woodworking equipment, welding equipment, and many other possible items. Ensure both adequate exhaust and make-up air supply.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

SPECIAL PURPOSE SPACES (cont'd)		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
5.2.3	Are workers handling animals, soil, plant material, or other organic material? <i>(Ensure there is adequate exhaust ventilation, and make-up air, serving the space(s) involved. Also ensure that workers have received instruction in, and are following, proper hygiene practices related to the nature of their work.)</i>				

Mandatory IAQ Walk-Through Inspection Checklist

SECTION 6: ANY OTHER OBSERVATIONS / COMMENTS

OBSERVATION / COMMENTS		Action Req'd?			
No.	Inspection Item	Ans Y/N	Yes	No	Comments
	Identify the location(s) to which each observation or comment applies.				

APPENDIX 'E'

B.C. Buildings Corporation

Mandatory Indoor Air Quality (IAQ) Detailed Inspection Checklist

Building No.	
Building Name	
Inspected by (Name / Company)	
Date of Inspection	



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APPENDIX 'E' - MANDATORY IAQ DETAILED INSPECTION CHECKLIST

SECTION 1: PURPOSE

This checklist responds to the new WCB Regulation concerning Indoor Air Quality (Sections 4.70 through 4.80) which came into effect on April 15, 1998. This Detailed IAQ Inspection Checklist **must be used**, in conjunction with the Walk-Through Checklist (Appendix 'D'), in Step 5 of the IAQ Investigation process to gather information which can then be analyzed and evaluated in order to identify the causes of an IAQ complaint and to suggest suitable corrective actions. Nothing in this standard precludes the use of additional forms, or limits the observations or measurements which may be made in order to identify possible legitimate causes for IAQ complaints.

There are two primary reasons for using a checklist. First, it may jog the investigator's memory concerning items which should be looked for. Second, the checklist document will be a convenient location to jot down notes as observations are made. Even if there is nothing untoward, merely noting down "no problem" or some similar note will indicate the item in question was looked at. If someone later questions "was such-and-such looked at?", the answer can be provided.

SECTION 2: ORGANIZATION

Section 3 contains information about weather conditions at the time of the inspection, and some general information about the building. Section 4 contains Base Building related items; Section 5 contains Tenant Improvement related items. Section 6 provides space for any observations which might be made, and which do not fit into any of the specific items found in the other sections.

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In Sections 4, 5 and 6, the tables in which the checklist items are located have six columns, as follows:

- Col. 1: This column contains the checklist item number. It is included to ensure certainty in discussions subsequent to the inspection about which observation is being referred to.
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Mandatory IAQ Detailed Inspection Checklist

shortcoming is identified or indicated. This part is in *italic typeface* and is enclosed in brackets.

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Col. 6: Column 6 is use to provide additional information concerning the observations made, plus any action which may be indicated or required. Use additional sheets if required, and make reference to this additional material in column 6.

Mandatory IAQ Detailed Inspection Checklist

SECTION 3: GENERAL ITEMS

Sub-Section 3.1: Weather Conditions

No.	Observation Item	Value	Comments
	Record weather conditions at the time of the inspection		
3.1.1	Dry-bulb Temperature		
3.1.2	Wet-bulb Temperature (or Relative Humidity)		
3.1.3	Wind (describe velocity and indicate direction)		
3.1.4	Precipitation (Is there any? If so, how heavy?)		
3.1.5	Any other weather observations.		

Sub-Section 3.2: Other General Building Data

No.	Inspection Item	Ans Y/N	Action Req'd?		Comments
			Yes	No	
3.2.1	Is there a documented Preventive Maintenance Program in the building? <i>(If there is, the documentation should be reviewed, and as evaluation made as to whether it meets WCB requirements. If there is no PM program, then one must be established.)</i>				

Mandatory IAQ Detailed Inspection Checklist

SECTION 4: BASE BUILDING ITEMS

Sub-Section 4.1: Outside the Building

This part of the inspection focuses on the exterior of the building and on conditions in its vicinity. It also includes situations where activities within one part of the building could create IAQ problems elsewhere in the building.

	OUTSIDE AIR INLETS	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
4.1.1	Are any outside air inlets located adjacent to roofs, or on roof-mounted equipment? <i>(If they are close to roof level, ensure snow is removed from in front of them as required.)</i>				
4.1.2	Does water pond on the roof close to any air inlets? <i>(If water ponds, ensure there is no evidence of organic growth which could generate toxins, which then enter the air inlet. Remove growth and disinfect as needed.)</i>				
4.1.3	Are any air inlets within 2 m of a plumbing vent? <i>(If close to a plumbing vent, consider extending the vent, or relocating the air inlet if there are persistent odour problems in the occupied spaces served by the ventilation system.)</i>				
4.1.4	Is any roof-mounted air-handling equipment mounted in a roof depression? <i>(Such an installation is discouraged. Adequate measures for exhaust air discharge [no recirculation to OA intake], maintenance access, drainage, and snow clearing MUST be confirmed.)</i>				
4.1.5	Is there vegetation which has pollens or spores located near OA inlets? <i>(Consider removal to take away the source of irritation.)</i>				

Mandatory IAQ Detailed Inspection Checklist

	GENERAL EXTERIOR ITEMS	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
4.1.6	Are occupant entrances exposed to air contaminant sources? If so, can inward airflow be sensed at those entrances? <i>(Evaluate possible contamination [e.g. CO from vehicles], especially if there have been IAQ complaints. Consider alterations to ensure entrance lobby pressurization.)</i>				
4.1.7	Is there inward air flow at shop or freight entrances? <i>(Evaluate possible CO contamination. Ensure engines of parked vehicles are turned off. Possibly install signs.)</i>				
4.1.8	Are there any potential sources of air contaminants in the vicinity of the building or its OA intakes? <i>(Check for restaurants, dry cleaners, chimneys, industrial plant discharges, bus/truck stops [engines running], etc. May need to consider odour-absorbing filters, relocation of OA intakes, or other measures.)</i>				

Mandatory IAQ Detailed Inspection Checklist

Sub-Section 4.2: Base Building Heating Systems

SYSTEM OR COMPONENT		Ans	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.2.1	Are there any fuel oil or natural gas odours? <i>(Consider EVACUATING THE BUILDING! Shut off fuel oil or gas supply. Check for leaks, in both piping and combustion appliances. For gas, consider asking the utility company to provide assistance.)</i>				

Sub-Section 4.3: Base Building Plumbing Systems

SYSTEM COMPONENTS		Ans	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.3.1	Are there any foul or unpleasant odours? <i>(Check floor drains [e.g. in washrooms]. Ensure trap primers exist for all floor drains, and that they are operational. Install trap primers if necessary.)</i>				

Mandatory IAQ Detailed Inspection Checklist

Sub-Section 4.4: Base Building Ventilation / Cooling Systems

SYSEM COMPONENTS		Ans Y/N	Action Req'd?		Comments
No.	Inspection Item		Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
4.4.1	Check outside air (OA) damper minimum setting, and estimate minimum OA flow by temperature or CO2 mixing calculations. <i>(Refer to Attachment 1 for details of the mixing calculation procedure.)</i>				
4.4.2	Check the condition of the return, relief and outside air dampers, including linkages. Stroke the dampers through their full operational range. <i>(If the dampers are dirty or corroded, then clean or replace them. If damper movement is not smooth, clean, service or replace bearings as needed. If dampers do not close tightly, adjust linkages and/or damper actuator action so they do.)</i>				
4.4.3	Check interior of air handling unit(s), including coils and heating elements, for dirt and evidence of stagnant water, or water staining. <i>(If there is excessive dirt accumulation, check for dusty conditions outside or inadequate janitorial inside. Consider more efficient filters, particularly if present filters are low efficiency panel type. If there is water, determine the source, do repairs, and clean & disinfect as needed.)</i>				

Mandatory IAQ Detailed Inspection Checklist

SYSTEM COMPONENTS (cont'd)		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
4.4.4	Check condensate drain pans under cooling coils in AH units, heat pumps, etc. to ensure there is complete drainage when the unit is off. <i>(Check the drain line to ensure it is not plugged. Check that drain pan is sloped to drain outlet for complete drainage of water. Correct as necessary.)</i>				
4.4.5	Test operation of all controls, including damper control and minimum OA position. <i>(Essentially this is a commissioning process for the specific system. Use of a functional performance test checklist specific to the system is recommended. Calibrate as required; document setpoints. Repair and maintain as required to achieve correct controls functions.)</i>				
4.4.6	If the air handling unit has an air-side economizer, confirm there is provision for relief air, and that any relief air controls are working effectively. <i>(Lack of provision will be indicated by excess pressurization of the building when in free cooling. Alterations to install relief air will be needed if there is none. Relief may be through a gravity backdraft damper.)</i>				

SECTION 5: TENANT IMPROVEMENT ITEMS

Sub-Section 5.1: Within the Building

The questions in this part of the inspection focus on spaces within the building. Sub-section 5.1 is to be used for all occupied spaces. Other sub-sections will be used for the specific types of spaces or systems as indicated.

	ALL OCCUPIED SPACES	Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
5.1.1	Does HVAC system zoning correspond to full-height partition layout, space usage, etc.? <i>(Evaluate thermal zoning. Use the principles listed in step 5 the IAQ Complaint Investigation process. If zoning does not fit the existing layout, identify any required zoning revisions, and implement the necessary renovations.)</i>				
5.1.2	Does the number of occupants (e.g. in offices, meeting rooms, etc.) or workstations appear to be excessive for the space available? <i>(Check the design occupancy intended for the space [if available]. If actual occupancy is higher, it may need to be reduced, or the capacity of the ventilation / cooling system increased to meet actual load.)</i>				
5.1.3	Are there any local exhaust systems in this area or space? If YES, check system operation, local controls, interlocks to air make-up, etc. <i>(If problems are detected, correct as needed. Consult a ventilation expert if needed to assist in diagnosis and recommended action.)</i>				

Mandatory IAQ Detailed Inspection Checklist

ALL OCCUPIED SPACES (cont'd)		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
5.1.4	Are some areas consistently hot during hot weather, or consistently cold during cold weather? <i>(Check for inadequate heating or cooling capacity in the base building heating /cooling systems, or in zone equipment for these systems. Load calculations may be needed.)</i>				
5.1.5	Has the space been converted from one use to another (e.g. from storage space or shops to offices)? <i>(Such space use conversions typically require significant HVAC system upgrades. Check for adequate systems, zoning and capacity for the current usage.)</i>				

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Sub-Section 5.2: Special Purpose Spaces

Complete a copy of the following questions related to Special Purpose spaces for each individual space which could be classified as such. What follows is not a complete list of space types which should be considered. Nor does it cover all relevant questions for some types of spaces. Be alert for any characteristics of the particular type of space being inspected for additional items which should be checked and documented. Special Purpose spaces will be areas such as laboratories, specialized storage spaces, print rooms, high production photocopy rooms, shops, gymnasiums, drafting rooms, etc. which may contain equipment or materials which will require special attention in order to avoid IAQ complaints or problems.

SPECIAL PURPOSE SPACES		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
	Identify the Special Purpose Space:				
5.2.1	Is there equipment or a process requiring a dedicated exhaust ventilation system? If so, is such a system installed? <i>(If there is no exhaust, and one is required, consult a ventilation expert to design the required system, or relocate the equipment / process to a space meeting its needs. Describe the existing equipment / process, and the existing exhaust system.)</i>				
5.2.2	If there is an exhaust system, is there an effective air make-up system installed? <i>(Effective air make-up is essential if the exhaust system is to function properly, and to avoid the undesirable effects of negative pressure, specially drafts and infiltration. If air make-up seems lacking, consult a ventilation expert to study the system and provide advice.)</i>				

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SPECIAL PURPOSE SPACES (cont'd)		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
5.2.3	If there is an exhaust system, does it appear to be working effectively? Are there any complaints from users? <i>(If there are concerns, then a ventilation expert should be consulted for an opinion. Even without concerns, evaluate the operation of the exhaust system every 5 years or so.)</i>				
5.2.4	If there is an exhaust system, do the exhaust grilles show signs of excessive grease, dust, lint or dirt buildup? <i>(If so, clean grilles and check exhaust ductwork for cleanliness. Clean as necessary.)</i>				
5.2.5					

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Sub-Section 5.3: Ventilation / Cooling Systems

SYSTEM COMPONENTS		Ans	Action Req'd?		Comments
No.	Inspection Item	Y/N	Yes	No	
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				
5.3.1	Check condensate drain pans under cooling coils in zone-level fan-coil units, heat pumps, etc. to ensure there is complete drainage when the unit is off. <i>(Check the drain line to ensure it is not plugged. Check that drain pan is sloped to drain outlet for complete drainage of water. Correct as necessary.)</i>				

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SECTION 6: ANY OTHER OBSERVATIONS / COMMENTS

OBSERVATIONS / COMMENTS		Ans	Action Req'd?		
No.	Inspection Item	Y/N	Yes	No	Comments
	Identify the area of the building to which these observations apply (e.g. wing, floor, air handling system, etc.)				

ATTACHMENT 1 AIR MIXING CALCULATIONS USED TO ESTIMATE OUTSIDE VENTILATION AIR FLOW

By measuring the temperatures of the outside air, recirculated air and mixed air in a ventilation system, it is possible to calculate the percentages of outside air and recirculated air which have been mixed together to form the mixed air stream. After passing through any heating and/or cooling sections in the air handling unit, the proportion of outside and recirculated air in the supply air stream will be the same as that in the mixed air. However, it is important to measure the mixed air temperature before any heating or cooling has taken place. And the mixed air temperature must be measured before the air goes through the supply air fan as well, because the fan will add energy (in the form of heat) to the air stream, thus increasing its temperature slightly. When the actual supply air flow rate is known, usually from a balancing report or for supply air flow measurements taken at the same time as the temperature measurements, then the actual outside air and recirculated air flow rates can be calculated using the proportion determined from the air temperature measurements.

This attachment provide these calculations.

The percentage of outside air in a mixed (or supply) air stream is calculated using the following formula:

$$P_{OA} = \frac{100 (T_{RA} - T_{MA})}{(T_{RA} - T_{OA})}$$

Where P_{OA} = the percentage of outside air in the mixed air (or supply air) stream,

T_{RA} = the temperature of the recirculated air (which will be the same as the return air temperature, measured downstream of any return fan),

T_{MA} = the temperature of the mixed air stream, measured upstream of the supply fan and any heating or cooling equipment in the air handling unit,

T_{OA} = the outside air temperature.

For example, if $T_{RA} = 22^{\circ}\text{C}$, $T_{MA} = 18^{\circ}\text{C}$, and $T_{OA} = 5^{\circ}\text{C}$, then the equation would be solved as follows:

$$P_{OA} = \frac{100 (22 - 18)}{(22 - 5)} = \frac{100 \times 4}{17} = 23.5\%$$

As a second example, consider the following:

$T_{RA} = 22^{\circ}\text{C}$, $T_{MA} = 15^{\circ}\text{C}$, and $T_{OA} = -5^{\circ}\text{C}$,

The equation would be solved as follows:

$$P_{OA} = \frac{100 (22 - 15)}{(22 - (-5))} = \frac{100 \times 7}{27} = 25.9\%$$

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(22 -[-5])

27

In the second example, care must be taken to treat the negative outside air temperature correctly.

Using the percentage of OA, the actual air flows would be calculated as follows:

$$\text{Outdoor Air Flow} = \frac{P_{OA} \times Q_{SA}}{100}$$

$$\text{Recirculated Air Flow} = \frac{(100 - P_{OA}) \times Q_{SA}}{100}$$

Where Q_{SA} = measured supply air flow rate. If the measurement is in cfm, then the calculated air flows will be in cfm. If the measurement is in L/s, then the calculated air flows will be in L/s.

The “100” in the denominator of each of the preceding equations is to convert the percentage value of “ P_{OA} ” to a decimal fraction.

The temperature calculation is most accurate if all three of the measured temperatures are quite different from each other. If they are too close together, then the errors in the individual measurements can result in quite a large percentage error when the two temperatures are subtracted. For example, if the accuracy of each measurement is plus-or-minus 0.25°C, and the difference between two temperatures is 5°C, then the uncertainty of the difference is 0.35°C, or an error of 7%. If the measurement accuracy is +/- 0.50°C (which is quite common), then the uncertainty doubles to 14%.

With the increasing availability of high quality carbon dioxide (CO₂) concentration instruments, the percentage of outside air can also be calculated using CO₂ measurements in the outside, recirculated (or return), and mixed (or supply) air streams. Generally speaking, the CO₂ concentrations in each of the three air streams are quite different, so this form of the calculation can be done if the air temperatures are close to one another. **HOWEVER, NOTE THE ACCURACY CAUTION FOLLOWING.** In this case, the location of the measurements in the return and supply air streams can be on either side of the supply or return fans, or on either side of any heating or cooling

The formula is virtually the same as that for the temperature mixing:

$$P_{OA} = \frac{100 (C_{RA} - C_{MA})}{(C_{RA} - C_{OA})}$$

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Where P_{OA} = the percentage of outside air in the mixed air (or supply air) stream,
 C_{RA} = the concentration of CO_2 in the recirculated air stream (which will be the same as the return air),
 C_{MA} = the concentration of CO_2 in the mixed air stream,
 C_{OA} = the concentration of CO_2 in the outside air stream.

However, typical CO_2 instruments have an accuracy of no better than plus-or-minus 50 ppm, and many are up around +/- 100 ppm or more. If the difference between two CO_2 concentrations is 500 ppm, then an accuracy of +/- 50 ppm will be expected to produce a 14% uncertainty in the difference between the two. If the accuracy is only +/- 100 ppm, then the uncertainty will be 28%.

Conclusion - Unless the temperatures are really very close together, it would probably be wiser to use temperature mixing calculations to determine outside air percentages and air flows, instead of CO_2 concentration mixing calculations.