State Claims Agency

Guidelines for Principals and Boards of Management on Managing Mould Growth in State Buildings

Prepared by the State Claims Agency

Copyright © State Claims Agency 2006

Index

1. **Background**

2. **What are moulds?**

3. **What are the possible health effects?**

4. **How do you prevent mould growth?**

5. **How do you identify a mould problem?**

6. **How do you manage mould growth?**

7. **Cleaning methods**

8. **Prevention of exposure during remediation**

9. **Personal protective equipment**

10. **How do I ensure the clean up job is complete?**

This Guideline has been produced solely for use by State Authorities that come within the remit of the State Claims Agency, as established by the National Treasury Management Agency (Amendment) Act, 2000. The State Claims Agency does not bear responsibility for use of the guideline or reliance on it in any manner by any other third party.

An Irish Version of these Guidelines is available at http:/www.education.gov.ie or on request from the School Building Section, Department of Education and Science, Portlaoise Road, Tullamore, Co. Offaly. Tel (05793) 24427.

1. Background

In the US and Canada, there have been a significant number of personal injury claims for ill health resulting from toxic mould exposure. In the UK and Europe, claims activity involving toxic mould has been more limited. However insurers, risk managers and others involved in this area are maintaining a watching brief and there is concern that it could be a source of mass action in the future.

In order to be in a strong position to defend any future claims that may be taken against the State, the State Claims Agency (SCA) carried out a survey of moulds in State buildings. The primary purpose of the survey was to quantify the extent of building contamination by mould and to recommend appropriate risk management controls.

The findings of the survey have informed this and other SCA guidelines on mould.

2. What are moulds?

Moulds are part of the natural environment. They are fungi which play an important part in nature by breaking down dead organic matter such as fallen leaves and dead trees. Mould may begin growing indoors when spores land on surfaces that are wet. The individual spores are invisible to the naked eye. However, when they grow en masse they are visible as the black, blue, green etc staining that people associate with mould.

Some moulds can produce vapors, which are detectable by the human nose at very low concentrations. This is what gives the unpleasant 'musty' odour associated with dampness and mould growth.

Most moulds grow well at warm ambient (15^0-25^0C) temperatures, but a few prefer lower or higher temperatures. All moulds require a steady supply of nutrition and moisture to live and grow. Nutrition, in the context of buildings, is provided by flour dust, cooking oil droplets, skin scales, hair, spiders' webs, wall paper, plaster-board, wood etc. Indoors, moisture can result from flooding, leaking pipes, damp etc.

3. What are the possible health effects?

Exposure to mould does not always present a health problem. However, a percentage of the population are sensitive to moulds. The types and severity of symptoms depend on;

- the types of mould present - some moulds are not associated with causing ill health effects
- the extent of the mould growth - ill health effects are usually associated with areas of large mould growth
- the extent of an individual's exposure. There are no occupational exposure limit's (OEL's) set for mould spores, i.e. there is no agreed limit for the number of mould spores that it is safe for an individual to be exposed to over an 8 hour day.
- the ages of the individuals (e.g children, elderly) and their existing sensitivities or allergies.

Mould growth could cause the following ill health effects;

- Allergic Reactions
- Asthma - can trigger attacks or worsen existing conditions
- Irritant Effects of the eyes, skin, nose, throat, and lungs
- Opportunistic Infections - people with weakened immune systems e.g. children, the elderly, ill may be more vulnerable to infections by moulds.

Moulds can also produce toxic substances called mycotoxins. The presence of mould in a building does not necessarily mean that mycotoxins are present or that they are present in large quantities. There is some evidence to suggest that toxic moulds can cause ill-health. However, a causal link between the presence of the toxic mould and these conditions has not been proven and research is on going.

4. How do you prevent mould growth?

Mould spores are ever-present in outdoor air and therefore it is not possible to entirely exclude them from the indoor environment. ***The most important fact about moulds is their need for moisture. If there is no moisture supply they will not grow. The key to the prevention of mould growth is to eliminate all sources of moisture.***

This includes;

- Fixing leaky plumbing immediately
- Preventing water leaking in from the exterior, clearing gutters regularly and repairing any damage to gutters.
- Preventing condensation by increasing the surface temperature or by reducing the humidity in the air. Surface temperature can be increased by insulating or by increasing air circulation. Humidity can be reduced by repairing leaks and increasing ventilation. Ideally humidity should be below 60% relative humidity.
- Venting dryers to the outdoors
- Fixing rising damp problems

If water damage has occurred, despite the above control measures e.g. flooding, it is critical to take immediate action to reduce the risk of mould growing. The guidelines (table A) should be followed within 48 hours to prevent mould growth;

Table A. Guidelines on actions to be taken after water damage has occurred.

Water-Damaged Material	**Actions**
Books and papers	• For non-valuable items, discard books and papers. • Photocopy valuable/important items, discard originals. • Freeze (in frost-free freezer)
Carpet and backing - dry within 24-48 hours	• Remove water with water extraction vacuum. • Reduce ambient humidity levels with dehumidifier. • Accelerate drying process with fans.
Ceiling tiles	• Discard and replace.
Cellulose insulation (wall paper, plaster board, wood)	• Discard and replace.

Concrete or cinder block surfaces	• Remove water with water extraction vacuum. • Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	• Discard and replace.
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	• Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary. • Check to make sure underflooring is dry; dry underflooring if necessary.
Non-porous, hard surfaces (Plastics, metals)	• Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	• Remove water with water extraction vacuum. • Accelerate drying process with dehumidifiers, fans, and/or heaters. • May be difficult to completely dry within 48 hours – disposal may be only option
Wallboard	• May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. • Ventilate the wall cavity, if possible.
Curtains, blinds	• Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	• Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.) • Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry. • Wet paneling should be pried away from wall for drying.

5. How do you identify a mould problem?

Early detection and remediation of mould growth is critical. School maintenance / cleaning staff can deal with smaller areas of growth (<3m^2). Larger areas will have to be dealt with by specialist expertise with significant clean up costs. Schools should complete a formal bi-annual check of areas, which are deemed higher risk of having moisture problems.

The identification of a mould problem does not require specialist expertise. Where there is evidence of dark patches of growth and staining on a surface and/or where there is a moisture source allied with a musty odour, it is likely that mould is present.

In most situations it is not critical to identify the type of mould. However, if staff or students have already complained of ill health effects then specialist expertise must be used to determine the exact mould type as this will confirm or otherwise whether the mould may have contributed to their ill health. This will be vitally important to preventing subsequent claims that may arise. Where no one has complained of ill health associated with the mould growth, sampling and further identification is not required. In both situations, the priority is to remove the mould and remediation work should be undertaken whatever the type.

Where the mould growth occurs as a result of the ingress of contaminated water, e.g. from a sewage leak, professional help should be sought because of the additional risk of Weil's disease, gastro intestinal infections etc.

6. How do you manage mould growth?

Mould problems are not a new phenomenon and are even mentioned in the bible where it describes a house desecrated by mould as an unfit place to live. The bible even recommends remedial measures!!

Flowchart A sets out the procedures to be followed after a suspected mould growth has been identified.

Assess
The appropriate personal protective equipment must be worn by the individual(s) completing the assessment (see section 9).

The assessment should establish the;
- area of surface covered by the mould growth,
- type of materials affected e.g. plasterboard, ceiling tiles
- source of the moisture problem

It is possible that mould may be growing on hidden surfaces, such as the back side of dry lining, wallpaper, paneling, the top of ceiling tiles, the underside of carpets, rugs, mats, etc.

The area of the mould growth determines who would be suitable to carry out the remediation and how it should be tackled. If the area covered by mould is less than $3m^2$ then work can be carried out by trained maintenance/cleaning staff. For larger areas ($>3m^2$) or where it is judged that there is a high risk to staff or students for other reasons (e.g. source of water ingress from a sewage leak), a professional cleaning company will be engaged by the school.

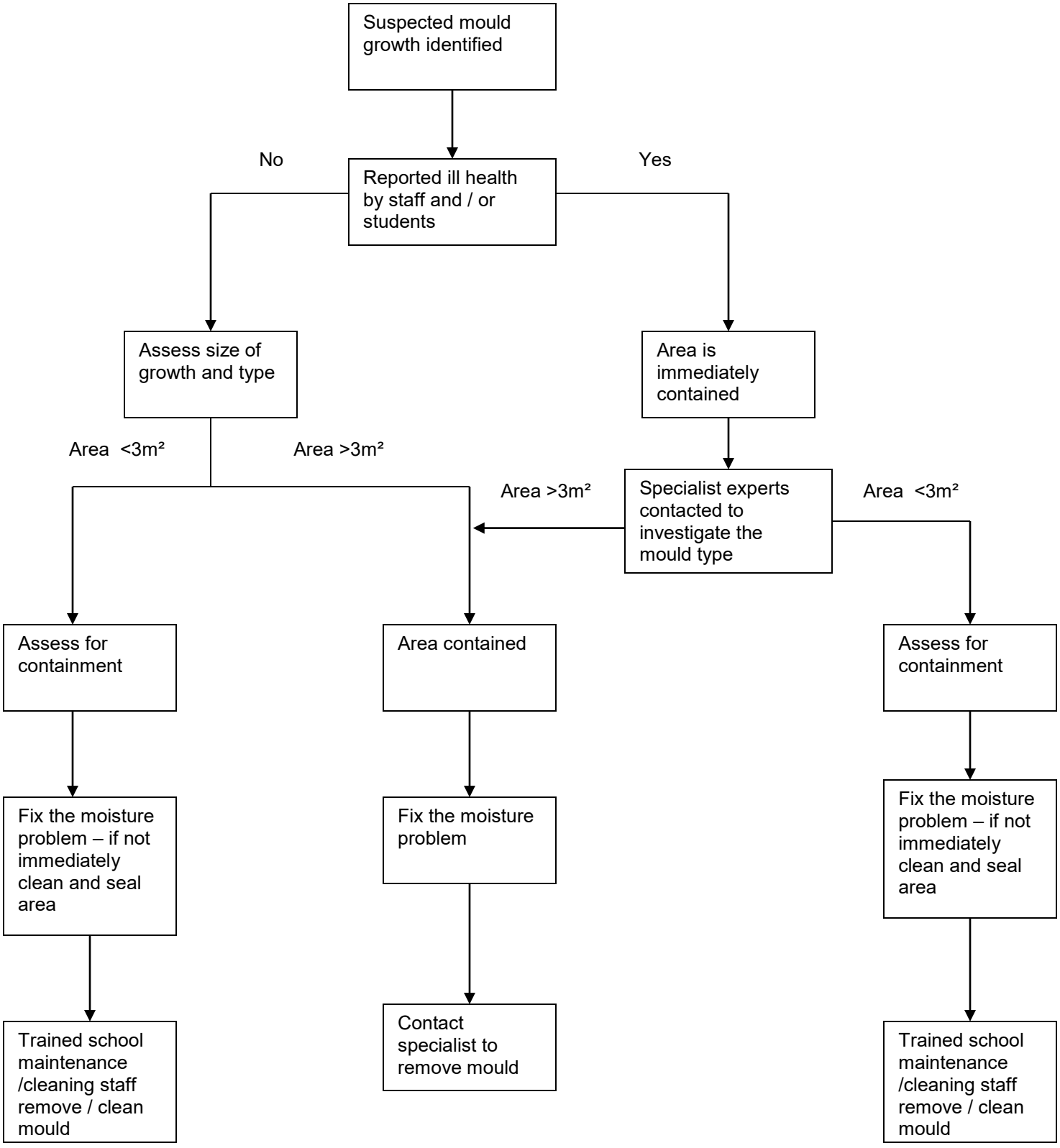
The size of the area determines the degree of containment required while carrying out the remediation work. If the area affected is approximately $3m^2$ or less then the work could be undertaken without containment. If work cannot commence immediately the area should be swabbed with 10% bleach and sealed off with a polyethylene membrane at least 450 mm bigger than the patch on all sides.

Fix the moisture problem
If the mould is removed without removing the moisture source, the problem is highly likely to reoccur.

Clean up
Persons, other than the school maintenance staff / cleaners, should be excluded from the area being remediated while work is on going and for 24 hours after.

The approach to clean up depends on the surface area affected by the mould, and the material to be cleaned. (see section 7)

Flowchart A : Procedures for assessment and managing mould growth



7. Cleaning methods

School maintenance / cleaning staff with existing respiratory conditions should not take part in cleaning and remediation of moulds. The appropriate personal protective equipment must be worn by the individual(s) involved in cleaning of moulds (see section 9).

Damp wipe
This method can only be used on hard surfaces by wiping or scrubbing with water and detergent.

Wet vacuum
Vacuum cleaners can be used to remove water from hard surfaces and carpets. They should not be used on porous materials or if there is insufficient water present. Where there is insufficient water the vacuum may spread spores. The vacuum and all its attachments must be cleaned and dried after use otherwise spores may stick to it.

Dry vacuum with High Efficiency Particulate Air (HEPA) filter
During final clean up a dry vacuum with a HEPA filter can be used to clean up dust that may have settled in the vicinity of the remediation area. Care must be taken when changing the filter and contents.

Disposal of damaged material
Building materials e.g. plasterboard and furnishings that cannot be salvaged must be removed for disposal.

Use of chemicals and biocides
Generally the use of chemicals or biocides does not provide a solution to mould problems. The chemicals may kill the spores but dead mould may still be allergenic. A level of spores will still remain in the air (similar to the level in the air outside). The spores will not grow if there is insufficient moisture present.

However in some cases it may not always be possible to solve the moisture problem immediately in which case the patches of mould can be sponged with a 10% solution of bleach (sodium hypochlorite) and allowed to dry. Note that some domestic bleaches have lower concentrations of sodium hypochlorite. Bleach must not be mixed with any other ammonia-containing or acidic detergents as toxic chlorine gas will be produced. Fungicides developed for use on soil, outdoor plants and grains should not be used indoors.

If the patch is so damp as to make drying impossible, the first application should be followed by another after approximately 30 minutes. The patch should then be scrubbed to remove adhering growth, loose paint and other debris which might provide nutrition to the mould. The area should then be painted with a good quality fungicidal paint.

Any generated waste materials e.g. removed damaged material, vacuum filters, PPE, cleaning materials, etc, must be disposed of. This requires them to be placed in strong (e.g 6mm) sealable polyethylene bags. Larger items can be covered with sheeting and sealed with duct tape to protect those carrying the waste.

The following tables show the recommended methods for cleaning/remediating mould growth on different surfaces and for different surface areas of growth.

Table B. Total area of mould growth less than 3 m^2

Material or Furnishing Affected	Damp wipe	Wet vacuum	Hepa vacuum after drying
Books and papers			✓
Carpet and backing	✓	✓	
Concrete or cinder block		✓	✓
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	✓	✓	✓
Non-porous, hard surfaces (plastics, metals)	✓	✓	✓
Upholstered furniture & curtains		✓	✓
Wallboard (drywall and gypsum board)			✓
Wood surfaces	✓	✓	✓

Table C. Total area of mould growth between 3m^2 and 30 m^2

Material or Furnishing Affected	Damp wipe	Wet vacuum	Hepa vacuum after drying	Discard where remediation is not possible
Books and papers			✓	
Carpet and backing		✓	✓	✓
Concrete block		✓	✓	
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	✓	✓	✓	
Non-porous, hard surfaces (plastics, metals)	✓	✓	✓	
Upholstered furniture & curtains		✓	✓	✓
Wallboard			✓	✓
Wood surfaces	✓	✓	✓	

Table D. Total area of mould growth greater than 30 m^2

Material or Furnishing Affected	Damp wipe	Wet vacuum	Hepa vacuum after drying	Discard where remediation is not possible
Books and papers			✓	
Carpet and backing		✓	✓	✓
Concrete or block		✓	✓	
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	✓	✓	✓	✓
Non-porous, hard surfaces (plastics, metals)	✓	✓	✓	
Upholstered furniture & curtains	✓	✓		✓
Wallboard			✓	✓
Wood surfaces	✓	✓	✓	✓

8. Prevention of exposure during remediation

Containment
The purpose of containment during remediation activities is to limit release of spores into the air and surroundings, in order to minimize the exposure of school maintenance staff , cleaners, teachers and students to mould. Mould and mouldy debris should not be allowed to spread to areas in the building beyond the contaminated site.

The size of the area determines the degree of containment required while carrying out the remediation work.

As previously stated, areas larger than $3m^2$ must be remediated by specialist contractors who are responsible for the specification and provision of their own containment.

Surface area of mould growth <3m^2
If the area affected is approximately $3m^2$ or less then the work could be undertaken without containment. However, persons, other than the school maintenance staff / cleaners, should be excluded from the area being remediated while work is on going and for 24 hours after. Appropriate signage and/or barriers should be erected.

If work cannot commence immediately the area should be swabbed with 10% bleach and sealed off with a polyethylene membrane at least 450 mm bigger than the patch on all sides.

Surface area of mould growth >3m^2 and <30m^2
Limited containment is generally recommended for areas involving between 3 and 30 m^2 of mould contamination. The enclosure around the mouldy area should consist of a single layer of 6-mm fire-retardant polyethylene sheeting. The containment should have a slit entry and covering flap on the outside of the containment area.

For small areas, the polyethylene sheeting can be fixed to floors and ceilings with tape. For larger areas, a steel or wooden stud frame can be erected and polyethylene sheeting attached to it. All air vents, doors service ducts etc within the containment area must be sealed with polyethylene sheeting to minimize the migration of contaminants to other parts of the building. If there are air handling units or air conditioning units in the vicinity of mould growth on ceiling tiles the units will have to be taken out of service and thoroughly cleaned, filters replaced etc after remediation.

The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside

of the building. For small, easily contained areas, an exhaust fan ducted to the outdoors can also be used. The surfaces of all objects removed from the containment area should be cleaned or bagged prior to removal.

Surface area of mould growth >30m^2

Full containment is recommended for the cleanup of mould-contaminated surface areas greater than **30m^2** or in any situation in which it appears likely that the occupant space would be further contaminated without full containment. Double layers of polyethylene should be used to create a barrier between the mouldy area and other parts of the building. A decontamination chamber or airlock should be constructed for entry into and exit from the remediation area. The entryways to the airlock from the outside and from the airlock to the main containment area should consist of a slit entry with covering flaps on the outside surface of each slit entry. The chamber should be large enough to hold a waste container and allow a person to put on and remove PPE. All contaminated PPE, except respirators, should be placed in a sealed bag while in this chamber. Respirators should be worn until school maintenance staff / cleaners are outside the decontamination chamber. PPE must be worn throughout the final stages of HEPA vacuuming and damp-wiping of the contained area. PPE must also be worn during HEPA vacuum filter changes or cleanup of the HEPA vacuum.

9. Personal protective equipment (PPE)

Remediation is likely to disturb the mould and spores will become airborne. The risk of respiratory exposure therefore increases. Skin and eyes must also be protected from contact with mould. Table E summaries the type of PPE that must be worn during the assessment and clean up process.

As previously stated, areas larger than $3m^2$ must be remediated by specialist contractors who are responsible for the specification and supply of their own PPE.

Respirators
Respirators are filtering devices that will protect school maintenance/cleaners from inhaling airborne moulds, mould spores and dust.

Cleaning small areas $<3m^2$

- A FFP3 (high efficiency to EN 149 standard) half mask should be worn.

Cleaning large areas $>3m^2$

- A full face forced air purifying respirator with P3 filter should be used. Only persons trained in the use of the respirator should be involved in clean up.

Protective clothing

- For small jobs overalls can be worn. For medium or large clean up/remediation jobs a disposable overall with hood is recommended such as a Tyvek suit. This prevents the spread of mould spores on clothing and prevents skin contact.
- Long rubber or nitrile gloves should be worn.

Eye Protection

- Eyes should be protected by wearing fitted goggles, which comply to standard EN 166, or a full face respirator. Safety glasses or goggles with vent holes will allow mould spores contact with eyes and should not be worn.

Table E. Type of PPE that must be worn during various stages of remediation

	Half mask (FFP3 to EN 149)	Full face respirator with a P3 filter	Tyvek suit (hooded)	Overalls	Rubber or nitrile gloves	Eye goggles
Assessors	✓				✓	✓
Maintenance staff, Cleaners - smaller area	✓			✓	✓	✓
Contractors - large area		✓	✓		✓	

10. How do I ensure that the clean up job is complete?

Mould will not be eliminated unless the source of moisture is removed. If the moisture problem is not rectified repeat clean up visits will be required on an on-going basis.

If the clean up is complete visible signs of mould, mould damaged materials and a musty odour should not be evident.

The school should be advised to revisit the area after approximately two weeks, four weeks and again after 8 weeks. There should be no sign of mould growth or water damage.