



WORKING AT ELEVATED PLACES

Working on Roofs or At Heights

University workers who carry out work on elevated places, including roof work can potentially be exposed to the risk of falling whether it be gaps or holes on a roof, an unstable roof slippery weather or an unprotected edge. A risk of falling may also occur during the erection or dismantling of the scaffolds when the guardrails are not in place. The risk of a fall exists for both activities of long and short durations. In addition, other nearby workers and the public may also be injured by objects falling from above.

APPLICATION:

Any worker performing work at elevated heights and is exposed to the risk of falling from a height of three meters /10 ft or more. Some common roof work tasks at the University may include roof maintenance and repair, building inspections, installation and maintenance of HVAC units, etc.

DEFINITIONS:

Fall Protection:	Any system that serves to protect a worker from falling, or minimizes the travel distance in the event of a fall.
Guardrail System:	An assembly that provides a barrier to prevent a worker from falling from an edge of a surface.
Roof:	The exterior surface on the top of a building.
Unprotected Sides and Edges:	Any side or edge (except at entrances to points of access) of a walking/working surface, e.g. floor, ramp, or runway where there is no wall or guardrail system.
Warning Line System:	Temporary demarcation which warns workers if they are approaching an unprotected edge. Where no guardrails or safety net systems are available, they must be placed at least 2m from the unprotected edge.

LEGISLATION AND REQUIREMENTS:

The Ontario Regulation, Industrial Establishments (851), Section 85, under the Occupational Health and Safety Act specifies that a worker who is exposed to a risk of falling from a height of more than 3 meters must wear a full body harness and lifeline adequately secured to a fixed support so the worker cannot fall freely for a vertical distance of more than 1.5 meters. Refer to the University's Fall Protection Standard. In addition, section 207, Construction Regulation (Ontario Regulation 213/91) indicates that when a built-up roof is being constructed, repaired or resurfaced, a barrier shall be placed in the immediate work area at least two meters from the perimeter of the roof.

In accordance with the Ontario Regulations 851 and 213/91, the University of Toronto requires that workers exposed to:

- A potential free-fall greater than 3 meters/10 feet, or
- If work at a height includes the work on roofs at an angle, or

- On a flat roof in circumstances when adequate railings are not provided, must receive fall protection training and implement the proper fall prevention methods.

Workers should never perform any duties close (2 meters) to an unprotected edge, platform or walkway of any building, or utilize elevated equipment unless they are properly trained and secured from falling. Special considerations must be implemented if workers are exposed to any openings in a surface (e.g. roof) that they can fall through.

In circumstances when a worker cannot be secured to a fixed support (e.g. on fragile roofs), other work methods must be used such as a lifting device. The use of a lifting device requires specific training for that particular device.

RESPONSIBILITIES:

Principal investigators/supervisors and all others in authority shall:

- Identify all situations where a fall hazard exists;
- Assess the situation including the task, the conditions and the associated risks prior to commencement of work and implement the appropriate fall prevention and fall protection measures to protect the worker;
- Develop a control plan to reduce the risk of a fall occurring and an emergency rescue plan in the event of a worker falling;
- Ensure all workers required to access or work on roofs are trained in the risks associated with working at heights, the use and care of fall protection equipment and on emergency procedures;
- Ensure that fragile roofs are sign-posted and special precautions such as crawl-boards are used;
- Ensure that appropriate fall protection and personal protective equipment are provided and used;
- Monitor and ensure that safe work practices are being followed, including the use of appropriate fall protection and personal protective equipment.

Workers shall:

- Have a clear understanding of the University's Working at Elevated Heights standard;
- Conduct a risk assessment of the roof work required at the site;
- Consider the prevailing weather conditions prior to the commencement of work;
- Ensure the roof is structurally sound and can hold the weight of the worker(s) and the required equipment;
- Not work on a pitched roof if it is wet or windy;
- If fall protection is required, ensure compliance with the University's Fall Protection Standard;
- Wear the appropriate personal protective equipment (PPE), including suitable footwear (e.g. non-slip);
- Inspect PPE, including fall arrest or restraint systems and harnesses.
- Defective or damaged PPE must be reported immediately, taken out of service and not used until repaired or replaced as applicable and appropriate;
- Some PPE may have expiration dates (e.g. N95 respirators or fall protection harnesses) and should not be used past the expiration. Report to your supervisor and take the PPE out of service;
- Use a "buddy system" to ensure persons are not left alone in the event of an emergency;

RISK ASSESSMENT:

A written risk assessment should be carried out for all roof work before the work commences. The necessary equipment, appropriate precautions and systems of work should be provided and implemented, and workers should have received training. All roof work, including short-duration work (lasting minutes rather than hours), needs careful planning to minimize the risks to workers. Refer to

Appendix A for questions that may assist in assessing the situation to determine the risks involved with roof work.

ACCESS TO AND FROM THE ROOF:

Getting on and off the roof can pose a major risk. A secure means of entry and exit is essential. Where a ladder is used to access or exit a roof, ensure that it is of a suitable type and set up in a safe manner. Refer to the University's Portable Ladders Standard. **FALL PREVENTION:**

Suitable preventative measures should be taken where there is a risk of falling from a height greater than 10 ft. Measures to protect workers against the risks of falls should be taken based on the findings of the risk assessment. Fall prevention uses physical means to keep workers away from situations where they might fall. These fall prevention measures include:

- Proper use of worksite access;
- Protective covers over roof openings;
- Visual Warnings: signs or tape, cones or boulders, paint or chalk;
- Physical barriers such as warning barriers and bump lines, handrails, fencing, guardrail systems, travel restraints. Any safeguard provided to prevent falls (such as edge protection) should be strong enough to prevent or arrest falls and stop injuries to workers.
- During erecting or dismantling of a scaffold, hand and guardrails may not be in place. The use of other fall prevention controls such as fall protection harness must be in place during these activities.

Fall prevention measures should be in place when working at heights begin and remain in place until the work is finished.

WEATHER CONDITIONS:

Weather conditions should be taken into account during roof work, as icy, wet or windy conditions can significantly increase the risk of people or material falling. Excessive exposure to sunlight should be avoided by wearing appropriate clothing and using sunscreen.

FALLING MATERIAL:

Falling material can cause injury. Nothing should be thrown from a roof. The following steps should be taken to minimize the risk of falling material wherever practicable:

- Use barricades/barriers/toe boards to prevent material from falling from above;
- Use enclosed rubbish chutes, or lower material to the ground;
- Keep worksite tidy and do not allow materials to accumulate;
- Prevent access to danger areas underneath or adjacent to roof work or areas where working at heights is occurring;
- Use debris netting, covered walkways or similar safeguards to stop falling material from causing injury;
- Where possible, avoid carrying large and heavy objects onto roofs. Minimize the need for manual material handling by using mechanical handling devices (e.g. hoists to deliver materials to the roof);
- Ensure that all material is stored correctly, particularly in windy weather;
- If there is public access close to the area is required, additional precautions are needed. If possible, try to arrange for work to be carried out when passers-by will not be there (e.g. carry out repairs during the school holidays or when foot traffic is not as busy). If this cannot be arranged, minimize the public access to danger areas by placing barriers (e.g. cones, caution tape) and/or using a ground-level spotter to direct foot traffic.
- If there is risk of head injury to workers (e.g. objects falling from above, handling objects to worker below, overhead objects such as steel beams, etc.) head protection must be worn.

TRAINING:

Training is required for all employees who utilize fall protection (e.g. Working at Heights training), aerial platform lifts (e.g. scissor or boom lifts) or other types of lifts. This training may be provided by an external organization (e.g. manufacturer) or internally by a competent person. Workers who perform roof work need the appropriate knowledge, skills and experience to work in a safe manner. Workers need training to recognize the risks, understand the appropriate systems of work and be competent in the skills to carry them out, such as putting up edge protection, operating a mobile access platform, or installing and wearing fall protection equipment.

Please note that before you are trained on lift/platforms designed to lift people, you must have current Working At Heights training because a fall arrest harness is worn during the lift's operations. Training expires every 3 years.

For Aerial Platform training (e.g. boom or scissor lifts), there is a theory and hands-on component. Depending on which type of lift you use, you may require hands-on training for both. The theory is typically the same for lifts. Training expires every 3 years.

For lifts that are outside of the scissor or boom category, equipment-specific training (including, where applicable, safe operation, selection of the appropriate personal protective equipment and harness and fall rescue plan) is required. Training may be provided by an external provider (e.g. manufacturer) or by a competent supervisor/lead hand. Training should be refreshed every 3 years unless specified by the manufacturer.

PROCEDURES FOR DIFFERENT ROOF TYPES:

Flat Roofs

Working on a flat roof can present a high amount of risk because the worker can fall from the edge of a complete roof, from the edge where work is being carried out, or through openings or gaps. Preventative measures are required during work on flat roofs where there is a risk of falling. Protective measures may be required at the roof edge, openings, and access points to and from the roof.

Edge protection

Unless the roof parapet (wall) provides equivalent safety (at least 36 inches in height), temporary edge protection is required during most work on flat roofs. Both the roof edge and any openings in it need to be protected. It is more appropriate to securely cover openings rather than put edge protection around them.

Demarcating safe areas

Full edge protection may not be necessary if limited work on a larger roof involves no one going any closer than 2 meters from an open edge. In such cases, demarcated areas can be set up, outside which no one is allowed. Demarcated areas should be:

- limited to areas from which nobody can fall;
- indicated by an obvious physical barrier (full edge protection is not necessary, but a painted line is not sufficient). A warning line system can be erected using painted lines in combination with ropes and posts to designate safe areas where roof work may take place without the use of guardrails, personal fall restraint/arrest systems, or safety net systems;
- adequate supervision.

Sloped Roofs

On sloped roofs, workers can fall from the eaves, by slipping down the roof and over the eaves, through the roof or from the gables. Edge protection needs to be strong enough to withstand a person falling against it. The longer the slope and the steeper the pitch, the stronger the edge protection needs to be. Powered access platforms can be a safe alternative to working on the roof itself.

Safe access, egress and working places should be provided. Roof ladders or similar equipment may be required because the surfaces on sloped roofs may not provide a safe footing for the worker, especially when wet. Roof ladders should be long enough to span the supports and be securely placed. Do not use gutters to support any ladder.

Where work is required on a steep roof (slope > 35°), do not stand on the roof. A steep pitched roof is an inappropriate surface to stand on due to the likelihood of sliding. Perimeter guard rails and catch platforms are also insufficient measures to protect workers on such roofs. In these circumstances, roof workers need a system to prevent sliding and to prevent falls from the perimeter. One of the following systems should be used in such circumstances:

- an aerial access equipment;
- a work positioning system, such as a travel restraint system; or
- a scaffold platform located at the roof edge and a roof ladder.

Fragile Roofs

A fragile material is one that does not safely support the weight of a person and any load they are carrying. Many roof assemblies are or can become fragile. Roofs can also have fragile areas which are not easily recognized such as roof lights. Roofs can also be temporarily fragile, particularly during construction. Sometimes the fragility of a roof can be hidden (e.g. old roofs that have been painted over). The fragility of a roof should be confirmed **before** the work starts.

Prevent unauthorized access

Make sure that unauthorized access to the roof is prevented (e.g. locking off the roof access). Make sure appropriate warning signs are displayed, particularly at roof access points.

Working on fragile materials

At no time should anyone work on, from or pass over fragile material, unless platforms, coverings or other similar means are provided that adequately support them. Properly installed safety netting beneath the roof surface will provide collective fall protection within the protected area. Fall protection can also be used, but they require adequate anchor points (capable of supporting 5000 pounds of force per worker) which may be difficult to locate on fragile roofs.

Support platforms should be wide and long enough to provide adequate support across roof members. Using a platform may spread the load, but will not provide enough support if it is only supported by fragile material. Workers should not have to constantly move platforms while on the roof; there should be enough platforms to avoid jumping from board to board. Precautions to prevent a person falling from the platform may be needed such as guardrails.

Working near fragile material

Protection is needed when anyone passes by or works closer than 2 meters to fragile materials. Wherever possible, make sure that all fragile materials, 2 meters or closer to the people at risk, are securely covered. Alternatively, provide full edge protection (i.e. top rail, intermediate guard rail or equivalent and toe board) around or along the fragile material to prevent access to it. Make sure appropriate precautions are taken when installing such protection (e.g. the use of netting or safety harnesses).

It may not be reasonable practicable to provide such protection if the proximity to fragile material is irregular and for a short duration (i.e. a matter of minutes). For these situations, safety harnesses may be used in conjunction with a warning line system.

Boundaries can be established to identify the safe areas of the workplace and routes to and from these areas. If boundaries are used:

- the boundary should be at least 2 meters from the nearest fragile material;
- the boundary does not need to comply with full edge protection standards, but there should be a physical barrier;
- discipline is essential to ensure everyone stays inside the safe area at all times.

SHORT-DURATION WORK:

Although short-duration work takes place in a matter of minutes rather than hours, appropriate safety measures still need to be implemented. It may not be practicable to provide edge protection for short-duration work. In such cases, any worker working closer than 2 meters to any unguarded edge should use fall protection. Wherever fall protection is required, ensure compliance with the University's Fall Protection Standard.

For minor tasks that are short in duration and there is an increased risk of falling due to either weather conditions, a sloping roof or access is required near a potentially fragile section – the following safety measures should be used where reasonably practicable. For such situations, use one or more of the measures below where feasible until the risk of a fall is minimized:

1. If the weather is the only factor increasing the risk of a fall, where possible wait until conditions improve before commencing or finishing a job.
2. Do the work from an elevated work platform such as a scissor lift.
3. If work is required near a fragile section, install either edge protection around it (e.g. guardrails) or install safety mesh/netting underneath before commencing work.
4. If an elevating work platform cannot be used or is not reasonably practicable, use the appropriate fall protection equipment.
5. If a non-fragile sloping roof is stable and other measures cannot be used, use a suitable roof ladder in combination with a fall arrest system.
6. If the risk of a fall is still significant after using these safety measures, consider installing a catch platform or a safety net to catch anyone who may fall.

Rooftops with Sub-Standard Fume Hood Exhausts:

Some rooftops have laboratory fume hood stacks and there is a subset of these stacks that, under certain atmospheric conditions, may exhaust at or close to roof level. Refer to Appendix B for more information on these stacks and appropriate safety procedures.

APPENDIX A: ASSESSING THE SITUATION

- What is the task to be undertaken?
- Are there other alternatives such as using a tool from ground level, using an aerial platform lift or for inspections, using a telescoping pole with camera attachment or binoculars from a safe position?
- Does it have to involve accessing or working on a roof? Is this all of the time or some of the time?
- What type of roof is it? Is it steep, fragile, unstable or slippery? Is this just in parts or all over? Is the roof made of rusted corrugated metal, plastic sheeting, glass or asbestos cement sheeting that is very fragile? Are there fragile parapets, skylights and vents present? Are these surfaces difficult to see due to weather or aging? Do fragile sections have guard railing installed around them?
- If there is some doubt regarding the integrity of the roof structure or any safety measures present, has it been checked by an engineer or relevant professional?
- How long will the task take- a few minutes, a few hours, a few days? (Generally the longer and more often someone has to work at height, the higher the risk of a fall).
- How high is the roof? (The higher the roof, generally the higher the risk of a fall and injury or death).
- Does the worker have appropriate training and experience? Do they know how to use equipment safely? Do they know how to identify when a task is too dangerous to undertake or continue?
- How do workers access and descend from the roof or different levels on the roof? Are the measures used safe?
- Do tools, equipment or materials need to be loaded or removed from the roof? If so, how is this done? Is a hoist system available and used?
- Does the work need to occur in sunny conditions that produce reflective glare and excessive heat making it difficult to see or work?
- Is the work required in close proximity to electricity or electrical sources where someone could be electrocuted?
- Is the area below the work being undertaken at height cluttered with equipment, rubble and impaling hazards that someone could fall on?
- What safety measures are already in place to prevent a fall? Guardrails, safety mesh, scaffolding, elevated work platform, suitable anchorage points, catch platform, etc.?
- Are these measures in good condition and able to be used safely?
- What supervision has been provided for employees working at heights?

APPENDIX B: ROOFTOPS WITH SUBSTANDARD FUME HOOD EXHAUSTS

BACKGROUND

At the University of Toronto, many older buildings with research labs contain fume hood exhaust vents at the roof level that do not meet current University design standards. Current and conservative air dispersion modeling demonstrates that all such substandard fume hood exhausts systems achieve compliance with environmental requirements. However, these systems have exhaust stacks that, under certain atmospheric conditions, are unable to adequately propel exhaust emissions beyond the building's envelope, including the air at roof level. This could result in a potential exposure risk to any individuals on a rooftop with an active, substandard fume hood exhaust stack.

PROCEDURE

In the long-term, these substandard exhausts need to be modified to meet current design standards, thereby removing any significant risk of exposure at the roof level. However, rooftop work and access at the University of Toronto is frequent, necessary and will continue to occur before any mitigation steps can be completed. Therefore, in the near-term, procedures are required to remove the risk of exposure to any individual accessing the rooftop.

1. Refer to the list of buildings and exhaust stacks that have been identified as substandard (End of this Section)
2. If the building requiring access is on the list, then contact the building's Property Manager to help facilitate communication with the lab members using the applicable fume hood exhaust systems
3. Scheduling rooftop access:
 - a. If possible, schedule necessary rooftop work or access for hours outside of normal University of Toronto operating hours;
 - b. Via the Property Manager, coordinate with the lab manager, or appropriate contact, to:
 - i. Avoid significant or extended disruption to research activities; and
 - ii. Ensure all affected lab users are aware of the work being conducted
4. During the scheduled period of rooftop access, any affected labs must cease all work in any fume hoods connected to the substandard fume hood exhaust systems:
 - a. The lab users must ensure all hazardous materials are removed from the hood(s) and are properly and safely stored prior to the scheduled shut-down
 - b. Signage, which provides notice of the times/dates of rooftop access, must be affixed to any fume hoods;
 - i. If the access is required for more than an hour, then any substandard fume hood exhaust systems should be deactivated and notification of this shut-down should be added to the signage
 - c. When work is completed and the fume hood exhaust system is reactivated/used, then the lab manager, or appropriate contact, should be notified, via the Property Manager, to remove the signage and recommence usage of the fume hood
 - d. It is the responsibility of the laboratory manager, or appropriate contact, to notify all other laboratory users of any pertinent information provided by the Property Manager.

List of Buildings with Substandard Fume Hood Exhaust Systems:

- Gage Building
- Rosebrough Building
- Haultain Building
- Ramsay Wright Zoological Laboratories
- McLennan Physical Laboratories (when accessing Penthouse Roof only)
- Pratt Building (when accessing Penthouse Roof only)

If it is found that any of the above exhaust systems have been either modified or removed, please contact ehs.office@utoronto.ca with the details.

REFERENCES

1. European Agency for Safety and Health at Work, Safe Roofwork, 2004.
2. Health and Safety Executive, Working on Roofs, November 2004 and December 2008
3. University of Ottawa, Office of Risk Management, Environment Health and Safety, Fall Protection Guidelines, October 2006.
4. WorkSafe Victoria, Prevention of Falls – Working on Roofs, 1st Edition, June 2005.