UNIVERSITY OF
TORONTO

LABORATORY DESIGN STANDARD AND GUIDELINES

Lab Safety Design Standards and Guidelines

Preface:

This document has been assembled by the University of Toronto, Department of Environmental Health and Safety (EHS) with consultation and input from University stake holders. This document specifically pertains to the built environment of laboratories as it pertains to health and safety and not operational practices. This document should be read and understood by all parties involved in lab development; please refer to the Roles section to learn more.

Scope:

These are design and construction standards to be applied to new construction and renovation of laboratories at the University of Toronto. For renovations of existing laboratories or new laboratories in existing buildings not all requirements will be practical to implement (e.g. changing existing building ventilation systems). For this and other provisions, EHS may provide variations on a case by case basis; Space Designers are responsible for contacting EHS staff for assistance. EHS must be consulted in the early stages of design, design development, and commissioning of new labs and all renovations to existing labs. We understand that each project is different in scope and may require specific hazard assessment. For cases which necessitate further consideration, please contact the Office of EHS.

As a general reminder, when considering any changes to the workspace such as installing new furniture, shelving, etc., any work that causes disturbance (e.g. drilling, screwing in, unscrewing, cutting, grinding, scraping, demolition) of the building fabric (e.g. walls, ceilings, flooring) should be vetted through a Facilities & Services Property Manager to ensure that Designated Substances such as asbestos are identified ahead of time. This ensures appropriate work procedures are used if asbestos, or other Designated Substances, are present. Occupants should not perform repairs, maintenance or new installations on their own.

In addition to these requirements, there may be other applicable codes & standards (e.g. Ontario Building Code and/or Ontario Fire Code) which apply to the planned work. Consult appropriate professionals to obtain those requirements. Where legislated codes & standards conflict with these standards, the stricter requirement shall apply.

Roles:

Environmental Health & Safety (EHS)

Establishes guidelines and standards to ensure compliance with legislation governing laboratory activities as it pertains to health and safety, biosafety, radiation safety, and/or chemical safety within the applicable municipality, the province of Ontario, and Canada. EHS provides reports

and recommendations, verifies compliance with regulations when commissioning of laboratories is carried out.

Principal Investigators (PI)

In application to this document, P.I. determines the research activities to be carried out in the lab. In collaboration with their Chair, Business Officers, Space Planning unit, and other applicable units, the P.I. review requirements to ensure that the lab space will correspond to the research activities. Refer to the Definitions section to find some of the applicable standards.

Project Planner

In application to this document, coordinates the requirements of these standards and guidelines, and any other applicable standards, codes and/or guidelines with EHS, the Principle Investigators and the contracted constructor, designer or other provider.

Project Manager

In application to this document, the Project Manager is responsible to provide the completed "*Laboratory Renovation & Construction Initiation Form*" to EHS (Appendix A). For lab renovation, the Project Manager must ensure the laboratory is decommissioned and approved by EHS prior to allowing contractor access to the laboratory.

Definitions and Abbreviations:

Ag	Agriculture, large animal facility
ALI	Annual Limit of Intake
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials (=ASTM International).
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BSC	Biosafety Cabinet
BSO	Biological Safety Officer (Biosafety Officer)
CBS	Canadian Biosafety Standards
CCAC	Canadian Council on Animal Care
CNSC	Canadian Nuclear Safety Commission
CCAC	Canadian Council on Animal Care
CL#	Containment Level Minimum physical containment and operational practice requirements for handling infectious material or toxins safely in laboratory and animal work environments. There are four containment levels ranging from a basic laboratory (CL1) to the highest level of containment (CL4).
CFIA	Canadian Food Inspection Agency

CSA	Canadian Standards Association
ECCC	Environment and Climate Change Canada
EHS	Environmental Health and Safety
EQ	Exemption Quantity
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation and Air Conditioning
IARC	International Agency for Research on Cancer
LD50	the amount of a substance (e.g. poison, virus, or radiation) that is sufficient to kill 50 percent of the test population — also referred to as "median lethal dose"
LPG	Liquefied Petroleum Gas
MOECC	Ministry of the Environment and Climate Change
MOL	Ministry of Labour
OHSA	Occupational Health and Safety Act
OBC	Ontario Building Code
OFC	Ontario Fire Code
P	Prion Laboratory
PHAC	Public Health Agency of Canada
PPE	Personal Protective Equipment
ULC	Underwriters Laboratory of Canada
SSBA	Security Sensitive Biological Agents*

* https://www.canada.ca/en/public-health/services/laboratory-biosafety-biosecurity/human-pathogens-toxins-act/security-sensitive-biological-agents.html

Design Standard – Wet Laboratories

These standards are applicable for all wet laboratories at U of T. Any proposed variation from these standards must be supported by additional information, which demonstrates, to the satisfaction of the EHS staff, that the standards are addressed by alternative measures in a manner that offers similar safety. There should be a consideration for providing accessible laboratory space for students with disabilities. Additional information on designing accessible labs available from www.accessiblecampus.ca.

For more information on compliance with room design where animals and/or plants are present, please consult the latest edition as applicable the CCAC guidelines on laboratory animal facilities – characteristics, design and development, the Containment Standards for Facilities Handling Aquatic Animals Pathogens, and/or the Containment Standards for Facilities Handling Plant Pests.

All applicable Codes and Standards must also be followed.

Chem1	Chemical containment 1: lab uses at most low toxicity solvents, low toxicity powders, and dilute acids, may include flammables and combustibles covered under the OFC.
Chem2	Chemical containment 2: lab uses higher hazard solvents, including flammables and combustibles covered under the OFC and powders and strong/concentrated acids, but does not fit the definition of a High Hazard Chemical Lab (Chem3).
Chem3	Chemical containment 3: high toxicity chemicals (LD50< 50mg/kg), high hazard corrosives (HF, aqua regia, piranha, perchloric, chromic etc.), confirmed and probable IARC carcinogens, confirmed reproductive toxins/teratogens, nanomaterials and/or when making novel compounds, in addition to Chem2 above.
CL1	Biosafety containment level 1 is suitable for work involving well-characterized agents not known to consistently cause disease in immunocompetent adult humans, and which present minimal potential hazard to laboratory personnel and the environment.
CL2	Biosafety containment level 2 is suitable for work involving agents that pose moderate hazards to personnel and the environment.
CL3	Biosafety containment level 3 (See #16.2)
Rad Basic	between 1 EQ and 5ALI
Rad Intermediate	between 5ALI and 50 ALI (See #16.3)
Rad High	between 50 ALI and 500 ALI (See #16.3)
☒	OHSA Sec. 25(2)(h)/University of Toronto requirement/ PHAC CL1 Guidelines
✶	Radiation CNSC GD-52 - Design Guide for Nuclear Substance Laboratories and Nuclear Medicine Rooms
■	PHAC Required for all containment zones
☐	PHAC Required for research using animals
❖	Required for CFIA import permit, and/or NIH funded research
P	Prions
S	SSBA or Toxins above trigger quantities
RA	Risk Assessment based on hazards [2]
R	Recommended

[2] https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition.html#ch4

1. General Laboratory Design Requirements – Architectural

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
1.1. Laboratories shall have separations from public areas by a secured door	☒	☒	☒	☒	■	✶	3.1.1
1.2. Dedicated paper/computer work stations within the containment zone to be segregated from laboratory work stations, biologicals, chemicals, radiologicals, animal rooms, animal cubicles, and post mortem rooms (PM rooms) to minimize the risk of contamination of office materials which may be difficult to decontaminate. This can be achieved by locating these stations in a dedicated room within the containment zone, by installing a physical partition (e.g., splash shield) between a paperwork station adjacent to a laboratory bench, or by locating paper/computer work stations in a space inside the containment zone but at a distance from benches.	☒	☒	☒	☒	■	✶	3.1.2
1.3. Laboratories shall have door openings to allow passage of all anticipated equipment e.g. -80 Freezer	☒	☒	☒	☒	☒	☒	
1.4. Where operable windows exist within the containment barrier to include effective pest control and security.	☒	☒	☒	☒	■		3.2.1
1.5. Windows on the containment barrier to be closed and secured at all times. Older buildings may have HVAC issues that don't allow windows to be sealed, please contact EHS in such cases.					PS	✶	3.2.2
1.6. Window glazing material to provide the appropriate level of security as determined by a biosecurity security risk assessment.				☐	☐ P S		3.2.4 3.2.5
1.7. Locations must be provided for mounting emergency posters and other warning signs immediately outside the lab.	☒	☒	☒	☒	■	✶	3.3.2 3.3.3
1.8. A storage area will be available for materials and equipment for decontamination and monitoring (e.g. spill kits, survey equipment, etc.)	☒	☒	☒	☒	☒	✶	
1.9. Space to be provided for the storage of PPE in use, preferably at the entry.	☒	☒	☒	☒	■	✶	3.3.9
1.10. Two-way communication system(s) to be provided inside the containment barrier that allows communication between inside the containment barrier to outside the containment zone, in accordance with function e.g. a phone.	☒	☒	☒	☒	■	✶	3.7.18
1.11. Laboratories should provide protection against vermin and insects. This includes sealing and/or screening breaks in the containment barrier such as windows, wiring, pipes, ceiling tiles as applicable, and conduit penetrations				☒	☒	✶	4.6.37

2. Finishes

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
2.1. Laboratory flooring must be continuous, non-porous and impervious to liquid	☒	☒	☒	☒	■	✶	3.4.1
2.2. Surfaces and interior coatings, including, but not limited to, floors, walls, doors, frames, casework, benchtops, and furniture, to be cleanable, non-absorbent, and resistant to scratches, stains, moisture, chemicals, heat, impact, repeated decontamination, in accordance with function.	☒	☒	☒	☒	■	✶	3.4.1
2.3. Surfaces to be continuous with adjacent and overlapping materials to prevent contaminated liquids from reaching surfaces that are hard to access and decontaminate.					☐ P		3.4.2
2.4. Floors must be slip-resistant according to function	☒	☒	☒	☒	■	✶	3.4.5
2.5. Flooring will be coved up the walls and cabinets to prevent spills from penetrating underneath e.g. using baseboard or cove flooring.	☒	☒	☒	☒	☒	✶	
2.6. Continuity of seal to be maintained between the floor and wall.					■ [3] RA [4]		3.4.7

3. Furnishings

3.1. All chair surfaces shall be cleanable, non-absorbent, resistant to stain, moisture and chemicals, and repeated decontamination, in accordance to function.	☒	☒	☒	☒	■	✶	3.4.1
3.2. Benches, countertops, backsplashes, when installed tight to the wall, to be sealed at the wall-bench junction and continuous with work surfaces.	R	☒	☒	R	■	✶	3.4.4
3.3. The counter top should include a lip to prevent run-off onto the floor.						✶	
3.4. Impervious, resistant surfaces to corrosive material shall be used for chemical storage areas (cabinets, shelves)	R	☒	☒	R	R	✶	
3.5. Chemical reagents shelving to be equipped with lip edges	R	☒	☒	R	R	R	
3.6. Maximum height of shelving is 96”(2440mm)	R	R	R	R	R	R	

4. Security

4.1. An access control system (non-duplicable key, keypad, key fob, other) will be in place to ensure that only authorized users can enter the restricted room. For the use of SSBA, contact the senior BSO	☒	☒	☒	☒	■	✶	3.3.5 3.3.6 3.3.8
4.2. If the room is shared with workers not authorized to use the restricted substance, a secondary lockable			RA		☒	✶	

[3] For new build and renovated labs

[4] Based on Local Risk Assessment / pathogenicity of biological agents

storage area (refrigerator, freezer, cupboard, etc.) will be provided within the room							

5. Storage of Chemicals

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
5.1. Adequate storage provision for separation of incompatible chemicals	☒	☒	☒				
5.2. Storage for flammable liquids to follow the UofT *Flammable Storage: Standard for Storage Cabinets*	☒	☒	☒	☒	☒	☒	
5.3. Separate storage for acids includes corrosion resistant shelving and secondary containment	R	☒	☒				
5.4. If large amounts of chemical waste are to be generated, consider provision for additional exhaust in the short term holding area	R	☒	☒				
5.5. Explosion proof refrigerators are required for cold storage of flammables above their flash point	☒	☒	☒				

6. Storage of Gas Cylinders

6.1. Labs must include provision for safe storage of gas cylinders as applicable	☒	☒	☒	☒	☒	✶	
6.2. Specific support for gas cylinders is required for compressed gas cylinders in use and stored	☒	☒	☒	☒	☒	✶	
6.3. Based on a local risk assessment, additional ventilation may be required for the use of toxic compressed or liquefied gases		RA	RA				
6.4. Shipping/receiving areas must include a safe storage area specific for gas cylinders	☒	☒	☒	☒	☒	✶	

7. Autoclave[5]

7.1. Autoclave to be available within the facility or other acceptable means of waste treatment/disposal to be provided				☒	☒		
7.2. Specific exhaust should be provided if odours from autoclave will cause health concerns to occupants				☒	☒		

[5] https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-11-15.html#s154

8. Biosafety Cabinet (BSC)[6]

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
8.1. A minimum unobstructed distance of 40 cm should be provided between the exhaust outlet on top of the cabinet and any overhead obstructions				☒	☒		
8.2. A 30 cm clearance should be provided on each side of the cabinet to allow for maintenance access				☒	☒		
8.3. For ducted cabinets, Class II B1 and B2, please consult mechanical engineers for the building considerations				☒	☒		
8.4. Biosafety cabinets should be located 1.1 m away from any doors and air vents and away from high traffic areas				☒	☒		
8.5. Separate electrical circuits are required for each BSC				☒	☒		

9. Fume Hood

(Fume hoods are required if volatile materials or toxic substances are used or stored or if aerosol or gases are likely to be produced)

9.1. Fume hood installations must follow the UofT Design Standard – Fume Hoods & Fume Hood Exhaust	☒	☒	☒	☒	☒	☒	

10. Heat, Ventilation, Air Conditioning (HVAC)

10.1. The HVAC system shall not interfere with the airflows of biosafety cabinets or fume-hoods, cross drafts shall be less than 30% of the face velocity	☒	☒	☒	☒	☒	✶	
10.2. All air exhausted from the lab will be exhausted to the outside of the building without recirculation	☒	☒	☒	☒	☒	✶	
10.3. Room ventilation shall have air changes per hour (ACH) according to the function and the hazardous material used (e.g. 6/3, 8/4 occupied/unoccupied) or more if required by research requirements. A system to measure contaminants for the use of on demand ventilation can be used for lower ventilation rates with the approval of EHS.	☒	☒	☒	☒	☒		
10.4. Room ventilation shall have 6 air exchanges or more for the use of open source radionuclides						✶	
10.5. Room shall have inward directional airflow (IDA) with respect to the surrounding areas such as offices and hallways; IDA is required in newly built labs, and renovated biological containment level 2 based on risk assessment, chemical containment 2 or higher hazard labs.	R	☒	☒	R	❖ RA	✶	
10.6. Room air flow shall be from the area of low hazard activity to the areas of higher hazard activity	R	☒	☒	R	☒	✶	
10.7. HEPA filtration on local exhaust ventilation systems may be required for research using nanomaterial		RA	RA		RA		

[6] https://www.canada.ca/en/public-health/services/canadian-biosafety-standards-guidelines/handbook-second-edition/chapter-11-15.html#ch11

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
10.8. Climate controlled rooms (e.g. cold rooms) should have separate temperature controls and adequate air exchange rates according to function. Consult with EHS.	☒			☒	☒	✶	
10.9. The renovated or a new build room shall have adequate temperature and humidity controls to account for heat load of equipment and in concordance with the *University of Toronto standard for the laboratory terminals and control design* (Standards available from Facilities & Services).	☒	☒	☒	☒	☒	☒	
11. Plumbing – Sinks							
11.1. Sinks to be provided and located to facilitate handwashing upon exit from the containment zone.	☒	☒	☒	☒	■	✶	3.6.4
11.2. Sinks provided for handwashing to be equipped with "hands-free" capability.					☐ R	RA	3.6.5
11.3. A separate utility/glassware washing sink to be provided as applicable to function	R	R	☒	☒	☒	✶	
11.4. Lab sinks must be chemical resistant according to function and hazardous material used (e.g. stainless steel T316 grade, epoxy resin, or polyolefin material)	☒	☒	☒	☒	☒	✶	
11.5. Pipes and fixtures must be chemically resistant.		☒	☒		☒	✶	
11.6. The height of the trap must be sufficient to prevent the negative pressure in the lab from allowing gases to escape from the drain line (off-gassing)		☒	☒		☒	✶	
11.7. The sink drain traps will be accessible for monitoring contamination						✶	
11.8. Back-flow prevention to be included		☒	☒	☒	☒	✶	
11.9. Each sink to have an overflow outlet						✶	
11.10. Faucets with vacuum or cooling line attachments to include back-flow protection devices	☒	☒	☒	☒	☒	✶	
12. Plumbing – Emergency Eyewash and Showers[7]							
12.1. Emergency eyewash and shower equipment to be provided in accordance with containment zone activities.		☒	☒	RA	■	✶	3.6.6.
12.2. All emergency eyewash and showers installations must follow the U of T "Safety Eyewash and Shower Standard"		☒	☒	☒	☒	✶	
13. Electrical – Power Lines							
13.1. Sufficient outlets adequately spaced to prevent the use of extension cords	☒	☒	☒	☒	☒	✶	
13.2. GFCI circuit interrupters required as per code and within 1.5m of sinks	☒	☒	☒	☒	☒	✶	

[7] Biosafety containment laboratories could be required to have a removable drain seal/plug in place over the drain, or provide a holding tank.

	Chem1	Chem2	Chem3	CL1	CL2	RB	CBS ref
13.3. Emergency power outlets should be provided in each lab and properly spaced to run equipment that requires continuous power (refrigerators, freezers, incubators, glove boxes, etc.)	R	R	R	R	R	R	
14. Waste Management							
14.1. Provide space for regular garbage containers and recycling totes	☒	☒	☒	☒	☒	✶	
14.2. Provide space for safe storage for hazardous waste	☒	☒	☒	☒	☒	✶	
14.3. Provide space for required supplies for hazardous waste; labels, pails, totes and jars	☒	☒	☒	☒	☒	✶	
15. Fire Safety							
15.1. Laboratory must follow Ontario Fire Code and other applicable codes and standards	☒	☒	☒	☒	☒	☒	

16. High Hazard Lab Specific Requirements

16.1. High Hazard Chemical

16.1.1. Labs which boil or heat significant volume of acids (>1L), or use particularly hazardous materials like hydrogen fluoride, perchloric acid or other explosive or dangerous persistent materials, may have additional requirements for fume hoods or other ventilation of the work area.

16.1.2. For highly toxic chemicals, special provisions may be needed to ensure that materials remain within a certain area and do not migrate to less well controlled areas. An example of a design consideration is the provision of an anteroom or a wash up room as the exit to the lab.

16.2. Biological Agents

16.2.1. For designing a containment level 3 (CL3), prion or large volume (>10L) biohazardous laboratory, the U of T Senior Biosafety Officer must be consulted as it may require a licence amendment or approval by regulatory agency e.g. PHAC, CFIA.

16.3. Radiation

16.3.1. When designing a room in which sealed sources (other than irradiators), or radioisotopes under exemption quantities are used, no special design requirements are necessary.

16.3.2. For designing intermediate and high level open sources radioisotope laboratories, as well as irradiator rooms, the U of T Senior Radiation Safety Officer must be consulted as it may require a licence amendment or approval by CNSC.

16.3.3. Cabinet X-ray machines and instruments containing enclosed beam laser, as well as low power lasers (class 1, 2 and 3R), can be installed in rooms without special safety requirements.

16.3.4. When designing a room in which an open beam X-ray machine, open beam class 3B or class 4 lasers will be installed, the U of T Senior Radiation Safety Officer must be consulted.

16.4. Engineering

16.4.1. Physical design of spaces for engineering labs must consider diverse issues including the following:

- Working at heights
- Confined spaces
- Design for minimal ladder use
- Lock-out and tag-out of equipment
- Engineered noise control at source
- Ventilation patterns
- Air leakage and pressure between spaces
- Lifting devices, cranes, hoists, etc.
- Safety interlocks for equipment not otherwise protected

- Special wiring for specialized equipment
- Heat and cold stress
- Provision of mechanical aids to prevent unneeded manual material handling
- Ergonomic design
- Guarding and ventilation to minimize PPE (respirators, face shields, etc.) requirements for hazards such as the following:
    - Guarding of pinch points, cutting tools and rotating shafts, etc.
    - Welding and hot work
    - Grinders, woodworking equipment
    - Battery charging stations
    - Any other equipment that generates a hazardous atmosphere or condition

17. Power Supply and Servers

17.1. Shielding may be required if power supply and servers are not able to meet the EMF emissions according to University of Toronto standards.

17.2. Control access and signage for workers if the EMF emissions are above the U of T intervention levels.

18. Nuclear Magnetic Resonance

18.1. Shielding may be required if the equipment is not able to meet the EMF emissions according to University of Toronto EMF Safety Program. Consult the U of T Senior Radiation Safety Officer.

19. UV Radiation in Labs

19.1. When designing a room in which an open UV source will be installed, the U of T Senior Radiation Safety Officer must be consulted. Please note that the current University of Toronto UV Safety Program does not cover exposure to solar UV light.

20. Sustainability in Labs

The design of the laboratories and support infrastructure will strive to:

20.1. Reduce negative impacts on the environment and increase the health and comfort of the facilities;

20.2. Optimize site layout and design to maximize safety and site potential;

20.3. Minimize non-renewable energy use;

20.4. Use low impact environmental preferred products;

20.5. Protect and conserve water;

20.6. Enhance indoor environmental quality;

20.7. Optimize operational and maintenance practices;

20.8. Integrate low impact environmental best practices with health, safety and productivity;

20.9. Emphasize the use of life-cycle cost analysis as a basis for energy investment decisions with a 10 year cycle. This allows for the consideration of high-efficiency equipment and designs;

20.10. Establish energy efficiency and quality indoor environments as a fundamental project goal along with EHS criteria;

20.11. Understand and minimize the implications of narrow band operating criteria;

20.12. Pursue a whole building and integrated approach to the design. Request and review design energy performance modeling of the designs. Consider ASHRAE 90.1, Appendix G as the basis for evaluation;

20.13. Encourage clarity and convenience of HVAC systems along with architectural needs such that convoluted duct runs, short circuit ventilation, poor lighting do not result;

20.14. Design to isolate offices and non-critical support spaces from laboratory modules and when feasible cascade airflow from offices to labs; place refrigeration equipment in dedicated rooms using heat recovery principles;

20.15. Incorporate digital BAS for monitoring, control and energy performance verification, integrated with the University of Toronto BAS Design Standards;

20.16. Allow for waste material differentiation, separation and collection;

20.17. Not allow once-through condenser cooling or water-based aspirators.

References

[1] Louis J. DiBerardinis, & others – Guidelines for Laboratory Design, fourth edition, John Wiley and Sons, 2013
[2] Canadian Biosafety Standards 2nd Edition, Health Canada, 2015
[3] Design Guides for Nuclear Substances and Nuclear Medicine Rooms, GD-52, CNSC, May 2010
[4] NFPA 801 – Standard for Fire Protection for Facilities Handling Radioactive Materials, 2008 Edition

U of T Institutional Standards:

U of T Safety Eyewash and Shower Standard

U of T Standard for Inert Cryogenic Liquid Usage in the Laboratory

Design Standard - Fume Hoods & Fume Hood Exhausts

Flammable Storage: Standard for Storage Cabinets

Flammable Liquids Storage: Standard for Refrigerators

Flammable Liquids Storage: Standard for Storage Rooms

University of Toronto - Building Automation Systems - Design Standard and Guidelines

U of T Related Safety Programs:

U of T Control Program for Liquid Cryogenic Transfer Facilities

U of T Laboratory Hazardous Waste Management and Disposal Manual

U of T Laboratory Safety Manual

U of T Biosafety Program

U of T Ionizing Radiation Procedures and Polices Manual

U of T X-ray Safety Program

U of T Laser Safety Program

U of T EMF Safety Program

U of T Ultraviolet Radiation Safety Program