

Standard operation procedure

High power and low power UV lamps for substrate exposure

PURPOSE

To outline the steps required to safely use ultraviolet radiation lamp (Spectroline XX-15NF) for exposure of UV-curable materials in the lab.

PRIOR TO BEGINNING WORK

All staff working with UV lamps should receive research-specific training by the Principal Investigator (PI).

PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Every device that can produce UV radiation above the exposure limit (<https://ehs.utoronto.ca/our-services/radiation-safety/8904-2/>) must have UV-light warning sign. All staff should wear appropriate personal protective equipment (PPE) when using the UV-light producing equipment:

- a. Gloves;
- b. Long sleeve lab coat or gown;
- c. UV-protecting safety eyeglasses (ANSI-Z87 rated).

UV LAMP MODEL SPECIFICATIONS

Long wave (UV-A, 365nm) / Short wave (UV-C, 254nm)

Model	Equipped with	Typical Peak UV Intensity ($\mu\text{W}/\text{cm}^2$) at 10" (25cm)
XX-15NF	One 15-Watt BL, BLE-1T151 One 15-watt SW, BLE-1T155	UV-A: 550 UV-C: 490

Complete detailed specifications and SDS available at <http://spectroline.com/product/x-series-specialty-inspection/>.

PROCEDURE

1. Ensure you are using proper PPE;
2. Place substrate to be exposed to UV light inside Styrofoam compartment for exposure;
3. Position UV lamp on top cutout of the Styrofoam compartment;
4. Turn on UV lamp for your specific exposure time (1-30 seconds);
5. Turn off UV lamp.

WARNINGS

For specific warnings and emergency measures please refer to the lamp specific SDS below.

Short wave (254nm) ultraviolet tubes contain mercury (Hg). As supplied by Spectronics Corporation, they are exempted from the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) because they are "articles." We provide the following information as a courtesy to our customers.

Section 1. Identification of the Product and Company

PRODUCT NAME: Short Wave UV Fluorescent Tubes
DESCRIPTION: Medium-Pressure, Mercury-Vapor Lamps
EMERGENCY TELEPHONE #: 800-424-9300 (24 HOURS)
CHEMTREC; Call collect outside continental U.S.: 703-527-3887.
PRODUCT INFORMATION: Spectronics Corporation, 956 Brush Hollow Road, Westbury, NY 11590, 800-274-8888.
For calls originating outside continental U.S.: 516-333-4840.

Section 2. Composition/Information on Ingredients

Chemical Name	CAS Number	% by wt.	Exposure Limits in Air (mg/cubic m)	
			ACGIH (TLV)	OSHA (PEL)
Inert components (glass, aluminum, brass, etc)		over 99%		
Mercury (1.2)	7439-97-6	0.0%	0.025	0.1 Ceiling

- (1) These chemicals are subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
- (2) The mercury in this product is s substances known in the state of California to cause reproductive toxicity if ingested. [California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).]

Section 3. Hazards Identification

EMERGENCY OVERVIEW:
THERE ARE NO KNOWN HEALTH HAZARDS FROM EXPOSURE TO LAMPS THAT ARE INTACT. If a tube is broken, the materials cited in Section 2 may be released.
Carcinogenic Assessment (NTP Annual Report, IARC Monographs, Other): None.

Section 4. Physical Properties

Not applicable to intact tube.

Section 5. Fire and Explosion Hazards

Flammability: Noncombustible. **Fire-Extinguishing Materials:** Use extinguishing agents suitable for surrounding fire. **Special Fire-Fighting Procedure:** Use a self-contained breathing apparatus to prevent inhalation of dust and/or fumes that might be generated from broken tubes during fire-fighting activities. **Unusual Fire and Explosion Hazards:** When exposed to high temperature, toxic fumes may be released from broken tubes.

Section 6. Operating Lamps

WARNING:
These tubes emit ultraviolet radiation when operating. Prolonged exposure to UV radiation may cause skin and eye irritation. Proper eye and skin protection should be worn when operating tubes. Exposure for unprotected eyes and skin should not exceed 60 J/m² within an 8-hour period. (Reference: ANSI/IESNA RP-27.1-96.)

Section 7. Lamp Materials

THERE ARE NO KNOWN HEALTH HAZARDS FROM EXPOSURE TO LAMPS THAT ARE INTACT. No adverse effects are expected from occasional exposure to broken lamps. As a matter of good practice, avoid prolonged or frequent exposure to broken lamps unless there is adequate ventilation. The major hazard from broken lamps is the possibility of sustaining glass cuts.

NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards and/or NIOSH Pocket Guide to Chemical Hazards list the following effects of overexposure to the chemicals/materials tabulated below when they are inhaled, ingested, or contacted with skin or eye.

- **Mercury:** Exposure to high concentrations of vapors for brief periods can cause acute symptoms such as pneumonitis, chest pains, shortness of breath, coughing, gingivitis, salivation and possibly stomatitis. May cause redness and irritation as a result of contact with the skin and/or eyes.
- **Glass:** Glass dust is considered to be physiologically inert and as such, has an OSHA exposure limit of 15 mg/cubic meter for total dust and 5 mg/cubic meter for respirable dust. The ACGIH TLVs for particulates not otherwise classified are 10 mg/cubic meter for total dust and 3 mg/cubic meter for respirable dust.

Section 8. Emergency and First-Aid Measures

Glass Cuts: Normal first aid procedures. Seek medical attention as required. **Inhalation:** If discomfort, irritation or symptoms of pulmonary involvement develop, remove from exposure and seek medical attention. **Ingestion:** Seek medical attention. **Contact, Skin:** Thoroughly wash affected area with mild soap and water. If irritation occurs, seek medical attention. **Contact, Eye:** Wash eyes immediately, including under eyelid, with water for 15 minutes. Seek medical attention.

Section 9. Stability and Reactivity

Stability: Stable.
Conditions to Avoid: None for intact lamps.
Incompatibility (Materials to Avoid): None for intact lamps.
Hazardous Decomposition Products: None for intact lamps.
Hazardous Polymerization Products: Will not occur.

Section 10. Disposal of Lamps

Cleanup: If lamps are broken, ventilate area where breakage occurred. Clean with a special mercury vacuum (not a standard vacuum) or other suitable means that avoids dust and mercury vapor generation. Take usual precautions for collection of broken glass.
Recycling: Mercury lamps can be recycled. For a list of lamp recyclers, and to obtain state regulatory disposal information, log onto www.lamprecycle.org.
Disposal: It is the responsibility of the waste generator to ensure proper classification and disposal of waste products. TCLP tests should be conducted on all waste products, including this one, to determine the ultimate disposition in accordance with applicable federal, state and local regulations.

Section 11. Special Handling of Broken Lamps/

Personal Protection

Ventilation: Use adequate general and local exhaust ventilation to maintain exposure levels below the PEL or TLV limits. If such ventilation is unavailable, use respirators as specified below.

Respiratory Protection: Use appropriate NIOSH-approved respirator if airborne dust concentrations exceed the pertinent PEL or TLV limits. All appropriate requirements set forth in 29 CFR 1910.134 should be met.

Eye Protection: OSHA-specified safety glasses, goggles or face shield are recommended if lamps are being broken. In the event an outer jacket is broken, the lamps should be shut off and replaced to avoid exposure to ultraviolet radiation.

Protective Clothing: OSHA-specified cut and puncture-resistant gloves are recommended for dealing with broken lamps.

Hygienic Practices: After handling broken lamps, wash thoroughly before eating, smoking or handling tobacco products, applying cosmetics or using toilet facilities.

Section 12. Other Information

USER'S RESPONSIBILITY: A bulletin such as this cannot be expected to cover all possible individual situations. As the user has the responsibility to provide a safe workplace, all aspects of an individual operation should be examined to determine if, or where, precautions (in addition to those described herein) are required. Any health hazard and safety information contained herein should be passed on to your customers or employees, as the case may be.

DISCLAIMER OF LIABILITY: The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by use of this material. It is the responsibility of the users to comply with all applicable federal, state and local laws and regulations.

Long wave (365nm) ultraviolet tubes contain mercury (Hg). As supplied by Spectronics Corporation, they are exempted from the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) because they are “articles.” We provide the following information as a courtesy to our customers.

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PRODUCT NAME: Long Wave UV Fluorescent Tubes
DESCRIPTION: Medium-Pressure, Mercury-Vapor Lamps
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 CHEMTREC; Call collect outside continental U.S.: 703-527-3887.
PRODUCT INFORMATION: Spectronics Corporation, 956 Brush Hollow Road, Westbury, NY 11590, 800-274-8888.
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Section 2. Composition/Information on Ingredients

Chemical Name	CAS Number	% by wt.	Exposure Limits in Air (mg/cubic m)	
			ACGIH (TLV)	OSHA (PEL)
Inert components (glass, aluminum, brass, etc)		over 99%		
Phosphor (1,2) (Barium silica, lead-doped)	68784-75-8	<0.01%		
Mercury (1,2)	7439-97-6	0.0%	0.025	0.1 Ceiling

(1) These chemicals are subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.
 (2) The mercury and lead in this product are substances known in the state of California to cause reproductive toxicity if ingested. [California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).]

Section 3. Hazards Identification

EMERGENCY OVERVIEW:
THERE ARE NO KNOWN HEALTH HAZARDS FROM EXPOSURE TO LAMPS THAT ARE INTACT. If a tube is broken, the materials cited in Section 2 may be released.
Carcinogenic Assessment (NTP Annual Report, IARC Monographs, Other): None.

Section 4. Physical Properties

Not applicable to intact tube.

Section 5. Fire and Explosion Hazards

Flammability: Noncombustible. **Fire-Extinguishing Materials:** Use extinguishing agents suitable for surrounding fire. **Special Fire-Fighting Procedure:** Use a self-contained breathing apparatus to prevent inhalation of dust and/or fumes that might be generated from broken tubes during fire-fighting activities. **Unusual Fire and Explosion Hazards:** When exposed to high temperature, toxic fumes may be released from broken tubes.

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- **Lead:** Ingestion and inhalation of lead dust or fume must be avoided. Irritation of the eyes and respiratory tract may occur. Excessive lead absorption is toxic and may include symptoms such as anemia, weakness, abdominal pain and kidney disease. However, the chemical inertness and insolubility of this material is expected to reduce the potential for systemic lead toxicity.
- **Mercury:** Exposure to high concentrations of vapors for brief periods can cause acute symptoms such as pneumonitis, chest pains, shortness of breath, coughing, gingivitis, salivation and possibly stomatitis. May cause redness and irritation as a result of contact with the skin and/or eyes.
- **Glass:** Glass dust is considered to be physiologically inert and as such, has an OSHA exposure limit of 15 mg/cubic meter for total dust and 5 mg/cubic meter for respirable dust. The ACGIH TLVs for particulates not otherwise classified are 10 mg/cubic meter for total dust and 3 mg/cubic meter for respirable dust.

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Section 11. Special Handling of Broken Lamps/ Personal Protection

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