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Beamline X-19C Room 1-140A

Darkroom Operating Procedures

Orientation Procedure

Orientation of a new user must be done only by the darkroom supervisor.

Once the orientation is complete, the new user is qualified to use the dark room for a period of 1 year, after which he/she shall have to repeat the orientation course.

The orientation course shall involve going through the orientation checklist in which the supervisor shall guide the new user stepwise through the darkroom procedure.

On completion of the orientation course, the user's name shall be added to the list of qualified users.

The Darkroom manager shall forward the training forms to the Training Coordinator.

Checklist for orienting new users

- ❑ Types of x-ray films used and loading x-ray films into different film cassettes
- ❑ Preparation of working solutions (developer, stop bath, fixer and rinse bath) for x-ray film processing
- ❑ Use of Personal Protective Equipment, safety glasses, nitrile gloves, lab coat
- ❑ Study the MSDS sheets for each chemical to be used
- ❑ Processing of x-ray films
  - o Developing
  - o Fixing
  - o Rinsing
  - o Washing
  - o Drying
- ❑ Moving waste chemicals from working tanks to the satellite area
- ❑ Moving waste chemicals to HWCA, or notification to Darkroom manager.
- ❑ Complete PhoSci ENV Awareness - Photographic Darkroom Ops (PS-ENV-PHOTO) course (Available at http://training.bnl.gov/demo/courses/PhoSciWebCourses.htm)
- ❑ General darkroom operating procedures
- ❑ Logging procedures
- ❑ Spill cleanup procedures
- ❑ Locations of eyebath and safety showers

Processing of X-ray Films

1. Preparation of working solutions for the developing procedure

Chemicals used in the dark room are Kodak D-19 Developer, Kodak Indicator Stop Bath and Kodak Rapid Fixer (Solutions A and B). A rinse bath is also used after fixing the x-ray films to remove excess fixer solution. A brief description of the procedure for preparing the working solutions is provided below.

Generally, about 1 gallon (3.78L) of each working solution is prepared for processing of x-ray films. 1 gallon glass beakers are used to prepare the solutions and mixing is achieved using a magnetic stirrer.

Kodak D-19 Developer: Working solution is prepared from a packet of dry powder. Start with 1 gallon (3.8L) of water at 52°C. With stirring slowly add the dry chemicals from the packet. Stir until the chemicals are dissolved and the solutions is completely mixed.

Kodak Indicator Stop Bath: Working solution is prepared from liquid concentrate. To make 1 gallon (3.8L) of stop bath solution, about 60mL of the concentrate is stirred into 1 gallon (3.8L) of water.

Kodak Rapid Fixer: Working solution is prepared by mixing and diluting two concentrates - Solution A and Solution B. To make 1 gallon (3.8L) of fixer solution, start with ½ gallon (1.9L) of water at 16-27°C and add 32 fl oz (946mL) of Solution A. With rapid agitation, add 3½ fl oz (104mL) of Solution B. Finally, add water to bring the solution to 1 gallon (3.8L) and stir until completely mixed.

Rinse Bath: Fill the glass tank with 1 gallon of fresh water.

2. Storage of working solutions

Once prepared, the working solutions should be transferred from the glass beaker to their respective glass tanks (as labeled) taking care to prevent spillage. The glass tanks are placed in a deep plastic tray to prevent spillage. When not in use, the glass tanks should be covered with glass plates.

3. X-ray film

Industrial x-ray films of the following types are usually used in the darkroom:

Agfa Structurix D3 SC
Kodak SO series (343)
Fuji Ix series

4. Processing of x-ray films

After exposure for the requisite time in the X-19C hutch, remove the x-ray film from the cassette, attach a clip to the top and dip it in the D-19 developing solution. Period of developing could vary from 30 to 2400 seconds depending on the type of film, the exposure conditions and the state of the developing solution. After developing, immerse and agitate the film in the stop bath for about 10-15 seconds and then immersed it in the fixing bath until the undeveloped silver bromide is dissolved. Fixing duration could vary from 3-5 minutes depending upon the usage extent of the fixer solution. After fixing, rinse the film in the static water tank for about 10-20 seconds. After each processing step, the film should be suspended above the respective processing tank for as long as practicable to allow the processing chemicals to drip off into their tanks. After rinsing, wash the films thoroughly under a stream of running water for about 30 minutes. Following the wash, load the films into the metal frames and dry them in the electrically heated drying oven in Room 1-140A.

5. Disposal of waste chemicals

When the processing solutions become sluggish, which is usually after processing about 100-150 films (typically 1 week of darkroom usage), they must be disposed appropriately and replaced, if necessary. The spent developer and stop bath solutions can be transferred to one container and labeled with the green INDUTRIAL WASTE label. The spent fixer and the static rinse bath should be transferred to a separate container labeled with the red HAZARDOUS WASTE CONTROL FORM (HWCF) label. Relevant information (name, beamline, phone no., chemical name, placement date, etc.) should be appropriately filled out on the labels. Use the flexible (4 feet long) plastic hose available to siphon the solutions from the glass tanks to the 2.5 or 5 gallon plastic carboys (waste containers). To do this, hold the hose in a U-shape configuration and fill it with water from the faucet. Cover the open ends of the hose with your thumbs (while wearing gloves).

Open one end and insert it into the working solution tank (located at a higher level on the work table) all the way to the bottom while continuing to hold the other end closed. Insert the other end into the open mouth of the carboy (located at a lower level on the lab floor) and release the thumb slowly to ensure that the liquid does not spill outside the carboy. The solution will flow from the glass tank to the carboy until the tank is almost completely drained. Do not move the glass tank and carboy from their secondary containment tray during this procedure to ensure that any spillage is contained. When the waste containers are filled, transfer them to the Hazardous Waste Collection Area located by the west roll-up door, or contact the Darkroom manager for instructions. After transferring the containers, complete the appropriate forms for each container type and record the form # as well as the placement date on the container labels. Submit the forms immediately to ESH Staff.

Note: During processing of x-ray films and handling of the processing chemicals, users should wear labcoats, protective eyewear and gloves.

6. Shipping of chemicals

The developer, fixer and stop bath chemicals are shipped by car from the University at Stony Brook to the NSLS and the working solutions are prepared in the darkroom.

7. Discharge of rinse wasters

Contamination of rinse waters by silver from the photodeveloping operations is minimized by draining the chemicals from the films as much as possible. The static rinse water is disposed through the Hazardous Waste Management Facility while the final stage rinse waters are discharged into the BNL Sewage Treatment Plant.

8. Ventilation in the darkroom

The MSDS sheets state that no respiratory protection is required while using the working solutions. Good general ventilation (typically 10 air changes per hour) is required. The air recirculation system currently in place in the darkroom meets these requirements and generally, the darkroom is free from odors.

In case the odors from the solutions, especially from the stop bath (dilute acetic acid) become persistent, a filtered exhaust apparatus shall be installed to collect the acetic acid vapors.

Spill Cleanup Procedure

In case of a major chemical spill, the following steps should be taken:

Identify the chemical and the quantity.

Refer to the Material Safety Data Sheets to identify the hazards: flammability, toxicity, etc. and carry out the necessary preventive measures.

During spill clean up, wear protective clothing, goggles and gloves. Ensure that your footwear is safe enough and impervious to the chemicals.

Locate the source of the spill and try to prevent further spill.

Cover the drain with the drain plug so that the chemicals do not reach a water supply.

Use dikes and booms from the spill kit (Located outside the East Roll-up door) to contain the spill and then, use pillows to absorb the spill.

The used sorbents (dikes and pillows) should be placed in the garbage bag provided in the spill kit. Contact ES&H Staff regarding their disposal.

While using the dark room

- Wear a lab coat at all times. Also wear protective gloves and safety glasses while using chemicals.
- Keep the darkroom clean and tidy at all times.
- Processing of x-ray films should be done with **utmost care**. **Avoid** chemical spillage on the floor and into the sink.
- Minimize the duration and speed of running water.
- In case of major chemical spillage, use the spill kit to contain and clean the spill. Refer to the "Darkroom Operating Procedures" binder for instructions on spill cleanup.

Before you leave the dark room

- Clean and dry the work table.
- Cover the chemical tanks with the glass plates.
- Record the number of film sheets processed, the conditions of the processing chemicals, their replacement or disposal, and other information relating to darkroom maintenance in the logbook.
- At the end of the beam time, transfer waste chemicals to waste containers and partially used chemicals to appropriately labeled plastic bottles.
- Return all things to their assigned places.
- Turn off the water tap.
- Empty the garbage bin.
- Turn off the lights.
- Do not lock the darkroom.