Before using a copy of this form, verify that it is an acceptable version by checking with your Experiment Review Coordinator. **Double-click to change the state of a checkbox, or type "X" over the box, or paste this ☑**

EXPERIMENT SAFETY REVIEW FORM

REVIEW NUMBER (supplied by ERC):

PRINCIPAL INVESTIGATOR: Jonathan Fitzsimmons **PREPARATION DATE: 4/14/16**

GROUP: Nuclear Chemistry Summer School

EXT: 4453 **E-MAIL: jfitzsimmons@bnl.gov** **LIFE NUMBER: 24856**

Project Title: **Laboratory Portion of the 2015 Nuclear and Radiochemistry Summer School (CHE-362)**
Location(s): Bldg 801, Rooms 2-40, 2-37
Proposed Start Date and Duration: June 13 through July 27 of 2016

SIGNATURES:

Principal Investigator:		**Date:**
Experiment Review Coordinator:		**Date:**
ESRC Chairman:	Michael Sivertz	**Date: 4/19/16**
		Date:
		Date:
		Date:
		Date:
Approval **Department Chairperson:**		**Date:**
Review/Approval Comments:		
Walkthrough Signature:		**Date:**
Expiration Date (max 1 yr.):		
FUA Change Required? ☐ Y x N	**Fire Rescue Run Card Changes Required? ☐ Y x N**	
Has a NEPA Review been Performed for this Project? x Y ☐ N		
Required Approvals: x RWP ☐ IACUC ☐ IRB ☐ IBC		
Project Termination Acceptance Signature: **Comments:**		**Date:**

I. DEFINE THE SCOPE OF WORK

A. Description

1. *Describe the experiment purpose/scope. Identify all apparatus that will be used, and associated requirements. List special equipment (X-ray generators, lasers etc.) that will be used during the project. Identify measurement and test equipment, apparatus operating conditions, and required maintenance procedures as appropriate. Include calibration frequency for formal calibration requirements. Attach supporting documents such as engineering calculations, drawings and specifications.*

   Include Human Performance Fundamentals, i.e., list any critical steps, tasks or phases of this experiment (important work in the experiment that ***must*** *go right); indicate how a mistake could be made at a critical step; include error precursors; indicate the worst thing that can go wrong, and review potential consequences and contingencies; and list barriers or defenses that are needed to prevent, or reduce the likelihood of an accident.*

   Indicate if modification of facility is required. Include the setup and decommissioning phases of the experiment. The Work Permit Process/Form may better address the hazards & controls of the set-up and/or tear down phases. Indicate if a Work Permit will be used.

The laboratory portion of the Nuclear and Radiochemistry Summer School (NCSS) consists of a sequence of 8 instructional experiments illustrating fundamentals of radiochemistry and nuclear instrumentation. Twelve students will be grouped as teams of 3 students each for these experiments. Students are supervised at all times by two Teaching Assistants and by the Course Instructor (Jonathan Fitzsimmons). Teaching Assistants are graduates of the BNL 2012 NCSS program and are familiar with the CHE-362 curriculum.

Detailed experiment descriptions are provided in the NCSS Laboratory Manual, 2013. The students will be under the continuous supervision of the Teaching Assistants. The teaching assistants and students will have undergone the BNL NCSS Program requisite web-based training prior to coming to BNL and the students will obtain their radiation safety training (Radiation Worker 1 and Benchtop Dispersibles) during week 1 of the program. The assistants will review laboratory process/procedures with Jonathan Fitzsimmons prior to the start of the program ensuring continuity of safe work practices with radioactivity and waste management. Once their training is completed, Jonathan Fitzsimmons and an RCD Representative will conduct a lab orientation which will include a review and signing of the RWP defining work practices in Building 801 for the NCSS program.

Students will perform lab work only under supervision of TA's and/or the course instructor. An important component in the laboratory phase of the Summer School is the "pre-lab" lectures and quiz that will be given by Jonathan Fitzsimmons to ensure that students are adequately prepared for that day's experiment and are aware of applicable safety issues.

The TAs will aliquot chemicals into smaller quantities for use by the students. This is done in a chemical fume hood in 2-37. The students will work with the small quantities of chemicals on a benchtop (not in a hood). In the past, the only concerns IH had during ESR review was the use of small volumes of toluene solvent in one of the planned experiments. Testing was performed by IH in 2006 for toxic exposures and toluene levels were found to be well below limits. That lab has successfully run in the years following. ESH (Nancy Felock) performed a passive diffusion test on all groups of students last year (2012) and validated the previous exposure results.

The NCSS uses a variety of conventional nuclear spectroscopic detector systems allowing students to assess basic properties of beta, gamma and alpha radiation. Principles of operation and operating conditions for Geiger Müller, NaI(Tl) and HPGE detectors are described in the Lab Manual and student's work on these experiments involves using sealed point source having ≤1μCi total activity. The Medical Isotope Research and Production (MIRP) Group has a calibration program for equipment and is responsible for handling liquid nitrogen to fill the detectors in Room 2-40 (ODH calculation 8/31/10 Felock see Safety Engineering ODH Tools Rev 4) This is not an ODH area.

2. *List equipment manuals and/or procedures that describe ESH-critical systems. Such manuals and/or procedures must be controlled following the Internal Controlled Documents Subject Area.*

   None that are ESH critical.

B. Materials Used /Waste Generated

List materials to be used and wastes generated. Refer to the BNL Chemical Management System for a complete listing of the chemicals in your locations. Include samples, chemicals, controlled substances, gases, cryogens, radioactive materials, and biological material. You may use generic chemical class descriptions for commonly used materials (e.g., organic solvents, acids). List disposal methods. ***Denote disposal method using the codes below.***

Materials Used & Wastes Generated	**Disposal Method Type (Code below)**	**Estimated Quantity Used** (provide units)		**Comments**
		Per Use	**Total/Yr**	
Small amounts of mineral acids (HCl and HNO_3) at 4N and 2N concentrations, respectively.	If rad, neutralized, then put in D waste system	~ 1 L	~ 1 L	**Dilutions in hood & in TPL lab 60**
Small amounts of nitromethane and nitroethane	M	<0.2L	<0.2L	**carcinogen**
Dispersible sources: ^{59}Fe, ^{113}Sn, ^{3}H, ^{14}C (all < 100 μCi total)	R	~1 L total for all isotopes	~1 L total for all isotopes	**Dilutions in TPL labs 62 and 60**
small quantities of stable carriers of several elements, e.g., $FeCl_3$	R	~ 1 L	~ 1 L	
Small quantities of pipette tips, Kim Wipes, gloves that will be contaminated with isotopes listed above.	R	.	1 cu ft	
AG1-X8 Anion Exchange Resin	R	0.5 L	0.5 L	
Toluene	M	20ml/grp	1 L	Reproductive toxin
Methanol, Acetone	M	20ml	1 L	

Note: Identify Age Sensitive materials or special handling requirements.

Disposal Method Codes:

Air Emissions	Liquid Effluents	Wastes
P = Point Source	**S** = Sanitary	**H** = Hazardous
F = Fugitive	**ST** = Storm water	**I** = Industrial (Non-hazardous waste e.g., oils)
	O = Other	**R** = Radioactive
		M = Mixed (Radioactive + Hazardous)
		RM = Radioactive Medical
		MW = Medical
		T = Trash

C. Waste Minimization/Pollution Prevention

Describe how you plan to minimize generation of the wastes described above, and identify pollution prevention opportunities. Consider Ordering/using the smallest amount, using recycled material substituting non-hazardous materials. The Pollution Prevention and Waste Minimization Subject Area describes how to plan, conduct, and closeout work activities to eliminate or minimize the impact of their activities on the environment.

Waste will be minimized by:

- All wastes segregated according to type (haz, rad, mixed)
- Using the least amount of material required to do the work
- Checking stock on-hand and laboratory inventory system prior to purchasing additional chemicals
- Recycling and reusing materials where feasible
- Using minimal quantities of reagents
- Substituting less hazardous materials when feasible
- No packing material present in a chemical contaminated area, and
- Limiting the quantity of hazardous materials ordered

II. IDENTIFY AND ANALYZE HAZARDS ASSOCIATED WITH THE WORK

In this section indicate the hazards in each class. Include the setup and decommissioning phases of the experiment.

Physical Hazards (check all that apply)	☐ None	
Cryogens (note: HPGe dewars will be filled by 801 personnel, not NCSS staff)	☐ Oxygen deficient atmosphere	☐ Noise > 85 dBA
☐ Fall hazards (e.g., ladders, elevated platforms, towers)		
☐ Material handling equipment (e.g., cranes, hoists, forklifts)		
☐ Machine shop or nonportable powered tools use		
☐ Electrical hazards (exposed conductors, large batteries, capacitors, etc)		
☐ Confined space	☐ Trenching/soil excavation	
☐ Extreme temperatures in workplace	☐ Remote location	
☐ Compressed gases (lecture bottles, cylinders, gas lines)		
☐ Pressurized vessels or systems		
☐ Vacuum chambers or systems with >1000 J stored energy		
☐ Autoclaves or high temperature ovens		

☐ Open flames		☐ Welding, brazing, silver soldering	
x Flammable gases/liquids/solids		☐ Other spark producing activity	
x Other (specify): ___plug-in detector systems. High voltage amplifier (up to 5000 volts). Enclosed system.			
Chemical Hazards (check all that apply)		☐ None	
x Carcinogens	Highly acute toxins	**X** Reproductive toxins	**x** Corrosives
x Flammable liquids	☐ Flammable solids	☐ Strong oxidizers	☐ Oils
x Explosives nitromethane/ethane	Peroxidizables	☐ Pyrophoric materials	☐ PCBs
☐ Asbestos	☐ Pesticides/herbicides	☐ Controlled substances	
☐ Highly reactive materials		☐ Perchlorates	
☐ Storage or use of Beryllium or Beryllium articles. Attach Beryllium Use Review Form if checked.			
☐ Toxic metals (e.g., As, Ba, Be, Cd, Cr, Hg, Pb, Se, Ag)			
x Other (specify): acetone, methanol and toluene			
Radiation Hazards (check all that apply)		☐ None	
x Sealed radioactive sources (≤ 1μCi calibration sources)		☐ Windowless radioactive sources	
x Dispersible radioactive materials		☐ Neutron-emitting radioactive sources	
☐ Non-fissionable radioactive materials		☐ Fissionable radionuclides	
☐ Ionizing radiation-generating devices (x-ray sources, accelerators)			
☐ Class II, IIIa, or IIIb (visible <15mW) lasers		☐ Class IIIb (nonvisible >15mW) or IV lasers	
☐ Dynamic magnetic fields >1G at 60 Hz or dynamic electric fields > 1kV/m at 60 Hz			
☐ Static magnetic fields < 5 G. No Exposure Form is required			
☐ Static magnetic fields > 5 G and < 600 G		☐ Static magnetic fields exposure. Attach Static Magnetic Fields Exposure Form when required.	
☐ Static magnetic fields ≥ 600 G			
☐ Radio frequency (RF) or Microwave sources exceeding 10 mW radiated output			
☐ Infrared sources > 10 W		☐ Ultraviolet sources > 1 W	
☐ Extremely low frequency (ELF) radio sources			
☐ Other (specify):			
Biological Hazards (check all that apply)		**x** None	
☐ Regulated etiological agent	☐ Recombinant DNA	☐ Animals	
☐ Human blood/components, human tissue/body fluids		☐ Human subjects	
☐ Other (specify):			

Offsite Work (check appropriate box)	**x** None
☐ Reviewed or controlled by ES&H programs at the offsite location	☐ Requires additional controls (include in the next section)
Other Issues (Security, Notifications, Community, etc.)	**x** None
☐ Specify:	

See Identification of Significant Environmental Aspects and Impacts Subject Area or your ECR if you need assistance completing the following table.

Significant Environmental Aspects (check all that apply)	☐ None
x Any amount of hazardous waste generation	
x Any amount of radioactive waste generation	
X Any amount of mixed waste generation (radioactive/hazardous waste)	
☐ Any amount of transuranic waste generation	
☐ Any amount of industrial waste generation (e.g., oils, vacuum pump oil)	
Any amount of Regulated Medical Waste	
☐ Any atmospheric discharges that require engineering controls to reduce hazardous air pollutants or radioactive emissions, or are identified as a Title V emission unit, or require monitoring under NESHAP	
☐ Any liquid discharges that require engineering controls to limit the quantity or concentration of the pollutant, or include radionuclides detectable at the point of discharge from the facility, or contain any of the chemicals listed on BNL's SPDES permit	
☐ Storage or use of any chemicals or radioactive materials that require engineering controls – see Storage and Transfer of Hazardous and Nonhazardous Materials Subject Area	
☐ On-site or off-site transportation of chemicals or dispersible radioactive materials	
☐ Any use of once-through cooling water with a flow of 4 gpm – 24 hrs/day (10 gpm – 8 hrs/day, daily use of >15 gpm for >60 days) and discharging to the sanitary sewer	
☐ Soil contamination or activation	
☐ Any underground pipes/ductwork that contains chemical or radioactive material/contamination	
☐ Any products or services resulting from this work that could impact the environment	
☐ Other environmental aspects related to your work (specify):	
☐ Process Assessment Form required (determined by ECR or other qualified person)	

III. DEVELOP AND IMPLEMENT HAZARD CONTROLS

For each hazard identified in the previous section, describe how that hazard is controlled. Identify the ***Engineering Controls (e.g., interlocks, shielding), Administrative Controls (e.g., procedures, RWPs) or Personal Protective Equipment (e.g., respirators, gloves; see the [Personal Protective Equipment Subject Area](#)****) that will be employed to reduce hazards to acceptable levels. List the Job Risk Assessments (JRAs) that are applicable to this work. Indicate any work for which there is no JRA, and contact your ESH Coordinator to perform one.*

The Experiment Review Coordinator, along with the ***Principal Investigator*** *(PI) and Building Manager, as appropriate, will evaluate this experiment for impacts that will require an update to the Facility Use Agreement (FUA), and or Fire/Rescue Run Cards.*

The ***PI*** *develops and implements hazard controls in consultation with, and using feedback from, the personnel who will be performing the work.*

A. Physical Hazards/Controls/JRA

Hazard	**Controls**	**JRA**
Sharp Edges or Points	Engineering Controls ·Separate trash receptacles exist for the disposal of large broken glassware. · The container will be labeled as: “Broken Glass Only” Administrative Controls ·Sharp glass will be disposed of in appropriate containers · No broken glassware shall be used in experiments · All glass shall be examined by the user before any experiment Personal Protection Equipment Heavy gloves will be worn when disposing of broken glassware	DJ-sharps
Heat lamp	Do not touch when on.	

Note: Include maintenance, inspection and testing, and formal calibration, including frequency as appropriate.

B. Chemical Hazards/Controls

Hazard	**Controls**	**JRA**
CHEMICALS USE	Small amounts of chemicals are used on the benchtop, larger amounts in hood. Nitromethane and nitroethane will be brought to prep lab to aliquot and then will be returned to flammable cabinet. These are highly flammable and form shock sensitive mixtures with amines, strong acids, bases and reducing agents. Teacher Assistants will prepare reagent dilutions in fume hoods in Lab 2-37. Position equipment so as not to block the exhaust slots in rear of hood; leave sash in place and in as maximally closed position as practical. Do not store more than absolutely necessary in hoods. Handle more than 6” from edge of hood. Face shields will be used by staff when preparing the diluted acid solutions for routine student use. The lab door for 2-37 will remain open during experiments. Students will be given safety goggles for the benchtop work with corrosives. Administrative: Laboratory Standard, Training Hazardous Waste Generator Training (students, Teacher Assts.).	DJ-Chemicals

Inhalation (type of hood and face velocity or breathing apparatus required)	IH monitoring for toluene exposure during the 2006 program demonstrated that this was not a safety issue. Only 20ml is used on a bench for a short period of time. In addition there is an email cut and pasted below from Bob Selvey, CHO, approving the use of small amounts of organic solvents on a benchtop. Felock performed the testing again in 2012 to validate the original results.	
Contact with chemicals (safety glasses, face shields, gloves, protective clothing)	Students and their Teaching Assistants are provided with safety equipment for use during all chemical manipulations—some of which is dictated by the Radiation Work Permit, e.g. safety glasses and/or goggles, nitrile and synthetic latex gloves, lab coats, sleeve gauntlets, rubber shoe covers. Closed shoes, not open sandals, will be worn when doing lab work. Gloves are changed often and whenever contaminated. Aspects of proper donning and doffing of PPE are covered during the lab orientation by Jonathan Fitzsimmons. We will institute a gauntlet and double glove policy for working within dispersible zones where the primary glove barrier will be 4 mil nitrile (Kimberly Clark powder-free Exam gloves) and the outer glove will be Conform XT 4 mil synthetic latex. PPE will be packaged for waste at the completion of each lab so as to avoid mixing of radioactive contaminants. Laboratory Standard Training is completed by all.	

Note: Refer to the Working with Chemicals Subject Area for requirements regarding particularly hazardous chemicals such as carcinogens, reproductive toxins, and highly acute toxins, including postings, decontamination plan, and address above.

C. Environmental Hazards/Controls

Hazard	Controls	JRA
Wastes	In general, student samples are combined at the conclusion of each lab module to minimize the number of samples which may require disposal as waste. A designated satellite area will be posted in Lab 2-37 to enable efficient accumulation and temporary storage of waste during the program. At the end of the program this waste will be processed either as radioactive waste or chemical waste depending on its nature. Radioactive samples are segregated, and at the end of the experiment will be disposed as radioactive waste by Jonathan Fitzsimmons through WM. Fe-59 will be processed as long-lived radioactive waste as it is more cost-effective to remove it as such than to allow decay in storage with RCD surveys. Jonathan Fitzsimmons is trained and responsible for disposal of hazardous, mixed, and radioactive waste in accordance with applicable BNL Subject Areas. All samples are labeled with the date and isotope to allow disposal. Bldg. 801 has SOPs for waste disposal; see CAD OPM 8.20 and 8.21.	DJ-HazWaste/ Rad Waste

Note: Identify the requirements from applicable waste management subject area (hazardous, radioactive, mixed, regulated medical). List all applicable environmental permits (Suffolk County Art. XII, Title V Emission Source, etc.) and the relevant controls required by those permits.

D. Radiation Hazards/Controls

Hazard	Controls	JRA
Dispersible Isotopes	Students and their Teaching Assistants receive BNL radiation training prior to the start of laboratory experiments. This includes Rad Worker - 1 and RTW-500 (Benchtop Dispersibles) training. Each student and Assistant is issued a personal radiation monitor (TLD) and several survey meters are routinely used in the lab for monitoring radioactive materials and sources. For stronger sources, appropriate shielding is employed and ALARA practices are implemented as described in RWP. The Scintillation lab module using ^{3}H, ^{14}C will necessitate additional RCD survey of benchtops to assure no loss of control of radioactive material. Areas used within hoods, on benchtops and on floors are covered, as appropriate, with recommended materials to catch any spills and facilitate cleanup. All radioactive liquids will be disposed of through HWM. Secondary containment pads are introduced for benchtop work in dispersible areas. Radiological frisking is performed prior to exiting Labs 2-37 and 2-40 using a GM counter. We also require that a PCM be used prior to exiting the building. Frequent surveys are requested of RCD representative in lab areas to assure no contamination. Proper posting is done in work areas with Radioactive Material Work Area signs and listing of isotopes in use and their activity levels. One lab module will make use of the house vacuum lines to filter radioactive samples for counting. House vacuum lines are protected with filter traps that will rely on dry ice only. This avoids introduction of water vapor into the pump lines and the potential hazard of trapping oxygen from air when unattended. When exiting the Summer School laboratory spaces, students, teaching assistants and instructional staff members shall perform self-frisking (hands and feet) to assure that any contamination is immediately detected and controlled and to assure that no radioactivity is tracked outside the controlled area. They will then proceed to the Personnel Contamination Monitor (PCM) for a final contamination check. A job-specific radiation work permit (RWP) is written for the duration of the experiment and cleanup period. It is signed at the start of each experiment. One worker on the RWP will be Contamination qualified (RWT300/300A) in case of a spill that would require that level of qualification to clean up.	DJ-Radiation

Note: List sources/materials. Attach or refer to Radiation Work Permits.

E. Biological Hazards/Controls

Hazard	Controls	JRA
None		

Note: List additional approvals/permits/reviews required (e.g., BNL Biosafety Committee approval).

F. Offsite Work Hazards/Controls

Hazard	Controls	JRA
None		

Note: List the location of all off-site work and identify any off-site organization whose ESH requirements will be followed (e.g., other DOE Labs). Indicate additional controls (not specified above) that are needed.

G. Other Issues (Security, Notifications to Other Organizations, Community Involvement, etc.)

Issue	Controls/Plan
None	

Note: See the Security Checklist, and, if necessary, consult the security office at 4691 or 4496 for more information or guidance.

IV. PERFORM WORK WITHIN CONTROLS

All work shall be performed within the controls identified within this document. It is the PI's responsibility to ensure that this document is kept up to date. The PI should consult with the ERC as appropriate to determine if changes to this document are significant enough to require a new review/document.

The PI will have project staff sign the Signature Sheet (attached) acknowledging that they have read the ESR and understand the hazards, controls, environmental aspects, and training required for this experiment.

If a hazard assessment is required for this experiment, the PI should contact the ERC and/or the ES&H Coordinator for assistance. The PI should document any hazard assessments performed for this experiment in Section VI.

A. OSHA/DOE Required Medical Surveillance

Indicate if potential exposure is in excess of trigger levels listed. Exposure evaluation and/or medical surveillance may be required. Additional training may be required for any indicated agent. See the SBMS for additional information and controls on the hazards listed.

Regulated Hazard	Hazard Specific Training Trigger	Medical Surveillance Exposure Trigger
x None		
☐ Inorganic Arsenic	Any day above the OSHA action level (without regard to respirator use)	30 days/year above the action level (without regard to respirator use)
☐ Lead	Any day above the OSHA action level	30 or more days/year at or above the action level
☐ Cadmium	Any day above the OSHA action level	30 or more days/year at or above the action level
☐ Methylene Chloride	Any day above the OSHA action level	- 30 days/year at or above the action level - 10 days/year above the 8-hour TWA PEL or the STEL - Any time above the 8-hour TWA PEL or STEL for any period of time where an employee at risk from cardiac disease or other serious MC-related health condition and employee requests inclusion in the

Regulated Hazard	Hazard Specific Training Trigger	Medical Surveillance Exposure Trigger
		program
☐ OSHA Regulated Chemicals *Acrylonitrile* *Benzene* *Benzidine* *1,3 Butadiene* *4-Dimethyl aminoazobenzene* *Ethylene oxide* *Ethyleneimine* *Formaldehyde* *Vinyl Chloride*	Any day above the OSHA PEL	- Routinely above the action level (or in the absence of an action level, the PEL) - Event such as a spill, leak or explosion results in the likelihood of a hazardous exposure
☐ Biohazards (CDC/NIH/WHO listed Agent)	None	See Subject Area for guidance
☐ Bloodborne Pathogens	Any use	Any use
☐ Health Care Protocol	Any use	Any use
☐ Small Animal	Any use	Any use
☐ Non Human Primate	Any use	Any use
☐ Other Regulated Etiologic Agent	Contact OMC	Contact OMC
☐ Lasers	Use Class IIIb or Class IV Lasers	Use Class IIIb or Class IV Lasers
☐ Static Magnetic Fields	Worker who routinely works in magnetic field	- Any time at ≥ 0.5 mT (5 G) for Medical Electronic Device wearer - Any day at ≥ 60 mT (600 G) to whole body [8 hour average] - Any day at ≥ 600 mT (6000 G) to limbs [8 hour average] - Any Time at ≥ 2 T (20,000 G) to whole body [ceiling] - Any time at ≥ 5 T (50,000 G) to limbs [ceiling]
☐ Noise	Any day above the ACGIH TLV	Any time equal or greater then 85 dBA TWA 8-hour dose

B. Training/Qualification

List all project personnel, indicating they are authorized and competent to perform the work described. List the training required for each individual. Identify any certifications or experiment-specific training required. Indicate if any project personnel are minors (under 18 yrs. of age). Contact your Training Coordinator and ES&H Coordinator as appropriate for assistance.

It is the responsibility of the PI to maintain a complete up-to-date list of personnel and their full training requirements, and to ensure that training and qualifications are maintained.

Student & Teaching Assistant Training Requirements	
TQ-GSO	Guest Site Orientation
TQ-LYME1	Lyme and Tick-borne Disease Prevention
GE-CYBERSEC	Cyber Security Training
HP-IND-220	Laboratory Standard
HP-RCRIGEN3	Hazardous Waste Generator Training
TQ-RW1-PART1	Radiation Work Training Part 1.
Facility Specific Training	Facilities training for 801 Labs
TQ-RW1-PART2	Radiation Worker Training Part 2. (Classroom)

HP-RWT-500	Benchtop Dispersibles Training (Classroom)

In addition, the Laboratory Director or his designee must be Contamination Qualified (RWT300/300A) in case of a spill of radioactivity.

*Note: Facility Specific training is conducted upon check in. Includes an informal briefing by ESH coordinator/Bldg manager (Steve Pantieri). Topics include Local Emergency plan and waste handling procedures.

Note: *The BNL Training and Qualifications Web Site contains course offerings and descriptions, required training checklist, as well as employee training records.*

C. Emergency Procedures

Identify any emergency actions, procedures, or equipment that must be in place to insure personnel safety and environmental protection. Include the location of emergency shutoffs, and spill control materials.

During laboratory work the students are under the continuous supervision of the two Teaching Assistants. Students are instructed to report emergencies to the Assistants and these in turn will report to Jonathan Fitzsimmons and then, as appropriate, to applicable Departmental and Laboratory safety/emergency staff. Student safety training at the beginning of the summer school informs them of the use of extension 2222 for major emergencies. This is reinforced during facility specific training.

801 Local Emergency Plan (C-A-OPM 3.30).

D. Transportation

Identify materials, hazards and controls for any on-site and off-site transportation of hazardous and/or radioactive materials. See relevant SBMS Subject Areas.

Small quantities of radioactive or hazardous samples will be transported between labs/counting room in Bldg 801. The samples will be transported in secondary containment and labeled. All radioactive samples are surveyed by FSS according to RCD procedures prior to moving between spaces.

E. Notifications

The PI or designee should notify building occupants of any activities that might impact them or their work, and document this here. List external personnel/organizations that require notification related to experimental activities and/or to be notified of changes (e.g., a BNL Committee for review/approval, Occupational Medicine Clinic, Fire/Rescue).

None. The course instructor/director is in contact with Facility Support to schedule coverage when required by the RWP.

F. Termination/Decommissioning

Describe any decommissioning plan, including decontamination (radioactive, chemical, or biohazard) of the area at termination of the experiment. Identify any hazards and controls, special precautions or procedures. Include chemical and waste reconciliation. Indicate if Work Permit Form/Procedure will be used.

Program is 6 weeks in length with 1-2 weeks preparation prior to start. The last week of the course is spent cleaning up. All chemical and radiological waste processing is handled directly by Jonathan Fitzsimmons with assistance from the TA staff. They are trained and follow the waste subject areas. All hazardous materials will be removed from Labs used at the end of the NCSS season. Before taking designated posting signs down, the area will be wet wiped down by Jonathan Fitzsimmons. There is no requirement for any IH monitoring. RCD will survey and down post the areas in 2-37. The lab will be emptied of all NCSS materials, the emergency placard and the Satellite posting will be removed and then the area will be turned over to the Facilities and Operations Division.

G. Community Involvement Issues

Identify issues that may require community involvement (see the Community Involvement in Laboratory Decision-making Subject Area) and describe the plan that addresses these issues. Attach the Community Involvement Checklist.

None

V. PROVIDE FEEDBACK ON ADEQUACY OF CONTROLS AND CONTINUE TO IMPROVE SAFETY MANAGEMENT

Provide comments on the review process, including this form and communication. Identify any safety-related lessons learned or worker feedback contributing to modifications/improvements to the safety controls or process. Consider the following questions:

- *Was the work accomplished with the expected results?*
- *Were procedures accurate and useful?*
- *Is this the way this type of project should be performed in the future?*
- *What didn't go as planned; how did that affect the outcome?*
- *Were there working conditions associated with errors, flawed defenses or near misses?*
- *Was the training for the job appropriate and effective?*
- *Were there any lessons learned that should be passed on to others?*

2012- During the 2011 course a spill of radioactivity occurred in the lab space. It required a contamination qualified worker to clean the spill so this year we will ensure at least one individual (the laboratory instructor or his designee) will be contamination qualified in case this should happen again.

2011 Feedback: There is a new Lab Director for the school this year however the previous Director will serve as a mentor. In addition last year the new Director observed in order to gain knowledge.. This year additional PPE for the 901 lab was purchased (gauntlets, booties) as a lessons learned from last year.

VI. ATTACHMENTS

Use this section to include any supporting documents, hazard assessments, figures, tables, etc. that were not entered into the previous sections of the form.

- See Jonathan Fitzsimmons for Laboratory Manual
- Included below are the emails regarding the approval by the Chemical Hygiene officer to perform chemical operations outside of a fume hood.

Experiment Safety Review Number MO-NCSS-Fitz:

I have read this Experimental Safety Review document and understand the hazards associated with my work activities and the controls in place to mitigate those hazards. I understand the environmental aspects of my work activities and will continually work to minimize waste generated and look for areas of improvement. I am aware of the training requirements and will maintain my qualifications.

Print Name	BNL #	Signature	Date

From: Selvey, Robert L
Sent: Tuesday, June 07, 2011 9:43 AM
To: Klaus, Keith C
Cc: Felock, Nancy; Emrick, Ann
Subject: Evaluation of potential exposure to Toluene in 801

Regarding the student experiment in Building 801, the Chemical Hygiene Plan (04/2011), Section 6.2.B and C on Particularly Hazardous Substances states:

> B. Use containment devices, such as fume hood or a glove box (e.g., chemical fume hood, glove box, or effective exhaust-capturing equipment), when handling Particularly Hazardous Substances in a manner that may produce an airborne hazard (such as fumes, gases, vapors, and mists). This includes operations such as transfer operations, preparation of mixtures, blending, sonification, spraying, heating, and distilling.
> C. Conduct worker exposure monitoring specified in the Work Planning & Control documentation to verify that exposure levels do not exceed the OSHA action level (or in the absence of an action level, the OSHA Permissible Exposure Limit [PEL] or ACGIH Threshold Limit Value®). Contact a Safety & Health Representative to perform worker exposure monitoring

The bench top pouring operation with a PHS would typically be inappropriate because containment would not be present. However, because previous monitoring results have indicated that the OSHA action level, OSHA Permissible Exposure Limit and ACGIH Threshold Limit Value® are not exceeded, then an "airborne hazard" is not produced. So, limited to this specific operation, the pouring of the solvent on the bench top is acceptable.

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From: Selvey, Robert L
Sent: Wednesday, June 08, 2011 2:57 PM
To: Felock, Nancy; Klaus, Keith C
Subject: RE: Evaluation of potential exposure to Toluene in 801

Both these scenarios are acceptable outside of local exhaust ventilation.

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From: Felock, Nancy
Sent: Tuesday, June 07, 2011 4:59 PM
To: Klaus, Keith C; Selvey, Robert L
Cc: Emrick, Ann
Subject: RE: Evaluation of potential exposure to Toluene in 801
Importance: High

Bob, Keith,
When you are doing your hazard assessment please keep the following in mind:
Nitromethane:

- Only 2 mls of nitromethane will be used
- The aliquots will be dispensed by the TA and Cleave Dodge, the researcher
- The 2 mls will be dispensed into liquid scintillation vials in a hood and sealed
- The students will only have sealed containers
- The nitromethane is listed as a PHS in the ESR already (refer to the table of materials used)
- The vapor pressure of nitromethane is similar to toluene. Therefore, if there was no over exposure to a larger volume of toluene used on the bench top then there should be no overexposure from nitromethane. The TLVs are the same.

Ethyl acetate:

- Ethyl acetate will be used as a TLC solvent.
- Approximately, 20 mls of ethyl acetate will be aliquot into a TLC bed in the hood by the TA and Rich Ferreiri, the researcher.
- The bed will be covered and given to the student. The student will uncover the bed briefly to add the TLC plate and the cover it again.
- This experiment won't be conducted in building 801 so it should not hold up the ORE or the use of the 801 lab.
- This experiment will be conducted in building 901.
- Again, the vapor pressure is similar to toluene.
- This chemical is also listed as a PHS on the ESR. Please refer to the table of materials used.

If you have any other questions or concerns, please let me know. I would appreciate a quick evaluation so I can take any additional steps that you may deem necessary.
Safety and Health Representative
Brookhaven National Laboratory