# CO FRA-05 Satellite/90-Day Area Use

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|---|---|---|---|---|---|---|
| **Risk Team Members:**<br>D. Cabelli, Richard Hahn, Debbie Bauer | **Point Value →<br>Parameter ↓** | **1** | **2** | **3** | **4** | **5** |
| **Name(s) of Specific Application Risk Team Members:<br>N/A** | **Frequency<br>(B)** | **≤once/year** | **≤once/month** | **≤once/week** | **≤once/shift** | **>once/shift** |
| **Job Title:** Satellite and 90-Day Area Operations<br><br>**Job Number or Job Identifier: FRA05** | **Severity<br>(C)** | **First Aid Only** | **Medical Treatment** | **Lost Time** | **Partial Disability** | **Death or Permanent Disability** |
| **Job Description:** Establish and maintain a satellite area and transport waste to 90-day area for pickup. Operate a 90-day area.<br>Approved by: Diane Cabelli Date:5/3/2013<br>Rev. #: 4 | **Likelihood<br>(D)** | **Extremely Unlikely** | **Unlikely** | **Possible** | **Probable** | **Multiple** |
| **Stressors (if applicable, please list all):** | | **Reason for Revision 1:** Monitoring for exposure to organic chemicals carried out (results appended).<br>**Reason for Revision 2**: Occurrence Report from ORNL on incompatible added to satellite area resulting in explosion.<br>**Reason for rev 3:** new PPE requirements, new Piranha waste requirements.<br>**Reason for Rev 4**: Explosion in Waste Management of temperature sensitive material | | | **Comments:** PPE requirements are safety glasses with side shields, long pants, closed shoes and labcoat. | |

| | | | **Before Additional Controls** | | | | | | **After Additional Controls** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Job Step / Task** | **Hazard** | **Control(s)** | **Stressors Y/N** | **# of People A** | **Frequency B** | **Severity C** | **Likelihood D** | **Risk* AxBxCxD** | **Control(s) Added to Reduce Risk** | **Stressors Y/N** | **# of People A** | **Frequency B** | **Severity C** | **Likelihood D** | **Risk* AxBxCxD** | **% Risk Reduction** |

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| Establish a satellite area | Spillage/breakage of container | Secondary containment, ensure area is in a secure location at or near point of generation, posting, training | N | 1 | 2 | 2 | 3 | 12 | | | | | | | | |
| Adding waste containers to satellite area | Exposure to chemical fumes | Bottle securely capped, PPE (appropriate gloves, safety glasses with side shields, long pants, closed shoes and labcoat) | N | 1 | 4 | 1 | 3 | 12 | | | | | | | | |
| | Chemicals reacting | Separation of incompatible material by use of secondary containment, ensuring outside of containers are clean, labeled correctly. **Prior to making/wasting Piranha, consult with the ECR/ESH coordinator.** | N | 1 | 4 | 2 | 2 | 16 | Discussed addition of incompatibles at CO Department Retraining (April 2007)-no change in risk ranking | | | | | | | |
| | Fire | Locate SA in area not subject to temperature extremes, locate far from heat source. Bottles securely capped. | N | 1 | 4 | 4 | 2 | 32 | | | | | | | | |
| | container breakage due to thermal expansion | Leave space for expansion due to temperature, variation in space. Account for unexpected changes such as loss of heat or air conditioning | N | 1 | 4 | 3 | 2 | 24 | | | | | | | | |

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| Adding waste to container already in satellite area. | Exposure to chemicals | Use hoods if necessary to eliminate exposure to chemical fumes, PPE | N | 1 | 4 | 1 | 3 | 12 | | | | | | | | |
| | Chemicals reacting, fire | Accurate labeling, separate incompatibles to keep fumes from one container reacting with material from other container, use appropriate funnel, funnel not left in bottle and container capped when addition of waste has been completed, add additional material to label/record using appropriate method | N | 1 | 4 | 3 | 2 | 24 | Discussed | | | | | | | |
| | container breakage due to thermal expansion | Leave space for expansion when adding cold solution to room temperature material. Account for heating or cooling upon mixing (i.e., in adding conc. Sulfuric acid to dilute sulfuric acid, allow for heat generation) | N | 1 | 4 | 3 | 2 | 24 | | | | | | | | |
| Transporting full container to 90-day area | Spillage/breakage of container | Secondary containment for transporting, PPE, do not use passenger elevator | N | 1 | 3 | 2 | 2 | 12 | | | | | | | | |

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| Adding container to 90-day area | container breakage due to thermal expansion | Ensure material is at room temperature before adding to 90-day area and that there is sufficient headroom for temperature variation | N | 1 | 3 | 3 | 3 | 27 | | | | | | | | |
| | Chemical exposure | Place container with compatible chemicals, place acutely hazardous chemicals (ie cyanide, azide) in additional closed containment to prevent exposure if the container breaks, PPE | N | 1 | 3 | 4 | 2 | 24 | Background air sampling showed no significant exposure in 90-day area space, no change in risk because assumption was that there was no exposure. | | | | | | | |
| | Spillage/breakage of container | Secondary containment. Heavy containers placed in stable location | N | 1 | 3 | 2 | 3 | 18 | | | | | | | | |
| Temperature sensitive material in satellite and 90-day area | Explosion from warming of material | Satellite area in stockroom refrigerator. | N | 1 | 3 | 2 | 3 | 18 | Speak with the Waste Management Rep prior to doing this | N | 1 | 3 | 2 | 2 | 12 | 33% |
| Pickup from 90-day area | Exposure to acutely hazardous material | Call for special pickup if hazards of material warrant | N | 1 | 1 | 5 | 2 | 10 | | | | | | | | |
| | | | | | | | | | | | | | | | | |

**Further Description of Controls Added to Reduce Risk:**

| | | | | | |
|---|---|---|---|---|---|
| | | **21 to 40 Acceptable** | **41 to 60 Moderate** | **61 to 80 Substantial** | **81 or greater Intolerable** |

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| Analyte | Location | | | | |
|---|---|---|---|---|---|
| | 90 Day Area 212B | Room 265 | Room 381 | Room 381 On Lab | ACGIH |
| | General Area | General Area | Inside Hood | Bench | TLV |
| Acetone | 0.075 | 0.04 | 1.3 | 0.91 | 500 |
| Benzene | ND | 0.0028 | ND | ND | 0.5 |
| Ethyl acetate | ND | ND | 0.58 | 0.1 | 400 |
| Hexane | ND | 0.0061 | 0.046 | 0.039 | 50 |
| Isopropyl alcohol | ND | ND | 0.022 | ND | 200 |
| Methylene Chloride | 0.077 | 0.099 | 0.056 | 0.057 | 50 |
| Toluene | ND | ND | 0.0019 | ND | 50 |

Notes: **1) ND = none detected** **2) all results are in parts per million**

# *Survey Details*

***Brookhaven Science Associates, LLC***
***Brookhaven National Laboratory***
***2 Center Street***
***Upton, NY 11973-5000***

**Survey Title:** VOC Area Air Sampling B555
**Survey Number:** 12331
**Facility:** Brookhaven National Laboratory
**Date:** 4/13/2006
**Survey:** Routine Monitoring
**Requestor:** Cabelli, Diane
**Similar Exposure Group** Chemists
**Date Range** 03/30/2006 to 04/13/2006
**Preparer:** Peters, John

**Survey Description:**

At the request of the ESH coordinator for the Chemistry department, area air monitoring was conducted in several locations throughout the chemistry building (555). The areas include: the 90 Day Storage area (Room 212B); Room 265; & Room 381. The project was an initial attempt to determine how potential fugitive emissions from typical chemistry work in laboratories and storage areas may be contributing to the overall air quality in the building.
Monitoring was conducted March 30, 2006 in accordance with OSHA Method No. 7. The method utilizes a charcoal sorbent sample tube for collection and a GC/MS scan to analyze for volatile organic chemicals (VOCs).

**Results/Recommendations Summary:**

The results indicate low levels of several volatile organic compounds are evident in typical lab work areas of the building. Also, the monitoring identified similar compounds and levels both inside and outside the hood in room 381.
Chemicals identified include: acetone, benzene, ethyl acetate, hexane, isopropyl alcohol, methylene chloride, and toluene. Levels were approximately 1 part per million or less (see attached table of results).
Monitoring was not conducted in non-lab areas.

**Concluding Remarks**

1) Additional monitoring should be conducted in non-lab areas to determine the extent, if any, of intrusion of chemicals to administrative areas. In addition, control samples of outdoor air should be collected for comparison.
2) Personal monitoring should be conducted on chemists specific to the activities they are conducting to ensure compliance with regulatory requirements.

# CO FRA-05 Satellite/90-Day Area Use

**1. Occurrence Report Number:** SC-ORO--ORNL-X10CENTRAL-2006-0013
Hazardous Waste Container Overpressurizes Following Addition of Nitric Acid Solution
**15. Description of Occurrence:**
On December 19, 2006, a researcher (W1) entered Lab F-263 in Building 4500 South to perform housekeeping in the fume hood where he had performed work the week before. A couple of weeks before the event after a discussion with a graduate student (GS) in the connecting lab, W1 decided to use a distillation unit in the Lab F-263 hood to speed up the reaction of his experiment (i.e., reduce the time it took to dissolve a polymer). In September a new polymer had been added to the task that needed almost boiling water to dissolve. The routine had been to use an open beaker and a hot plate, which proved to be a slow process. When W1 used the distillation unit, he unexpectedly got foaming that contaminated the glass distillation column with a polymer residue. After more discussion with the GS, W1 decided to try to clean the column, ultimately using a series of organic solvents, potassium hydroxide (KOH), and then finally a strong concentration of nitric acid.

As a result of several tries to clean the column with different solvents, W1 had generated hazardous organic waste which he added to one or both of the 4 L waste containers in the SAA in Lab F-263. W1 added the waste without consulting the SAA log before making additions to determine chemical contents of the container, without logging additions, and without contacting the SAA operator (who was also the group leader/ laboratory space manager or GL/LSM) according to the posting above the SAA. W1 then placed the column in a "base bath" (KOH). This, again, did not clean the column so, after a discussion with the GS, he decided on trying a solution of 100 mL of water to 100 mL of nitric acid ($HNO_3$). When he prepared the solution he added the water to the concentrated acid--he should have added acid to water-- and noticed fumes. He added the solution to the column and placed the column back on the distillation unit in the hood. A second researcher in the lab (W2) communicated W1's activities to the GL/LSM. GL/LSM went to the lab and labeled the column on the distillation unit as nitric acid, leaving it with the intent he would come back and dispose of it later and verbally communicated to his group the distillation unit would be replaced. W1 was not in the communication loop because he was not expected to use the unit again since it was not within his scope of work.

About a week later the GL/LSM sent an email to the various users of lab F-263 requesting that they clean up the lab for upcoming inspections. W1 was included in the generally worded e-mail. W1 began cleanup in lab F-263. He removed the acid-filled column (which contained approximately 200 mL of solution) and emptied it into one of the two 4L glass hazardous waste containers in the SAA. Upon adding the acid to the waste container to which he had previously added organics he noticed some fuming. Having seen it before when he added water to acid to make the cleaning solution, W1 did not see it as a problem and capped the bottle. He then placed the empty column in the sink next to the fume hood to rinse it with water. When he returned to the hood to hang the cleaned column, he heard a hissing noise, and determined that the sound was coming from the cap of the hazardous waste container into which he had emptied the nitric acid solution. He lowered the sash of the hood to the stop, leaving approximately a 6-inch opening, and proceeded to exit the lab to seek assistance. As he was approaching the door, he heard a loud noise from within the hood. He looked back and saw green liquid and broken glass on the floor. There was no evidence of fire or smoke and the sash appeared intact. He left the lab and went to notify the lab space manager. Other personnel in adjacent labs who had heard the loud noise came into the corridor. At 1439 hours, one of the individuals in the corridor called the emergency communications line (911), notifying the LSS office.

**19. Immediate Actions Taken and Results:**
As the emergency director (ED), the on-shift LSS dispatched the emergency response team, who responded to the south side of Bldg. 4500S and established an incident command post. The researcher reported to the command post and informed the incident commander and ED about the event that had occurred in lab F- 263. He was then transported to Medical for evaluation, and was found to be uninjured. At the direction of
the ED, the fire alarm for bldg. 4500S was manually activated to evacuate all personnel from the building. Shortly thereafter, hazardous material (HazMat) response personnel entered the building, approached the lab, assessed the situation, and the apparent level of damage, then reported to the ED. At 1459 hours the ED declared the event an operational emergency, not further classified, under emergency action level (EAL) #HS02.

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Verbal notifications were made to the DOE Oak Ridge Operations Center (OROC) and to the Tennessee Emergency Management Agency (TEMA) at 1509 hours. Access to Bldg. 4500S was restricted. The ORNL emergency operations center (EOC) was activated, and responsibility for the emergency was turned over to EOC at 1530 hours.

HazMat personnel entered the lab and performed additional assessments and monitoring. After HazMat personnel determined no further possibility of chemical reactions and respiratory hazards existed, initial clean-up began. The EOC activation was terminated at 1744 hours, and personnel were allowed to reenter Bldg. 4500S except for corridors near F-263. HazMat personnel completed clean-up activities inside the lab,
except for the fume hood, at 1940 hours. At 2010 hours the isolation zone was reduced to F-263 and the adjoining lab E-263. Access to those labs was restricted to approval from the LSS. Responsibility for the event was turned over to Chemical Sciences Division (CSD) operations manager.

At 2252 hours, a directive was issued by the CSD director about the event, requiring all CSD personnel to verify chemical compatibility of waste prior to making any additions to hazardous waste containers in satellite accumulation areas.

**23. Evaluation (by Facility Manager/Designee):**
Preliminary assessment of the incident determined that the sash of the fume hood remained intact. The majority of the reaction was contained within the fume hood, and only a small amount of glass and chemicals were expelled from the hood onto the floor. Most of the equipment and glassware in the hood remained intact. Upon final analysis, the general integrity of the facility was not jeopardized. Although communication was identified as a cause for this event, the response of W1 to this event was acknowledged to be the correct response for the situation. Staff is instructed that when they see an abnormal event, they are to put in a safe mode if possible and go get help. This is exactly what this worker did. When he recognized there was a problem, he lowered the sash to the hood and turned to leave the lab to find help. It was this deliberate action that prevented the worker from being injured.
**26. Lessons Learned:**
There needs to be a balance in allowing an employee to develop and take initiative with the need to ensure work has been properly reviewed, hazards analyzed, and controls established. The best mechanism to do this is through constant communication and anticipation of problems before they occur.
**31. HQ Summary:**
An abnormal event occurred in Room. F-263 of Building 4500 South, when a researcher emptied a nitric acid solution into a hazardous waste container, in fume hood, that caused the container to over-pressurize and shatter. An emergency response team was dispatched in response to a 911 call and the building was evacuated and secured. No personnel were injured as a result of this occurrence. Notifications were made, the spill was cleaned up, and a critique was held.