

The logo for NJIT (New Jersey Institute of Technology) is displayed in white serif font on a red background. The letters 'N', 'J', 'I', and 'T' are arranged horizontally, with a white curved line arching underneath them.

Lab Safety

<http://www.njit.edu/environmentalsafety>

Laboratory Safety

The Basics:

- Handle chemicals with care
- ALWAYS use correct protective clothing and equipment
- ALWAYS label containers
- Read labels on containers of chemicals
- Read Safety Data Sheets (SDSs)
- Know emergency procedures

Typical Hazards in the Lab

Chemical Hazards:

- Absorption of Chemicals
- Inhalation of Chemicals
- Ingestion of Chemicals
- Chemical and Thermal Burns
- Fire/Explosion

Physical Hazards

- Cuts, Scrapes, Bruises
- Slips, Trips and Falls

Biological Hazards

- Contact with Infectious Agents

Electrical Hazards

Radiation Hazards

Nanoparticle Hazards

Lasers

PPE for Eye and Face Protection

Safety Glasses/Goggles:

- Protects against flying particles striking the eye.
- Special eyewear may be required for intense light such as UV, lasers, or welding.



Chemical Splash Goggles:

- Required from both impact and chemical splash.
- Required when working with particularly injurious or corrosive chemicals and any time there is the possibility of a chemical splash.

Face Shield: (for additional protection)

- Required when working with larger quantities of materials when a high probability of eye and face injury exists.

Note: Contact lenses do not provide eye protection in the lab; however their use is acceptable as long as appropriate eye protection is used and the SDS does not identify restrictions.

PPE for Skin and Body

Gloves:

- Required when working with hazardous chemicals, biological hazards, unknown toxics, corrosives, sharp objects, or hot/cold objects.
- Some gloves may be incompatible with certain chemicals: refer to the SDS, the glove manufacturer, or contact EHS x3059

Protective Clothing:

- Level of protective clothing varies depending upon the hazards.
- If there is a reasonable risk of splash or spill, skin should be protected.
- Lab coats, coveralls, aprons (Tyvek for corrosive, irritant chemicals and biological hazards).

Footwear:

- Open toed shoes and sandals **are not permitted** due to chemical and physical hazards in the lab.
- Working with corrosives or large quantities of corrosives may require chemical resistant overshoes, boots or shoes.

PPE for Respiratory & Hearing Protection

Respirators

Required only where general ventilation does not reduce exposure to acceptable levels.

- Paper masks may be worn voluntarily to reduce nuisance dusts, but they are not enough in areas with respiratory hazards.
- Tight fitting masks may be used for solvents or other respiratory hazards but require:
 - Training in usage
 - Explicit permission from a doctor
 - Medical clearance
 - Fit testing



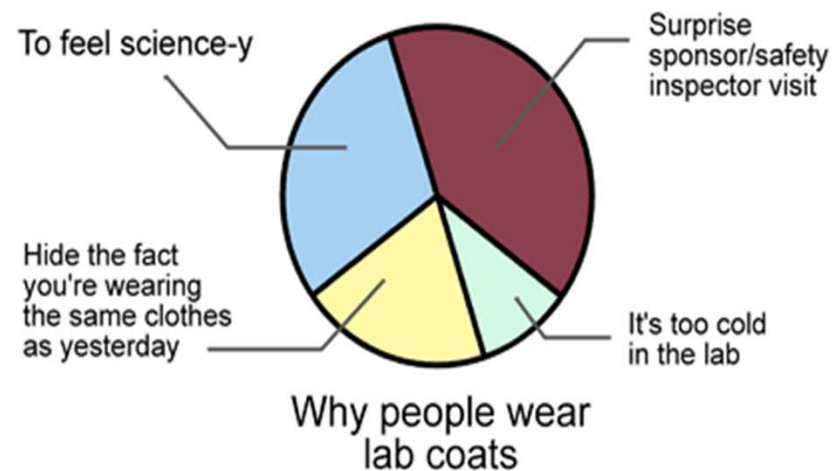
Hearing Protection

- Required in areas with noise levels above 85 decibels.



Proper Lab Attire

- No sandals or flip-flops
- Long hair tied back
- Safety Glasses or Splash Goggles
- No Jewelry (especially dangling)
- Long Pants
- Lab Coats
- Gloves
- Remove protective clothing in public



JORGE CHAM © 2010

WWW.PHDCOMICS.COM

Lab Safety Equipment

Safety Showers and Eyewash Facilities:

- Prior to working in the lab, identify the nearest eyewash and shower.



Ventilation:

- All operations that could generate air contaminants or have the potential to ignite or react should be done in fume hoods or use other ventilation. For safety and energy efficiency, keep the hood closed at all times when not in use.

First Aid Kit:

- A first aid kit should be available in all labs. Locate the nearest kit and ensure it is adequately stocked.



THE FUME HOOD: Where does it go??

WWW.PHDCOMICS.COM
JORGE CHAM © 2008

Intended use: containment and extraction of hazardous fumes
Actual use: a really expensive storage closet



Ever wonder where it all goes?



Chemicals casually laying about:

Will kill you instantly

Slow and agonizing death

Two chemicals that should *never* be that close together

No idea.

Something you should probably avoid if you plan on reproducing one day.

(What is this anyway?
A trap door?)

Ramblings of a mad man

Layers of ~~crud~~
"research"

It spins by itself! Magic!



The hot plate/stirrer:
abused more than the undergrad interns.

In Case of Accidents

Unexpected accidents may occur, at the time of an emergency react quickly and contact NJIT Campus Police immediately.

- Who should I call for help?
 - **NJIT Public Safety Emergency – (973) 596-3111**
- Report ALL injuries to your Supervisor immediately.
- Supervisors must report ALL incidents to EHS x3059, as soon as possible.

Be Prepared for an Emergency

- Know where emergency phone numbers are posted
- Review SDS
- Know where to go and what to do in an emergency
- Know the location of the closest safety showers, eyewashes, first aid kit, and fire extinguishers



Medical Emergencies

Only trained individuals should respond to an injury or illness

Locate your copy of the SDS!!!

- For chemicals on skin, eyes or clothing:
 - Flush with water for no less than 15 minutes.
 - Consult **SDS** for specific instructions, **dial 3111**.
- For skin contact with infectious agents:
 - wash with soap and water for at least 1 minute.
 - If skin is punctured wash and **dial 3111**.
- For Ingestion or symptoms of inhalation:
 - consult the SDS and **dial 3111**.

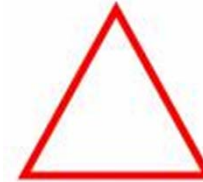
FIRE SAFETY



Fire Basics

Fires need three components to exist:

1. Oxygen:
Air, Oxidizers
2. Fuel:
Hazardous Materials
Trash, Paper, Solvents
3. Heat:
Flame, Oven Spark



**This is known as the fire triangle.
Remove one part of the triangle
and the fire will go out.**

Extinguishing a Fire

There are four basic methods for putting out a fire:

1. Cooling – remove the heat from the fire by adding water
2. Smothering – remove the oxygen from the fire
3. Starving – remove the fuel from the fire
4. Interrupting Chain Reaction - interrupt the chemical chain reaction to extinguish the fire.

In Case Of Fire

Do not endanger yourself or others
when attempting to put out a fire.
When a fire is discovered:

- Assist any person in immediate danger to safety provided it can be accomplished without risk to yourself.
- Activate the building fire alarm and then evacuate the building.
- Contact NJIT Campus Police **ext. 3111**
- If the fire is small (and only after having activated the alarm) you may attempt to use an extinguisher to put it out.

Rules For Fighting Fires

Before fighting a fire:

| | | | |
|----------|---|-----------------------------|--|
| A |  | Common Combustibles | Wood, paper, cloth etc. |
| B |  | Flammable liquids and gases | Gasoline, propane and solvents |
| C |  | Live electrical equipment | Computers, fax machines <i>(see note!)</i> |
| D |  | Combustible metals | Magnesium, lithium, titanium |
| K |  | Cooking media | Cooking oils and fats |

- Know what's burning. If you don't know what's burning, you won't know what kind of extinguisher to use.
Let the fire department handle it.
- Even if there is an ABC fire extinguisher, there may be something that may explode or produce toxic fumes.
- Is the fire spreading rapidly beyond the point where it started? The time to use an extinguisher is at the beginning stage of the fire.
- If the fire is already spreading quickly, evacuate the building.

Rules For Fighting Fires

- Always position yourself with an exit or means of escape at your back before you attempt to use an extinguisher to put out a fire.



- In case the extinguisher malfunctions, or something unexpected happens, you need to be able to get out quickly. You don't want to become trapped.
- As you evacuate a building, close doors and windows behind you as you leave. This will help to slow the spread of smoke and fire.

Classes of Fires and Fire Extinguishers

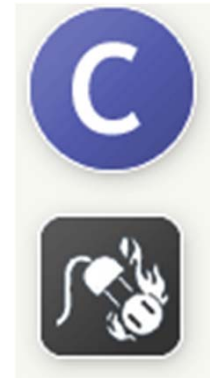
- Class A fires - Combustibles:
 - Paper, Wood, Cloth, Rubber, Rags



- Class B fires - Flammable liquid or gases



- Class C fires – Electrical
 - Never use water
 - Shut the power to equipment



Special Classes

- **Class D Fires – Burning metals**
 - Can be extremely difficult to extinguish.
 - Can burn up to 5000°F.
 - Never use water to extinguish. This can release oxygen and increase the intensity of the fire.

- **Class K fires – Kitchen fires**
 - Oils and fats
 - Never use water on grease fires



K



Use the P.A.S.S. Method

Pull the pin

Aim at the base of the fire

Squeeze the nozzle

Sweep from side to side



If the extinguisher runs out, the fire grows, or you have any doubt in your ability to fight the fire, evacuate immediately!

Fire Extinguisher Requirements

- Mount portable fire extinguishers, do not block so they are readily accessible.
- They must be fully charged and operable at all times.
- Select an extinguisher on the basis of the potential size of the fire and the type of fire.
- Never attempt to fight a fire larger than a small garbage pail.



The Importance Of Good Housekeeping

- **Minimize Clutter**

- Keep all areas and equipment clear of loose materials, paper, chemicals, etc.
- Clutter increases the probability and severity of accidents
- Combustible or flammable clutter will provide a fuel for fires
- Clutter reduces work efficiency



- **Watch Combustibles**

- Avoid collecting combustible materials such as trash and paper.

- **Clean Up Spills**

- Water and chemical spills can cause accidents as well as fires.
- Find your spill kit; York in hallways; Tiernan in labs



Excessive clutter can be a dangerous fire hazard.

Emergency Response Plan

Fire:

- Activate building fire alarm
- Evacuate building (close the door behind you)
- Contact the NJIT Campus Police **ext 3111** immediately
- Safely use a fire extinguisher on small fires

Hazardous Chemical Spill (over 1 pint):

- Evacuate the room immediately
- Close the door behind you
- Contact the NJIT Campus Police **ext 3111** immediately



Emergency Evacuation Tips

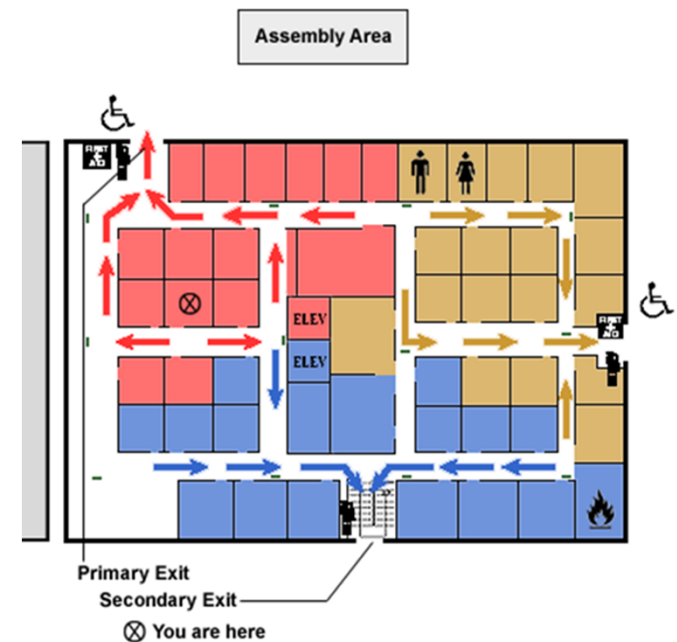
- Remain calm!
- Leave your personal belongings behind.
- Assist those who need assistance.
- Do not lock doors on the way out.
- Stay low to the ground to avoid smoke and gasses.
- Once outside, go directly to the assembly point.



Exit the building quickly and calmly.

Minimize Danger to Employees

- Exit routes must be kept free and unobstructed
- Keep exit routes free of flammable materials and other hazards
- Emergency safeguards (e.g., sprinkler systems, alarm systems, fire doors, exit lighting) must be in proper working order at all times
- Know your evacuation route and assembly area



Storage and Safe Use of Chemicals

- Physically separate incompatible chemicals according to physical hazard class.
- Store in chemical storage cabinets or chemical refrigerators.
- Store chemicals away from heat sources and post signs on chemical storage areas.
- Store liquids in spill trays.
- Ensure all containers are in good condition, properly capped, and **labeled**.
- Never store chemicals on the floor.



Storage of Flammable and Combustible Materials

Flammables have flash points $< 100^{\circ}\text{F}$ (37.8°C).

- Store in approved containers in storage cabinets or designated areas.
- Store in well ventilated areas.
- Ensure fire extinguishers and/or sprinkler systems are in the area.
- Use only refrigerators designed for flammable liquid storage.
- Store away from strong oxidizers, direct sunlight, and heat sources, such as hot plates.

Storage and Safe Use of Corrosives

A corrosive substance is one that causes skin damage or is destructive to steel.

- Segregate acids from bases.
- Never add water to acid.
- Store liquid below eye level.
- Containers and equipment used for storage and processing of corrosive materials should be corrosion resistant.
- When handling corrosive chemicals:
Wear proper personal protective equipment and know the location of eyewash and safety shower.

Storage and Safe Use of Oxidizers

Oxidizing Agents are known to readily give up oxygen and are reactive to cause fire and explosion hazards.

Examples: hydrogen peroxide, nitric acid, sulfuric acid.

- Store with tight fitting screw-top lids, in a cool dry place.
- Store away from flammables, organics, and reducers.
- Know the reactivity of the materials you are working with in the experiment or process.
- Ensure there are no extraneous materials in the area that could become involved.
- If the reaction is anticipated to be violent or explosive, use shields or other methods for isolating the materials or the process.

Storage and Safe Use of Water Reactive and Pyrophoric Chemicals

Pyrophorics ignite spontaneously upon contact with air. Examples: silane, diethylzinc, sodium, some fine metals.

Water Reactives react violently with water. Examples: aluminum chloride, lithium, sodium, potassium, acid anhydrides, and acid chlorides.

- Stored in cool, dry, inert environments such as glove boxes.
- Ensure proper fire extinguishers are available and know the locations of safety showers.
- Never work alone with pyrophoric materials.

Storage and Safe Use of Peroxidizable and Unstable Chemicals

May form peroxides which may explode when the cap is removed. Peroxides can be formed even if a container has not been opened, necessitating careful handling. Examples: acrylic acid, diethyl ether, cyclohexanol, tetrahydrofuran

- Dispose of or check for peroxide formation after the recommended time: 3 months or one year, depending on the chemical.
- Do not open any container that has obvious solid formation around the lid.
- Store away from light and heat.
- Date all containers of explosive or shock sensitive materials upon receipt.
- If there is a chance of explosion, use barriers or other methods for isolating the materials or the process.



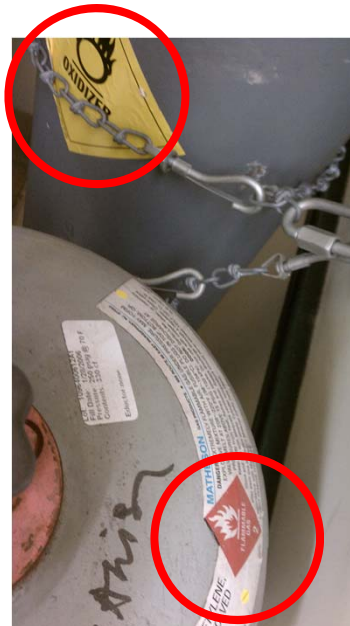
Storage and Safe Use of Cryogenics

Liquids and/or gasses capable of achieving very low temperatures: Typically liquid nitrogen, oxygen, and CO₂.

- Hazards include fire, explosion, pressure buildup, frostbite, and asphyxiation.
- Use proper PPE and rubber or wood tongs to remove materials immersed in cryogenics.
- Cylinders and dewars should not be filled to more than 80% capacity.
- Storage of radioactive, toxic, or infectious agents should be placed in plastic cryogenic storage ampoules.

Compressed Gas Cylinders

- Gas Cylinder Storage
 - Cylinders must be capped (remove regulators)
 - Cylinders must be chained
 - Oxygen must be segregated from flammables
 - 20 feet minimum
 - 1 hour fire rated wall
- Remove Old Cylinders
 - Cylinders must be tested every 5-10 years
 - NJIT pays a daily rental fee
 - Use a cylinder cart to move

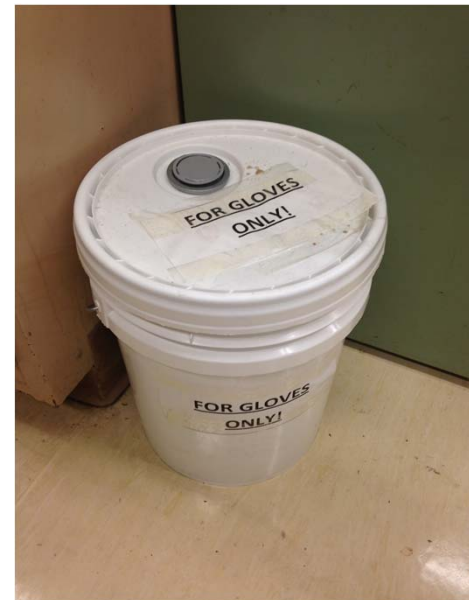


Waste Disposal

- Universal, hazardous and biological wastes have special procedures for proper disposal.
- It is important to properly dispose of wastes to ensure human and environmental health.
- NJDEP and USEPA regulates the wastes that are generated at NJIT.

Hazardous Waste

- Proper disposal of waste:
 - Separate gloves, paper towels, and regular trash, which is considered non-hazardous waste.
 - What to do:



Hazardous Waste

- Proper disposal of waste:
 - What not to do:



Hazardous Waste

- Proper disposal of waste:
 - Waste glassware which can be non-hazardous or hazardous can be put into the same container.

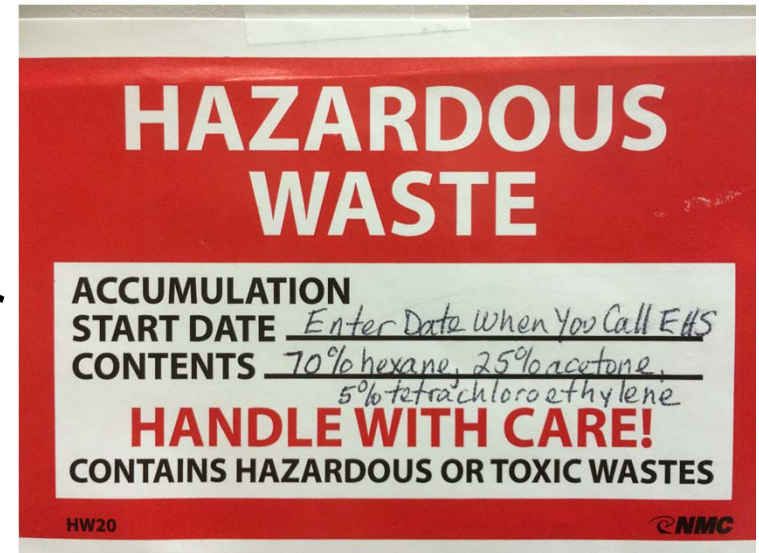


Handling Hazardous Waste

- It is responsible for all lab users to properly characterize the chemical waste generated in the lab. Consult the **NJIT EHS x3059** for assistance.
- Each lab must have a designated area for clearly labeled waste containers or bottles for accumulating waste.
- Use appropriate containers.
- Chemical waste may be mixed, only if compatible.
- When the waste container is full, move it to the designated waste storage site or contact the **NJIT EHS x3059**.

Labeling of Hazardous Waste

- Label all Hazardous Waste with content type
- DO NOT DATE the container until you contact EHS for a pickup
- Enter the PI name and room number
- The approximant amount (%) of each chemical is also helpful
- Segregate incompatible chemicals:
 - Toxic, Corrosive, Ignitable, Flammable, or Oxidizer



Hazardous Waste Disposal

For hazardous waste pick-up submit the hazardous waste removal form to EHS HealthandSafety@NJIT.edu

An EHS Student Manager will assist you.



WASTE REMOVAL REQUEST

Building: _____ Room#: _____
 Professor: _____ Contact Info: _____

| Contents: (Please be specific) Ex: 2 bottles – Methanol 1 box broken glass 1 drum 50:50 (name contents) | State of Contents: Ex: Solid, Liquid | Size of Container: Ex: Small box, 30 gallon drum, 5 gallon bucket | Location of Waste: (Please be specific) Ex: By the door, Under the hood, etc. |
|---|---|--|---|
| | | | |

LABEL ALL WASTE CONTAINERS WITH CONTENTS BEFORE SUBMITTING THIS FORM

If waste is not properly labeled on the container, waste will not be removed

DO NOT DATE WASTE

Hazardous and Non Hazardous Waste Labels are available in Spect Room 9

Submit this form and any other questions to:

healthandsafety@njit.edu

Phone Number: (973) 596 3059

Biological Waste

- Proper disposal of waste:
 - Medical waste that is used in an experiment such as gloves, chemical wipes and containers are put in the same container.



Nanoparticle Waste

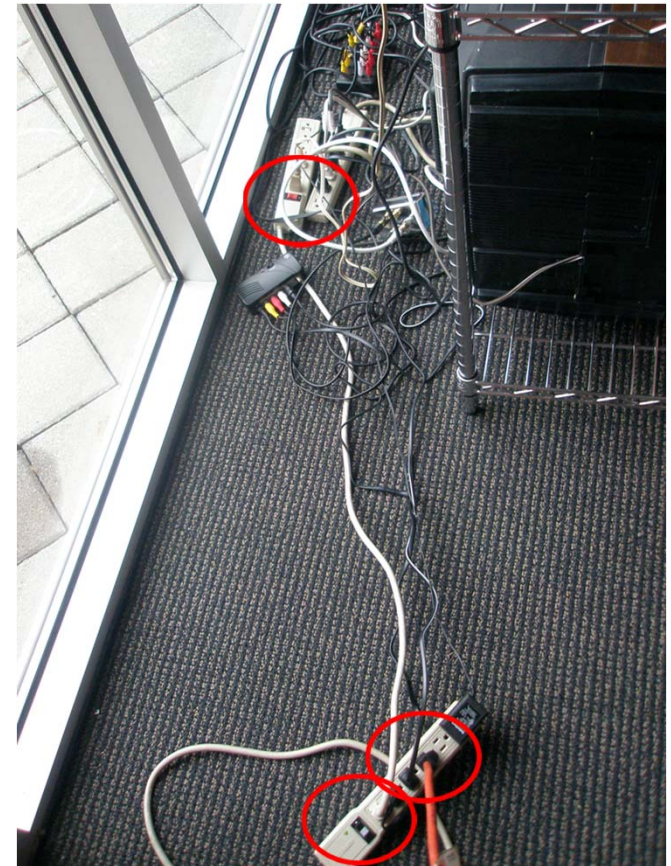
- Since the toxicology and environmental fate of nanoparticles is still largely unknown, all nanoparticle waste (solid material and liquids) should be conservatively managed as hazardous waste.
- This also includes any debris (i.e. PPE, plastic) that has become heavily contaminated with nanoparticles.
- All nanoparticle waste must be placed in an appropriate container and labeled. The label should indicate all constituents in the waste using a percent format; nanoparticles can be listed as “trace”.

Radiological Waste

- It is responsible for all lab users to properly characterize the waste generated in the lab.
Consult **NJIT EHS x3059** for assistance.
- Each lab must have an area with clearly labeled waste containers or bottles for accumulating waste.
- Waste is collected in the lab, and is clearly labeled and secured in containers. Do not mix radiological waste with non radiological waste.
- When the waste container is full, move it to the designated waste storage site or contact **NJIT EHS x3059**.

General Safety Rules

- NO unmarked or unsealed containers of any kind.
- Properly label ALL waste containers, identifying contents of all containers.
- No extension cords – surge protectors are permitted.
- Maintain adequate aisle space in and between labs (min 28”).
- All benches are cleaned and organized





**Work Safe
Keep Everyone Safe
Enjoy the Laboratory
Environment
at NJIT**

<http://www.njit.edu/environmentalsafety>