Standard Operating Procedure
BNC
PETS Reactive Ion Etcher (RIE 1)
Version 2008 September 19

I. Purpose
This Standard Operating Procedure (SOP) outlines requirements to be considered by an authorized user of the PETS RIE 1 as well as describes the normal operation of the RIE and any hazards that may be encountered during normal operation. Finally, the SOP explains how to minimize any hazards and how to respond in an emergency situation. This document is to be reviewed one year from the date of approval or as conditions warrant, whichever is the shorter time period.

II. Personnel
A. Authorized Personnel: The PETS RIE 1 may be operated only by authorized personnel who are fully cognizant of all safety issues involved in the operation of such a device. These personnel are to ensure that the RIE is only operated in the manner laid out in this document. To become an authorized user, one must:
   1. Complete Environment, Health & Safety (EH&S) training class.
   2. Take the baseline MicroLab (Cory Hall) Safety Orientation class
   3. Read and fully understand the SOP
   4. Receive training on the RIE 1 by an authorized user.
   5. Sign the authorized user sheet to affirm that the above steps have been completed.

B. Unauthorized personnel: No unauthorized personnel may enter the BNC clean room facility unless accompanied by an authorized user. All visitors must be briefed on proper safety protocol and must wear appropriate protective eyewear located on the premises.

III. Hazards
A. Electrical Hazards: electrical shock or electrocution could result from direct contact with high voltage. Such hazards are typically interlocked by the RIE system. High voltage RF electrode and conductors are located inside the RIE system chassis. In addition, the external RF power supply unit has connections behind the RF power supply chassis. Do not disconnect the external RF lines. Use normal precautions with external house (110VAC) connections behind the RIE chassis.
C. **Chemical**: Bottled gases are used with the RIE. Do not disconnect or tamper with gas lines behind the RIE.

D. **Pressure Hazards**: Pressurized bottled and house gases are used with the RIE. Do not disconnect or tamper with gas lines behind the RIE. Contact lab management for information.

E. **Other**: UV radiation is generated and emitted through the RIE chamber viewing port. Wear protective eye wear when looking through the chamber view port.

**IV. Hazard Controls**

A. **Electrical**

1. Enclosures for protection against the high voltages of the RIE or RF power supply may only be removed after the power supply has been unplugged from the outlets and after following the safety procedures outlined in the safety and operations manual provided by the manufacturer.

2. Only qualified personnel may perform all internal maintenance to the RIE and more than one user must be present when performing said maintenance.

3. Every portion of the electrical system, including the printed circuit cards, should be assumed to be at dangerous voltage level.

C. **Chemical and Pressure**

1. Enclosures for protection against valves and internal gas plumbing may only be removed after the system has been turned off and gases have been valve off and relieved of line pressure.

2. Only qualified personnel may perform all internal gas maintenance to the RIE and more than one user must be present when performing said maintenance.

D. **Other**

1. Proper eye protection must be worn at all times in the clean room and while operating the RIE.
V. Normal Operation

A. Inspect all electrical and water connections for damage and connectivity.

B. Complete the “check-in” log.

C. Turn RIE system on (If it is off).
   1. Turn on the vacuum pump in the service corridor (The vacuum pump is normally left on at all times). Allow the pump to run for at least 30 minutes to stabilize, if it was off.
   2. Turn on the RIE system (switch on back of system and the emergency shut off shut be up).
   3. Turn on the RF power supply (switch on front panel)
   4. Turn on the gases in the service corridor (tank valve and the line valve). Do not adjust the gas regulators. Regulated gas pressures should not exceed 10 PSI. If the tank pressure is noted to be below 100 PSI, lab management should be immediately notified to order another tank. The utility gases (CDA and nitrogen) should always be on and should not be adjusted.
   5. Turn on computer (If it is off).

D. Select PETS RIE icon. This will initialize the RIE system.
   1. Check that the vent and chamber vacuum pump valve indicators are closed.
   2. Check that the gas manifold valves for mass flow controller indicators are closed.
   3. Check that the RF indicator is off.
   4. Note that if any chassis panels are off or the chamber is open, the interlock indicator will be red.

E. Perform desired RIE operation using manual or automatic recipe mode. Consult User’s manual for recipe development and loading.

F. When usage of RIE is complete, vent valve should be closed and the RIE chamber pumped down to the base pressure. Main vacuum pump gate valve should be closed (to prevent oil back streaming).

G. Shut down the RIE system.
   1. Turn off the RF power supply (switch on front panel).
   2. Turn off the gases in the service corridor (tank valve and the line valve). Do not adjust the gas regulators. Regulated gas pressures should not exceed 10 PSI. If the tank pressure is noted to be below 100 PSI, lab management should be immediately notified to order another tank. The utility gases (CDA and nitrogen) should always be on and should not be adjusted.
3. Turn off the RIE system (switch on back of system and the emergency shut off shut be up).
4. Do not turn off the vacuum pump.
5. Turn off the computer.
6. Complete the user log sheet.

VI. Emergency Procedures

A. RIE accidents: Notify lab management and PI immediately.

B. Power outage: If there is a power outage, turn off the RIE per the RIE shut down procedure to avoid a hazardous situation when power is restored.
**Authorized Users**
I have read and understood the Standard Operating Procedures for RIE 1

<table>
<thead>
<tr>
<th>Name (print)</th>
<th>Signature</th>
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<th>PI Initial</th>
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Appendix A – In case of medical emergencies, consult lab safety protocol or lab safety plan.

In the event of a RIE accident, follow the procedure below:

1. Ensure that the RIE is shut off.

2. Provide for the safety of the personnel (first aid, evacuation, etc.) as needed.

3. Obtain medical assistance for anyone who may be injured.

<table>
<thead>
<tr>
<th>UC Optometry Clinic (Normal Hours)</th>
<th>642-2020</th>
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<tbody>
<tr>
<td>UC Optometry Clinic (24 Hour Emergencies)</td>
<td>642-0992</td>
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<td>University Health Services (Emergency)</td>
<td>642-3188</td>
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<tr>
<td>Ambulance (urgent medical care)</td>
<td>9-911</td>
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4. If there is a fire, pull the alarm, and contact the fire department by calling 9-911. Do not fight the fire unless it is very small and you have been trained in fire fighting techniques.

5. Inform the Office of Environment Health, & Safety (EH&S) as soon as possible.

6. During normal working hours, call the following:

| EH&S Office                  | 642-3073 |
| BNC Safety Officer           | 666-3356 |
| EH&S Health & Safety Manager | 642-3073 |

After normal working hours, call 642-6760 to contact the UC Police Department who can contact the above using their emergency call list.

7. Inform (PI NAME) and the BNC safety officer as soon as possible. If there is an injury, (PI NAME) will need to submit a report of injury to the Worker’s Compensation Office.

8. After the incident, do not resume use of the RIE system until the lab manager and EH&S has reviewed the incident and approved the resumption of research.