**Using small-angle scattering X-ray generator (SAXSess Lab)**

**Procedure:**

**School/Department:** School of Molecular Bioscience

**SOP prepared by:** Jill Trehwella, Nick Coleman

**Version:** SMB027.3

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**Section 1 - Personal Protective Equipment**

1. Lab coat or lab gown
2. Proper enclosed footwear
3. Hair tied back if long

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**Section 2 – Potential Hazards + Safety precautions**

1. The X-ray equipment is hazardous. Do not use it unless you have been personally instructed by the equipment custodian, and you have been added to the qualified users list. This list can only be amended by Professor Jill Trehwella. Just reading this SOP is not sufficient to allow safe use.

2. X-rays can cause burns and DNA damage leading to cancer. Read the risk assessment for X-ray equipment and ensure you understand the risks and how to control them during this procedure.

3. No safety circuits (Figure D) may be disabled or bypassed except during maintenance procedures under the supervision of qualified maintenance personnel designated by Professor Jill Trehwella.

4. The X-ray equipment contains very high voltages, and thus possibility of electric shock if equipment is faulty or misused. Inspect equipment before use to ensure everything is in good working order, and take precautions to avoid the possibility of water spills in the room.

5. Workers with pre-existing medical conditions (e.g. allergy, immunocompromised state, chemical sensitivity) and workers who are pregnant or expecting pregnancy must consult with their supervisor AND medical specialist AND the university's WHS services before performing this procedure. If there are any serious concerns expressed by any of these individuals, this task must not be performed.

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**Section 3 – Equipment and Procedure**

1. Equipment: Panalytical PW3830 X-ray generator located in Room 282 (SAXSess Lab) connected to an Anton Paar SAXSess small-angle X-ray scattering instrument – Figure A (next page). The SAXSess system, generator and X-ray source (cathode tube) are a completely sealed system. The chiller is located in room 285.

**Powering up:**

2. Press POWER ON and wait for two minutes for the unit to self-check.

3. Turn the HT ON Key (clockwise) and wait for two minutes. The system should indicate a setting of 20kV/10mA (Standby mode). All LED indicators (Figure B) should be off except the Shutter safety circuit (X-rays on lam should be illuminated (Figure D.).

4. Slowly increase voltage from 20 kV to 25 kV by pressing the left side + button (once every three seconds – Figure B). Wait for 1 minute. Repeat process with 30 kV, 35 kV until 40 kV is reached.

5. Slowly increase to current from 10 mA to 20 mA by pressing the right side + button (once every three seconds (Figure B)). Wait for 1 min. Repeat process with 30 mA, 40 mA until 50 mA is reached.

6. Ensure both of the black vacuum valves are closed (vertical position) See Fig A and C. Check the vacuum controller; if nothing displays on the screen, turn on the switch from the backside of the controller and wait 30 seconds for vacuum to calibrate. Once complete, press the ‘Start/Stop’ button to start the pump.

7. Fill out the generator log book (Figure C) – User and hours.

**Using the X-rays:**


9. Load sample cell.
10. Close sample cell.
11. Evacuate camera – it is impossible to open the shutter unless the camera(s) are under vacuum.
12. Dual button shutter control is required to open either Shutter 1 or Shutter 4. Press ‘Shutter open enable’ button in combination with ‘Open’ (Shutter 1 or 4.) (Fig B).
13. To close shutter: Press Close (Shutter 1 or 4). Figure B.
14. Experiments are run through CCD QUANT software. After sample loading, there is no need to touch the unit other than to open or close the shutter.

**Powering Down:**
15. Ensure that that BOTH cameras are under vacuum. Close both the vacuum valves (Figure A). Press the vacuum controller Start/Stop button to stop the pumping and turn off the vacuum controller from the backside.
16. Slowly decrease the current by pressing the right side – button (once every three seconds) until the current is 10 mA (Figure B).
17. Slowly decrease the voltage by pressing the right side – button (once every three seconds (Figure B)) until the voltage reads 20 kV. The system will be in standby mode (20 kV/10 mA). Fill out generator log-book (user and Hours)
18. The system is usually kept in standby mode. If there is a requirement to shut the system down:
19. When in standby mode turn the HT key anticlockwise to the OFF position.
20. Press the OFF button to shut the system down.

**Section 4 – Disposal / Spills / Incidents**
1. Any incidents that involve injuries to personnel need to be reported immediately to your supervisor and via the online reporting system. Near misses (situations that appear hazardous) should also be reported in the same way.

**Section 5 – Repairs / Certification / Validation**
1. Repairs and annual maintenance of the SAXess is performed by Anton Paar,

**Section 6 – Relevant safety data sheets**
Not applicable.

**Section 7 – References**
1. Risk assessments for X-ray equipment
2. Instruction manuals for SAXSess equipment
**Figure A** – SAXSess & PW3830 X-ray generator setup located in room 282.

**Figure B** – PW3830 X-ray generator located in room 282.

**Figure C** – PW3830 X-ray generator instructions and log book. The log book must document every user who has powered up/powered down the X-ray generator, the time and instrument hours. Located in room 282
X-ray generator Safety Circuits. Instrument will not enable shutter operation if any of these circuits are disabled. Instrument will not operate if vacuum has not been enabled.

X-rays on/Rayons on lamp illuminated when high voltage is applied through generator. Two other safety circuits are present (not shown) – a) sample cell holder must be closed to enable the shutter; b) camera lid must be closed to enable shutter.

**Figure D** – Safety circuits – to be changed by AUTHORISED personnel only

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**Laboratory Induction Manual**
(Posted inside door, SAXSess lab (Rm 282).)

**Other Posted Forms**
(Rm 282)

- SOP Summary
- Emergency Assist contacts
- Incident reporting (forms)

**ALL users MUST** read these materials prior to their first experiment. This includes SAXSess and wet-lab safety protocols.

**Figure E** – SOP and documentation – Posted in SAXSess lab.

<table>
<thead>
<tr>
<th>Primary Qualified Training Personnel</th>
<th>Trained Personnel</th>
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<tbody>
<tr>
<td>Prof. Jill Trewhella</td>
<td>Paul Fitzgerald. (Chemistry)</td>
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<tr>
<td>Don M. Parkin</td>
<td>Naveed Nadvi</td>
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<td>Ann Kwan (power up and down only)</td>
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**SOP Consultation, Training and Approval**

Print names and enter signatures and dates to certify that the persons named in this section have been consulted/trained in relation to the development and implementation of this Standard Operating Procedure. WHS Representative (WHS Committee) certifies that consultation has taken place.

<table>
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<tr>
<th>Position</th>
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**Name Authorising (Printed):** DIANNE FISHER ..........................................................

**Signature:** .................................................................**Date:** 2/3/15 .........................

**WHS Committee Representative Name (Printed):** MARKUS HOFER .................

**Signature:** .................................................................**Date:** 2/3/15 .........................