**Local Rules for the use of**

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| **Manufacturer**  **Model**  **S/N: Serial Number** | |
| **RUA No.** | **Asset Number** |

**Instructions – delete the box when you are done**

* Please address all the points in RED
* Whenever there is ### you must adapt the text to suit your need

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# Introduction

The purpose of these Local Rules is to set out the key arrangements for restricting exposure to ionizing radiation from work with radiation-producing equipment. The Local Rules have been written in compliance with article (57) of the General Instructions on Protection against Ionizing Radiation in the Kingdom of Saudi Arabia (2007).

## **Purpose**

The purpose of the Local Rules is to describe the operation for safe use of all equipment which contain sealed radioactive sources such as gas chromatograph, liquid scintillation counter, etc.

## **Potential Hazards & Risk Assessment**

Please adapt point 1 to the specific emission from the sealed source enclosed in the equipment.

Failure to follow these Local Rules may results in exposure to:

1. **Beta radiation –** The system is equipped with a Ni-63 source which releases beta particles with energies up to 65.87 keV. Beta particles at these energies have little penetrating power; most particles will be stopped by the surface layer of the skin or few sheets of paper. So this source does not present external radiation hazard. However, the source can be hazardous if the radioactive substance is ingested or inhaled.
2. **Electrical hazard –** In order to produce an x-ray beam the device requires a high voltage. The device should be grounded appropriately and the high voltage power supply should be lifted from the ground by approximately 5 cm to avoid being in contact with water in case of flood.
3. **Chemical hazard –** In some cases, chemicals are used as part of the procedure and all safety recommendations should be followed, including the use of all required personal protective equipment. See [Lab Safety Manual](https://hse.kaust.edu.sa/Services/Pages/LabSafetyManual/Introduction.aspx) for more detailed information.
4. **Compressed gases –** In some cases compressed gases are used as part of the procedure. Please ensure that all gas bottles have the appropriate regulator and are secured to a wall or bracket. For more information see the Compressed Gas Standard (see [Compressed Gas Standard](https://hse.kaust.edu.sa/Services/PublishingImages/Pages/labsafety/Compressed%20Gas%20Standard.pdf)).

## **Area Designation**

Laboratories where equipment which contain sealed radioactive sources are designated as Non-Designated Area. There is no special restriction on access to the Non-Designated Area but the equipment should be marked with a radiation hazard trefoil sign. In addition, only authorized users, who have gained permission through training, are allowed to operate the equipment.

# Training

It is the responsibility of supervisors and/or PI to ensure that their students, postgraduates, research scientists, etc. are adequately trained in the safe use of ionizing radiation prior to the commencement of the work. The required safety training course that users must undertake is: HSE-124 “Radiation Safety Training” as well as practical operation training for the equipment.

Upon completion of these trainings, and acceptable score on the written examinations, users can ask their PI or LSR to add them on the authorized users list. Note that for Core Lab and few other labs, authorized users will be added to the Badger System.

Training can also be taken [online](https://blackboard.kaust.edu.sa/webapps/login/) or arranged on demand with the Research Safety Team ([researchsafety@kaust.edu.sa](mailto:researchsafety@kaust.edu.sa)).

# Personnel Monitoring

## **Staff Designation and Dose** **Limits**

All users of the radiation-producing equipment which have an enclosed and shielded x-ray beam are regarded as non-classified workers; i.e. the general public dose limits and accepted dose limits apply to them. The article (80) of the general regulations states the annual dose limits for members of the public. A summary of these limits is shown in Table 2.

**Table 2.** Non-classified workers radiation dose limits set by K.A.CARE and accepted dose levels set at KAUST.

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| --- | --- | --- |
|  | **Non-Occupational worker and General Public** | **Non-occupational exposure accepted level set at KAUST** |
| **Whole Body** | 1 mSv/year | 1 mSv/year |
| **Lens of the eye** | 15 mSv/year | 15 mSv/year |
| **Extremities** | 50 mSv/year | 20 mSv/year |

For staff members, designated as non-classified workers, accepted dose limits are set (see Table 2). The accepted dose limit is a specified level of radiation dose received by a worker above which a formal investigation will be undertaken by the RSO in order to ensure that exposure to ionizing radiation is being restricted as low as is reasonably achievable.

The article (51) also sets an exposure limits for the fetus of pregnant women to 1 mSv from the declaration of the pregnancy.

## **Personnel Monitoring**

Workers using equipment containing sealed radioactive source in Non-Designated Area are not expected to receive a radiation dose above background level because of the nature of the source and the engineering controls in place. As a result, they do not require personal dosimeters. However, the equipment is subject to area dosimetry monitoring to confirm that non-occupational workers are unlikely to exceed the accepted dose levels set at KAUST. All dose records will be kept on file.

## **Pregnant staff**

Whilst pregnant workers are not generally banned from working with devices producing ionizing radiation, it is extremely important that female members of staff and students are informed of the importance of declaring any pregnancy. Only after such declaration can steps be taken to restrict any exposure of the fetus to ionizing radiation.

For the majority of mothers-to-be, there will likely be no requirement to alter their work activities / research practices involving ionizing radiation.

# Maintenance Plan

A Maintenance Plan has been submitted to the RSO and should include the following:

* General maintenance of the equipment shall be carried out only by manufacturer’s engineer or authorized users who have been trained to perform these maintenances on the equipment (e.g. beam alignment, filament replacement, vacuum pumps checks, etc.). However, authorized users are not allowed to work with open x-ray beam;
* A service engineer from the manufacturer’s equipment or sub-contractor may be contracted if work on open x-ray beam are required.

# Safety Measures

## **Safety Features**

The equipment which contain a sealed radioactive source should be fitted with radiation protection features. Understanding these features is the most important step to ensure radiation safety. Note that the list below includes most safety features and that some equipment may not be fitted with all of these.

* Housing - The radioactive material is firmly enclosed in a capsule or housing designed to prevent release and dispersal in the environment of the radioactive material.
* Training - Users shall not operate the equipment unless they have been trained to do so.
* Leak Test - Leak test are performed at regular time interval to ensure the integrity of the source.
* Enclosure - It houses the samples and prevents accessing the sealed source. The enclosure is constructed of appropriate materials (e.g. steel, lead, lead glass, etc.) to attenuate emitted radiation.
* Service/disruption Notice - When a user finds a problem of operation or safety, he/she must shut down the unit, put a notice in front of the unit and then inform the LSR or PI. When users find a warning notice has been placed on the equipment, DO NOT use that unit until you are told it is safe to use by the LSR, PI and/or RSO.
* Maintenance - Regular maintenance of the system by KAUST staff and/or manufacturer’s service engineers ensure that the radiation-producing equipment operates safely.

## **Systems of Work**

**Access to the area**

* All persons must observe notices at the entrance to the Non-Designated;
* Access to the laboratory may be restricted via card reader access or pin-coded door;
* Some equipment may have their access restricted via log-in code;

**Protection of staff and visitors**

* Only authorized users may operate the radiation-producing equipment;
* The person operating the radiation producing equipment is responsible for the safety of others who work in the area;
* When entering the room follow the lab safety plans policy toward PPE use;
* Users MUST NOT defeat the safety interlock and expose themselves or any other person to radiation;
* If you are pregnant, then you are encouraged to notify the RSO, in confidence.
* Notify the LSR, PI and RSO immediately if there is any reason to believe that any person may have been exposed to radiation accidentally.

## Standard Operating procedures

These can be found in a separate document that is kept in the lab.

# **Emergency Procedures**

Use as it is for *SEM/TEM or X-ray Analysis Equipment - For* CT/Irradiator just keep the points that apply to the device.

## **Radiation Incident**

Where a radiation accident is accompanied by serious personal injury, treatment of the injury takes precedence over equipment fault. However, it is necessary to turn off the system. Immediate medical assistance can be obtained by dialing 911 from a landline or 012 808 0911 from a mobile phone.

Please follow the steps below:

1. In an emergency interrupt the x-ray emission by hitting the Red emergency stop button, or turning the key switch off.
2. Deal with life threatening conditions first. Summon someone trained in First Aid if necessary.
3. Stabilize the Situation: If possible, return to the radiation-producing equipment, ensure it is switched off and that the x-ray source is electrically isolated.
4. Prevent Access: Ensure that no one is able to restart the x-ray generator. Post appropriate warning messages on the machine and remove the keys.
5. Contact your LSR, PI and RSO and let them know what has happened. If the equipment has been damaged in any way seek advice before using the equipment again.
6. After the incident has been satisfactorily dealt with you will need to report the incident using the university’s accident reporting system ([Report it](https://apps.kaust.edu.sa/sites/reportit/Pages/InitialForm.aspx)).

## **Oven or detector heated zone go into thermal runaway**

*Point 6.2 only applicable to Gas Chromatograph for other equipment containing sealed source include possible emergency procedure (if none jus delete 6.2).*

If the oven or detector heated zone go into thermal runway (i.e. uncontrolled heating in excess of 400°) and the detector remains exposed to this condition for more than 12 hours this can damage the sealed radioactive source. If this situation occurs please follow the steps below:

1. Turn off the system and allow it to cool down to room temperature.
2. Cap the inlet and exhaust vent openings using disposable gloves.
3. Place a warning notice on the equipment “DO NOT USE – EQUIPMENT FAULT”.
4. Contact your LSR, PI and RSO and let them know about the issue.
5. The PI/responsible person will then contact the manufacturer for advice and repair.

## **Laboratory Fires and Explosions**

In the event of a fire or explosion affecting the laboratory, local area fire drill procedures should be followed.

Please follow the steps below:

1. In an emergency interrupt the x-ray emission by hitting the Red emergency stop button, or turning the key switch off.
2. Call the Fire Department and inform the Lab Manager and Research Safety Team.
3. Prevent Access: Ensure that no one is able to restart the x-ray generator (e.g. by removing the key).
4. Evacuate the laboratory according to the local area fire drills.
5. Report: After the incident has been dealt with in a satisfying manner you will need to report the incident using the University’s accident reporting system.

It is considered radiologically safe for emergency services to enter Non-Designated and Supervised Areas where radiation-producing equipment are used. However, due to the other hazards present in the lab, chemical suits and breathing apparatus may need to be worn when entering these areas.

**Document History**

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| **Revision #** | **Details of Significant Changes** | **Date (dd/mm/yyy)** |
| 0 | First version | 28-Aug-2018 |
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