Local Rules
TS2 Target Station

Ionising Radiations Regulations 2017

Science & Technology Facilities Council
ISIS Neutron and Muon Source

Reference	LR-ISIS-TS2		
Date	January 2025	**Date of next review**	In accordance with IROC
Designated Areas External radiation (incl. activated materials) and radioactive contamination	Controlled Areas The entire target station is a controlled area due to the potential for dose rates in excess of 7.5 µSv/h in accessible areas. The area beyond the change barrier is designated as contamination controlled areas: The area beyond the change barrier. Layout of controlled areas is included in Section 4 of these local rules. Additional contamination controlled areas may be designated during specific tasks in accordance with Written arrangement 3. Supervised Areas The area between the target station entrance and change barrier is a contamination supervised area.		
Nature of Hazard	Beam on: External γ/n hazard within the target station and tunnels. Potential for β/γ surface contamination beyond change barrier. Beam off: External β/γ hazard exists from activated components and components containing activated materials. Localised β/γ surface contamination present in specific areas inside the target station and potentially generated during specific strip-out tasks. Potential for airborne β/γ activity during TS1 strip-out.		
Dose investigation levels	Classified persons: 3 mSv Non-classified persons: 1 mSv Daily action level (all persons): 200 µSv		
Written Arrangements	The following written arrangements must be observed: 1. General requirements for access to target station. 2. Removal of items from RHC and TSA 3. Designation of temporary restricted areas Diagrams: 4. Layout of controlled and supervised areas		

				Signatures
RPS	Julius Bullock	x6459	mob 07796 937729	
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RPA	Mark Bradley	x5492	mob 07922 197171	
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The management arrangements for radiation safety within STFC are detailed in STFC Safety Code 29

Incident Procedures and Contingency Plans

In the event that any element of the following contingency plans are enacted, the incident must be reported using SHE Assure and the RPA must be informed. All notified incidents will be investigated.

Nothing in this plan precludes action which needs to be taken to save life or assist an injured person. However, where such action is required in the presence of high radiation dose rates or radioactive contamination, this should be done under radiation protection supervision where possible.

During enactment of a contingency plan, the advice of the RPA can be sought at any point.

a. Fire

Do not panic. Smoke/fire present a far greater risk than exposure to foreseeable levels of radiation/contamination in the target station.

On discovering a fire:

i. Shout to alert people nearby and break nearest *break glass* point to sound alarm.

ii. Leave the building by nearest exit, go to the assembly point and remain there until further instructions are given. See "Evacuation" below.

iii. Notify ISIS Duty Officer (01235 44 6789) and RAL Site Security (01235 77 8888) of the location of the fire and any additional details of the current radiation hazard that would be relevant to the attending emergency services.

On hearing the fire alarm:

i. RPS to obtain information from the MCR on the status of the alarm and location of the fire.

ii. Secure any radioactive material if it is safe to do so. DO NOT SIGNIFICANTLY DELAY YOUR EXIT.

iii. *Evacuation from outside the change barrier - No PPE*:

- Leave building by the nearest exit, go to assembly point D (between R55 and R80) and remain there until further instructions are given.

iv. *Evacuation from inside the change barrier - Wearing PPE*:

- If leaving the TSA, air hoods and outer gloves can be removed as you leave.
- If leaving the RHC, air hoods and outer gloves can be removed once inside the South Tunnel.
- If you are informed by the RPS/MCR that there is sufficient time and you are confident to do so, continue via the standard TSA departure route via the change barrier, and proceed to assembly point D.
- Unless you are certain (having been told by the RPS/MCR) that you have time to follow your usual exit via the barrier, exit through the break-out doors. Put a pair of overshoes (available at the cage) over your existing PPE as you leave.
- Proceed to assembly point D in your PPE. Maintain a short distance away from others, and await HP support. Warn others to keep clear.

v. *In the event of a confirmed false alarm*, you may exit as normal.

At the assembly point:

vi. RPS to inform the building warden and the ISIS Duty Officer (01235 44 6789) of the presence of radioactive materials or other relevant hazards e.g. open Dolavs open storage flasks.

vii. Health Physics Section/Team Leader and RPS to communicate directly with RPA on the status of any radioactive materials in the TSA, in anticipation of the arrival of the emergency services. HP survey data to be made available.

viii. On arrival of the emergency services, RPA to liaise as necessary with the Incident Commander.

Before returning to the area:

ix. If the fire has affected the area to any extent, the advice of the RPA must be sought before allowing

people to return to the area. Health Physics radiation and contamination monitoring will be carried out to inform any advice given.

x. If personnel escaped wearing PPE, Health Physics must retrace the evacuation route, performing necessary contamination measurements and undertaking remedial actions to deal with any contamination spread outside the TSA as a result of the evacuation.

b. Loss or theft of radioactive materials

If any radioactive materials, items of waste, or activate machine components cannot be accounted for:

i. Perform an immediate physical check on all radioactive sources within the Isostock location to confirm the loss and identify whether other sources are missing. A description should be prepared of the missing materials.

ii. Inform the RPS, RPA, ISIS Duty Officer (01235 44 6789) and RAL Site Security (01235 77 8888).

iii. Continue to search for the missing materials until the RPA has confirmed that the search can be stopped.

iv. The RPA will advise if statutory authorities need to be informed and on additional Health Physics actions.

c. Discovery of radioactive contamination

This may arise from damage to activated materials or spread of radioactive contamination from an area in which it has been controlled by containment. Spills from cooling water circuits are addressed in (d).

i. Contact the ISIS Duty Officer and RPS immediately, noting if personal contamination may have occurred. Get someone else to call if there is a risk of contamination.

ii. Do not take any action that would spread radioactive contamination outside the immediate area. Do not touch or move equipment that may be contaminated. Make a mental note of where spread may have occurred. Until assistance arrives, instruct others to stay away.

iii. If personal contamination is suspected, keep the individual stationary and contact the RPS or ISIS Duty Officer (01235 44 6789) for advice.

iv. The RPS will contact Health Physics and the RPA to check for contamination and will maintain an exclusion zone until they arrive. In the specific case of suspected damage to a sealed source, contact Health Physics to perform a repeat leak test of the source.

v. The RPA will advise if statutory authorities need to be informed and on subsequent actions.

d. Water leaks/puddles

Note: These procedures apply only to a water leak from the target cooling circuit. A spill of water from other circuits, could not cause a significant exposure under reasonably foreseeable conditions.

In the case of a spill from the target cooling circuit:

i. Do not approach close to the area. All actions taken in the immediate vicinity of the contamination should be carried out wearing appropriate PPE: double gloves, overshoes, and disposable coveralls.

ii. Contact the ISIS Duty Officer (01235 44 6789) and ask them to contact the RPA, RPS and Health Physics; requesting the immediate assistance of Health Physics.

iii. Do not take any action that would spread radioactive contamination outside the immediate area. Do not touch or move equipment that may be contaminated. Make a mental note of where spread may have occurred. Until assistance arrives, instruct others to stay away.

iv. Without placing yourself at risk of contamination:
   a. Attempt to identify the source/location of the leak.
   b. If pooling of water is continuing, place absorbent sock around the spill.

v. If personal contamination is suspected remove contaminated items of clothing and place to one side to be dealt with by Health Physics as radioactive waste.

vi. Health Physics will enact their own written arrangements for dealing with the incident.

vii. In the event of significant (more than 10 ml) water contamination of the skin, initially dab the affected area dry with absorbent tissues/towel, taking care not to cause further bodily contamination. In particular, take care not to spread contamination to the eyes, nose or mouth. The contaminated areas of skin should then be washed thoroughly, taking care not to abrade the skin.

viii. The RPA will advise on subsequent actions and whether statutory authorities need to be informed.

e. Damage or reduction of radiation shielding and failure of radiation protection systems

Any suspected damage or reduction of radiation shielding (either deliberate or accidental) must be reported to the RPS and RPA immediately.

In the event of failure of any of the installed safety features (interlocks, emergency stops etc.), the ISIS Duty Officer (01235 44 6789) must be informed immediately. All operations to the area must cease and the RPS and RPA must be informed immediately.

Any failure of control systems identified during commissioning or cycle start-up must be remedied before generating the beam.

f. Loss of ventilation

Suspend work. Notify MCR. Instate particulate and tritium air sampling equipment before work continues. If airborne activity excess of stated sampler hold points, stop, retire from the area and consult RPA. If ventilation cannot be quickly re-established, RPA will advise on measures required to continue work, including need for RPE (air-hoods).

g. Failure of PPE

In the event of PPE failure, cease work and immediately retire from the TSA. Obtain Health Physics support. If personal contamination is suspected, follow appropriate contingency plan. Health Physics will implement their own written arrangements for dealing with the incident.

h. Elevated radiation levels and/or contamination

If accessible radiation or contamination levels are identified that exceed those expected or detailed within the local rules, the RPS must be informed, and the advice of the RPA obtained. In the event that:

- Accessible radiation levels outside the target station exceed 7.5 μSv/h (whole body) or 75 μSv/h (extremities) or any other reference levels specified in these local rules, **and those levels are higher than expected for the area** (c.f. levels recorded in the TSA RRA), then the RPS should be informed. The RPS will contact the RPA if radiation levels are higher than expected for the area.

  or

- Contamination is identified outside the demarcated area (the contamination controlled area), restrict all access to the area. Inform RPS, MCR and RPA. At the same time, check all persons currently inside/near the area for personal contamination as they are asked to retire. Extensive contamination monitoring to be carried out to confirm the extent of the contamination spread. Note that indirect methods (wipe to probe) must be adopted due to the high gamma background in the area. Area and personal contamination to be dealt with in accordance with Health Physics written arrangements.

i. Exposure or contamination of persons and high radiation levels

Anyone who considers they may have received a significant radiation exposure (**including a cumulative annual exposure in excess of the STFC dose investigation levels on page 1 of these local rules**) should notify the RPS as soon as possible. The exact details (source of exposure, distances, exposure times, part of body, witnesses etc.) should be recorded and the advice of the RPA sought.

Anyone who considers they may be contaminated should seek the immediate assistance of Health Physics. Workers in the immediate vicinity should be informed if a contamination hazard is thought to exist. Health Physics will implement their own written arrangements for dealing with the incident.

j. Accidents, injuries & illness

In the event of personal injury, follow general first aid requirements. Do not rush and do not delay the administration of first aid because of radiological hazards. The foreseeable levels of radiation and contamination in the occupied areas of the target station do not warrant any delay to potentially life-saving treatment.

i. Notify the RPS and ISIS Duty Officer (01235 44 6789) who will summon a first aider and the emergency services as appropriate.

ii. If the person can be safely moved without exacerbating their condition, move them to a low dose rate and uncontaminated area. Otherwise, do not attempt to move them. If they are unconscious, take advice from a first aider before moving them. The RPA should be consulted on potential exposures when providing first aid in situ.

iii. Where a dose rate hazard exists:

   a. If first aid is required in situ, the RPA should be consulted if the instantaneous dose rate in the area exceeds 100 μSv/h.

   b. The RPS should monitor the dose accumulated on the casualty's electronic dosemeter, informing the RPA if exposures exceed the ISIS daily action level, and subsequently if they exceed a relevant dose investigation level.

iv. If radiological contamination is suspected:

   a. Request that Health Physics attend to deal with the contamination. Health Physics staff should remain in attendance to assist paramedics.

   b. If first aid is required in a contaminated area, the RPA should be consulted. The RPS should monitor the dose accumulated on the casualty's electronic dosemeter.

   c. Assist the first aider or paramedic in getting into PPE. If there is an immediate risk to life (e.g. seizure, suspected heart attack, stroke, etc.) then minimal PPE should be worn. The radiation risk is not sufficient to require the delay of potentially lifesaving treatment, particularly with Health Physics monitoring support.

v. Attending first aiders or paramedics must be provided with an electronic dosemeter and be supervised by the RPS at all times. The RPA should be contacted to provide information and instruction to the paramedics relevant to patient management and personal safety.

vi. Health Physics will implement their own written arrangements for dealing with the incident

k. Crane or electric tug failure

In the event of crane failure leaving a loaded transfer flask hanging, high dose rates may exist in the generally accessible areas of R55. In the event of electric tug failure, very high radiation levels may exist in the tunnel, target station and wider R55 hall, particularly if the failure occurs before the main flask lid has been fitted.

Access to be restricted to any area where dose rates exceed 7.5 μSv/h. This may be a wide area of the Hall. Contact RPA and Health Physics. Flask recovery will be planned, in accordance with ISIS daily action levels, or such higher dose constraint specified by the RPA.

l. Perceived inability to comply with the local rules

If it is considered that compliance with the local rules is not possible for any reason, work must be suspended the RPS must be notified. The RPS will seek the advice of the RPA, and the risk assessment and radiation safety procedures must be reviewed and agreed accordingly before work continues.

m. Failure to follow procedures

The RPS must be notified of any breakdown in procedural controls whether or not it resulted in significant exposure or loss/damage to a source/equipment. For example, the use of the facility or access into controlled areas by unauthorised persons. The RPS will investigate all notified incidents to review whether existing procedures remain sufficient. RPA advice should be sought.

n. Inadequate controls identified

If it is identified that potentially significant radiation/contamination risks might exist that have not been adequately assessed as part of the risk assessment, the RPS must be notified. The RPS will seek the advice of the RPA. The risk assessment and radiation safety procedures must be revised as necessary before work continues.

Note also the requirements of paragraph (f) above.

1. Written Arrangements: General requirements for access to the target station

i. Only those persons who have been individually authorised by the responsible manager for the relevant area are permitted to enter the target station. Authorisation is conditional on satisfactory completion of the ISIS radiation safety training. Further to this, practical induction training (covering the local rules, relevant ISIS instructions, and to address specific hazards and safety requirements) must be provided by the responsible manager or RPS before authorisation to gain access is granted.

ii. Access to the target station, is via personnel door from the R55 South Extension only.

iii. No eating, drinking, chewing, vaping in target station.

iv. A personal dosemeter must be worn at all times within the area.

v. The TSA is a contamination controlled area and the following PPE is required as a minimum:

- Overshoes or personal-issue contact shoes
- Coveralls.
- Disposable gloves. Two pairs should be worn when handling potentially contaminated equipment or performing tasks presenting a contamination hazard. The outer pair should be changed frequently.
- Eyewear e.g. where a splash/airborne projectile hazard exists.
- Additional PPE (including RPE) detailed in written arrangements for specific tasks to be carried out, or being carried out when access is required.

vi. Access to the TSA is via the personnel access cage. On entering the cage a personnel key must be taken from the key exchange and its number and the name of the keyholder stated to the MCR. The personnel key must be kept with the keyholder at all times and not handed to anyone else. It must then be returned to the key exchange on departure.

vii. No attempt must be made to access the TSA or any areas beyond the PPS when the beam is on.

viii. Do not interfere with or attempt to defeat or bypass any radiation safety features (e.g. captive keys, safety interlocks, warning devices, emergency stop devices).

ix. When inside the TSA or RHC cross tunnel, on hearing the ISIS pre-exposure warning or observing illumination of blue lights, press the nearest beam off button, leave the area immediately by the nearest exit, and report to the ISIS Duty Officer.

x. On hearing a fire alarm (bells), leave the area immediately by the nearest available exit. See also contingency plans for fire.

xi. Ensure you are familiar with the hazard profile of the target station before entry i.e. that you are aware of the locations of high dose rate or the potential for radioactive contamination, informed by the most recent HP monitoring surveys.

xii. The RadEye GM dose rate meter should be used where required to assess the radiation hazard in the work area. Any dose rate higher than expected should be reported to the RPS. Health Physics surveyor support should be requested if necessary.

xiii. Do not undertake any task that cannot be performed in accordance with these local rules until a task-specific radiation risk assessment has been carried out and supplementary written arrangements prepared.

xiv. Only undertake tasks that you have been authorised to carry out and that you are competent to undertake; having received the necessary information, instruction and training to complete the task safely; and the requisite Health Physics support.

xv. Adopt the exposure restriction principles of time, distance, shielding and containment where possible to minimise exposures. Where a task-specific risk assessment identifies a need for additional control measures (e.g. pig mat or spill trays during work on water circuits, or local shielding during work around high dose rate components), these must be provided.

xvi. If any of the following **hold points** are reached, the action specified should be taken:

Measurement	Hold point	Action
<u>Airborne contamination</u>		
Bionix reading (H-3 in air)	0.3 MBq/m^3	Stop. Retire from area. Consult RPA on need for RPE.
iCAM reading (airborne particulate)	0.6 kBq/m^3	
<u>Surface contamination</u>		
Ludlum 43-93 direct monitoring	100 cps above BG	Stop. Retire from area. Consult RPA on need for RPE.
100 cm^2 wipe presented to Ludlum 43-93	10 cps above BG	
1000 cm^2 wipe presented to Ludlum 43-93	100 cps above BG	
^3H spill from TSA cooling circuits	> 10 ml on person	Stop. Seek HP help with decontamination.

Where a high dose rate hazard exists, occupancy times should be managed as follows:

Dose rate for close access tasks (body)	Maximum time in close proximity	Note
< 100 µSv/h	1 hour	-
100 – 200 µSv/h	30 mins	-
200 – 400 µSv/h	15 mins	Inform RPA before proceeding
400 – 600 µSv/h	10 mins	
600 µSv/h – 1 mSv/h	6 mins	
1 mSv/h – 2 mSv/h	3 mins	
> 2 mSv/h	Do not proceed	Seek RPA advice before work commences

<u>Note</u>: In many of these situations, the DMC3000 electronic personal dosemeter will alarm due to high dose rates. Observe the dosemeter and act according to the relevant action level/hold point within the written arrangements.

xvii. Do not enter areas within the TSA where a specific contamination hazard is known to exist unless it is essential for completion of the task and:

- You are familiar with the extent of the contamination and a HP survey has confirmed that no further PPE/RPE is required to that specific in point (viii) (ref hold points in section (xiii)).
- A HP surveyor is in attendance to assist with task-related contamination monitoring, and to perform contamination monitoring on departing the area.

<u>Note</u>: This requirement is further to the barrier control measures in place on exit from the TSA during routine access and is for specific situations where a contamination hazard has been identified.

xviii. In the event of an incident or accident, implement the appropriate contingency plan. All radiation safety related incidents should be notified using SHE Assure.

xix. If the control measures in these local rules (or risk assessment supporting them) are considered to be inadequate, the RPS must be informed immediately. Access must be restricted and/or work suspended until the RPA has been consulted. See contingency plans. The RPA will advise on the need to review the existing arrangements before restrictions are lifted and work can continue.

xx. If you have any radiation protection concerns, leave the area and discuss your concerns with the RPS.

2. Written Arrangements: Removal of items from RHC and TSA

i. All radioactive materials (activated or contaminated items) removed from the target station must be managed in accordance with ISIS SI-16 and Safety Codes 21 and 28.

Items posted out of the RHC via the TSA trolley

ii. All items removed from the TSA must be checked for radioactive contamination before they are removed from the contamination controlled area. Externally contaminated items must be wrapped/bagged/contained appropriately before removal.

iii. Items posted from the RHC into the TSA via the movement of the trolley must be checked for radioactive contamination before they are taken from the trolley. Contamination measurements should be made by wipe and presented to a counter in a low background area. Items found to be contaminated must be double bagged before removal from the TSA. On their removal from the TSA, before they are removed from the contamination controlled area, further contamination measurements must be made to confirm that no contamination has transferred to the outside of the bag.

Items removed from RHC via the floor hatch into the cross tunnel:

iv. Large items removed from the remote handling cell, including manipulator slave arms, must be managed in accordance with the relevant ISIS operating instruction.

v. Only those persons directly involved with task to be present within South Tunnel i.e.

- Target Operations personnel essential for performance of the task
- 1 x HP surveyor to perform initial & task-associated contamination & dose rate monitoring, & to assist with the implementation of contingency plans if required.
- Heavy gang (if required) to connect lifting equipment to flasks for ultimate removal from South Tunnel.

vi. No persons to be present within tunnels/cross tunnels during flask loading procedures.

vii. All transfer operations to be performed remotely where practicable. Access to cross tunnel to be prevented by locked “garage door” from the South Tunnel. Only where it is unavoidable and essential for operational reasons (e.g. for visual alignment / disconnection of lifting hooks using long reachers) is access into the cross tunnel permitted when the floor hatch is open. In these situations:

- No persons are permitted to work in an area where the dose rate exceeds 2 mSv/h. If this is necessary, the task should be suspended and a further RRA performed.
- The 200 µSv hold point on accumulated dose applies.

viii. TLD & EPD to be worn by all persons in tunnels during operations involving item transfers between tunnels and RHC. Relevant task code to be applied. Alarm level set at 200 µSv cumulative dose.

ix. HP to undertake radiation & contamination monitoring in support of task.

x. Extendable dose rate monitor (Teletector) to be used where surveyor would be exposed to dose rates in excess of 100 µSv/h or where cumulative dose for monitoring task could exceed 200 µSv.

xi. Contamination monitoring to be performed by wipe & presented to a suitable contamination monitoring instrument in a low background area.

xii. Where a task-specific RRA identifies that an airborne activity hazard exists, monitoring to be performed using iCAM particulate-in-air & βionix 3H-in-air real time monitors positioned in cross tunnel. In the event of an alarm (βionix 0.3 MBq/m^3 ^{3}H in air or iCAM 0.6 kBq/m^3 particulate in air), all persons without RPE to be ejected from tunnel/target station. RPA advice to be sought.

xiii. Minimise length of time to between item being lowered into the recipient flask/frame in the cross tunnel & the fitting of the outer shielded lid.

xiv. Minimum time to be spent close to flask/item. Long-handled tools to be used where practicable to increase distance from hazard.

xv. Target station to be cleared of personnel during any electric tug operations involving flasks that are not fully shielded. Eye TLD & Aegis ED3 electronic dosemeter to be worn by electric tug operator (in addition to body EPD) where flasks are not fully shielded. ED3 D1 probe to be attached to forehead of operator. Alarm level set at 200 µSv cumulative dose.

xvi. Procedures & contingency plans for experimental halls & target station apply as documented with the relevant local rules.

3. Written Arrangements: Designation of temporary restricted area

This procedure must be followed in any situation where an item is in the R80 extension

Barriers are available to cordon off the whole area from the main halls.

These items may present a **dose rate and contamination hazard**.

The RPS is responsible for supervising this procedure:

i. Before setting down any potentially contaminated item(s), the floor must be covered with heavy duty polythene sheet.

ii. Once they have been set down, barriers must be erected around the item(s) to prevent all non-essential access to areas where a contamination hazard exists. An initial contamination survey must be carried out at the boundary. Radiation warning signs with legend “Contamination. Keep out” must be displayed on the barriers.

iii. If the item(s) also present a dose rate hazard, the warning sign must indicate this. The barriers must be set up at (or outside) the 7.5 µSv/h dose rate contour. If this cannot be achieved, signs at the boundary must state the measured dose rate.

iv. Persons requiring access inside the area must wear appropriate PPE, including:
    a. Overshoes.
    b. Gloves.
    c. Coveralls or laboratory coat (as appropriate to task to be performed).

    All personnel and items must be subject to Health Physics contamination monitoring on exit.

v. The RPS is responsible for supervising access restriction and boundary control arrangements to the area.

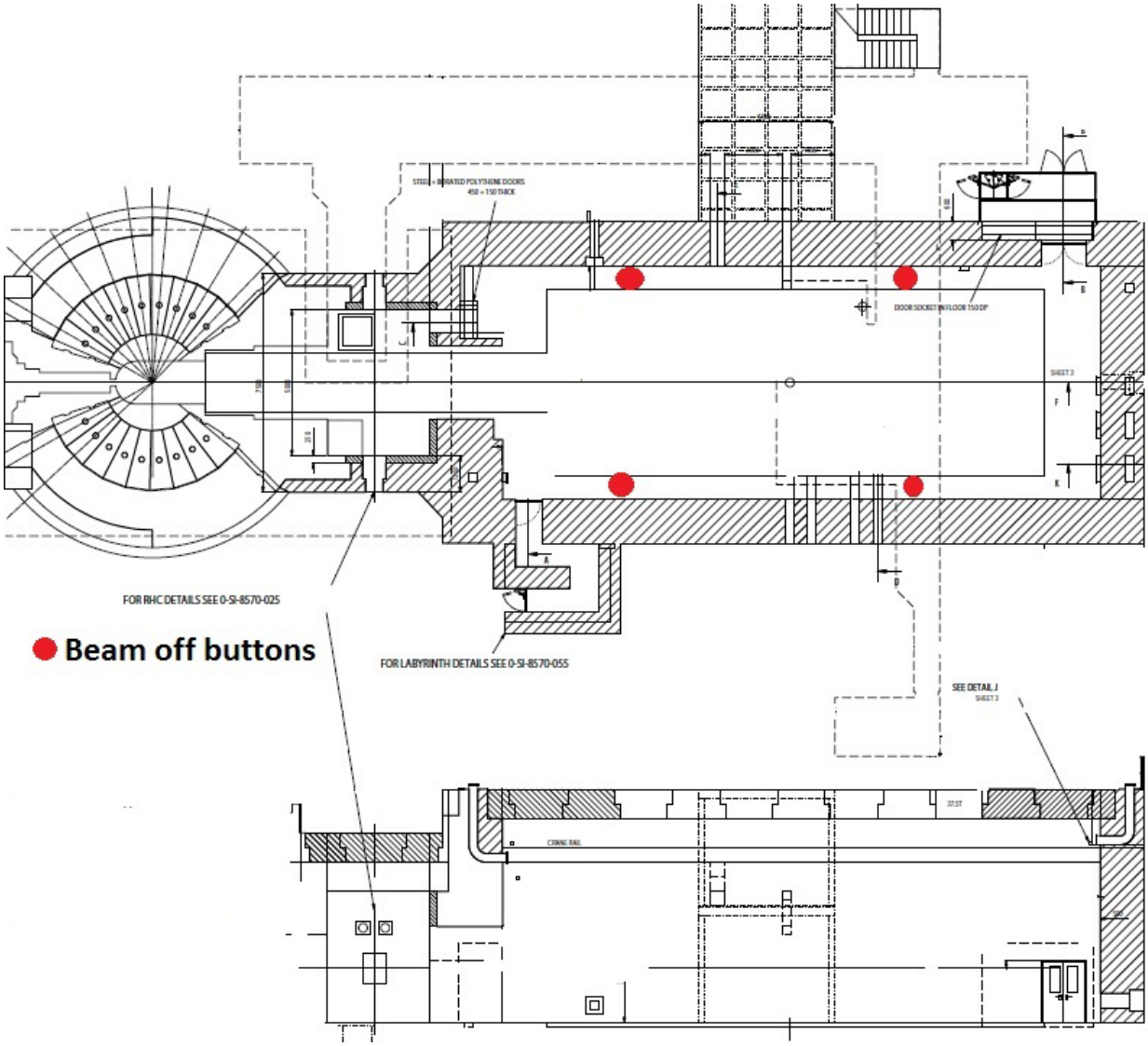
vi. Whilst the temporary restricted area is in force, daily contamination monitoring must be performed and recorded around the boundary. Depending on the results of this monitoring, the RPA may advise on the relaxation of this monitoring requirement.

vii. Once the item(s) have been removed and there is no further anticipated need for the demarcated area, a Health Physics clearance survey must be undertaken before removing barriers and warning signs. The polythene ground sheet should be considered as potentially contaminated, and disposed of as combustible waste.

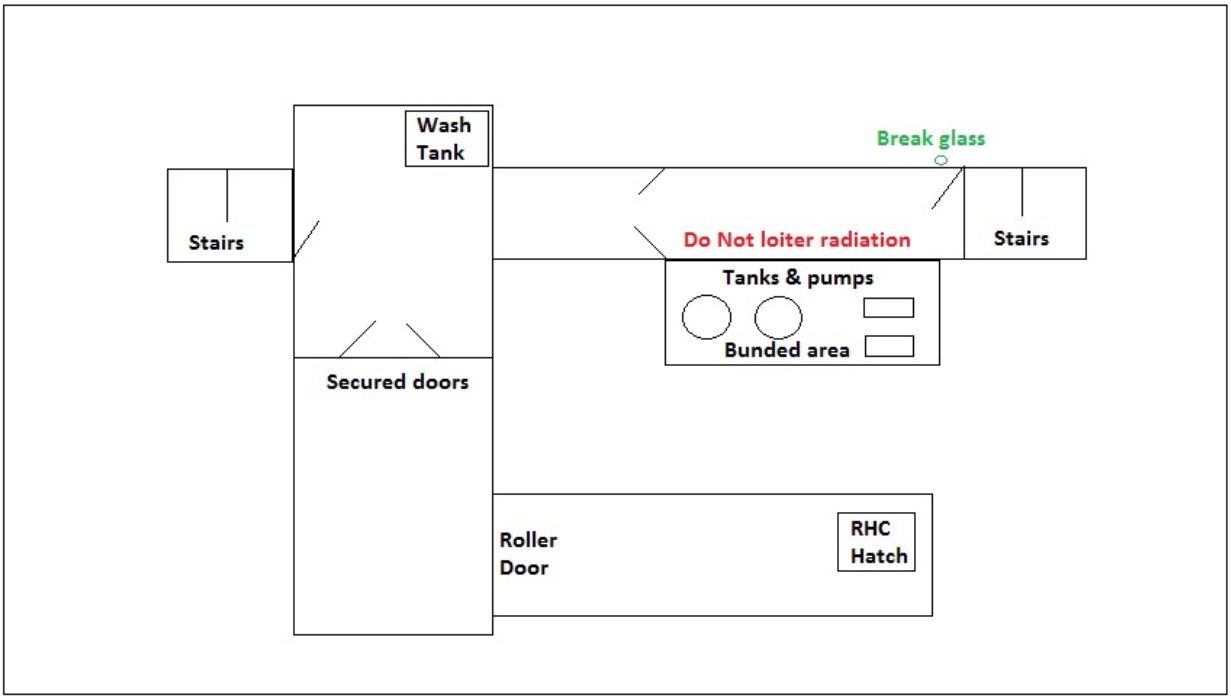
viii. In the event of an incident or accident inside the restricted area, the appropriate contingency plan should be followed.

4. Layout of controlled areas

A. TS2 floor level & TSA



B. TS2 low level



C. TS2 high level