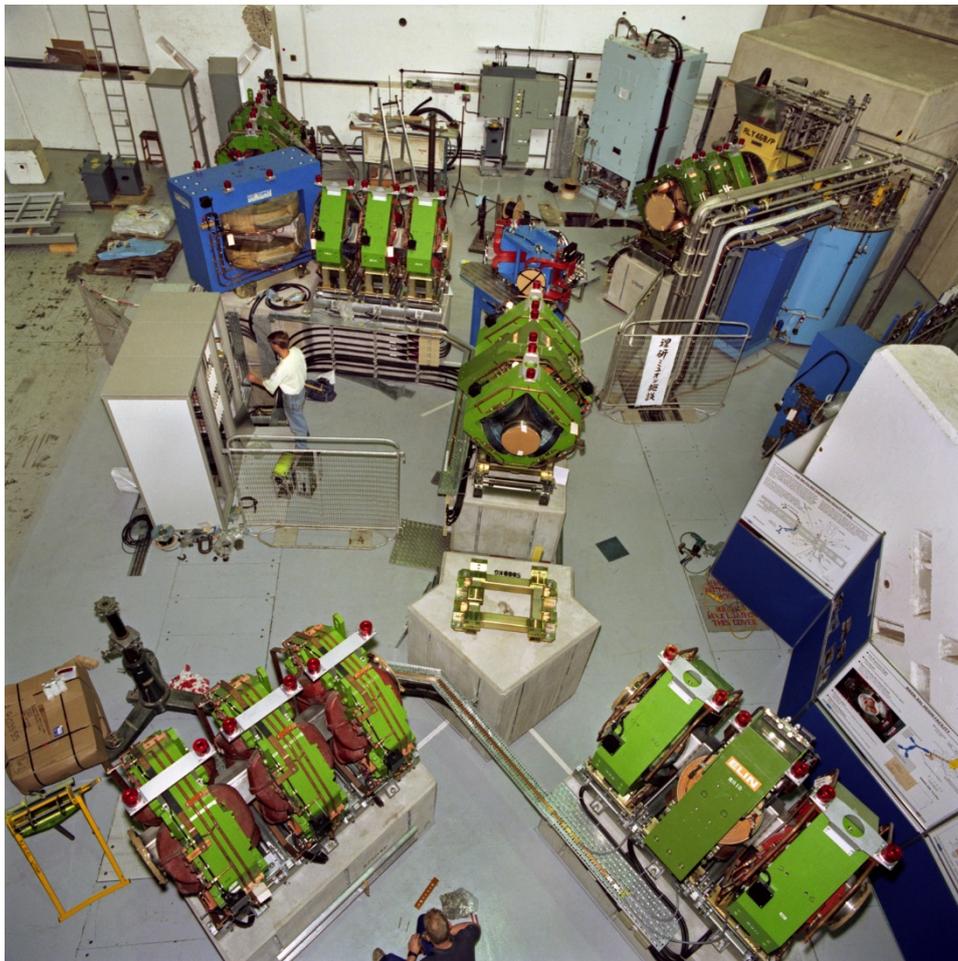


# Riken Pipework Upgrade Project Tender and Specification



<i>Rev</i>	<i>Description</i>	<i>By</i>	<i>Chk'd</i>	<i>Approved</i>
7	Issue for tender	VM	GT	KJ
		09/10/19		

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## 1. Background

The ISIS Neutron and Muon Source is a world-leading centre for research at the STFC Rutherford Appleton Laboratory near Oxford.

RIKEN is an instrument beamline that guides Muons – sub-atomic particle - to the end of each beamline where research huts or ports are situated. Various instruments allow the scientist to use the muon source for a wide range of applications (e.g. examine superconductors, battery materials, catalysts, cultural heritage artefacts etc). There are four ports of which only three are currently active (i.e. Ports 2, 3 and 4). The whole RIKEN beamline and supporting systems are over 30 years old.

The beamlines consist of a series of focusing and bending magnets require a very low conductivity demineralised cooling water supply because they are fabricated with numerous Copper windings with 'bored out' cooling channels. This supply is provided by existing flow and return mains pipe work located in the north tunnel of the R55 facility. These pipes are connected to the EPB1 main magnet cooling water system.

## 2. Description of Scope of Work

The R55 Riken Magnet Cooling Water System currently consists of a series of flow and return Copper pipes that conveys demineralised cooling water to all of the quadrapole magnets; bending magnets and associated power supplies. In all, there are 33 no RIKEN flow and return lines. Behind the beam shielding, these flow lines are attached to unitsrut supports along the side of each magnet concrete support block (see Appendix B).

Given the system age and recent minor leakages, STFC have decided to replace all of the demineralised cooling water system pipe work with an equivalent using ASME BPE 316L Hygienic grade stainless steel pipe work.

The existing main RIKEN flow panel situated in the North Tunnel, which monitors and measures flow and temperature for each magnet return, is to be replaced with the latest panel design using 316L stainless steel instead of Copper.

A single existing floor penetration within the 'Kicker cell' allows a single flow pipe all the magnet return pipes to be connected to the new RIKEN panel.

In outline, this tender calls for the following work to be carried out;

- To replace the main RIKEN flow panel in the Northern Corridor with a new ISIS equivalent. The Contractor will be responsible for the supply and installation for all materials associated with the panels except the flowmeters and control valves.
- To replace all flow and return Copper pipework – from the EPB1 main magnet cooling water system - that terminates at water panels or ‘take off’ points for each beamline magnet / power supply with ASME BPE 316L Hygienic grade stainless steel pipe work. The Contractor will be responsible for the supply and installation for all pipework, hoses and fittings as detailed herein.

This document defines the piping specifications for the R55 Riken Magnet Cooling Water System and should be read in conjunction with the contract drawings listed in Section 15.

### 3. SHE Arrangements and requirements

#### 3.1 Existing Environment

The work shall be carried out within the R55 Experimental Hall of the ISIS Facility. The area is a radiation controlled area.

Figure 1-4 in Appendix A shows the RIKEN instrument beam line off the intermediate target TS1 and photos of the existing Copper pipework to be removed. The current concrete block radiological shielding and attached services shall be removed by STFC to allow the Contractor full access to the existing magnets / Copper pipework.

Other RIKEN project installation work (e.g. new power supply cabling to each magnet and various power supplies) managed by the STFC electrical engineers (EEG Group) will be carried out concurrently within the Construction Design and Management (CDM) area. It is anticipated that their work will not interfere with the pipe work installation. To prevent the risk of conflict, the Contractor is required to produce a Gantt chart and sequence of installation works for information.

The project is notifiable under the CDM Regulations (2015) and the following project roles have been assigned;

- Client - STFC
- Principal Designer - STFC
- Designer - STFC
- Principal Contractor - TBD
- Contractor(s) - TBD

The Contractor will be notified of the CDM works area by the RIKEN Project Manager in advance of the installation start date.

### 3.2 Safety induction

All Contractor personnel will be required to attend a mandatory Safety Induction course held at RAL by the STFC SHE Group. Normally these sessions last approximately 2-3 hours. Each of the Contractor's staff are classed as an unaccompanied worker and will be required to complete the following;

- On-line ISIS Basic Safety and Radiation Awareness Course.

STFC will provide each fitter with appropriate radiation badges for the duration of the contract.

Prior to the start of any installation work, the successful tenderer shall supply a copy of the following to the ISIS Work Control Centre (Peter Phillips) for approval and to the STFC representative. No work can start in the 'Works Area' until a signed off Work Authority Form (WAF) has been issued.

- A 'signed off' full Risk Assessment and Method Statement (RAMS) in accordance with the 'The management of Health and Safety At Work Regulations 1999' for all removal/installation activities.
- A completed SI10 form – The name and contact number for every fitter used for the installation will need providing to STFC at least two weeks in advance of the commencement of the project. This is necessary so that access arrangements can be made to the 'Works Area' and the WAF can be raised.

The RAMS must clearly state the following;

- The names of the fitters and the equipment / tools to be used for the work.
- The location of all materials / equipment necessary for the work and the method of transportation (and any other special measures).
- Arrangements for the removal and disposal of the existing Copper pipework . STFC will instruct the Contractor the location of the secure compound necessary to store the waste Copper.
- Arrangements for managing the works area to maintain a clear and safe area.

Note:- Given the scale of the work, the successful Contractor would not be expected to provide a fixed welfare facility (e.g. portakabin) but must consider other welfare arrangements and the need for any portable workshop.

### 3.3 Radiation Controlled Area

The Contractor's staff will be required to start work in the vicinity of the existing RIKEN magnets once the shielding – surrounding the activated RIKEN magnets - has been removed 4 weeks into the ISIS planned 2020 long shut down. Approximately 2-3 weeks after the ISIS shut down a Radiation Survey and Radiation Risk Assessment will be carried out by STFC for all of the Contractor's staff working inside the Radiation Controlled Area. For STFC to be able to complete a Radiation survey, the Contractors must provide a work schedule showing the number of pipe fitters being present in different areas behind the shielding and in the North Tunnel including expected work duration in those areas. The Contractor will be required to work in such a manner as to minimize the expected dose to the pipework installation crew.

STFC had completed two surveys in 2019. The first survey was around the magnets behind the shielding with the beam off. The gamma radiation levels reached a maximum dose of 5  $\mu\text{Sv/hr}$  situated adjacent to the front-end beam plug (i.e. near Q3). Other area behind the shielding had typical doses 2-3  $\mu\text{Sv/hr}$ . The second survey focused on the North tunnel walkway and pipework which showed gamma dose rates typically 0.1-0.2  $\mu\text{Sv/hr}$  (see Appendix C) this was also the case for the upstairs Hall area.

An assessment by STFC shows that classified workers – as defined by the Ionising Radiation Regulations 2017 – are not required for the work based upon the survey results and expected exposure durations by the Contractors staff.

The Contractor will be required to work with STFC in accordance with the Ionising Radiation Regulations 2017. Attention is drawn to the following sections/sub-section;

- Regulation 16 – Co-operation between employers.
- Employers sharing the same workplace.
- Sharing dose information.
- Outside workers.

To this end, it is advisable that the Contractor employ the services of a Radiation Protection Advisor (RPA) to access existing staff historical records and monitor / audit the dosage for all Contractor personnel employed during the period of this Contract.

### 3.4 STFC Safety Codes

The Contractor will have read, understood and made health and safety arrangements necessary to comply with STFC's codes of practice. Furthermore, it is imperative that all such arrangements are communicated to STFC prior to the commencement of onsite work. The following codes are deemed mandatory for the nature of the work covered by this Contract;

- Code SC2 – Safe movement of vehicles on STFC sites.
- Code SC4 – Safe use of equipment.
- Code SC5 – Incident Reporting and investigation.1
- Code SC6 - Risk Management.
- Code SC9 – Working at heights.
- Code SC10 – Provision of SHE training.
- Code SC11 – Work in confined spaces.
- Code SC12 – Manual handling.
- Code SC13 – Construction Design and Management Regulations.
- Code SC15 – Management of Contractors.
- Code SC17 – Portable electrical equipment.
- Code SC18 – Control of noise at work.
- Code SC19 – Work on buildings, premises, services and infrastructure.
- Code SC20 – Controlling explosive and flammable gases and dusts.
- Code SC24 – Occupational health surveillance and health screening medicals.
- Code SC26- Safe use of lifting equipment and lifting accessories.
- Code SC29 – Management of ionising radiation at work.
- Code SC30 – SHE auditing and inspection.
- Code SC32 – Fire and Emergency Management
- Code SC34 – Electrical safety.
- Code SC35 – Asbestos Management.
- Code SC36 – First Aid.
- Code SC37 – COSHH: Safe use of chemicals/hazardous substances.
- Code SC41 – Controlling Pollution to air, land and water.

A link to the STFC safety codes is given below;

<https://staff.she.stfc.ac.uk/Pages/Codes.aspx>

#### 4. Construction Quality Assurance (CQA) Plan

It is mission critical that the structural integrity of the new magnet pipework remains intact for the next 30+ years. To this end, STFC have decided to request the Contractor to produce a Construction Quality Plan (CQA)

The CQA plan must include;

- A basic weld plan showing the location of each joint with identifiers.
- Pipe production batch records as evidence to demonstrate that each jointed section is sourced from the same location. This is required to minimize the effects that varying pipe composition has on joint integrity.
- For all orbitally welded joints a printed record is required displaying
  - Weld identifier – this will be a unique number.
  - The name of the welder and time of jointing.
  - Weld variables used during jointing.
- Suitably 'marked up' isometric drawings showing the location of each weld by means of the weld identifier is required.

An inspection plan for STFC's representative to visually inspect and 'pass' a proportion – i.e. of all manually made joints.

Dye joint penetration tests using an appropriate fluorescent dye and sufficient dwell time to show up surface imperfections shall be applied to a proportion – i.e. 10% - of all manually welded joints (e.g. TIG welded). The installation Contractor shall submit a plan for approval to the STFC representative. Testing should be carried out in accordance with ISO 10893-4: 'Non-destructive testing of steel tubes. Liquid penetrant inspection of seamless and welded steel tubes for the detection of surface imperfections'.

In the event that a joint has failed any of the following tests, then the joint shall be 'cut out' and the affected pipe section appropriately replaced.

## **5. General Installation Requirements**

The Contractor shall only use pipe sizes and fittings specified in this tender. Short radius butt weld elbows are not permitted. No 'dead' legs are allowed. Only eccentric reducers are permitted and should be positioned to facilitate drainage and venting where appropriate.

The tender drawings provide information to the fitter about the basic logical pipework connections for the system and pipe diameters. The pipe routes have been assessed based upon the overarching RIKEN SOLID EDGE model and thus there may be better alternative pipe routes offering practical advantages to be made during installation. Any alternative, pipe layouts should be agreed with STFC's representative. This is especially true for the layout of the return pipes through the floor penetration in the KICKER area.

The Contractor is expected to use the least amount of fittings possible during installation. To this end where the 0.5" diameter return lines bend along the beamline profile at angles other than 90° these should be formed.

The Main RIKEN Water Panel will have to be assembled in position because of tunnel height limitations when accessing the North Tunnel. All parts will be carried to the panel location before being assembled. A new platform is required to be installed behind the panel to allow STFC personnel access to electrical isolation boxes.

## **6. Welds**

It is expected that the majority of welding will be carried out using automated orbital welding equipment. Where there are spatial restrictions (e.g. making connections in the services trenches and completing connection through floor penetrations into the North Tunnel) which make the use of an orbital welding head impractical then manual Tungsten Inert Gas (TIG) welding can be used. Care should be taken to protect adjacent cabling when welding.

The welding procedure and sequence used shall aim to minimise distortion and shrinkage. Welding personnel shall be suitably trained and qualified in accordance with BS EN ISO 9606-1:2013 (formerly BS EN 287).

Welds must be fully penetrated with good alignment, with a flat outside and inside diameter profile. There must be no joint discolouration.

## **7. Alignment of Bores and Threading**

With the exception of securing flexible hoses to each magnet, no other threaded joints are permitted.

A mechanical mill or saw should be used to ensure that the cut face is exactly at right angles to the longitudinal axis of the pipe. Any burrs must be removed. Care must be taken to avoid removing the corner edges of the pipe as this can cause problems with fusion of the root weld.

No protrusions; sharp steps or crevices are permitted after forming each joint. To this end the general guidelines of the European Hygienic Engineering and Design Group (EHEDG) should be followed. The salient points for each weld completed are as follows (Ref 'Welding stainless steel to meet hygienic requirements' – Trends in Food Science and Technology September 1993 Vol 4) ;

- Misalignment must be limited to less than 20% of the maximum wall thickness for each pipe section.
- Ideally, there should be no gap between faces but less than 0.25mm is acceptable.

The practice of flaring pipe ends as a means of joining two pipes of different diameters is not permitted.

## **8. Pipe Hanging, Supports and Spacers**

Pipe runs should be adequately supported by hangings and/or supports. Unless otherwise specified, all materials used for fabrication of pipe supports will be supplied by the Contractor.

For pipework installed along the beamline, each pipe support shall be prefabricated, cut to suit and erected in advance of pipe work being installed. The existing grouted in unistrut supports in each magnet block will be used. There are approximately 3 no such unistrut channels per supporting magnet block. Pipes shall not be supported by other pipes without express permission from STFC.

To prevent the risk of unwanted pipe 'sagging' which would create localized 'low points' in the system each span of magnet return lines should be supported using 'fit-for-purpose' spacer blocks mounted vertically using unistrut or similar frame. If it is feasible, the existing grouted in unistrut should be used rather than drilling the concrete floor to secure each frame. The spacers should be positioned no greater than 4 m for every horizontal pipe span as a precaution.

Welding of clamps, lugs or other erection aids to any alloy, stainless steel or lined pipe are not permitted.

The type, size and location of each support should be assessed by the Contractor with regard to the loading, thermal movement and direction of expansion and contraction.

The quantity and location for each support shall be initially assessed by the Contractor at the start of the works following the beam shielding being removed by STFC. This is to allow the Contractor sufficient time for the supports to be manufactured.

## **9. Magnet Hose connections and Isolation valves**

All existing magnet flow and return hoses and associated fittings are required to be replaced.

The existing magnet tails are Contite threads which are now obsolete. Consequently, STFC are proposing to cut and remove each Contite tail and extend the magnet manifold tubing accordingly (using a low temperature welding technique) to accommodate suitable – STFC approved – connections to the new hoses. Each magnet will have to be reviewed on a case-by-case basis to see if sufficient length of tail is present. The Contractor will be responsible for undertaking all magnet tail extensions and purchasing and installing all hoses and associated fittings. It is imperative that The Contractor inspect each magnet at the beginning of the project to ascertain the fittings and optimum hose lengths required for every flow and return. The Contractor shall submit to STFC – for written approval – a simple magnet hose connection design. Following STFC approval, The Contractor shall order all hoses and fittings to allow sufficient delivery time.

STFC require standardization of parts across the facility. To this end, the hose specification should be Arcflex APS-25-1SB corrugated 316 stainless steel with a single layer of braid. Such hoses are pressure rated to 6 barg. High pressure braided hoses (double skinned) which are inflexible and not 'fit-for-purpose' are not permitted.

Each magnet flow branch will have an isolation valve. These valves are behind the shielded area and must be 3 piece butt weld end full bore 316 stainless steel ball valves with Ultra High Molecular Weight (UHMW) polyethylene seats and seals for hardened resistance against the radiation environment. The valves must not contain Polytetrafluoroethylene (PTFE). Any valves outside of the shielded area (radiation environment) are permitted to have Ethylene Propylene Diene Monomer (EPDM) seats and seals.

## **10. Port 1 to 4 Trench Pipework and Water panel connections**

There are certain flow and return water connections that require to be made from the main magnet cooling water system in the North Tunnel to each of the Port House Water Panels. Currently there is Copper pipework installed in trenches serving each panel. This requires removing and replacing with stainless steel equivalent. Please note that The Contractor is not required to replace the water panels only the services leading up to each as required.

### **10.1 Port 1**

No connection required.

### **10.2 Port 2**

Currently, It is understood that the Port 2 Water Panel is fed by an existing Copper pipe running in trench 4 North through the Port house 1 area. The pipe route then turns 90° behind Port House 1 before routing through into Port House 2. STFC would like an alternative route for the new hygienic grade steel pipework (see drg SI-1301-000 Sheet 11).

The Contractor is to replace the existing 1" Copper flow and return pipe from the North Corridor with the equivalent stainless steel hygienic pipework and fittings up to the Port 2 Water Panel as proposed by the pipe route shown by drg no SI-1301-000 Sheet 11.

The Water panel in Port 2 supplies the Helmholtz magnet and ARGUS Power supply. The 0.5" ARGUS power supply flow and return lines from the Port 2 Water panel lines should be routed at floor level underneath the existing magnet and installed in trench 3 North to the ARGUS power supply (see drg SI-1301-000 Sheet 11). The copper pipe leading to the Helmholtz magnet from the panel should be left insitu.

Suitable fittings and adaptors are required to terminate into the Port 2 Water Panel and in the North Tunnel pipework are required.

### **10.3 Port 3**

The existing flow and return Copper pipework from North Corridor mains requires replacement with equivalent stainless steel hygienic pipework and fittings. All works for this item will be completed under a 'Day Works' schedule.

Suitable fittings and adaptors are required to terminate into the Port 3 water panel and in the North Tunnel pipework are required.

**10.4 Port 4**

The Contractor is to replace the existing ¾" Copper flow and return pipe from the North Corridor with the equivalent stainless steel hygienic pipework and fittings up to the Port 4 Water Panel as proposed by the pipe route shown by drg no SI-1301-000 Sheet 12. STFC can arrange – upon request of the Contractor – for the Port House wall panel that sits over the trench to be removed if it facilitates installation.

Suitable fittings and adaptors are required to terminate into the Port 4 Water Panel and in the North Tunnel pipework are required.

## **11. North Corridor pipework and terminations**

The existing RIKEN panel in the North Corridor is to be decommissioned and removed to waste storage. Once the panel is removed it can then be decided how best to connect the new panel flow and return connections to the existing magnet cooling water mains (these are 4" flanged connections) – see photos in Appendix A showing existing magnet mains connections.

Further pipework needs to be installed in the North Tunnel from the Trenches to complete the following flow and return connections into the main magnet cooling water mains;

- 1) To connect into the existing RB1, RQ1 and RQ2 Copper flow and return pipes from trench 5 South.
- 2) Extending Port 2 water panel flow and return pipe in trench 5 South and connecting to magnet cooling water mains.
- 3) Extending Port 3 water panel flow and return pipe in trench 3 South and connecting into the magnet cooling water mains.
- 4) Extending Port 4 water panel flow and return pipe in trench 2 North and connecting into the magnet cooling water mains.
- 5) Capping off existing redundant main magnet connections (e.g. 3" and 1.5" Copper flow and return lines) plus other pipe modification as required.

All of the above work will have to be completed under 'Day Work' rates with the scope decided between the Contractor and STFC's representative.

The trench pipework for the above is accounted for in the Bill of Quantities.

## 12. Existing Copper pipework removal

### 12.1 Specific Health and Safety issues

Health Physics carry out radiation and radioactive contamination surveys in the RIKEN area. This includes monitoring all waste's and equipment prior to leaving the work area. Examples are detailed below.

- Copper bus bar from Riken R55.
- Riken Port 1 Oxford Magnet.
- Riken Port 1 Galvanised steel.
- Riken Port 1 plastic and Galvanised steel trunking.
- Riken Port 1 Copper pipe.
- Waste pipework from RIKEN.

Radiation and radioactive contamination results show that ambient dose rates and surface radioactive contamination levels are negligible. However, to ensure compliance with STFC permits for the disposal of radioactive waste, all waste materials arising from this will be subject to analysis before disposal. For the purposes of tendering the Contractor should treat the Copper and other waste arisings as Low Level Waste. STFC will remove and temporarily store waste prior to disposal.

There maybe exceptionally low concentrations of tritium adsorbed onto the inner surface of each tube. Tritium is a beta particle emitter and can be absorbed on the inner surface of the Copper pipework Magnet cooling water analysis - carried out by STFC - indicate <500 Bq/l of Tritium in the water. The Radiation protection Adviser (RPA) advice note RPA Advice Note RPA/AN/STFC/2018/004, states that concentrations of Tritium in the magnet cooling water circuit is below the level that would require any specific precautions to be taken. No 'Hot Work' is permitted when removing the Copper pipework for these reasons. It is the Contractor's responsibility to mitigate the health and safety risks to their employees by recommending; supplying and maintaining suitable Personal Protective Equipment (PPE).

### 12.2 Handling and temporary storage

Prior to the Contractor starting any removal work, the existing magnet demineralised water circuit will be drained down by STFC operations. All Copper pipework that is required to be removed will require cutting - using a hydraulic cropper - into less than 1 m lengths for storage in secure Dolav containers (provided by STFC). The cropper head could be contaminated with very low levels of radioactive material and should be specifically bought for the project. The cropper will not be permitted to leave the STFC site. All other equipment can be hired.

There maybe a requirement for the Contractor to provide a padlocked secure fenced off area (nominally 10m x 10m) where the Dolav containers will be located – the need for this will be decided at the project ‘Kick off’ meeting The Contractor shall have procedures in place to allow only their staff and STFC Health Physics staff access to the Dolavs. All Contractor personnel involved in removing the existing Copper will be subjected to a basic security check – organised by STFC - prior to starting on site.

## 13. System Pressure Testing

### 13.1 Test Plan

Two weeks prior to the completion of the installation, The Contractor is required to submit a plan for the successful hydrostatic pressure testing of the complete magnet cooling water system. The test plan should include the following;

- RAMS on how the testing is to be carried out and what monitoring is required.
- Test Pressure and length of testing required.
- Production of a test certificate for the whole system – A signed off pressure test certificate must be made before STFC can 'Take-over' the new magnet cooling water system.

### 13.2 Joint/fitting failure

The Contractor will be responsible for all re-work and costs associated with the following;

- If a joint fails under test then STFC would require joint clamps and seals to be replaced accordingly.
- If a fitting fails under test then STFC would require the wholesale replacement of the item.
- If any pipe/fitting fails during the warranty period of 1 year following completion of the project.

## 14. Exclusions

The Contractor is not responsible for undertaking - and costs arising from - the following project related activities;

1. The Drain Down of the existing Copper fabricated Magnet cooling water circuit.
2. The disposal of the effluent arising from the drain down.
3. The re-fill of the newly installed steel pipework with 'fresh' demineralised water.
4. The disposal of the stripped out Copper pipework.

All of the above activities will be completed by either the Infrastructure Plant Operations team or STFC's Waste management Group (WMG).

## 15. Schedule of Drawings

The following are the Contract Drawings. Series SI-1301 show the flow and return pipework routes along the beamlines and into the North Tunnel. Also, the trench pipe routes to each Port House water panel are shown. Series SI-1321 show the main RIKEN water panel assembly drawings;

1. RIKEN LOCATION PLAN.
2. SI-1321-001/A; RIKEN FLOW PANEL LHS MANIFOLD
3. SI-1321-002/A; RIKEN FLOW PANEL RHS MANIFOLD TUBE
4. SI-1321-006/A; RIKEN LH FRAME PIPE SUPPORT RAIL
5. SI-1321-007/A; RIKEN FLOW PANEL RH FRAME
6. SI-1321-015/A; RIKEN FLOW PANEL ASSEMBLY
7. SI-1321-017/A; MAGNET COOLING FLOW STICK
8. SI-1301-000 Sheet 1 MAGNETS Q3, Q4 and Q5 PIPEWORK.
9. SI-1301-000 Sheet 2 MAGNETS Q6, Q7 and SEPARATOR VESSELS XF1 AND XF2 PIPEWORK.
10. SI-1301-000 Sheet 3 MAGNETS Q9, Q10, and Q11 PIPEWORK.
11. SI-1301-000 Sheet 4 MAGNETS Q12, Q13, Q14 and RB3 PIPEWORK.
12. SI-1301-000 Sheet 5 MAGNETS Q15, 16, 17, RB2, SY1, SY2 PIPEWORK.
13. SI-1301-000 Sheet 6 MAGNETS Q18, 19 and Q20 PIPEWORK.
14. SI-1301-000 Sheet 7 MAGNETS Q21, 22 and Q23 PIPEWORK.
15. SI-1301-000 Sheet 8 RIKEN FACILITY TOP VIEW.
16. SI-1301-000 Sheet 9 FLOW AND RETURN LINE POSITIONS TOP VIEW.
17. SI-1301-000 Sheet 10 FLOW AND RETURN LINE POSITIONS ISOMETRIC VIEW.

18. SI-1301-000 Sheet 11 PORT 2 PIPE POSITIONS.
19. SI-1301-000 Sheet 12 PORT 4 PIPE POSITIONS.
20. SI-1301-000 Sheet 13 BEAMLIN CONTRACT DRAWING.
21. SI-1301-000 Sheet 14 PIPES TO PANEL POSITIONS.

## **16. Information on Completing Bill of Quantities**

The BoQ has been written following a work breakdown structure for each component part of the project. When pricing each item the following must be noted;

**Item No 1** – As an estimate assume the existing listed quantities of pipework, fittings and supporting blocks quantities in Section C & D (up to item 31), F, G and H are the representative of the installed Copper pipework to be removed. These should be used to estimate 'strip out' costs.

**Item No 2** – Assume the panel depicted by drawings with reference No's SI-1321-001, SI-1321-002, SI-1321-006, SI-1321-015 & SI-1321-0017 for the purposes of producing the cost to disassemble and remove the existing fabricated Main RIKEN panel.

**Section D** - Note – all reducers are of the eccentric design to facilitate draining and venting where applicable.

**Item 31** – An assumption on the number of blocks has been made. The cost to supply and install pipe blocks and associated fixtures and fittings for the supply and return pipe work along the beamline will be determined after the initial survey. No other supports are necessary for lines in the North Tunnel from the main RIKEN panel.

**Section E** - The MPB flowmeters depicted on the flow stick drawing SI-1321-017/A will be provided free-of-charge by STFC when constructing the new Main RIKEN Water Panel. Do not allow for the supply of flowmeters within this item.

**Section F, G** – Allow for the installation of new pipework within a shallow trench from the North Tunnel up to the back wall of Port 1. The fittings and modifications required to the Port 2 Water panel required to connect the new stainless steel flow and return pipes and to the ARGUS supply are unknown at the time of tendering. This aspect of work will be done under Day work rates.

**Section H** – Note that the pipework from the North Tunnel up to the wall of Port 4 will be installed in a shallow trench. It is hoped the steel pipework from the trench plates adjacent to the Port House and feeding it along the trench into the North Tunnel.

**Sections J, K** – leave blank. These works will be done under Day Works and agreed with a STFC's representative.

**Section S** – The Tenderer is required to complete the Schedule of Dayworks rates for all labour and tools under this section of the Bill of Quantities.

**Item No 68** – All welding work to the existing magnet tails to accommodate new hoses and the supply and installation of the hoses and associated fittings are to be agreed with an STFC representative after the initial survey.

APPENDIX A  
Bill of Quantities

Section / Item No	Item Description	Drawing reference	(S)upply, (I)nstall, (R)emove	Quantity	Unit	Price per unit	Item Cost
<b>A</b>	<b>Strip out' Costs</b>						
1	Cut out existing Copper flow and return pipework from each Magnets to existing Main RIKEN panel. Remove all pipework to area directed by STFC representative.		R	1	item		
2	Disassemble and remove existing Main RIKEN panel to area directed by STFC representative		R	1	item		
<b>B</b>	<b>Initial Survey Work</b>						
3	Inaccordance with section 8 and 9, Carry out an initial survey to determine design and quantities of pipe blocks, fixtures and fittings and 'fit for purpose' stainless steel hoses.		S	1	item		
<b>C</b>	<b>Magnet and North Tunnel F&amp;R Hygeinic Pipework Costs</b>						
4	1/2" pipe		S&I	448	m		
5	3/4" pipe		S&I	46	m		
6	1" pipe		S&I	12	m		
7	1 1/2" pipe		S&I	12	m		
8	2" pipe		S&I	6	m		
9	3" pipe		S&I	6	m		
<b>D</b>	<b>Magnet; North Tunnel and Main Flow Panel F&amp;R Hygeinic Fittings Costs</b>						
10	1/2" 90° bend		S&I	212	no		
11	3/4" 90° bend		S&I	32	no		
12	3/4" 45° bend		S&I	21	no		
13	3/4" equal tee		S&I	1	no		
14	3/4" end caps		S&I	5	no		
15	3/4" x 1/2" Tees		S&I	16	no		
16	1" 90° bend		S&I	3	no		
17	1" 45° bend		S&I	6	no		
18	1" x 1/2" tee		S&I	6	no		
19	1" x 3/4" tee		S&I	1	no		
20	1" x 3/4" reducers		S&I	1	no		
21	1" equal tee		S&I	2	no		
22	1 1/2" 45° bends		S&I	1	no		
23	1 1/2" 90° bend		S&I	2	no		
24	1 1/2" x 1" reducers		S&I	2	no		
25	1 1/2" x 1/2" tee		S&I	5	no		
26	2" 45° bend		S&I	1	no		
27	2" x 3/4" reducers		S&I	1	no		
28	2" x 1 1/2" reducers		S&I	2	no		
29	3" x 2" tee		S&I	2	no		
30	3" 90° bend		S&I	4	no		
31	Beamline return pipe blocks, fixtures and fittings		S&I	30	no		To Be Determined
32	3 piece butt weld end full bore 316L stainless steel 1/2" ball valves with UHMW Polyethylene seats and seals(see section 9)		S&I	28	no		
33	3 piece butt weld end full bore 316L stainless steel 3/4" ball valves with UHMW Polyethylene seats and seals(see section 9)		S&I	4	no		
34	3 piece butt weld end full bore 1.5" 316L stainless steel ball valves with EPDM seats and seals (RB2 PSU) (see section 9)		S&I	1	no		
						Sub-Total	
						VAT (@ 20%)	
						Total C/F £	

<b>E</b>	<b>Main RIKEN Water Panel</b>						
35	Supply and Install of a 63cm wide x 57cm high x 8m long steel platform with Aluminium checker plate (anti-slip surface) behind the main panel		S&I	1	no		
36	Supply and Install Panel frames in situ - except electrical boxes - in accordance with drgs no SI-1329-029A and B	SI-1321-001/A,002A,006A	S&I	1	no		
37	Supply and Install Complete set of 1" return flow sticks as depicted by drg no SI-1321-017/A	SI-1321-017A	S&I	33	no		
38	Supply and Install stainless steel 3" metric TRUBORE (with pulled tees) Common return manifold assembly complete with flanged 3" equal tee ends and end caps. Also Automatic Air Valves (AAVs).	SI-1321-015A	S&I	1	no		
39	0.5" pipe		S&I	28	m		
40	3/4" pipe		S&I	4	m		
41	1 1/2" pipe		S&I	1	m		
42	0.5" 90° bends 1.5 D		S&I	56	no		
43	3/4" 90° bends 1.5 D		S&I	8	no		
44	1 1/2" 90° bends 1.5 D		S&I	1	no		
45	0.5" x 1" concentric reducers		S&I	28	no		
46	3/4" x 1" concentric reducers		S&I	4	no		
47	1 1/2" x 1" concentric reducers		S&I	1	no		
48	3 piece butt weld end full bore 316L stainless steel 1" ball valves with EPDM seats and seals. To act as isolation valves for flow stick removal.		S&I	66	no		
49	3 piece butt weld end flow regulation 'V'-notch 316L stainless steel 1" ball valves as specified on drg no SI-1321-017/A	SI-1321-017A	S&I	33	no		
50	1" Tri clover weld ferrules for securing each flow stick		S&I	66	no		
51	All 1" pipe fixing clamps to horizontal frame		S&I	66	no		
<b>F</b>	<b>Port 2 (HELMHOLTZ) Trench Pipework/fitting costs</b>						
52	1" pipe		S&I	42	m		
53	1" 90° bends		S&I	10	no		
54	3 piece butt weld end full bore 316L stainless steel 1" ball valves with EPDM seats and seals		S&I	2	no		
<b>G</b>	<b>ARGUS Power supply 2 Trench Pipework/fitting costs</b>						
55	1/2" pipe		S&I	20	m		
56	1/2" 90° elbows		S&I	10	no		
<b>H</b>	<b>Port 4 Trench Pipework/fitting costs</b>						
57	3/4" pipe		S&I	35	m		
58	3/4" 90° bends		S&I	16	no		
59	3/4" 45° bends		S&I	4	no		
<b>J</b>	<b>Port 3 (CRONOS) Pipework/fitting costs</b>						
60	TBC						Dayworks
61	TBC						Dayworks
<b>K</b>	<b>RQ1,RQ2 and RB1 Pipework/fitting cost</b>						
62	TBC						Dayworks
63	TBC						Dayworks
<b>L</b>	<b>RB2 PSU</b>						
64	1 1/2" pipe		S&I	12	m		
65	1 1/2" 45° bends		S&I	2	no		
66	1 1/2" 90° bend		S&I	10	no		
						Sub-Total	
						VAT (@ 20%)	
						Total C/F £	



## APPENDIX B

### RIKEN Location Plan and Photos

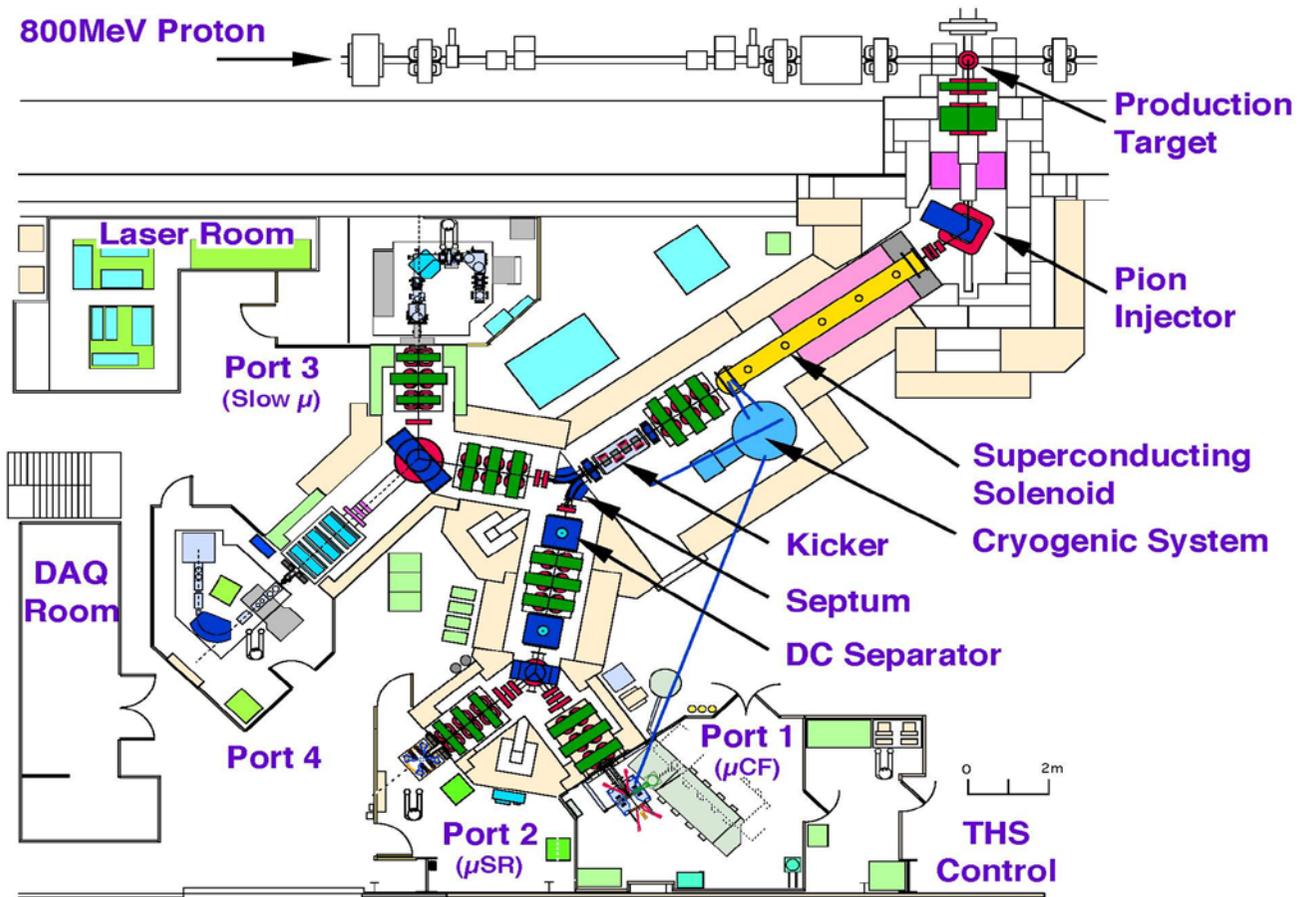


Figure 1 -Plan View of RIKEN

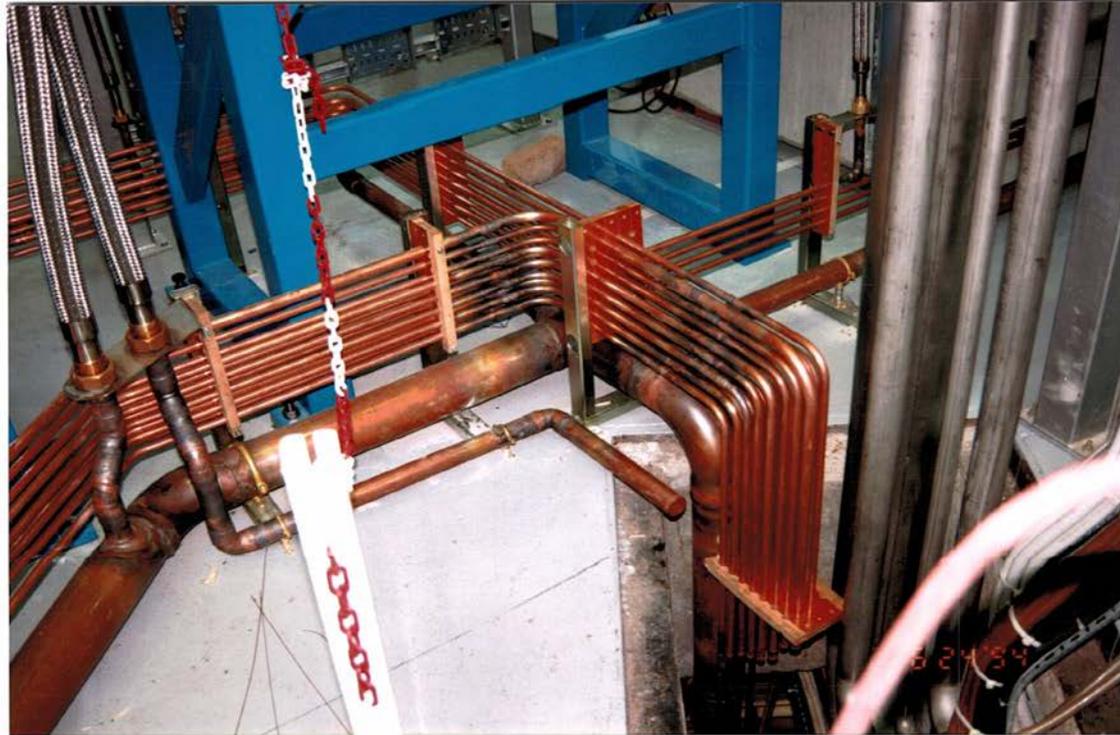
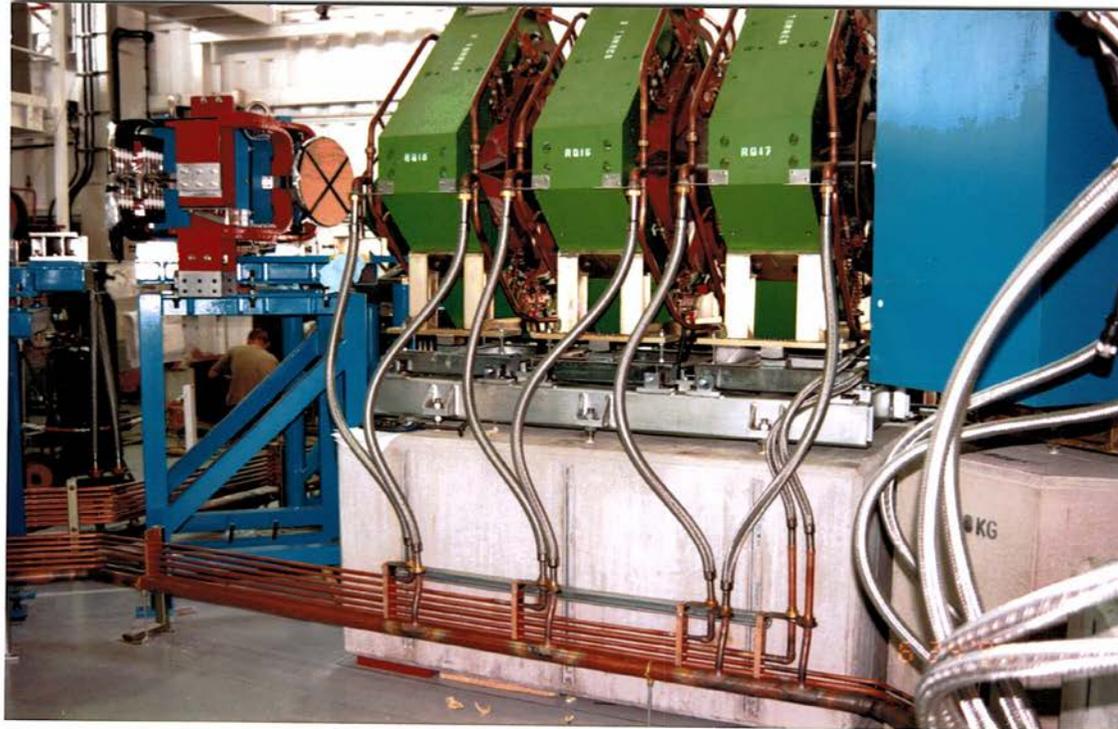
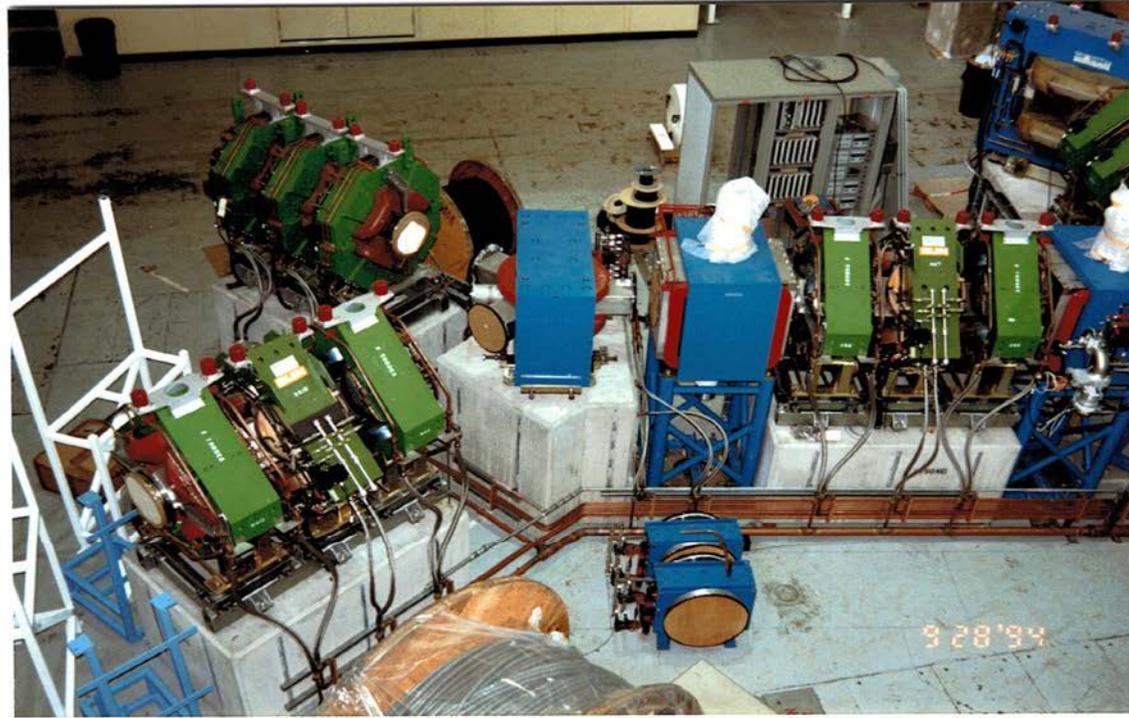


Figure 2 - Floor penetration in 'Kicker cell' showing F&I Copper pipe between North Corridor and magnets



**Figure 3 - Typical current Copper pipework installation along beamline**



**Figure 4 - Existing Copper pipework installation along beamline magnet blocks**



## APPENDIX C

Previous Radiation and Radioactive Contamination Surveys

Magnet Cooling Water Circuits Tritium Results



## STFC ISIS Health Physics Survey Form

Location & Task: R55 Riken port 1 waste		
Date: 27.01.17	Time: 1100	Area Designation: R3

A	Inst: mini 900 -41	Ser# 044630-2140	Pre Check	Y	Cal Due 14.04.17
B	Inst: DPG	Ser# 7021-3571	Pre Check	Y	Cal Due 21.02.17
C	Inst:	Ser#	Pre Check		Cal Due
D	Inst:	Ser#	Pre Check		Cal Due

Air sample run	NO	Result:	Volume:	Ser#
<sup>3</sup> H sample run	YES	Result: attached	Volume: smear	Ser#

Background dose rate	0.05	$\mu\text{Sv/h}$ $\gamma$	Background Probe	5-7 / CPS $\beta\gamma$
Background dose rate		$\mu\text{Sv/h}$ n	Background Probe	0 / CPS $\alpha$

Location	Radiation Dose Rate ( $\mu\text{Sv/h}$ )		Contamination cps (cps)			
	$\gamma$	n	$\alpha$ swab	$\beta\gamma$ swab	$\alpha$ probe	$\beta\gamma$ probe
<b>Bagged waste</b>						
Metal waste blue label 12363	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Soft waste blue label 12369	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Soft waste blue label 12370	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Soft waste blue label 12364	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Soft waste blue label 12365	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Soft waste blue label 12366	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
<b>Items cleared</b>						
Galvanised steel trunking	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Cable trays	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Glass windows	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD

<b>Action levels: Radiation</b> Negligible - <7.5 $\mu\text{Sv/h}$ Moderate - 7.5 $\mu\text{Sv/h}$ - 25 $\mu\text{Sv/h}$ High - >25 $\mu\text{Sv/h}$	<b>Contamination</b> Negligible - <0.4Bq/cm <sup>2</sup> $\alpha$ or <4 Bq/cm <sup>2</sup> $\beta$ Moderate - >0.4Bq/cm <sup>2</sup> $\alpha$ or >4 Bq/cm <sup>2</sup> $\beta$ High - >40Bq/cm <sup>2</sup> $\alpha$ or >40 Bq/cm <sup>2</sup> $\beta$
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Additional information:			
HP Surveyor	HP Surveyor Signature	HP/RW Team Lead	HP/RW Team Lead Signature
C. Jones G. Bridges		John M. Jones	
HP Section Leader	HP Section Leader Signature	HP Section Leader Comments:	



### STFC ISIS Health Physics Survey Form

Location & Task: R55 RIKEN BLOCKHOUSE, WALKWAYS AND NORTH SERVICE TUNNELS AS INDICATED ON PRE WORK WALKROUND <b>BEAM OFF CONDITIONS</b>		
Date: 26-07-19	Time: 1015	Area Designation 3/1 CONTROLLED

A	Inst: 3002-4393	Ser# 25013241-359784	Pre Check	YES	Cal Due	24-05-20
B	Inst: LUDLUM 26-1	Ser# 006542	Pre Check	YES	Cal Due	09-07-20
C	Inst:	Ser#	Pre Check		Cal Due	
D	Inst:	Ser#	Pre Check		Cal Due	
Air sample run	NO	Result:	Volume:	Ser#		
<sup>3</sup> H sample run	NO	Result:	Volume:	Ser#		

Background dose rate AS REPORTED	$\mu\text{Sv/h } \gamma$	Background Probe	1 TO 2 CPS $\beta\gamma$
Background dose rate	$\mu\text{Sv/h n}$	Background Probe	0 CPS $\alpha$

Location	Radiation Dose Rate ( $\mu\text{Sv/h}$ )		Contamination cps (cps)			
	$\gamma$	n	$\alpha$ swab	$\beta\gamma$ swab	$\alpha$ probe	$\beta\gamma$ probe
R55 ENTRANCE TO RIKEN	0.1-0.15		B/G	B/G		
GROUND FLOOR ENTRANCE TO RIKEN	0.1-0.15		B/G	B/G		
R55 ENTRANCE TO NORTH SERVICE TUNNEL	0.1-0.3		B/G	B/G		
RIKEN BLOCKHOUSE ENTRANCE	0.1		B/G	B/G		
BLOCKHOUSE FLOOR AND RAISED AREAS ENVIRONMENTAL	0.1-0.15					
BEAMLINE AND MAGNETS	0.1-0.2		B/G	B/G		
COPPER PIPE INTO FLOOR DUCT	0.1-0.2		B/G	B/G		
HAND RAILS AND BEAMLINE SUPPORT FRAMES	0.1-0.2		B/G	B/G		
NORTH SERVICE TUNNEL TO WORK AREA ENVIRONMENTAL	0.1-0.3		B/G	B/G		
DEMIN MAGNET COOLING PIPEWORK CONTACT	0.2					
NORTH TUNNEL PROPOSED WORK AREAS	0.1-0.2		B/G	B/G		
TUNNEL FLOOR AREAS, PIPE TOPS AND CABLES			B/G	B/G		



## STFC ISIS Health Physics Survey Form

Location & description of Task: Riken waste		
Date: 21.04.16	Time: 1030	Area Designation: 3/1

A	Inst type: Mini 500 - 41	Serial # 0000327-2349	Pre Check	Y	Cal Due 21.01.17
B	Inst Type:DP6	Serial # 7021-3571	Pre Check	Y	Cal Due 24.02.17
C	Inst Type:	Serial #	Pre Check	Y/N	Cal Due
D	Inst Type:	Serial #	Pre Check	Y/N	Cal Due
Air sample run	Y/N	Result: Bq/m <sup>3</sup>	Volume:	Serial #	
H sample run	Y/N	Result: Bq/m <sup>3</sup>	Volume:	Serial #	

Background dose rate	<0.1 μSv/h	γ	Background Probe	0 cps α 5 – 10 cps β
Background dose rate	μSv/h-n		Background Probe	cps/cpm

Point/ Location/ Item	Radiation Dose Rate (μSv/h)		Contamination cps			
	γ	n	α swab	β swab	α probe	β probe
Riken waste pipework	<0.1	-	Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Cables	<0.1	-	Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Old active samples cupboard	<0.1	-	Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Helium tank	<0.1	-	Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD

Action levels: *Radiation*  
 Negligible - <7.5 μSv/h  
 Moderate - 7.5 μSv/h - 25 μSv/h  
 High - >25 μSv/h

Contamination  
 Negligible - <0.48 Bq/cm<sup>2</sup> α or <4 Bq/cm<sup>2</sup> β  
 Moderate - >0.48 Bq/cm<sup>2</sup> α or >4 Bq/cm<sup>2</sup> β  
 High - >48 Bq/cm<sup>2</sup> α or >40 Bq/cm<sup>2</sup> β

**Additional information:**

Monitoring of riken waste items, all accessible areas monitored no dose rate above 0.1 μSv/h γ detected no loose or fixed contam found above background levels.

HP Surveyor	HP Surveyor Signature	HP Section Lead	HP Section Lead Signature
Craig Jones		John More	
RPA	RPA Signature	RPA Comments:	



Science & Technology Facilities Council  
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ISIS-HOPI-003 Appendix A rev 3

## STFC ISIS Health Physics Survey Form

Location & Task: Riken magnet pipe work	
Date: 13.02.17	Time: 1530 Area Designation R3

A	Inst: mini 900 -41	Ser#	030190-1834	Pre Check	Y	Cal Due	19.09.17
B	Inst: LB174	Ser#	20-6463	Pre Check	Y	Cal Due	19.09.17
C	Inst:	Ser#		Pre Check		Cal Due	
D	Inst:	Ser#		Pre Check		Cal Due	
Air sample run	NO	Result:		Volume:		Ser#	
<sup>3</sup> H sample run	NO	Result:		Volume:		Ser#	

Background dose rate	0.05	$\mu\text{Sv/h}$	$\gamma$	Background Probe	8-10	/ CPS	$\beta\gamma$
Background dose rate		$\mu\text{Sv/h}$	n	Background Probe	0	/ CPS	$\alpha$

Location	Radiation Dose Rate ( $\mu\text{Sv/h}$ )		Contamination cps (cps)			
	$\gamma$	n	$\alpha$ swab	$\beta\gamma$ swab	$\alpha$ probe	$\beta\gamma$ probe
Riken magnet pipework	Nil > BGD		Nil > BGD	Nil > BGD	Nil > BGD	Nil > BGD
Tritium smears taken on each end of pipes (4)	Results attached					

Action levels: Radiation  
Negligible -  $<7.5\mu\text{Sv/h}$   
Moderate -  $7.5\mu\text{Sv/h} - 25\mu\text{Sv/h}$   
High -  $>25\mu\text{Sv/h}$

Contamination  
Negligible -  $<0.4\text{Bq/cm}^2$   $\alpha$  or  $<4\text{Bq/cm}^2$   $\beta$   
Moderate -  $>0.4\text{Bq/cm}^2$   $\alpha$  or  $>4\text{Bq/cm}^2$   $\beta$   
High -  $>4\text{Bq/cm}^2$   $\alpha$  or  $>40\text{Bq/cm}^2$   $\beta$

Additional information:

HP Surveyor	HP Surveyor Signature	HP/RW Team Lead	HP/RW Team Lead Signature
C. Jones		John Moir	
HP Section Leader	HP Section Leader Signature	HP Section Leader Comments:	

14/02/2017 01:43:24 QuantaSmart (TM) - 3.00 - Serial# 094719 Page #  
 Protocol# 4 - Tritium smears..lsa User: provec

#### Assay Definition

Assay Description:  
 RIKEN MAGNET PIPE WORK  
 Assay Type: DPM (Single)  
 Report Name: TRITIUM SMEARS  
 Output Data Path: C:\Packard\Tricarb\Results\proveout\Tritium smears.\20170213\_1524  
 Raw Results Path: C:\Packard\Tricarb\Results\proveout\Tritium smears.\20170213\_1524\20170213\_1524.results  
 Comma-Delimited File Name: C:\Packard\Tricarb\Results\proveout\Tritium smears.\20170213\_1524\Report1.csv  
 Assay File Name: C:\Packard\TriCarb\Assays\Tritium smears..lsa

#### Count Conditions

Nuclide: 3H  
 Quench Indicator: tSIE  
 External Std Terminator (sec): 0.5 2s%  
 Pre-Count Delay (min): 0.00  
 Quench Set:  
 Low Energy: 3H-UG  
 Count Time (min): 120.00  
 Count Mode: Normal  
 Assay Count Cycles: 1 Repeat Sample Count: 1  
 #Vials/Sample: 1 Calculate % Reference: Off

#### Background Subtract

Background Subtract: On - 1st Vial  
 Low CPM Threshold: Off  
 2 Sigma % Terminator: On - Any Region

Regions	LL	UL	Bkg Subtract	2Sigma % Terminator
A	0.0	18.6	1st Vial	2.00
B	2.0	18.6	1st Vial	0.00
C	0.0	0.0	1st Vial	0.00

#### Count Corrections

Static Controller: On Luminescence Correction: n/a  
 Colored Samples: Off Heterogeneity Monitor: n/a  
 Coincidence Time (nsec): 18 Delay Before Burst (nsec): 75

#### Cycle 1 Results

DATE	Count	Time	SIS	tSIE	Eff %	SMPL ID	Bq:1	CPMA	DPM1	P#
13/02/2017	120.00	1107.63	897.30	0.00	1st Vial	Bkgnd	0.000		9	0
13/02/2017	120.00	2095.65	696.98	57.97		1	0.000	0	0	4
13/02/2017	120.00	1925.67	714.98	58.72		2	0.006	0	0	4
13/02/2017	120.00	2112.18	660.22	56.45		3	0.015	1	1	4
13/02/2017	120.00	2937.88	786.39	61.67		4	0.000	0	0	4

SMEAR AREA ~ 10cm<sup>2</sup>

OPEN ENDS

14/02/17 JM.

Water circuit	Location	Supplying	Circuit volume M <sup>3</sup>	Header tank volume M <sup>3</sup>	Contents	Activity Bq/ml				
						21/10/16	20/3/17	26/3/18	21/6/19	
Main magnet & EPB1	R55 & R6	Synchrotron, Epb1 & Muon beam magnets	200	4.5	demin water	0.419		0.4849	0.346	
RFHP	R4, synchrotron & injector	RF valves in linac & Synchrotron	150	4.5	demin water					
EBP 2 magnet circuit	R6 link	EPB 2 magnets	15	4	demin water					
EPB 2 power supply circuit	R6 link	EPB 2 magnet power supplies	8	1	demin water					
70Mev linac	Linac R5.1	injector tanks, RFQ & debuncher	7	0.1	demin water					
Extract septum 1	Catacomb 3	extract septum 1	2	0.2	demin water					
Extract septum 2	R6 chalk pits	extract septum 2	3	0.5	demin water					
beam stops & collectors	Catacomb 4	beams stops & collectors	2	0.3	demin water					
RF cavity 2,3 & 4	Catacomb 5	RF cavity 2,3 & 4	2	0.3	demin water					
RF cavity 7,8 & 9	Catacomb 2	RF cavity 7,8 & 9	2	0.3	demin water					
2nd RF cavity 4,5,6 & 8	catacomb 8	2nd RF cavity 4,5,6 & 8	2.5	0.3	demin water					
Fundamental Liquid resistors	Catacomb 5	liquid resistors 2,3,4,7,8 & 9	2	0.1	copper sulphate					
2nd liquid resistors	Catacomb 7	Liquid resistors 4,5,6 & 8	1.5	0.1	copper sulphate					
Choke	R6a	Chokes	2	1	demin water					
Dc Bias supply	R6a	DC bias power supply	0.5	1	demin water					
R6a power supplies	R6a	R6 extract powers supplies	3	1	demin water					
Bias regulators	R55	R5.4 bias power supplies	2	0.2	demin water					
Beam entry window	R55 south tunnel	Beam entry window	0.5	0.1	demin water					
Intermediate target	R55 south tunnel	Intermediate target	0.5	N/A	demin water					
EC Muon	R55	Muon power supplies	0.5	0.1	demin water					

