

RADIATION SAFETY AND PROTECTION PLAN

FOR THE USE OF SEALED SOURCE APPARATUS IN THE BOREHOLE-LOGGING PRACTICE

OF

H3 – Tritium Logging Sources

Signature

Date

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5 Nov 24	5 Nov 25	Page 1 of 27

RADIATION SAFETY AND PROTECTION PLAN FOR USE OF SEALED SOURCE APPARATUS IN THE BOREHOLE-LOGGING PRACTICE OF A TRITIUM SOURCE

Contents

- 1 Introduction
 - (a) Purpose
 - (b) Who must read this document
 - (c) Reference documents
 - (d) Definitions
- 2 Hazard Assessment
- 3 Responsibilities of Possession Licensee
- 4 Duties of Radiation Safety Officer
 - (a) Functions
 - (b) Reporting to the possession licensee
- 5 Responsibilities of Borehole Loggers
- 6 Responsibilities of Assistant Borehole Loggers
- 7 Access Control
- 8 Training
 - (a) Borehole loggers and assistant borehole loggers
 - (b) All other staff of the possession licensee
- 9 Safe Work Practices
 - (a) General
 - (b) Enclosed sites
 - (c) Open sites
 - (d) Source transfer
- 10 Transport
 - (a) Industrial radiography equipment
 - (b) Gamma-radiography equipment
 - (c) Movement of a source container within the owner's establishment or within the premises where radiography is performed
- 11 Storage
 - (a) Storage of industrial radiography X-ray equipment
 - (b) Storage of gamma-radiography source containers
- 12 Personal Radiation Monitoring
 - (a) Personal monitoring devices
 - (b) Personal alarm dosimeters
- 13 Safety Devices, Personal Protective Equipment and Emergency Equipment

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 1 of 27

- (a) Safety devices
 - (b) Personal protective equipment
 - (c) Emergency equipment
- 14 Radiation Monitoring Equipment
- 15 Repairs and Maintenance
- (a) Industrial radiography X-ray equipment and gamma-radiography source containers
 - (b) Radiation monitoring device and personal alarm monitoring device
 - (c) Other equipment
 - (d) Processor chemical disposal
- 16 Safety Checks
- (a) Monthly checks
 - (b) Three monthly checks
 - (c) Six monthly checks
 - (d) Annual checks
- 17 Records
- 18 Acquisition, Supply, Disposal and Relocation of Industrial Radiography Equipment
- (a) Acquisition
 - (b) Supply
 - (c) Disposal
 - (d) Relocation
- 19 Remediation Procedures
- (a) General
 - (b) Industrial radiography X-ray equipment
 - (c) Loss of or damage to a gamma-radiography source container during transport
 - (d) Loose gamma-radiography source
 - (e) Gamma-radiography source lost or irretrievable
- 20 Incident Notification

Attachments

Attachment 1 Source Details

Attachment 2 Contact Details

Attachment 3 List of Authorised Persons

Attachment 4 Details of radiation monitoring devices

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 2 of 27

1. INTRODUCTION

(a) Purpose

The *Radiation Safety Act 1999* requires that a Radiation Safety and Protection Plan be developed. This plan has been formulated for the purpose of ensuring that all borehole – logging practices using sealed radioactive sources are conducted safely and in compliance with the *Radiation Safety Act 1999* and the *Radiation Safety Regulation 2021*.

This plan applies to the borehole logging sources and its premises in the possession of the possession licensee. For the information of the reader, details of the source and its premises are listed in Attachment 1. The possession licensee will update this attachment when logging apparatus containing sealed sources are acquired, sold or relocated.

Compliance with this Radiation Safety and Protection Plan will help ensure that the radiation doses to all employees and visitors are below the prescribed limits and are as low as reasonably achievable. It will also help ensure that the number of people exposed to radiation and the likelihood of unexpected exposure to radiation are minimised.

This plan outlines the obligations of the possession licensee and other persons involved in carrying out borehole logging using the borehole logging apparatus for the possession licensee.

(b) Who must read this document?

All persons who are involved in carrying out borehole logging using the borehole logging sources must be familiar with this plan. All borehole-logging practices involving the possession licensee's equipment and facilities must be conducted in accordance with this plan.

(c) Reference documents

In addition to this Radiation Safety and Protection Plan, the following documents must be complied with:

- *Radiation Safety Act 1999 and Radiation Safety Regulation 2021*
- Radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*
- Radiation safety standard *Standard for premises – Ionising radiation sources (2021)*
- *ARPANSA Code of practice for the safe transport of radioactive material (2008).*
- National Health and Medical Research Council Radiation Health Series No. 28: 1989 *Code of practice for the safe use of sealed radioactive sources in borehole logging.*

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 3 of 27

2. HAZARD ASSESSMENT

Borehole-logging tools that incorporate sealed radioactive substances are used to provide geophysical data of rock types intersected in boreholes. The tool contains a linear accelerator and a sealed H-3 (Tritium) radioactive source, producing neutrons used for the purposes of surface well monitoring. Attachment 1 contains full details of the sources and devices in possession, their purpose and storage locations and brief outlines of the principles of the borehole-logging tool containing a sealed source, possessed by the possession licensee.

The radioactive substance incorporated in the borehole-logging tool is adequately shielded. However, accidental or intentional damage to the apparatus may result in a significant health hazard. Unauthorised persons should not remove, or in any way interfere with, the radioactive substances or carry out any maintenance, adjustment or modification to the borehole-logging tool.

Radiation doses to persons involved in the practice, other employees and members of the public, depend mainly on the type of radioactive substances being used, the extent of compliance with work practices, and the extent of compliance of the logging tool with relevant radiation safety standards made under the *Radiation Safety Act 1999*.

The *Radiation Safety Regulation 2021* prescribes an annual radiation dose limit of 20mSv for persons actually involved in carrying out a radiation practice, and an annual radiation dose limit of 1mSv for all other persons. Also, if a female employee who is involved in the radiation practice becomes pregnant, her radiation dose limit is reduced to 1mSv per annum for the term of the pregnancy.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 4 of 27

3. RESPONSIBILITIES OF POSSESSION LICENSEE

Huracan Pty Ltd holds a licence to possess a sealed source in borehole logging apparatus. Attachment 2 contains the details of the contact person for the possession licensee. The nominee will update attachment 2 if the name or contact details change.

The licensee obtained this licence after demonstrating to the Chief Executive, Queensland Health that all of the radiation safety criteria set by the *Radiation Safety Act 1999* have been satisfied.

Nevertheless, there are on-going obligations borne by the possession licensee, which are the responsibility of the nominee. The possession licensee must take reasonable steps to ensure any person's health and safety are not adversely affected by exposure to radiation because of the way a person carries out the practice. To do this, the possession licensee must:

- hold a licence, issued under the *Radiation Safety Act 1999*, with an authority to possess sealed radioactive substances incorporated in borehole logging apparatus;
- ensure that the radiation doses arising from the radiation practice are kept below the limits specified in the *Radiation Safety Regulation 2021* and are as low as reasonably achievable;
- provide personal monitoring devices to monitored persons as required by this Radiation Safety and Protection Plan, and ensure that:
 - (i) personal monitoring devices are handled properly
 - (ii) monitored persons are advised of their personal monitoring assessment results
 - (iii) copies of the personal monitoring assessment results are submitted to the Chief Executive of Queensland Health;
- keep a personal monitoring record for each person monitored;
- ensure that the persons who use the borehole logging apparatus for borehole logging hold licences issued under the *Radiation Safety Act 1999*, allowing them to use such equipment for performing geological measurements (borehole logging);
- ensure that the persons who use the borehole logging apparatus during initial installation, repair and maintenance hold licences issued under the *Radiation Safety Act 1999*, allowing them to use such equipment for installation, repair and maintenance (borehole logging);
- ensure there are always 2 people present when performing borehole logging practices;
- ensure compliance with any conditions imposed on the possession licensee by the Chief Executive, Queensland Health and with those stated in the *Radiation Safety Act 1999* and the *Radiation Safety Regulation 2021*;
- ensure that the version of the Radiation Safety and Protection Plan being used has been approved by the Chief Executive, Queensland Health;
- appoint a Radiation Safety Officer certified under the *Radiation Safety Act 1999*;
- ensure that the Radiation Safety Officer is carrying out his/her functions properly so that the possession licensee is able to be adequately informed of the radiation safety status of the

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 5 of 27

practice at all times;

- ensure that adequate resources are provided to implement this Radiation Safety and Protection Plan (eg. provision of appropriate training in radiation safety, radiation monitoring devices etc);
- ensure that the records, specified in this Radiation Safety and Protection Plan, are kept;
- ensure that the borehole logging apparatus continues to comply with radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*, and obtain certificates of compliance from an appropriately accredited person, before initial use and every three years thereafter;
- ensure that the premises where radioactive substances are stored continue to comply with radiation safety standard *Standard for premises – Ionising radiation sources (2021)*, and obtain certificates of compliance from an appropriately accredited person, before initial use and every five years thereafter;
- ensure that the approval of the Chief Executive, Queensland Health is obtained before acquiring any radiation sources;
- ensure that the approval of the Chief Executive, Queensland Health is obtained before relocating any radiation sources to a place outside Queensland;
- ensure that if any radiation sources are sold or traded in within Queensland, that the person to whom the sources is sold or traded in has an approval to acquire the radiation source;
- ensure that the approval of the Chief Executive, Queensland Health is obtained before disposing of radioactive material greater than the amount and concentration prescribed in the *Radiation Safety Regulation 2021*;
- ensure that the transport of radioactive substances is conducted in accordance with the *ARPANSA Code of practice for the safe transport of radioactive material (2008)* (Transport Code); and
- immediately notify the Chief Executive, Queensland Health after an incident, either orally or in writing. If the notice is given orally, written confirmation must be provided within seven (7) days.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 6 of 27

4. DUTIES OF RADIATION SAFETY OFFICER

(a) Functions

The Radiation Safety Officer advises the possession licensee and employees on radiation safety matters associated with the practice. The name and contact details of the Radiation Safety Officer are detailed in Attachment 2. The possession licensee will update attachment 2 if the name or contact details of the Radiation Safety Officer change.

On an on-going basis

On an on-going basis, the Radiation Safety Officer must:

- ensure that the borehole logging apparatus continues to comply with radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*;
- ensure that the premises where the borehole logging apparatus is stored continue to comply with the radiation safety standard *Standard for premises – Ionising radiation sources (2021)*;
- provide, or arrange for the provision of training about radiation hazards and safe working practices (see section 7 of this plan);
- ensure that the likely maximum radiation doses a person could receive are within the limits prescribed by the *Radiation Safety Regulation 2021*, and are as low as reasonably achievable;
- Ensure that personal monitoring records (where necessary) are updated; and
- If a user declares her pregnancy, ensure that, during her pregnancy, her radiation dose is kept to as low as reasonably achievable and below the radiation dose limits prescribed by the *Radiation Safety Regulation 2021*, ie. pro rata 1mSv per annum. Such a user must not be engaged in procedures, which may result in higher radiation dose.

Annually

At the commencement of the practice and annually thereafter, the Radiation Safety Officer must check, and record, that:

- all relevant persons (ie. Users) have read, understood and are complying with this Radiation Safety and Protection Plan;
- ensure that all users of the borehole logging apparatus are licensed, under the *Radiation Safety Act 1999*, to use radioactive substances in sealed source apparatus for borehole logging;
- the details of the radioactive substances and sealed source apparatus are accurately stated in this Radiation Safety and Protection Plan;

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 7 of 27

- the person in possession of the radioactive substances is appropriately licensed under the *Radiation Safety Act 1999*;
- all maintenance, repair and safety checks (see sections 12 and 13) are being conducted and recorded and any relevant problems have been appropriately rectified;
- radiation monitoring devices are available and are in good working order (see section 11);
- all records required in this Radiation Safety and Protection Plan are being kept (see section 14);
- compliance certificates for the borehole logging apparatus and radioactive materials have been obtained within the necessary timeframes;
- all borehole logging tools with sealed sources comply with radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*; and
- the calibration of the radiation monitoring device has been checked and is within calibration (ie. $\pm 25\%$). This is done by annual checking the calibration check report submitted by the service provider.

(b) Reporting to the possession licensee

The Radiation Safety Officer must report the following to the possession licensee:

- any radiation incidents immediately;
- any contravention of this Radiation Safety and Protection Plan and relevant radiation safety standard;
- any action that needs to be taken to achieve compliance with this Radiation Safety and Protection Plan and/or relevant radiation safety standard;
- the effectiveness and extent of compliance with this radiation safety and protection plan on an annual basis; and
- continually identify and advise the possession licensee of ways to minimise radiation doses to persons engaged in the practice; and
- recommendations about changes to the plan to ensure its continued effectiveness and that the information it contains is correct by reviewing this Radiation Safety and Protection Plan on an annual basis.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 8 of 27

5. RESPONSIBILITIES OF USERS

All users of the borehole logging apparatus are responsible for ensuring that any radiation doses received by persons as a result of carrying out the practice are kept below the radiation dose limits prescribed in the *Radiation Safety Regulation 2021* and are as low as reasonably achievable.

Users must take reasonable steps to ensure that a person's health and safety are not adversely affected by exposure to radiation because of the way the employee carries out the practice.

Users must:

- comply with this Radiation Safety and Protection Plan;
- hold a licence, issued under the *Radiation Safety Act 1999*, with an authority to use sealed radioactive substances in borehole logging apparatus for geological measurements (borehole logging);
- comply with the conditions of the license imposed by the Chief Executive, Queensland Health and with those stated in the *Radiation Safety Act 1999* and the *Radiation Safety Regulation 2021*;
- ensure that they are authorised by the possession licensee to use and transport the borehole logging apparatus;
- as required by this Radiation Safety and Protection Plan, wear a personal monitoring device and, if provided, use personal protective equipment and safety devices;
- record the movement of the borehole logging tool in and out of the radioactive materials store in a log book provided by the possession licensee;
- ensure that no repair or routine maintenance is conducted on the borehole logging tool unless the Radiation Safety Officer considers it safe;
- undertake and satisfactorily complete the training specified in this Radiation Safety and Protection Plan;
- test the radiation survey meter before use (see section 11)
- report any contravention of this Radiation Safety and Protection Plan to the possession licensee;
- report to the possession licensee any difficulties with working procedures or defects in the borehole logging apparatus that come to their notice;
- report any incident which may adversely affect the health or safety of any person, including borehole logging apparatus malfunction, to the possession licensee; and
- in the event of an incident involving a damaged tool or tool lost down a borehole, cordon off area, restrict access and contact the radiation safety officer.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 9 of 27

6. ACCESS CONTROL

The persons detailed in Attachment 4 are responsible for the keys to the radiation store.

When not in use, the borehole logging apparatus is stored in a locked storage facility. During transportation around the mine-site, the borehole logging source is locked in the designated transport container which is then locked in the logging vehicle storage areas. Keys are in the control of the Senior On-site Geologist. The logging vehicle is only used for borehole logging at the designated sites.

Only persons authorised by the possession licensees will have access to the sources either on-site or off-site.

Sources will be signed in and out by authorised users and records kept for tracking purposes.

All reasonable physical and administrative measures will be in place to control access to sources. And to minimise the unauthorised access to these sources by persons which may have malicious intent.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 10 of 27

7. TRAINING

The Radiation Safety Officer must provide, or arrange for the provision of, appropriate training to users of the borehole-logging tool and other persons on radiation safety matters.

All staff involved in using and transporting borehole logging apparatus must be trained in correct techniques initially and their skills reviewed every year thereafter.

(a) Borehole loggers and trainee borehole loggers

The radiation safety training program must include at least:

- specific instructions on how to use, and the features of, the borehole logging equipment
- specific instructions on transport requirements
- setting up a site to perform borehole logging, including the placement of barriers
- radiation hazards in the practice
- instructions regarding appropriate techniques for the care of logging cables (e.g. avoidance of kinking and corrosion)
- hazards that may be encountered in environments where equipment may be used
- how to avoid the hazards
- instructions on how to use personal monitoring devices and radiation monitoring equipment (radiation survey meters)
- details of the radiation safety and protection plan
- remediation procedures following an incident or suspected incident

Trainee borehole loggers may assist a licensed borehole logger in a borehole logging practice once they have completed this training. Once a trainee borehole logger has gained practical competency in the use of the borehole logging equipment, he or she may apply for a licence under the *Radiation Safety Act 1999* to use the equipment. Once a licence has been granted, the trainee borehole logger will gain ‘borehole logger’ status and may work unsupervised.

All employees and contractors are made aware of radiation hazards at site during inductions.

(b) All other staff of the possession licensee

The radiation safety training program must include at least the following:

- a description of the radiation hazards in the practice
- how to avoid the hazards
- minimising radiation dose (eg. minimise exposure time and maximise distance)
- details of the radiation safety and protection plan
- remedial procedures

These persons will undergo re-familiarisation of the above radiation safety training program once a year.

All employees and contractors are made aware of radiation hazards at site during inductions.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 11 of 27

8. SAFE WORK PRACTICES

The three simple rules to minimise personal radiation doses are:

Time: minimise exposure time
 Distance: keep as far away as practicable from the radioactive substances
 Shielding: add additional shielding

To ensure radiation doses to all persons are minimised, the following practices must be followed.

(a) General

- All persons involved in carrying out the practice using the possession licensee's borehole logging tool must comply with this radiation safety and protection plan.
- The user of the borehole-logging tool must ensure that he/she is authorised by the possession licensee to carry out borehole logging (see Attachment 4).
- The user of the borehole-logging tool must ensure that he/she is licensed, under the *Radiation Safety Act 1999*, to use radioactive substances in sealed source apparatus for borehole logging;
- The borehole logging apparatus may only be used if it is in compliance with radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*.
- The borehole logging apparatus may only be stored in premises that are in compliance with radiation safety standard *Standard for premises – Ionising radiation sources (2021)*.
- All persons not required to assist with the measurements are excluded from the vicinity of the borehole logging equipment (3 metres minimum) prior to moving the tool from its housing on the logging vehicle and removal from the radiation store.
- All maintenance work on the tool not intended by the manufacturer to be undertaken by the owner, is to be conducted by a person qualified to perform such work.

(b) Use of Apparatus

When using the Apparatus, the following must be conducted:

- Users must ensure that radiation warning notices are displayed on the logging vehicle when transporting or using the borehole logging tool
- Users must only remove the borehole-logging tool from the radiation store to either log holes or dispatch the tool for repair.
- Users must only remove the borehole-logging source (locked in the designated transport container) from the logging vehicle storage area immediately prior to logging a hole and return the tool immediately after the hole has been satisfactorily logged.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 12 of 27

- Users must minimise the number of people assisting or observing the operation of the logging equipment while stringing and loading logging apparatus.
- A non-radioactive tool will be used to test the condition of the hole before logging the hole with a tool incorporating radioactive sources.
- Radioactive sources should not remain down a borehole any longer than necessary to carry out the series of measurements required at that time.
- Boreholes shall be covered at all times while the source transfers are carried out above or nearby the boreholes to prevent loss of the source down the hole.
- Users must not stay close to the borehole logging tool except when necessary to conduct measurements
- Users shall not conduct measurements unless they wear appropriate personal monitoring devices
- Users shall take due care not to place the borehole logging tool in a position where it can be damaged by vehicles or machinery
- Users shall not leave the borehole-logging tool unattended unless it is securely stored in the logging vehicle or the radiation store.

(c) Transport

- The packaging and transport of radioactive substances are to be in compliance with the ARPANSA *Code of practice for the safe transport of radioactive material (2008)* (Transport Code).
- Except in emergency situations, the borehole logging source must only be transported whilst locked in the designated transport container which is then locked in the logging vehicle storage area.
- The borehole logging apparatus must not be transported in the passenger compartment of a vehicle.
- Transport signs in compliance with the Transport Code are to be affixed to both sides and the rear of the vehicle.
- A fire resistant metal plaque engraved with appropriate emergency telephone numbers and other relevant information shall be carried in the passenger compartment of the vehicle.
- Only persons authorised by the possession licensee are to transport borehole-logging apparatus.
- The borehole logging tool may only be transported by: -

Persons who are licensed under the Radiation Safety Act 1999 to use a borehole-logging tool containing a sealed radioactive source

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 13 of 27

A person who is licensed under the Radiation Safety Act 1999 to transport radioactive substances.

- The borehole logging apparatus will only leave site in the event of requiring maintenance or repair that cannot be done on site by suitably qualified persons or in the event of source disposal.
- Unless the radioactive substances can be transported as an excepted package (as defined in the Transport Code), it will be consigned to a person licensed under the *Radiation Safety Act 1999* to transport such substances.
- A shipper's declaration for transport of radioactive substances must be correctly completed before consignment.

(d) Storage

- The borehole-logging tool must be stored in the premises that have been certified as meeting radiation safety, standard *Standard for premises – Ionising radiation sources (2021)*. This store is located at the location nominated in Attachment 3.

(e) Routine work

When performing routine work, the protocols and procedures detailed in the company codes and safe practices shall be followed.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 14 of 27

9. PERSONAL RADIATION MONITORING

(a) Personal monitoring devices

Under the *Radiation Safety Act 1999* and the *Radiation Safety Regulation 2021*, personal monitoring devices are to be provided to a person if the person may receive an annual radiation dose greater than 1mSv as a result of the carrying out of the practice.

Persons who use the borehole logging apparatus are to be provided with personal monitoring devices, which are capable of measuring gamma radiation at levels and energies specific to the radioactive sources used.

The following personal monitoring program must be followed:

- All users of the borehole logging apparatus are required to wear an appropriate personal monitoring device, at chest or waist height, whenever they use the borehole logging apparatus;
- Personal monitoring devices are to be obtained from, and assessed by a service provider that has a personal radiation monitoring service that uses reference sources directly traceable to the Australian National Standards as required by the National Measurement Act 1960;
- The personal monitoring device-wearing period is 3 months.
- Personal monitoring devices must not be tampered with or be misused;
- At the end of each working day the devices must be stored well away from radiation sources
- Personal monitoring devices are not to be worn of the monitored person is undergoing a radiographic examination as a patient;
- A control device must be stored as far away from radiation sources as possible.

As soon as practicable after the assessment of the personal monitoring devices, the possession licensee must:

- Arrange for a copy of the results to be sent to the Chief Executive of Queensland Health, and
- Advise the monitored persons of their radiation assessment results;

The Radiation Safety Officer is to update the personal monitoring record for each monitored person.

The personal monitoring records are to be kept for the duration of the wearer's working life and for not less than 30 years after the last exposure assessment, and at least until the person has reached the age of 75 years; and

The personal monitoring records are to be checked by the Radiation Safety Officer to ensure the radiation doses are below the prescribed limits in the *Radiation Safety Regulation 2021* and are as low as reasonably achievable. If any unusual doses are received, the work practices of the wearer are to be investigated and, if necessary, remedial action to be taken.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 15 of 27

10. SAFETY DEVICES AND PERSONAL PROTECTIVE EQUIPMENT

(a) Safety Devices

No specific safety devices are provided.

(b) Personal Protective Equipment

No specific personal protective equipment is provided.

11. RADIATION MONITORING DEVICES

The licensee will provide a radiation-monitoring device (or radiation survey meter) having the following characteristics:-

- has a dose rate range of at least between 10 μ Sv/h and 10000 μ Sv/h, or equivalent for the radiations emitted from the radioactive substances used in borehole logging;
- has appropriate energy response;
- has a measurement uncertainty not greater than $\pm 25\%$ over the energy range of the radiation emitted from the radioactive substances; and
- continues to indicate, either visibly or audibly, when radiation levels exceed the maximum readings in their measurement range.

The radiation survey meter is stored within the office of the RSO or Nominee, details of whom are supplied in Attachment 2.

Details of the radiation survey meter (make, model and serial number) are listed in Attachment 5.

Radiation survey meters must not tampered with or misused.

Prior to use, the radiation survey meter will be subjected to a battery test and a test to ensure that it responds to radiation by measuring the dose rate at the source housing of the borehole logging apparatus.

Survey meters will:

- be a separate device from a personal alarm dosimeter (PAD);
- be checked every 12 months for sensitivity, accuracy, range and energy response by the service provider listed in Attachment 5, who has a calibration check service that uses reference sources directly traceable to the Australian National Standards as required by the *National Measurement Act 1960*; and
- not be used after it has been repaired, or suspected to have been damaged, until it has been checked for sensitivity, accuracy, range and energy response by the service provider listed in Attachment 5.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 16 of 27

12. REPAIR

The following sections detail the requirements to repair the borehole logging apparatus. The borehole logging apparatus is housed in a tough stainless steel casing and is not subject to routine maintenance. Records of all repair work are to be kept in the equipment logbook provided by the possession licensee.

All repair work not intended by the manufacturer to be undertaken by the owner is to be conducted by a person qualified to perform such work. Typically, the person will hold a licence to use radioactive substances in borehole logging apparatus during maintenance, repair or commissioning. The licence of the person engaged to perform this work is to be sighted by the Radiation Safety Officer prior to the commencement of work.

Any repair work done on the borehole logging equipment must receive, or have received instruction in avoidance in kinking and corrosion of logging cables; renewal of cable head terminations, identification of various cable fault conditions and inspection and replacements intervals of cabling and cable terminations.

It is the Company's intentions that personnel do not work directly on radioisotope borehole logging apparatus. The company will enter into service agreements with equipment suppliers for the purpose of routine maintenance and repair (see Attachment 4 for suppliers).

Radiation monitoring device

A calibration check of the radiation survey meter will be performed once every twelve months and following suspected damage or repair. The survey meter is to be calibrated if the calibration check yields erroneous results.

This check will be performed by the provider listed in Attachment 5 who has a calibration service that uses reference sources directly traceable to the Australian National Standards as required by the *National Measurement Act 1960*.

Use of Sources beyond the Recommended Working Life

A radioactive substance incorporated into a neutron generation tool that has reached the end of its recommended working life as stated on the sealed source certificate required by ISO 2919 or equivalent, must have an assessment undertaken as approved by the chief executive to verify that the radioactive substance is fit for continued use.

The assessment must include:

- (a) an inspection and a technical assessment of the radioactive substance;
- (b) leakage and/or contamination testing of the radioactive substance;
- (c) a review of the design safety for the radioactive substance in the context of the particular radiation practice for which it is used; and
- (d) a determination of when any reassessment of the sealed radioactive substance will be required, stating the date by which the reassessment must be commenced.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 17 of 27

13. SAFETY CHECKS

Records of all safety checks are to be kept in the equipment logbook provided by the possession licensee. Any action taken as a result of the inspection must also be recorded.

(a) Six monthly checks

The following checks are to be conducted every six months:

- Radiation warning signs, as required in radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*, are displayed on each borehole logging apparatus, and are in a clean, intact and legible state.
- An area warning sign for the radioactive substances store, as required in radiation safety standard *Standard for premises – Ionising radiation sources (2021)*, is available and is in good condition.
- The condition of the borehole logging apparatus is determined by checking:
 - (i) radiation dose rates around the sealed source
 - (ii) for corrosion, damage or wear of the casing around the borehole logging apparatus
 - (iii) wear of the wireline

If any radioactive substances have passed the end of their recommended working life, as set by the manufacturer, a source leakage test is to be conducted every six months.

Radiation monitoring is to be performed around the Radiation Store. Monitoring is to be undertaken at designated points as shown in Attachment 3.

(b) Three yearly checks

The following checks are to be conducted every 3 years:

- ensure that the borehole logging apparatus continues to comply with radiation safety standard *Standard for radiation sources – industrial, mining manufacturing, and other practices (2021)*, and certificates of compliance from an appropriately accredited person have been obtained within the necessary time frames;
- ensure that the premises where radioactive substances are stored continue to comply with radiation safety standard *Standard for premises – Ionising radiation sources (2021)*, and certificates of compliance from an appropriately accredited person have been obtained within the necessary time frames;

(c) Five yearly checks

Radioactive substances are to be leak tested, in accordance with Annex A.3 of ISO9978 *Radiation protection – Sealed radioactive sources- Leakage test methods* to confirm that they are not leaking.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 18 of 27

14. RECORDS

The following records are to be maintained by the possession licensee. These are held within the nominee's office, details of whom are supplied in attachment 2.

- Possession licence issued under the *Radiation Safety Act 1999*
- The Radiation Safety and Protection Plan approved by the Chief Executive, Queensland Health
- Approvals to acquire radioactive substances
- Reports by the radiation safety officer
- Equipment maintenance log book
- Results of all safety checks performed
- Inventory and location of borehole logging apparatus containing sealed sources
- Assessment reports of the borehole logging apparatus and premises
- Calibration check certificates of the radiation survey meters
- Radioactive materials store log
- Incident reports.
- Personal monitoring records and explanations of unusual dose readings.
- Training records

15. ACQUISITIONS, SUPPLY AND RELOCATION OF BOREHOLE LOGGING APPARATUS

This section outlines the legislative requirements associated with the acquisition, supply and relocation of radioactive substances. Attachment 2 provides the contact details for Radiation Health and the Chief Executive, Queensland Health.

(a) Acquisition

An approval of the Chief Executive, Queensland Health must be sought and obtained prior to acquiring borehole-logging apparatus.

(b) Supply

If the borehole logging apparatus is to be sold, lent or hired to another person in Queensland, the possession licensee must ensure that the proposed new owner has:

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 19 of 27

- a licence to possess borehole logging tools with sealed sources; and
- an approval to acquire the borehole logging apparatus.

(c) Relocation

The approval of the Chief Executive, Queensland Health is to be sought and obtained prior to the relocation of the borehole logging apparatus to a place outside Queensland. Application forms are available from Radiation Health. The Chief Executive must be notified within seven (7) days after the device has been relocated.

Note: Approval to relocate is not required if the possession licensee is remaining in possession of the radioactive substance, eg. If the borehole logging apparatus is being sent to an interstate service company for maintenance.

16. REMEDIATION PROCEDURES

A radiation incident is an incident adversely affecting, or likely to adversely affect, the health or safety of any person because of the emission of radiation, for example, if a radioactive substance is lost or stolen or when unintended exposures may occur or have occurred.

The following remediation procedures are to be implemented in the event of an incident involving the borehole logging apparatus containing radioactive substances.

- Immediately take action to protect human life, to limit injury and to provide first aid, if necessary.
- Allay panic.
- Cordon off the area and prevent unauthorised and unnecessary access to the secured area.
- Contact the Radiation Safety Officer (refer to Attachment 2).
- Do not attempt to move or interfere with the borehole-logging tool unless directed by the radiation safety officer.
- Remain at an appropriate distance from the borehole-logging tool (consistent with maintaining site access control, eg. 5m minimum).
- The Radiation Safety Officer is to conduct a radiation survey around the borehole-logging tool and compare the results with previous monitoring results.
- If the radiation measurements are not significantly different and the radioactive substance is shielded, the logging tool is to be returned to the store.
- If the measurements differ significantly from the established values, the Radiation Safety Officer should determine the course of action to be taken to render the situation safe (eg. placing additional shielding over the borehole logging apparatus). Pending advice from the

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 20 of 27

radiation safety officer, access control must be maintained.

- The Radiation Safety Officer is to immediately notify the nominee (who acts on behalf of the possession licensee), who will then notify the Chief Executive, Queensland Health of the incident.
- The tool involved in an incident is not be used again until the Radiation Safety Officer confirms the safety of the borehole logging apparatus by obtaining a certificate of compliance for the borehole logging apparatus from an appropriately accredited person.
- The possession licensee and the Chief Executive, Queensland Health are to be immediately advised if a radioactive substance is unaccounted for.

(a) Specific Emergency Procedures

Radioactive Source Becoming Stuck Within the Borehole

In the event of a borehole logging apparatus becomes stuck within a borehole:

- (a) notify the Radiation Safety Officer after reasonable attempt to retrieve the tool yield no results,
- (b) immediately evacuate the area and cordon off to a distance of at least 20 metres if the tool is less than 20m from ground level,
- (c) the Radiation Safety Officer shall notify the Chief Executive of Queensland Health immediately,
- (d) as soon as the incident is brought under control, investigate the circumstances of the incident and arrange for the estimation of the radiation exposure to any person who may have been exposed, and
- (e) submit a detailed account of the incident in writing to the Chief Executive of Queensland Health within 7 days, stating the steps to be taken to prevent a recurrence.

Loss of Radioactive Source

If it is suspected that a source has been lost or stolen, the Radiation Safety Officer shall be informed and a thorough search carried out using a monitoring instrument. The Chief Executive, Queensland Health shall be notified as soon as possible.

Failure of Safety Procedures

Steps must be taken immediately to prevent a recurrence. Should this failure cause an incident to occur as described in either of the above items then the appropriate action will be taken.

Further to the above, the Radiation Safety Officer will immediately report to the Chief Executive, Queensland Health if a radioactive source is lost or if the radiation doses equivalent to any person as a results of an incident exceeds or may have exceeded 1000 μ Sv or any incident involving radiation. He / she will then -

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 21 of 27

- (a) Propose a course of action to restore the normal situation.
- (b) Submit the personal monitoring devices of any employees concerned for urgent assessment, and
- (c) Submit a detailed account of the incident in writing to Chief Executive of Queensland Health within 7 days, stating the steps to be taken to prevent a recurrence.

Fire

In the event of a major fire the Radiation Safety Officer shall determine, as soon as possible after the fire has been brought under control, whether or not the source capsule has ruptured. Advice must be sought from Queensland Health as soon as possible.

Evacuate the area and cordon off to a distance of at least 25 metres immediately.

Allow fire crew rescue squad to control and extinguish fire.

Check those involved in the incident and with fighting the fire.

The possibility of particles being inhaled or ingested must be avoided. People attending the fire must wear breathing apparatus. The Radiation Safety Officer should monitor radiation levels throughout the operation and determine safe distances for personnel, taking into account the degree of attention necessary to successfully control the fire.

Once the Fire Officer has declared the area safe, the Radiation Safety Officer shall carry out a survey. If he / she determines radiation levels to be too high a plan of action must be formulated to reduce this to a satisfactory level.

(b) Incident notification

A written incident report is to be produced by the Radiation Safety Officer and submitted through the possession licensee to the Chief Executive, Queensland Health at the address shown in Attachment 2 within seven (7) days of the occurrence of an incident. This report is to include:

- incident description (including the source and its location);
- estimates of radiation exposure to individuals (if applicable);
- action taken; and
- proposals to prevent a recurrence.

Note: A radiation incident means an incident adversely affecting, or likely to adversely affect, the health or safety of any person because of the emission of radiation.

Document Owner	Document Approver	Document Number	Control	Rev Date	Next Review	Page
J. Hollingworth	P. Nunn	RSPP_H3	Public	5-Nov-24	5-Nov-25	Page 22 of 27

ATTACHMENT 1**SOURCE DETAILS**

Source Serial Number	Store Location	Store Compliance
TBA	151 Warooby Lane – Euthulla -Qld-4455	N/A

ATTACHMENT 2

CONTACT DETAILS

Possession Licensee Huracan Pty Ltd

Nominee Jon Hollingworth - + 61 414 717 907

Radiation Safety Officer Paul Nunn - +61 408 686 616

Chief Executive, Queensland Health c/o Director
Radiation Health
P.O. Box 2365
FORTITUDE VALLEY BC QLD 4006

Telephone: (07) 3328 9310

Facsimile: (07) 3328 9266

On Call Mobile: 0413 279 672

(emergencies and out of hours calls)

Radiation Health

Radiation Health
15 Butterfield Street
HERSTON QLD 4006

Telephone: (07) 3328 9310

(9am - 5pm Monday - Friday)

Facsimile: (07) 3328 9366

Email: <https://www.health.qld.gov.au/system-governance/licences/radiation-licensing/contact>

ATTACHMENT 3**LIST OF PERSONS**

Name	Queensland License Number
Radiation Safety Officer (RSO)	
Paul Nunn	809524-5619780R
Operators	
Jon Hollingworth	For Borehole Logging under application

ATTACHMENT 4**DETAILS OF RADIATION MONITORING DEVICES**

Manufacturer	Model	Serial Number
Thermo Scientific	G20-10	52068