bp	**AZERBAIJAN BUSINESS UNIT (AzBU)**	

Procedure for:

~~Radioactive Sources~~ Management ~~of Radioactive Materials and Radiation Generators~~

Rev	Date	Reason for Issue	Prepared by	Checked by	Approved by TA	Endorsed by
C1	~~03~~20. 10~~09~~.04	Updated and Issued for use	Elman Shikhkerimov	~~SSpW~~WG	G.Hunt	G.Campbell

Notes: C1: Renumbered and more clarity added.

HSE - SAFETY

Azerbaijan BU Document Reference

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1 INTRODUCTION

1.1 Document Purpose

Radiation Protection is based on three principles recommended by the International Commission on Radiological Protection (ICRP) and is described below.

Justification: Every practice resulting in exposure to Ionising Radiation shall be justified by the advantages it produces.

Optimisation: All exposures shall be kept as low as reasonably achievable (ALARA), economic and social factors being taken into consideration.

Dose Limits: The sum of all doses received shall not exceed certain limits.

This Safe System of Work employs these principles and, if correctly applied, will ensure that all exposures to Ionising Radiation and therefore all associated risks are kept as low as reasonably achievable.

1.2 Document Scope

This Safe System of Work applies to all work with ionising radiation carried out on BP installations and sites in Azerbaijan and Georgia. Contractors working on BP owned or operated sites/installations are also responsible for alignment with this SSOW. Responsibilities are detailed with written instructions that will ensure radiation doses are as low as reasonably practicable.

This SSOW contributes to compliance with the “HSE expectations” contained in “getting HSE right”.

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2 RESPONSIBILITIES

2.1 Site Manager/OIM

The manager of any BP Facility or Site either onshore or offshore has overall responsibility for the implementation of this SSOW.

2.2 Radiation Protection Supervisor (RPS)

A Radiation Protection Supervisors (RPS) shall be appointed where any work involving ionising radiation is to be carried out. At BP operating sites the Safety Advisors/Officers should be trained to RPS certification. They will exercise supervision to the extent that any work with ionising radiation is carried out in accordance with this SSOW. The RPS will review the local rules of any third party that intends to work with radioactive substances or radiation generators.

To enable them to carry out this role, appointed persons should receive appropriate training, including a written assessment, at an approved course prior to appointment. They will also receive suitable refresher training at a period of not more than three years.

The appointment describing areas of responsibility shall be in writing by the Site Manager/OIM.

The RPS is responsible for:

- Ensuring all work involving ionising radiation is carried out in accordance with this Safe System of Work
- Ensuring all hazards related to work with ionising radiation are identified and suitable precautions are taken to minimize the risks associated with these hazards
- Maintaining a full and up-to-date record of all radioactive sources that are under his control and held on the site/installation.

The RPS will make use of the checklist contained in Appendix 3 when a contracting company brings sources of ionising radiation to the site/installation or when specialist companies arrive on the site/installation to carry out activities with naturally occurring radioactive material.

Copies of letters of appointment for RPSs shall be retained at the facility.

2.3 Radiation Protection Adviser (RPA)

The RPA is responsible for providing advice on all aspects of work with ionising radiation and for evaluating and approving the plans, organisation and arrangements of specialist contractors. ~~The RPA is also responsible for carrying out an annual review of work with ionising radiation to ensure doses received by workers, visitors~~

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~~and members of the public are as low as reasonably achievable. This review will ensure the accounting system used to record the location and quantity of radioactive material provides a true record.~~

The RPA is also responsible for carrying out an annual review of work with ionising radiation to ensure doses received by workers, visitors and members of the public are as low as reasonably achievable. This review will ensure the accounting system used to record the location and quantity of radioactive material provides a true record.

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3 CONDITIONS FOR WORK WITH IONISING RADIATION

3.1 Work with Ionising Radiation

The following work with ionising radiation may be carried out on BP sites/installations:

- The use of installed nucleonic gauges
- Accumulation and disposal of naturally occurring radioactive material
- Work with equipment contaminated with naturally occurring radioactive material
- Use of radiography sources
- Use of sealed and unsealed radioactive sources for process investigation and measurement
- Use of well logging sources
- The use of casing depth markers
- Use and storage of instrument test sources
- Use and storage of smoke detectors incorporating radioactive sources.

3.2 General Conditions for Work with Ionising Radiation

Any use of sources of ionising radiation must be justified and measures must be taken to ensure radiation doses are as low as reasonably practicable. In general this can be achieved by following basic rules when working with sealed sources and radiation generators:

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Most importantly, radioactive sources must never be handled directly:

- Use appropriate shielding to reduce the intensity of the radiation.
- Maximize the distance between radiation sources and personnel.
- Minimize the time spent in the vicinity of radiation sources.

The risks associated with unsealed radioactive material can be minimized by:

- Keeping the material contained within vessels or pipe work
- Observing good standards of hygiene and housekeeping
- Carrying out operations in such a way that material does not become airborne.

3.3 Risk Assessment

Supervisors will ensure that a suitable and sufficient written risk assessment is carried out prior to any new applications involving the use of ionising radiation. Risk Assessment is required in order to identify the measures to restrict the exposure of employees, contractors or members of the public to ionising radiation. Generic Risk Assessments for nucleonics and NORM have been provided by the RPA.

The RPS should be consulted if there is any doubt about the requirement for, or the content of, a risk assessment.

Changes in work activities may result in the requirement for a review of the assessment.

3.4 Designated Areas

To assist in managing the work with ionising radiation, the RPS will decide if the area should be designated as a Supervised Area or Controlled Area. Dose criteria for Designation of Areas are given in the following Tables 1~~1~~ and 2~~2~~ (reference to ~~National Radiological Protection Board's "Training in Radiological Protection" Manual, hereafter called NRPB~~ Tracerco Training manual fro Radiation Protection section 3, ~~Manual and "Work with Ionising Radiation; "~~Ionising Radiations Regulations 1999" ACOP and Guidance):

Table 1 Dose Criteria for Designation of Areas

Annual Dose Criteria (greater than)		
PART OF BODY	**CONTROLLED AREAS**	**SUPERVISED AREAS**
Whole body	6 mSv	1 mSv
Lens of eye	45 mSv	15 mSv
Skin and extremities	150 mSv	50 mSv

Table 2 Annual Dose Limits

CATEGORIES OF PERSONNEL	PART OF BODY	DOSE LIMITS
Employees* of 18 years of age or above	Effective Dose	20 mSv (annual)
	Equivalent Dose – Lens of Eye	150 mSv (annual)
	Equivalent Dose – Skin	500 mSv (annual)
	Equivalent Dose – Extremities	500 mSv (annual)

Trainees aged under 18 years	Effective Dose	6 mSv (annual)
	Equivalent Dose – Lens of Eye	50 mSv (annual)
	Equivalent Dose – Skin	150 mSv (annual)
	Equivalent Dose – Extremities	150 mSv (annual)
Women of reproductive capacity	Without prejudice to Limits for both Categories above, Equivalent Dose for the abdomen, averaged	13 mSv in any consecutive period of 3 months (for abdomen)
Other Persons**	Effective Dose	1 mSv

Notes:

Employee* - is a competent person, certified and authorised to work with radioactive sources.
Other Persons** - other than Employee or Trainee, including any person aged under 16 years.

3.5 Controlled Areas

Sealed Sources

An area will be designated as a controlled area when one or more of the following is applicable

- i) A prior risk assessment indicates that the person is likely to exceed 3/10 of any dose limit (whole body 6 mSv/y: single organ 150 mSv/y)
- ii) The instantaneous radiation dose rate is greater than 7.5 μSv/h
- iii) A control measure is put in place to ensure the dose to an individual does not exceed 1 mSv/y

Note1 If the dose rate is less than 7.5μSv/h the risk assessment will still need to prove that 6 mS/y will not be exceeded otherwise a controlled area will be designated.

Note 2 The closing of a shutter mechanism is seen as a control measure. Therefore the first person into a vessel with nucleonics attached will do so under controlled area conditions. He will carry out radiation dose rate measurements, proving the shutter is closed and then de-designate the area. If NORM is present the area will remain a controlled area.

Unsealed Material

An area will be designated as a controlled area when one or more of the following is applicable

- A prior risk assessment indicates that the person is likely to exceed 3/10 of any dose limit (whole body 6 mSv/y: single organ 150 mSv/y)

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- A control measure is put in place to ensure the dose to an individual does not exceed 1 mSv/y.

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Note1 Any vessel containing NORM will be designated a Controlled area due to the potential activities and volumes of material.

Note2 Any major containment break will be done under controlled area conditions, due to the potential activities and volumes of material

Note3 Small containment breaks may, following the risk assessment, be carried out under Supervised area conditions

Note4 The wearing of respiratory protection could be seen as a control measure unless the RPS is confident that the risk assessment shows the wearing of RPE is not to reduce the possible dose below 1 mSv/y.

All Controlled areas must be barriered and a suitable number of notices placed at the barrier displaying the Trefoil symbol, the legend "Radiation Controlled Area" the nature of the radiation i.e. Gamma radiography and the hazard – External.

~~3.5~~3.6 Supervised Areas

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Sealed and Unsealed material

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A Supervised area will be designated, following a risk assessment,

- where any person is likely to exceed 1/10 of any dose limit. (Whole body 1 mSv/y : single organ 50 mSv/y)
- where an area is required to be kept under supervision for purposes of contamination or possible increased radiation dose rates.

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Supervised areas do not require being barriered but must have a suitable number of warning signs to delineate the area. The signs must display the Trefoil symbol, the legend "Radiation Supervised Area" the nature of radiation i.e. NORM and the hazard – Internal.

Note: There is no acceptable level of contamination. Any contamination must be removed as soon as possible after it is detected.

~~An area in which employees or visitors can, due to any practice, be exposed to ionising radiation will be classified as a Supervised Area. Members of the public will generally be excluded from supervised areas and employees and visitors should only enter supervised areas if necessary. According to NRPB Manual the Supervised Area is one whether either:~~

- ~~Conditions need to be kept under review to determine whether it should be designated as a controlled area; or~~
- ~~The exposure of persons is likely to exceed the criteria in Tables 1 and 2.~~

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~~A sign displaying the trefoil symbol and the legend "radiation supervised area" the type of radiation i.e. gamma, beta, LSA / norm etc and the hazard i.e. internal or external, will be located at suitable points to demarcate the supervised area.~~

~~The conditions inside supervised areas will be kept under review to ensure doses are as low as reasonably achievable.~~

~~3.6Controlled Areas~~

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~~Any area in which any individual can, due to any practice, receive an annual radiation dose greater than 6 millisieverts will be classified as a Controlled Area. Operationally, an area in which the instantaneous dose rate exceeds 7.5 microsieverts per hour will be classified as a controlled area. According to NRPB Manual the Controlled Area is one where:~~

- ~~Persons are required to follow a specified system of work designed to restrict radiation exposures or reduce the risk of radiation accidents; or~~
- ~~The exposure of persons is likely to exceed the criteria in Tables 1 and 2.~~

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~~For a person to enter a Controlled Area he must be either:~~

- ~~A classified employee~~
- ~~An outside worker (i.e. a classified employee of another Company); or~~
- ~~A non-classified person who enters in accordance with suitable written arrangements that ensure that:~~

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  - ~~For an employee, the dose received is less than that which require designation as a classified person; or~~
  - ~~For other persons, the dose limits (i.e. those specified for "other persons" in Table 2) are not exceeded.~~

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~~Members of the public are not allowed to enter controlled areas.~~

~~The RPA can be consulted about the best methods of restricting access to controlled areas. In all cases the boundary of the controlled area will be clearly marked and suitable warning notices displaying the trefoil symbol and the legend "radiation controlled area" the nature of the radiation (gamma, beta, LSA / Norm etc) and the nature of the hazard i.e. internal or external, will be located at suitable points around the designated area.~~

~~The purpose of the written system of work for non-classified workers is to ensure the radiation dose they receive in any calendar year does not exceed 6 millisieverts. An example of a written system of work is shown in Appendix 2.~~

~~If the area has been designated due to the presence of contamination, then everyone entering the area must wear appropriate protective clothing and facilities must be available to allow people leaving the area to be monitored and washed and to dispose of contaminated clothing.~~

~~The RPS will carry out regular inspections of designated areas to ensure the local rules are being fully complied with.~~

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~~3.7Undesignated Areas~~

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~~Circumstances may arise where external dose rates are greater than normal background but less than 2.5 µSv/h. In these cases, the following conditions will apply:~~

- ~~Personnel will not remain longer than necessary in these areas.~~
- ~~Basic PPE, including gloves, will be worn if contamination is present.~~

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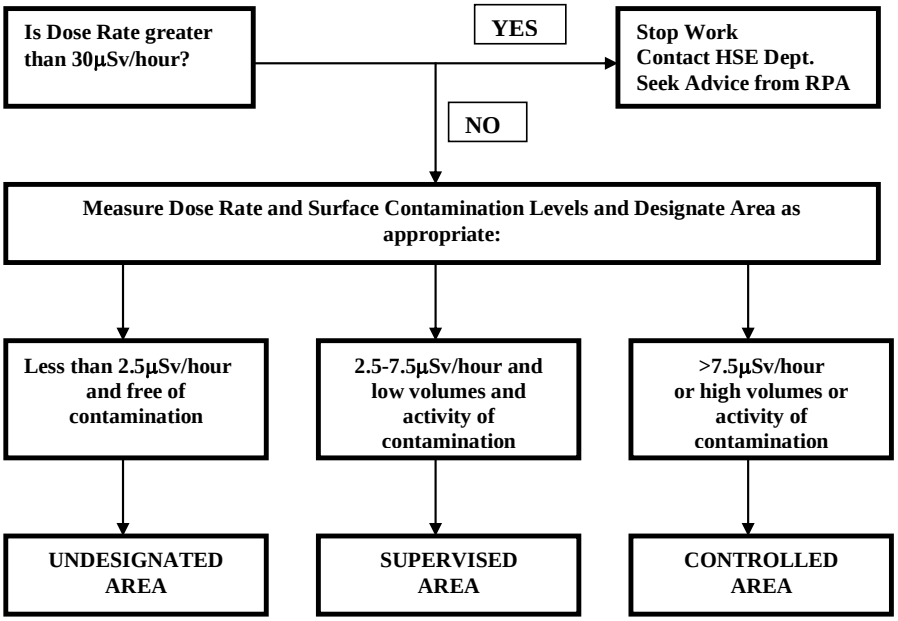
~~**Note**: There is no acceptable level of contamination. Any contamination must be removed as soon as possible after it is detected.~~

These conditions are summarized in the Diagram 1 below:

Diagram 1 Procedure for Designated, Supervised and Controlled Areas



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4 LOCAL RULES FOR WORK WITH IONISING RADIATION

4.1 Storing Radioactive Sources

Storage When Not in Use

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When not in use, radioactive sources must be stored in an appropriate container locked in a secure store. The following conditions apply to the storage of radioactive sources:

- The store must be used exclusively for this purpose.
- The store should be in a low occupancy area away from accommodation and not near explosives.
- The store must not restrict access to the emergency services.
- A sign marked with a trefoil and the word “RADIOACTIVE” must be prominently displayed at all access points.
- Regular surveys must be carried out to ensure the external radiation dose rate is below 7.5 μSv/h.
- The RPS must maintain a full and up-to-date register for all sources held in the store.
- All movements of sources must be logged in and out of the store by the RPS.
- All packages containing radioactive substances must be suitably labelled.

Source Security

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The keys for stores containing radioactive material will be kept under the control of the RPS.

Source Accountancy

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The RPS will keep an up to date record of all radioactive sources on the installation. The quantity and location of all radioactive sources will be recorded as follows:

INSTALLED SOURCES (i.e. nucleonic gauges)	Once per calendar month
MOBILE SOURCES	Once per day
(e.g. radiography sources)	(Unless in storage when Once per week)

Contractors bringing radioactive material onto BP sites/installations will carry out checks according to this frequency.

4.2 Outside Contractors Using Sealed Sources

Before contractors bring radioactive sources or radiation generators onto BP facilities the following information must be exchanged:

- A detailed description of the work to be done
- An estimate of the total radiation dose likely to arise

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- The arrangements that will be in place to restrict exposure
- The name of the contractor's representative who will be responsible for the work
- Arrangements in place for receipt, storage and transport of the radioactive source
- Details of the contingency plan that will be invoked in the event of an incident.

Where considered appropriate, the RPS will liase with the RPA over any aspects of the work to be done.

Details relating to the source(s) must be supplied to the Site Manager/OIM, RPS and the sponsoring department representative, at least 24 hours before the despatch to the installation.

These shall include:

- Isotope name
- Source strength at a particular date
- Source identification number
- Container number
- Transport index
- Transport category
- Name of Radiation Protection Supervisor
- Appropriate transport details, e.g. date, ETD, ETA including Contractors.

Sources must not be left on the site/installation premises unless prior agreement has been reached with the Site Manager/OIM.

4.3 Radiography

The following instructions must be adhered to in conjunction with all previously mentioned responsibilities and instructions:

- All work involving the use of a radioactive source or radiation generator shall only be undertaken in accordance with detailed procedures agreed with the installation RPS under the Permit to Work System.

- The contractor shall be responsible for preparing procedures, agreed with the RPA, which shall include:

    - Arrangements for excluding non-classified personnel from the work site
    - A detailed description of the work to be done
    - A description of agreed pre-exposure and exposure warnings
    - Detailed contingency plans for dealing with any emergency likely to arise in the course of the work and actions to be taken in the event of a site/installation alarm.

- Descriptions of individual operations must be specific to the work to be undertaken.

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- At least two contractor's personnel will be present while radiography is undertaken. Both will be classified workers and one will be the nominated RPS.

- The contractor shall be responsible for supplying a minimum of two radiation dose rate monitors and for checking that these monitors are functioning correctly. A valid certificate of test must be available for each instrument.

- The contractor shall be responsible for ensuring that all equipment required in the case of an emergency is available as agreed with the RPA. The emergency equipment will include 2 bags of lead shot, remote handling tongs, a hacksaw or wire cutters, barriers and warning lamps, an audible radiation monitor, emergency pot and suitable hand tools.

- The contractor will be responsible for maintaining appropriate records and for supplying copies of these to the installation RPS on request.

- Where appropriate, sealed radioactive sources shall have a current certificate of test for leakage of radioactive material and sources should be re-tested within 24 months of the date of the last test. This requirement does not apply to sources that are replaced within 24 months period because of decay (e.g. Iridium 192 sources with 74 day half life).

- These are three conditions upon which the Site Manager/OIM and RPS must be informed immediately:

    - A sealed source or container is damaged, lost or mislaid.
    - The immediate container or the bonding of a sealed source is broken.
    - The radiation level from the immediate container or the bonding of a sealed source increases significantly above its previous level.

4.4 Radioactive Sources Used in Well Logging Operations

In addition to the instructions detailed above the following instructions must be adhered to:

- All work involving the use of radioactive sources shall only be undertaken in accordance with detailed procedures agreed with the RPS under the Permit to Work System.

- The contractor shall be responsible for preparing procedures, agreed with the RPA, which shall include:

    - Arrangements for excluding non-classified personnel from the work site
    - A detailed description of the work to be done
    - Detailed contingency plans for dealing with any emergency likely to arise in the course of the work and actions to be taken in the event of an installation alarm.

- The contractor's local rules should specify any more stringent requirements and identify specified controlled areas when logging tools are in use.

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- If a neutron source or generator is being used, the contractor must make a neutron detector available.
- Only the contractor's RPS or other classified persons are allowed to transport the source to the rig floor.
- The rig floor must be cleared of all non-essential personnel until the source has been loaded into the tool by the contractor's RPS.
- After the tool has been loaded personnel may re-enter the rig floor.
- When the log has been completed the rig floor must be cleared prior to the tool being pulled clear of the riser and the source being unloaded.
- On completion of the operation, the source must be returned and logged back into the radioactive source store.

4.5 Use of Other Mobile Sources

Specialist contractors may use mobile radioactive sources for purposes such as non-invasive process investigations. The following conditions will apply to the use of these sources:

- All work involving the use of a radioactive source shall only be undertaken in accordance with detailed procedures agreed with the RPS under the Permit to Work System.
- The contractor shall be responsible for preparing procedures, agreed with the RPA, which shall include:
    - Arrangements for excluding non-classified personnel from the work site
    - A detailed description of the work to be done
    - Detailed contingency plans for dealing with any emergency likely to arise in the course of the work and actions to be taken in the event of an installation alarm.
- Descriptions of individual operations must be specific to the work to be undertaken.
- The contractor shall be responsible for supplying appropriate radiation dose rate monitors and for checking that these monitors are functioning correctly. A valid certificate of test must be available for each instrument.
- The contractor shall be responsible for ensuring that all equipment required in the case of an emergency is available as agreed with the RPA.
- The contractor will be responsible for maintaining appropriate records and for supplying copies of these to the installation RPS on request.
- Where appropriate, sealed radioactive sources shall have a current certificate of test for leakage of radioactive material and sources should be re-tested within *24* months of the date of the last test. This requirement does not apply to sources that are replaced within *24* months period because of decay (e.g. Iridium 192 sources with 74 day half life).

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- These are three conditions upon which the Facilities and RPS must be informed immediately:
    - A sealed source or container is damaged, lost or mislaid.
    - The immediate container or the bonding of a sealed source is broken.
    - The radiation level from the immediate container or the bonding of a sealed source increases significantly above its previous level.

4.6 Use of Installed Sealed Radioactive Sources in Nucleonic Interface Gauges

Radioactive sources may be installed at various locations for level and interface detection and density measurement. These sources emit penetrating gamma rays and are housed in lead containers. The gauges are designed, manufactured and installed to standards that ensure any risks associated with their use are insignificant. Specific safety information on each of the gauges is contained in the hand over documentation supplied at the time of installation.

Accounting for Sealed Sources

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The installation RPS is responsible for maintaining an up to date record of all sealed sources on the installation. This record must contain the following information:

- Name of isotope
- Serial number of each source (or other unique identification mark)
- Date of receipt
- Activity of source at date of receipt
- Current location of each source
- Date and manner of disposal (when appropriate)~~.~~

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This record must be updated every time the source is moved to a new location or, for installed sources once per calendar month and, for mobile sources once per day (if in storage once per week will suffice)~~.~~

Copies of these records must be maintained for two years, or longer if required by the certificate of registration.

Leakage Tests

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Sealed sources must be tested for leakage at least once in every 24 months. Normally this will be carried out by the RPA during the annual audit. ~~Normally this will be carried out by the RPA during the annual audit.~~ The site/installation RPS must retain copies of the test results for two years from the date of test.

Routine Checks

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Once each calendar month, the site/installation RPS will carry out basic checks to ensure the continued radiological safety of the installed gauges. These checks will include:

- Measure radiation dose rate and check it does not exceed 7.5 µSv/h at accessible points.
- Check the source container is securely bolted to the mounting brackets.
- Ensure all warning notices are in place and are legible.

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- Check the source is secured in the container with a padlock.
- Check that the state of the shutter mechanism is clear and that the shutter has not been padlocked in the "OPEN" position.

General Precautions for Work in Vessels on Which Nucleonic Interface Gauges are installed

Warning notices must be displayed on all man ways on vessels on which nucleonic gauges are installed. Sources must be withdrawn and shutters locked in the "SHUT" position before man ways are opened. The installation RPS will confirm this has been done before anyone is permitted to enter the vessel.

Precautions for Vessels Incorporating Nucleonic Interface Gauges

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During normal operations, the source is retained in a dip pipe inside the vessel. The fluids inside the vessel provide adequate shielding. If the liquid level inside the vessel falls it is possible that radiation dose rates outside the vessel will increase. In this event, the sources must be withdrawn into their shielded container and the shutter must be locked in the "SHUT" position. The RPS will retain the key and will ensure that the source is not exposed until the fluid level has increased to the normal level.

For operational reasons it may, exceptionally, be necessary to operate the gauge with the source exposed above the liquid level. In these circumstances the RPS must measure the radiation dose rate outside the vessel and designate the area as appropriate. As a rule of thumb, if the source is to be exposed for more than one hour the source will be retracted into the housing.

Source Removal

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Under no circumstances may a radioactive source be removed from its shielded container. If it is necessary to remove the container from the vessel, either temporarily or permanently, the RPS must ensure by measurement that the source is shielded within the container and that the shutter mechanism is padlocked in the "SHUT" position. The container may then be moved to an appropriate storage location.

4.7 Contingency Plans for Incidents Involving Sealed Radioactive Sources

The hazards associated with any job involving the use of sealed sources must be assessed before the work begins and precautions implemented to minimise risks. In the unlikely event of an incident, which could result in the conditions for a controlled area applying or any person being overexposed to ionising radiation, the following actions must be taken.

Loss of or Damage to Shielding

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The following actions must be taken in event of loss or damage to shielding:

- The person discovering the damage will evacuate the immediate area and warn others to do the same.
- Contact the Site Manager/OIM, Control Room and the RPS.

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- The RPS will attend the scene and ensure all personnel have withdrawn to a safe area i.e. dose rate less than 7.5 µSv/h.
- Erect barriers to prevent access bearing in mind that access may need to be restricted on the levels above and below the incident.
- Prepare a recovery plan with the aim of ensuring that no individual involved in the recovery receives a radiation dose greater than 1 millisievert.

Advice can be obtained from the Radiation Protection Adviser on how radiation doses can be restricted. In general:

- Keep as far from the unshielded source as possible.
- Make use of available shielding materials (lead sheet etc.).
- Limit the amount of time spent in the area.
- Never handle the unshielded source directly.
- In the case of fire, no attempt should be made to withdraw the sources into their housings or to close shutters if this involves personnel entering hazardous areas.
- In the event of a significant emergency that threatens the lives of personnel or the continuing integrity of the installation, the potential presence of radioactive sources should not be regarded as sufficient reason to prevent entry of any incident team to the affected area.
- When the situation has been made safe the RPA will make assessments of the radiation doses received by those involved in the incident and advise on notifications to be made to regulatory authorities.

Loss of a Radioactive Source

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In the event that a sealed source is lost or otherwise unaccounted for the RPS shall immediately notify the Site Manager/OIM and the RPA. The RPS shall initiate a search of all likely areas using available dose rate meters. When the source is found the RPS shall implement a retrieval plan incorporating information from the RPA on dose limitation and, if necessary, temporary source storage.

All packages leaving the installation/site must be surveyed using a radiation dose rate meter until the source is found.

If the source cannot be readily found, the RPS shall prepare a detailed report of the incident and hand over responsibility for further action to the Site Manager/OIM. The RPA will advise on statutory notifications that must be made to regulatory bodies.

Sources Owned and Used by Third Parties

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If the radioactive source belongs to a contracting company, the contractor's RPS will immediately implement the appropriate contingency plan. The RPS and other personnel will provide any assistance necessary to make the situation safe.

4.8 Removal of Equipment Contaminated with Naturally Occurring Radioactive Material

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The removal of equipment including pumps, meters, spool pieces etc. that are suspected, either by measurement or location, of being contaminated must be done as follows:

- Written authorisation must be obtained from the area authority before work can proceed.
- Persons carrying out the work must use the recommended protective equipment and a suitable floor covering must be used to limit the spread of contamination.
- When containment has been breached, contamination measurements must be made and the area will be designated as Controlled, Supervised or released as free for normal work.
- Any contaminated item removed from the area must be securely capped at all open ends using blank flanges, end caps or by wrapping with heavy-duty polythene and the ends labelled with LSA / NORM tape.~~.~~
- Equipment that requires maintenance in a workshop must be decontaminated to background level if the work could result in radioactive material becoming airborne.
- Prior to equipment being released from the installation for refurbishment, disposal or movement it must be cleaned to background level or sent to an authorised decontamination facility.
- Any tools or equipment used must be monitored for contamination at the end of the operation. If contaminated they should be washed until background levels are achieved.
- The work area should be kept as free from contamination as possible. Measurements of contamination in the area should be made at regular intervals. Following completion of the work the area should be monitored using a contamination monitor and monitoring records should be kept.

4.9 Entry into Vessels Contaminated with Naturally Occurring Radioactive Material

Specialist contractors who carry out this work shall be responsible for preparing procedures, agreed with the RPA, which shall include:

- Arrangements for excluding non-classified personnel from controlled areas
- A detailed description of the work to be done
- Detailed contingency plans for dealing with any emergency likely to arise in the course of the work and actions to be taken in the event of an installation alarm.

Clearance

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Written permission (Permit To Work System) is required for opening up or for entry into vessels, etc. The clearance must give consideration to the use of air tools that will cause a volume of air to be discharged inside the vessel and hence affect extraction flows.

Protective Equipment and General Safety

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All persons entering the vessel must wear suitable impervious overalls, boots and gloves.

If any dust (or spray containing dust) is likely to arise from the cleaning operation, breathing apparatus must be worn. Any inhalation of radioactive dust is to be avoided.

Ideally, surfaces should be kept damp to prevent the production of dust and its dispersal into the atmosphere. If the only practical last resort is sand-blasting, burning, grinding or similar to complete a particular task the RPS should, in consultation with the RPA, assess the best method for radiation protection on a case by case basis.

Preparatory Work Prior to Vessel Entry

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Pre-Entry precautions include the following:

- A polythene or PVC tent should be erected where required around the vessel entry point to create a decontamination area. The structure should be such that any contamination, which is released during entry and cleaning operations can be contained. The tent should be of sufficient size to allow capping, cleaning or containment operations to be carried out on contaminated items. Washing facilities in the form of a water supply, detergent and scrubbing brush should be provided within the tented area, as well as storage facilities for personal protective clothing and receptacles for contaminated clothing.
- The tented area shall be designated as necessary. Only classified workers and personnel working under the written system of work are allowed into a Controlled Area. A control point must be set up at the entrance of any controlled area.
- Prior to opening any vessel, rigorous attempts must be made to flush away or remove as much debris, sludge and scale as possible by jet washing, water washing or steam injections, etc.
- All monitoring for contamination should be carried out under the general supervision of an RPS.
- Any tools or equipment used must be monitored for contamination at the end of the operation. If contaminated, they should be washed until background levels are achieved. If this is not possible, they should be sealed in strong plastic bags marked “Radioactive” and retained for future similar use or sent for decontamination in accordance with local regulations.
- The work area should be kept as free from contamination as possible. Measurements of contamination in the area should be made at regular intervals.
- Following completion of work the area should be monitored using a contamination monitor. Records of monitoring must be kept.

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Disposal of Radioactive Material

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All loose material with an activity greater than background as measured with a suitable contamination monitor must be disposed of as required by local regulations. Records of the date of disposal of such waste including its weight and specific activity should be retained by the RPS in a clear and legible form. Representative samples of material disposed of must be sent for radiochemical analysis in order to assess the total activity of the material.

Handling Contaminated Items

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Any item removed from the decontamination area must be securely capped at all open ends using blank flanges, protective end caps, or by wrapping with heavy duty polythene to prevent the spread of contamination during subsequent handling.

Similarly, drums of scale removed during the cleaning operation must be securely fastened to prevent dispersal of radioactive materials. The outside surfaces of the drums should be washed to reduce the contamination level on the surface as far as possible.

Items of contaminated equipment if they should be returned to the vessel should be capped or plastic wrapped to prevent the spread of contamination prior to their refitting.

Access to Vessel After Decontamination

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Once decontaminated to background, radiological restrictions can be removed, good hygiene practices should still be applied.

4.10 Contingency Plans for Incidents Involving Naturally Occurring Radioactive Material

Ensuring the material is contained within vessels or pipe work can normally control the hazards associated with radioactive material. When this is not possible operation, which could lead to the material becoming airborne or released in an uncontrolled manner should, as far as is practicable, be avoided.

In the unlikely event of an incident involving naturally occurring radioactive material, the following actions must be taken.

Spill of Radioactive Material in an Uncontrolled Area

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In event of spill of radioactive material in an Uncontrolled Area the following actions must be taken:

- The person who discovers the incident must evacuate the area and warn others to do the same.
- Notify the Site Manager/OIM, Control Room and the RPS.
- The RPS will attend the scene and establish barriers around the incident. Personnel who may have been contaminated as a result of the incident will be monitored for contamination. Remove any contaminated clothing and seal it in a plastic bag. Any contamination on the skin should be washed away taking care to ensure material is not ingested.

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- The material shall then be collected and disposed of under the direction of the RPS.

4.11 Transport of Radioactive Material

Radioactive material must be transported in appropriate containers packaged and labelled in accordance with appropriate national and international legislation. The following specific conditions apply to the transport of radioactive material to and from the site/installation:

- The Site Manager/OIM must be notified at least 24 hours before a radioactive source is transported to the site/installation.
- The supplier of the radioactive material must ensure he has an RPS on the installation to receive the material. The supplier's RPS shall liase with the site/installation RPS regarding the storage arrangements for the material.
- In exceptional circumstances it may not be possible for the supplier's RPS to be present on the installation/site when the material is received. The Site Manager/OIM may allow the material to be received provided the supplier has provided detailed written instructions regarding how the material should be handled.
- The site/installation RPS will inspect packages or containers containing radioactive material and ensure they are correctly labelled and provide adequate shielding. If packages are incorrectly labelled or if dose rates are greater than 7.5 μSv/h, they will be placed in a barriered area until dealt with by the supplier.
- The owner of the radioactive material will be responsible for ensuring the transport of radioactive material from the facility complies with all legislative requirements. Radioactive material must be packed inside the appropriate, labelled containers.

Transport of Naturally Occurring Radioactive Material

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Samples of naturally occurring radioactive material or equipment contaminated with naturally occurring radioactive material are transported as "Excepted Packages". The following conditions will apply:

- The material must be suitably contained so that it cannot escape from the package during transport.
- The RPS must confirm that the dose rate at the surface of the package does not exceed 5 μSv/h.
- The package must be free of surface contamination.

Note: loose scale other than samples must not be transported onshore.

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5 MONITORING FOR RADIATION AND CONTAMINATION

Calibrated radiation dose rate monitors, appropriate to the radiation being used, must be available wherever radioactive sources are likely to be used.

These monitors must be thoroughly examined and tested at least once in every period of 12 months. A qualified and certified Contractor company shall undertake the examination and test of radiation dose rate monitors.

The certificate resulting from such a test must be retained for two years from the date of the test.

If a radiation-monitoring instrument is damaged such that the accuracy of the calibration may have been affected, then the instrument must be repaired and re-calibrated.

Only individuals who have been trained in their safe use may use these monitors.

~~Individuals who have been trained in their safe use may only use these monitors.~~

Under normal operating conditions, dose rates around sites/installations, which incorporate a radioactive source shall be monitored monthly or following any work which has been carried out which could affect the adequacy of the shielding.

The Radiation Protection Supervisor or his delegate will carry out this activity. The results of such monitoring shall be recorded and retained on the facility for 2 years.

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Appendix A

Glossary of terms

TERM	DEFINITION
Absorbed Dose	Quantity of energy imparted by ionising radiation to unit mass of matter such as tissue. Unit gray, Symbol Gy. Gy = 1 joule per kilogram.
Activity	Measure of an amount of a radionuclide. Describes the rate at which transformations occur in it. Unit becquerel. Symbol Bq. 1 Bq = 1 transformation per second.
Classified Person	Classified person is a person who is likely to receive an effective dose in excess of 6 mSv per year or an equivalent dose that exceeds three-tenths of any relevant dose limit. Classified person should be informed if he/she is so designated. Classified person should be over 18 years old and has a health record certified by doctor confirming he/she is fit for this job.
Contamination	Loose unsealed radioactive material/substance.
Contingency Plan	Document the purpose of which is to restrict any exposure that arises from an accident both to the employees themselves and to others, including emergency services personnel, who may be affected by it.
Controlled Area	Controlled Area is the area where: 1. It is necessary for any person who enters or works in the area to follow special procedures designated to restrict significant exposure to ionising radiation in that area or prevent or limit the probability and magnitude of radiation accidents or their effects; or 2. Any person working in the area is likely to receive an effective dose greater that 6 mSv a year or an equivalent dose greater than three-tenths of any relevant dose limit in respect of an employee aged 18 years or above.
Decay	The process of spontaneous transformation of a radionuclide. The decrease in activity of a radioactive substance.
Designated Area	Designated Areas include Controlled and Supervised Areas.
Disposal	In relation to radioactive waste, dispersal or emplacement in any medium without the intention of retrieval.
Dose	General term for quantity of radiation. See absorbed dose, equivalent dose, and effective dose.
Dose Limit	Dose Limit in relation to persons of a specified class is the limit on effective dose or equivalent dose in relation to a person of that class.
Dose Rate	Dose Rate, in relation to a place, is the rate at which a person or part of a person would receive a dose of ionising radiation from external radiation if he were at that place being a dose rate at that place averaged over one minute.

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Effective Dose	The quantity obtained by multiplying the dose equivalents to various tissues and organs by the tissue weighting factor appropriate to each and summing the products. Unit sievert, symbol Sv. Frequently abbreviated to dose.
Equivalent Dose	The quantity obtained by multiplying the absorbed dose by a weighting factor to allow for the different effectiveness of the various ionising radiations in causing harm to tissue. Unit sievert, symbol Sv. Usually the factor for gamma rays, X-rays and beta particles is 1 but for alpha particles is 20.
External Radiation	External radiation, in relation to a person, is the ionising radiation coming from outside the body of that person.
Internal Radiation	Internal radiation, in relation to a person, is the ionising radiation coming from inside the body of that person.
Ionising Radiation	Gamma rays, x-rays or corpuscular radiations such as alpha and beta, which are capable of producing ions either directly or indirectly.
Local Rules	Set of working procedures written in accordance with the Ionising Radiations Regulations, 1999, to enable work with ionising radiations to proceed safely, and in accordance with the Health and Safety at Work Act, 1974. Incorporating Contingency Plans.
LSA Scale	Inorganic based chemical scale produced in conjunction with oil and gas production and containing low levels of naturally occurring radioactive material.
Non-ionising radiation	Radiation that does not produce ionisation in matter. Examples are ultraviolet radiation, light, infrared radiation, and radio frequency radiation.
NORM	Naturally Occurring Radioactive Material produced with oil and gas deposits within process equipment.
Overexposure	Any exposure of a person to ionising radiation to the extent that the dose received by that person causes a dose limit relevant to that person to be exceeded or causes a proportion of a dose limit relevant to any employee to be exceeded.
Practice	Practice means work involving: 1. The production, processing, handling, use, holding, storage, transport or disposal of radioactive substances; or 2. The operation of any electrical equipment emitting ionising radiation and containing components operating at a potential difference of more than 5Kv, that can increase the exposure of individuals to radiation from an artificial source, or from a radioactive substance containing naturally occurring radionuclides that are processed for their radioactive, fissile or fertile properties.
Radiation	The process of emitting energy as waves or particles.
Radiation accident	Accident where immediate action would be required to prevent

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	or reduce the exposure to ionising radiation of employees or any other persons.
Radiation control	Obtaining information about radiation state in the organisation, in the environment and of the level of exposure to radiation (includes do~~z~~simetric and radiometric control)
Radiation Protection Adviser	Person or body consulted in accordance with the Ionising Radiations Regulations, 1999, to give advice on radiation protection.
Radiation Protection Supervisor	Person appointed in accordance with the Ionising Radiations Regulations, 1999 who is responsible for day-to-day supervision of work with ionising radiation.
Radioactive Material	Substance in any aggregated state containing active radionuclids
Radioactive Waste	Waste material containing radionuclides. Frequently categorised, in the nuclear power industry, according to activity content and other criteria, as low level, intermediate level, and high-level waste.
Radioactivity	The property of radionuclides of spontaneously emitting ionising radiation.
Radionuclid source	Source of ionising radiation containing radionuclid or a mixture of radionuclids
Risk Assessment	Assessment that must be carried out in accordance with the Ionising Radiations Regulations, 1999. Forms basis of Contingency Plans. See Local Rules.
Source of ionising radiation	Radioactive substance or device emitting or capable of emitting ionising radiation
Sealed Source	Radiation source containing a radioactive material and constructed to certain standards to prevent loss of that material.
Unsealed Radioactive Materials	Radioactive material not in the form of a sealed source, e.g. gas, liquids or solid powder.
Waste Management	The control of radioactive waste from creation to disposal.
Written System of Work	A written method of work that permits non-classified workers who to enter a controlled area.

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Appendix B

Written System of Work

1. This written system of work applies to all non-classified workers who are required to enter controlled areas.

2. Before work begins in a controlled area, each individual worker must be given a copy of the written system of work form attached below. The RPS is responsible for ensuring the details of the form are completed.

3. No non-classified person may enter a controlled area where the external dose rate is more than 30 microsieverts per hour without reference to the radiation protection adviser.

4. No non-classified person may work in controlled areas for more than 200 hours in any calendar year.

5. No person will remain in a controlled area for longer than is necessary.

6. No person will enter a controlled area unless a Permit to Work has been issued. This Permit to Work shall include the following details:

   - A description of the work to be done
   - The precautions to be used to minimise the effects of any hazard
   - A copy of the relevant local rule
   - The period of time for which the permit is valid.

7. The Permit to Work will be signed by the Area Authority and countersigned by the RPS.

8. The following conditions will apply when the controlled area has been established because of the presence of uncontained radioactive material:

   - All persons entering the controlled area will use the appropriate personal protective equipment.
   - Washing, changing and monitoring facilities will be provided as close as reasonably practicable to the exit from the controlled area.
   - Eating, drinking, smoking and chewing gum are prohibited in the controlled area.
   - Minor cuts, grazes etc. must be covered with a suitable waterproof dressing before entry to the controlled area. Any cuts received in the controlled area must be reported to the RPS and appropriate first aid treatment obtained.
   - All reasonably practicable steps will be taken to eliminate the production of airborne radioactive material and to control surface contamination to prevent the spread of contamination outside the controlled area.

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9. The RPS will frequently carry out radiation dose rate and contamination measurements in and around the controlled area to ensure the precautions in place are effective.

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Written System of Work

Name of Worker_____

Radiation dose for year to date _____ mSv (confirmed by RPS)

Time spent in controlled areas this year_____ hours (confirmed by RPS)

Description of Work Area: _____

Brief Description of Work: _____

_____

Permit to Work Reference _____

This area has been designated as a **Controlled Area**. The radiation protection supervisor for this area is _____.

The maximum radiation dose rate in this area is _____ microsieverts per hour.

The average level of surface contamination in this area is _____ Becquerels per cm^2.

While in this area you must use the protective equipment selected by the radiation protection supervisor. You will be instructed in the use of any equipment with which you are not familiar. You must not eat, drink or smoke in the controlled area. Any cuts must be covered.

Any contaminated clothing must be left inside the controlled area. You will be monitored for contamination when you leave the controlled area. You should then go to the locker room and wash before eating. The radiation protection supervisor must monitor any tools or equipment before being removed from the controlled area. Contaminated equipment must be suitably bagged or wrapped and labelled before being removed from the controlled area.

The log sheet on the other side of this form will be kept to record each time you enter and leave the controlled area. You must make sure this is completed every time you enter and leave the area.

Issued by _____ (RPS) Date _____

I understand and will comply with the conditions contained in this written system of work:

Signed _____ Print _____

Date _____

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Record of Entries into Controlled Areas

Date	Time of Entry	Time of Exit	Time Spent in Controlled Area (1)	Free of Contamination Yes/No (2)	Initialled by RPS (3)
		Total Time in Area (hours)			

(1) Rounded up to nearest half hour.

(2) All contamination MUST be removed before worker can leave the area.

(3) RPS or appointed deputy.

On completion of the work one copy of this form is sent to the worker's employer and one is retained on the installation for two years.

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Appendix C

Contractors Checklist

Details of contractor using radioactive material

Contractor's Name and Address .....

Contract Company's RPA: .....

Contract Company's RPS on site .....

Nature of work: .....

Has hazard assessment been seen and accepted?	Yes ☐	No ☐	N/A ☐
Valid Registration Seen	Yes ☐	No ☐	N/A ☐
Valid Authorisation Seen	Yes ☐	No ☐	N/A ☐
Local Rules Seen and Acceptable	Yes ☐	No ☐	N/A ☐
Notification Given to HSE	Yes ☐	No ☐	N/A ☐
Are Workers classified?	Yes ☐	No ☐	
Is Personal Dosimeter Available?	Yes ☐	No ☐	
Is Functioning Dose rate Meter Available?	Yes ☐	No ☐	N/A ☐
Test certificate seen?	Yes ☐	No ☐	
Is Functioning Contamination Meter Available?	Yes ☐	No ☐	N/A ☐
Test certificate seen?	Yes ☐	No ☐	
Is Neutron Monitor Available?	Yes ☐	No ☐	N/A ☐
Test certificate seen?	Yes ☐	No ☐	

Source Movement Notification Details .....

Container/Packing Adequate?	Yes ☐	No ☐	
Are Source Leakage Tests Available?	Yes ☐	No☐	N/A ☐

Intended Source Storage Location on site .....

Responsible Person when Contractor .....not on site
Details of Emergency Equipment/ .....
Warning Notices
Special Precautions .....

Comments:.....

Signed
Facilities RPS..... Contractor .....

Print ..... Print .....

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Date ..... Date .....

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Appendix D

Sealed Radioactive Source Management & Accountancy Register

														Local I.D. No. (if applicable)			
Distinguishing Mark No		Nature of Element		Radioactive Strength			Date Measured							Date of Receipt			
Address of Normal Location of Source				Initial Date Source Accounted For.										Year:			
Location Dept/Area Site				Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Date
Used for																	
Source Movements/Inspection Comments																	
Date and Time	New Location of Source	Mover. (Inspector: Signature)															

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Appendix E

References

- The Ionising Radiations Regulations 1999 SI 1999/3232 Stationery Office 1999.
- Work with Ionising Radiation. Ionising Radiations Regulations 1999. Approved Code of Practice and Guidance HSE Books (L121) 2000.
- Health and Safety at Work etc. Act 1974 HMSO 1974.
- ”Council Directive 96/29 Euratom of 13 May 1996 laying down basic safety standards for the protection of health of workers and the general public against the dangers arising from ionising radiation” Official Journal of the European Communities 1996 39(L159) 1-114.
- “Council Directive 97/43 Euratom of 30 June 1997 on health protection of individuals against the dangers of ionising radiation in relation to medical exposure” Official Journal of the European Communities 1997 40 (L180).
- Radioactive Substances Act 1993 HMSO 1993.
- Radiation doses – assessment and recording IRIS (rev) HSE Books 2000.
- Radiation protection – sealed radioactive sources – leakage test methods ISO 9978: 1992.
- Atomic Energy and Radioactive Substances: Radioactive Material (Road Transport) (Great Britain) Regulations 1996 HMSO 1996.
- Packaging, Labelling and Carriage of Radioactive Material by Rail Regulations 1996 SI 1996/2090 HMSO 1996.
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 SI 1995/3163 HMSO 1995.

Appendix F

Correlation

Between SI system of units and Off-system Units of Activity and Radiation Field Features

Value and its symbol	Name and symbol of units		Relation between the units
	SI unit	Off-system unit	
Activity (A)	Becquerel (Bq) equals to one disintegration per second (dec../s)	Curie (Ci)	1 Ci = 3.700 *10^{10} Bq; 1 Bq = 1 dec../s; 1 Bq = 1 dec../s = 2.703 * 10^{-11} Ci
Absorbed Doze (D)	Gray (Gy) equals to one joule per kilogram (J/kg)	Rad (rad)	1 rad = 100 erg/g = 1*10^{-2} J/kg = = 1*10^{-2} Gy; 1 Gy = 1 J/kg; 1 Gy = 1 J/kg = 10^{4} egr/g = 100 rad.
Equivalent Doze (H)	Sievert (Sv) equals to one gray per Quality coefficient [1 Gy/Q = 1 (J/kg)/Q]	Rem (Rem)	1 Rem = 1 rad/Q = 1*10^{-2} J/kg / Q = = 1* 10^{-2} Gy/Q = 1*10^{-2} Sv; 1 Sv = 1 Gy/Q = 1 J/kg/Q = 100 rad/Q= = 100 Rem.
Equivalent Doze rating(H)	Sievert per second (Sv/s)	Rem per second (Rem/s)	1 Rem/s = 1 *10^{-2} Sv/s; 1 Sv/s = 100 Rem/s
Exposure Doze (X)	Coulomb per kilogram (C/kg)	Roentgen (R)	1 R = 2.58*10^{-4} C/kg (exact); 1 C/kg = 3.88 10^{3} R (approximately)
Kerma (K)	Gray (Gy) equals to one joule per kilogram (J/kg)	Rad (rad)	1 rad = 100 erg/g = 1*10^{-2} J/kg = = 1*10^{-2} Gy; 1 Gy = 1 J/kg; 1 Gy = 1 J/kg = 10^{4} egr/g = 100 rad.