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DATE 2020-11-04	DATE 2020-12-17	DATE 2020-12-17

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1.0 PURPOSE

- 1.1 To describe the process to manage and control all radiation instrumentation on Koeberg site.

2.0 SCOPE

- 2.1 Applicable to the following instruments on site:
- (1) Portable and fixed surveillance instruments;
 - (2) Analytical instruments;
 - (3) Plant radiation monitoring instruments;
 - (4) Secondary standard;
 - (5) Electronic Personal Dosimeters;
 - (6) Portable Air Sample Equipment.
- 2.2 Covers the following aspects of radiation instrumentation:
- (1) Maintenance;
 - (2) Calibration;
 - (3) Quality control.
- 2.3 Not applicable; Thermoluminescent Dosimeters and Emergency Plan instrumentation.

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

- 3.1.1 **Analytical Instruments** – Instruments used to accurately and quantitatively determine the radioactivity in a sample, e.g. gamma spectrometers.

- 3.1.2 **Calibration** – To determine and adjust the response of a detector to give a reading accurate within predetermined acceptance criteria, relative to radiation sources and/or electronic signals, over a predetermined range. Sources and/or instruments are used that have been standardised against a measurement system traceable to a recognised national or international standard laboratory or bureau to ensure that the detector response is accurate within prescribed limits.

- 3.1.3 **Check Source** – A radioactive source, not necessarily calibrated, which is used to confirm the operation of the instrument. This is the source that is noted on the instrument calibration sticker. Refer to 3.1.12.
- 3.1.4 **Function Check** – To operate or perform as specified.
- 3.1.5 **Independent Verification** – A qualified person performs verification on another person's actions without interaction prior to or during component or control manipulation. This technique is employed when immediate consequence to the plant is unlikely should a component or control be mispositioned.
- 3.1.6 **Peer Checking** – Peer checking is the act of checking the correct component identification and discussing subsequent component manipulation prior to action being taken. Peer checking shall be performed by individuals of equal or higher authorisation than the performer. When performing peer checks, if there is any uncertainty about the action to be taken, the action shall not be taken until a determination is made. If at any time the performer and the peer checker cannot achieve a clear concise determination, then the supervisor shall be informed. Peer checking requires the performance of the action to be observable and methodical in the actions being taken, with discrete pauses to allow observers to correct any errors. A qualified plant expert can serve as the peer checker for positioning equipment related to their field of expertise, provided the performer is qualified to manipulate that equipment. The peer checker shall also consider the evolutions in progress that could affect the outcome of the task being performed. HUMAN ERROR PREVENTION TOOL – Peer checking and STAR (Stop Think Act Review) can be included in 3-way communication, the practice of pointing and include the word "checked" in order to verify correctness.
- 3.1.7 **Performance Check** – Verification of an instrument's operability using performance sources or dedicated radioactive plant components.
- 3.1.8 **Performance Source** – A radioactive source or a dedicated radioactive plant component which is used to confirm the response of an instrument before and after use.
- 3.1.9 **Primary Standard** – A unit, against which all Secondary Standards are calibrated.
- 3.1.10 **Reference Source** – A source used to calibrate, which in itself is calibrated to a national or international standard. The calibration can be done using the secondary standard. A reference source will comply with the requirements stipulated for reference sources in the relative international standard referenced in 238-44. Also referred to as Certified source.
- 3.1.11 **Response** – The instrument reading when exposed to a source.

3.1.12 **Secondary Standard** – A measurement standard that is used in comparison with a Primary Standard. (Used to ensure that calibrating and testing equipment is traceable to a national or international standard. Can be used to calibrate reference sources.)

3.1.13 **Source Check** – Verification of instrument operability using a Check source as per instrument calibration sticker to include alarm / threshold trip and operational checks of the instrument on a routine basis.

3.2 Abbreviations

3.2.1 **DVK** – Fuel Building Ventilation System

3.2.2 **EBA** – Containment Ventilation System

3.2.3 **EP** – Emergency Plan

3.2.4 **EPD** – Electronic Personal Dosemeter

3.2.5 **ESL** – Environmental Survey Lab

3.2.6 **GENIE 2000** – Software used to Analyse the Accumulated Gamma Spectrum

3.2.7 **ICAM** – Intelligent Continuous Air Monitor

3.2.8 **ISOCS** – In Situ Object Counting System

3.2.9 **KRT** – Plant Radiation Monitoring System

3.2.10 **M&TE No** – Measuring and Test Equipment Number

3.2.11 **OEG** – Operations Engineering Group

3.2.12 **OPS** – Operating

3.2.13 **OTS** – Operating Technical Specifications

3.2.14 **RP** – Radiation Protection

3.2.15 **RPOO** – Radiation Protection Operations Office

3.2.16 **SRPA** – Senior Radiation Protection Assistant

3.2.17 **SRSM** – Safety Related Surveillance Manual

3.2.18 **SSS** – Senior Shift Supervisor

3.2.19 **STAR** – Stop Think Act Review

4.0 REFERENCES

4.1 Referenced Documents

- 4.1.1 335-2, Rev 5: Koeberg Nuclear Power Station Management Manual
- 4.1.2 KAA-500, Rev 13: The Process for Controlled Documents
- 4.1.3 KAA-636, Rev 6: Management of the Radioactive Effluents Programme
- 4.1.4 KGH-013, Rev 2: Guide for the Canberra ICAM Moving Filter Alpha/Beta Continuous Air Monitor
- 4.1.5 KSA-011, Rev 14: The Requirements for Controlled Documents
- 4.1.6 KSA-138, Rev 2: Nuclear Services Standards and Expectations
- 4.1.7 KWB-S.KRT, Rev 10b: Plant Radiation Monitoring System
- 4.1.8 KWH-I-086, Rev 1: Verification of the EPD Irradiator and DMC EPD's
- 4.1.9 KWH-I-090, Rev 2: Operation and Use of the Tracerco EPD

4.2 Applicable Documents

- 4.2.1 238-44: Requirements for Radiological Surveillance Instrumentation
- 4.2.2 238-49: Liquid and Gaseous Effluent Management Requirements for Koeberg Nuclear Power Station
- 4.2.3 Alarm Cards Operating
- 4.2.4 KAA-679: Control and Operation of the Measuring and Test Equipment at Koeberg Nuclear Power Station
- 4.2.5 KBA-0022-SRSM-000-00: Safety Related Surveillance Manual (SRSM)
- 4.2.6 KFH-HP-040: KRT Threshold Change Tracking Form
- 4.2.7 KFH-HP-140: KRT Surveillance
- 4.2.8 KFH-HP-141: Alarming or Inoperable Radiation Monitoring System
- 4.2.9 KSC-001: The Radiochemistry Quality Control Programme
- 4.2.10 KSH-008: Radiation Protection Records, Data and Information Management
- 4.2.11 KWC-RC-KRT: KRT Surveillance and Threshold Setting Control
- 4.2.12 KWH-I-063: Radiation Protection KRT Functions

- 4.2.13 KWH-I-066: The Operation and Use of the AMS-4 Beta Particulate Monitor
- 4.2.14 KWH-I-074: Gamma Spectroscopy with GENIE 2000 and ISOCS
- 4.2.15 KWH-I-077: Function Test of Portal Monitors
- 4.2.16 KWH-I-078: Calibration of Beta Flow Detectors on the Portal Monitors
- 4.2.17 KWH-I-079: Calibration of Gamma Detectors on Portal Monitors
- 4.2.18 KWH-I-080: Operation and Source Response Check of the Portal Monitors
- 4.2.19 KWH-I-085: Operation, Calibration, Source and Function Check of the Gamma Exit Monitors
- 4.2.20 KWH-I-089: Operation and Source Check of the Floor Monitor (Omnittrak)
- 4.2.21 KWH-I-091: Operation, Use and Calibration of the Cronos-4
- 4.2.22 KWH-I-093: Operation and Use of Radiation Protection Portable Area Radiation Monitors
- 4.2.23 KWH-I-094: Operation and Use of Radiation Protection Portable Radiation Instruments
- 4.2.24 KWH-I-095: Operation and Use of Portable and Installed Contamination Monitors
- 4.2.25 KWH-I-096: Operation, Use and Setting of the Canberra ICAM Moving Filter Alpha/Beta Continuous Air Monitor
- 4.2.26 KWH-S-015: Airborne Contamination Surveys
- 4.2.27 KWH-S-044: Radiation Protection Requirements for Normal Maintenance Shutdown
- 4.2.28 KWH-X-019: Operation and Use of the Laundry Contamination Monitor
- 4.2.29 OTS: Operating Technical Specifications

5.0 RESPONSIBILITIES

5.1 Power Station Manager

- 5.1.1 The Power Station Manager responsibilities are delegated to the Radiation Protection Manager for ensuring compliance with the relevant standards for portable surveillance instrumentation, the secondary standard and plant radiation monitoring instrumentation.
- 5.1.2 The Power Station Manager responsibilities are delegated to the Chemistry Manager for ensuring compliance with the relevant standards for analytical instrumentation.

5.2 Radiation Protection Manager

- 5.2.1 Ensures an adequate supply of portable doserate and contamination surveillance instrumentation.
- 5.2.2 Ensures an adequate supply of portal monitors and fixed contamination monitors.
- 5.2.3 Ensures control over calibration sources and check sources.
- 5.2.4 Ensures the availability of the secondary standard and that it conforms to the requirements of 238-44.
- 5.2.5 Ensures that portable radiation instruments are operated and source checked according to procedures KWH-I-089, KWH-I-093, KWH-I-094 and KWH-I-095.
- 5.2.6 Ensures that fixed small article monitors are maintained and calibrated according to procedure KWH-I-091 and as specified by the manufacturer.
- 5.2.7 Ensures that the vehicle monitors at the site exit are function checked, maintained and calibrated.
- 5.2.8 Ensures that portable airborne contamination instruments are operated, maintained and calibrated according to procedures KWH-S-015, KWH-I-066, KWH-I-096 and as specified by the manufacturer.
- 5.2.9 Ensures that the portal monitors and the gamma exit monitors are function checked, operated, maintained and calibrated according to procedures KWH-I-078, KWH-I-079, KWH-I-080, KWH-I-085 and as specified by the manufacturer.
- 5.2.10 Ensures that laundry contamination monitors are operated, maintained and calibrated according to procedure KWH-X-019 and as specified by the manufacturer.

- 5.2.11 Ensures that analytical instrumentation used by the Radiation Protection Group is operated, maintained and calibrated, and conforms to the quality control requirements according to procedures KWH-I-074.
- 5.2.12 Ensures that thresholds for portal monitors are set correctly.
- 5.2.13 Ensures that portal monitors are source and function checked according to procedures KWH-I-077 and KWH-I-080.
- 5.2.14 Ensures that an inventory listing of all instruments used by Radiation Protection is maintained.
- 5.2.15 Implements RP responsibilities for KRT surveillances as described in KRT Surveillances KFH-HP-140.
- 5.2.16 Ensures an adequate supply of EPD's and those EPD's are maintained and calibrated.
- 5.2.17 Ensures an adequate supply of maintenance spares for all radiation instruments under RP control.

5.3 Chemistry Manager

- 5.3.1 Ensures an adequate availability of radiochemistry instrumentation, and supply of spares.
- 5.3.2 Ensures an adequate availability of relevant calibration sources, check sources, test and calibration equipment for the instrumentation.
- 5.3.3 Ensures that radiochemistry instrumentation is calibrated and conforms to the quality control requirements stipulated in KSC-001.
- 5.3.4 Maintains an inventory listing of all instruments used by Radiochemistry.
- 5.3.5 Implements Chemistry responsibilities for KRT surveillances as described in KRT Surveillances KFH-HP-140, SRSM and the OTS.

5.4 Instrument Maintenance Services Manager

- 5.4.1 Ensures that the following radiation instruments are maintained and calibrated in accordance with the international standards referenced in 238-44:
 - (1) Portable doserate and contamination measuring instrumentation;
 - (2) Portable air sampling equipment;
 - (3) All KRT's;
 - (4) Tracerco EPD's;
 - (5) CM-11 installed contamination measuring instrumentation.

- 5.4.2 Ensures that calibration and maintenance procedures are compiled.
- 5.4.3 Ensures an adequate supply of relevant test and calibration equipment.
- 5.4.4 Ensures that the Radiation Protection Group reviews applicable instrument calibration procedures.
- 5.4.5 Implements responsibilities for KRT surveillances as described in KBA-022-SRSM-000-00.

5.5 Operating Manager

- 5.5.1 Implements Operating responsibilities for KRT surveillances as described in KRT Surveillances KFH-HP-140.
- 5.5.2 Ensures that Operating response to inoperable or alarming KRT channels are in accordance with the OTS and Alarming or Inoperable Radiation Monitoring table KFH-HP-141, as well as relevant alarm cards for each KRT channel.

5.6 Training Manager

- 5.6.1 Ensures that training programmes are developed and maintained for personnel operating, maintaining and calibrating instruments described in this procedure.
- 5.6.2 Provides training to radworkers on the use of portal monitors and small article monitors.

6.0 PROCEDURE

6.1 Analytical Instruments

- 6.1.1 The quality control requirements for radiochemistry instruments used by the Chemistry Group are documented in KSC-001.

6.2 KRTs

- 6.2.1 KRT Surveillances KFH-HP-140 indicates the responsibilities of the Lead Department/Group for all KRT`s.
- 6.2.2 Prescribed actions for defective KRT channels are described in the OTS and Alarming or Inoperable Radiation Monitoring table in KFH-HP-141. The defective state of a KRT must be logged in the duty SRPA shift log book and tracked until the KRT is declared operable.
- 6.2.3 KRT threshold settings are specified in 238-49, KWH-I-063, KWH-S-044 and KWC-RC-KRT as applicable.

- 6.2.4 KRT Threshold changes must be tracked using the KRT Threshold Change Tracking Form (KFH-HP-040). This form is retained in the RPOO, as well as the Unit Control Rooms. The relevant SRPA and SSS, for each unit, on shift shall be accountable for the forms.
- 6.2.5 KRT threshold changes shall have a peer check and be independently verified, after any change by either, RP, Chemistry, IMS or OPS. When performing the verification ensure that the correct units and values as defined in procedure KWH-I-063, KWH-S-044 and KWC-RC-KRT are complied with.
- 6.2.6 Test requirements for EBA in conjunction with KRT 011/012 MA shall be performed according to KBA-0022-SRSM-000-00.
- 6.2.7 Test requirements for DVK in conjunction with KRT 013/014 MA shall be performed according to KBA-0022-SRSM-000-00.
- 6.2.8 All other KRT Channel surveillances shall be performed according to KBA-0022-SRSM-000-00.

6.3 Calibration

- 6.3.1 KAA-679 describes the control of the Measuring and Test Equipment at Koeberg Nuclear Power Station (for those instruments for which the site Calibration Laboratory is responsible).
- 6.3.2 Portable RP instruments will be calibrated based on the Manufacture`s Manual or Calibration Certificate.
- 6.3.3 Instruments described in this procedure shall be calibrated under the following conditions:
- (1) Analytical instruments in a 12 ± 2 month interval;
 - (2) DMC EPD`s in a 12 ± 2 month interval;
 - (3) All other instruments within a 12 monthly basis;
 - (4) KRT system in accordance with SRSM;
 - (5) Those KRT Channels not in SRSM, calibration will be on a 12 monthly basis (and associated tolerance of 25%);
 - (6) When an instrument has been repaired or maintained;
 - (7) When an instrument's operation is suspect.

NOTE: *If the instrument is new, a valid manufacturer's calibration certificate is acceptable. For new KRT's calibration will be done on site.*

6.3.4 No instrument shall be used if it has not been calibrated or if it falls outside its valid calibration period.

6.3.5 All instruments shall be marked with a calibration sticker, except for analytical instruments and EPD`s, depicting the following:

- (1) Date of last calibration;
- (2) Date of next calibration;
- (3) Certificate Number;
- (4) Source type, source / serial number and check parameters, if applicable;
- (5) Equipment number (M&TE No).

6.4 Operability Checks of Radiation Instruments

6.4.1 Operability Frequencies:

- (1) The response of portable surveillance instruments shall be source checked using Performance sources, before it is used as well as after it is used.
- (2) Portable monitors and Small Item monitors shall be source checked daily using Check sources.
- (3) Portable and installed contamination monitors located at Controlled Zone Exit points or Step-Off Pad areas shall be source checked weekly by using Check sources.
- (4) All contamination monitors (friskers) in use at the ESL shall be source checked by ESL staff on a daily basis including the friskers used at the barriers / step-off pads for EP purposes at the same venue using Check sources.

6.4.2 For portable surveillance instruments the reading obtained using a Check source is not allowed to vary by more than 20% from the reading obtained during calibration, in which case it must not be used.

6.4.3 A performance check of portable instruments should include a battery check.

6.4.4 Should a portable surveillance instrument fail a source check after being used to perform **routine surveillance**, another survey shall be done to verify that the readings obtained with the instrument at the time were correct. If other surveys were done in the time interval between the instrument being found defective and since it was last used, these subsequent surveys shall be used to validate the results obtained by the now defective instrument.

- 6.4.5 Should a portable surveillance instrument fail a source check after being used to perform **non-routine surveillance** where no individual dose or dose rate alarms on the EPD were experienced it shall be taken that the portable instrument responded correctly.
- 6.4.6 Portal monitors must be verified that the instruments respond to the Check source.
- 6.4.7 Plant radiation monitoring instruments (KRTs) has no Check sources. Testing is in accordance with SRSM.
- 6.4.8 Those KRT channels not in SRSM are tested at the same time as the calibration.

6.5 Purchase of New Instruments

- 6.5.1 The following factors should be considered when instruments are purchased:

- (1) Intended use;
- (2) Radiation type to be measured;
- (3) Range of measurement;
- (4) Sensitivity, accuracy, precision, response time;
- (5) Maintenance and calibration requirements/specifications procedure;
- (6) Reference and check sources required;
- (7) Intrinsic source forming part of the instrument;
- (8) Reliability;
- (9) Operating, both internal and external, on the instrument.

- 6.5.2 Input from all relevant groups involved in the use and maintenance of the instrument should be considered before purchasing.

6.6 Defective Instruments

- 6.6.1 No defective instrument shall be used.
- 6.6.2 When a defect is observed, the instrument shall be declared defective, and removed from service. A defect label attached to the instrument identifies it as being defective.
- 6.6.3 The defective instrument should be repaired as soon as possible to ensure an adequate supply of instruments.

7.0 RECORDS

- 7.1 KFH-HP-040 (KRT Threshold Change Tracking Form) is generated by this procedure and is a non-permanent record and must be retained in accordance with KSH-008.
- 7.2 All calibration and maintenance records are permanent records and shall be retained in accordance with KSH-008.
- 7.3 The performance checks of portable instruments, before and after use, shall be recorded on all reports generated, using the results obtained from that instrument.
- 7.4 The performance check reports are non-permanent records and shall be retained in accordance with the relevant retention matrix as per KSH-008.
- 7.5 The routine source check verification reports are non-permanent records and shall be retained in accordance with the relevant retention matrix as per KSH-008.

8.0 ATTACHMENTS

Appendix 1 – Justification

APPENDIX 1

JUSTIFICATION

Revision 11

1. Corrected calibration period requirement for analytical instruments back to 12 ± 2 month interval.
2. Add KRT calibration and source check requirements.
3. Changed record retaining requirements of KFH-HP-040, KRT Threshold Change Tracking form, to a non-permanent record (added to QRL).

Revision 12

1. Full review-3 yearly update required.
2. Add responsibilities to Radiation Protection Manager, paragraph 5.2.
3. Replace “analytical” with “radiochemistry” in paragraph 5.3.
4. Change paragraph 6.11 to read: ‘The quality control requirements for radiochemistry instruments used by the Chemistry Group are documented in KSC-001’.
5. Add DMC EPD`s in a 12 ± 2 month interval to calibration section.
6. Update records section in Section 7.0.