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SENIOR PHYSICIST RADIATION PROTECTION	SENIOR PHYSICIST RADIATION PROTECTION	MANAGER RADIATION PROTECTION
DATE 2018-01-24	**DATE** 2018-01-24	**DATE** 2018-01-26

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FCA	ALARA REVIEW	SUPERSEDES
PROTECTION	NO	KSH-012, Rev 1a dd. 2015-11-26 FULL REVIEW

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1.0 PURPOSE

- To ensure that Radiation Protection is conducted in an effective, consistent and professional manner within the Site Licence requirements.
- To establish standards and expectations associated with activities conducted by Radiation Protection at Koeberg Nuclear Power Station.
- This procedure emphasises safety in every aspect of plant operation in order to pursue continuous improvement and achieve excellence.

2.0 SCOPE

2.1 Introduction

2.1.1 It is the responsibility of Radiation Protection staff to ensure activities are conducted in a safe and efficient manner in compliance with applicable station licences, OTS, procedures, NNR regulations, legislation, corporate requirements, administrative requirements and safety rules. The objective is to ensure consistency and to achieve excellence.

Any clarity required regarding the implementation of the Standards and Expectations shall be referred to the Radiation Protection Manager for resolution.

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

3.1.1 **Critical Step** – An action or manipulation that has the possibility of an immediate, irreversible and undesirable consequence which could result in a threat to Nuclear or Conventional Safety, Generation or Plant Stability.

3.1.2 **Knowledge Worker** – Individuals who interact with the paper plant rather than physical plant work. Examples include Engineering, OCC, Commercial, Work Control, QA etc**.**

3.1.3 **Plant Worker** – Individuals who directly and physically interact with the plant. Examples are Maintenance, Operating, Chemistry and RP.

3.2 Abbreviations

3.2.1 **CA** – Corrective Action

3.2.2 **CAPCO** – Corrective Action Programme Co-ordinator

3.2.3 **CAR** – Corrective Action Review

3.2.4 **CR** – Condition Report

3.2.5 **EPD** – Electronic Personal Dosemeter

3.2.6 **EPRI** – Electrical Power Research Institute

3.2.7 **HP** – Human Performance

3.2.8 **KEG** – Koeberg Event Group

3.2.9 **KORC** – Koeberg Operations Review Committee

3.2.10 **LCO** – Limiting Condition for Operation

3.2.11 **NECSA** – Nuclear Energy Corporation of South Africa

3.2.12 **NNR** – National Nuclear Regulator

3.2.13 **OE** – Operating Experience

3.2.14 **OTS** – Operating Technical Specifications

3.2.15 **PPE** – Personal Protective Equipment

3.2.16 **PSR** – Plant Safety Regulations

3.2.17 **PTW** – Permit to Work

3.2.18 **RP** – Radiation Protection

3.2.19 **RP (PSR)** – Responsible Person (Plant Safety Regulations)

3.2.20 **RT** – Radiography Testing

3.2.21 **SRPA** – Senior Radiation Protection Assistant

3.2.22 **STAR** – Stop, Think, Act and Review

4.0 REFERENCES

4.1 Referenced Documents

4.1.1 335-2, Rev 4: Koeberg Nuclear Power Station Management Manual

4.1.2 KAA-500, Rev 12a: The Process for Controlled Documents

4.1.3 KGA-100, Rev 4: Plant Status Control at Koeberg Nuclear Power Station

4.1.4 KSA-011, Rev 13: The Requirements for Controlled Documents

4.1.5 KSA-122, Rev 3: Human Performance Tools

4.1.6 KSA-134, Rev 0: Nuclear Services Standards and Expectations

4.1.7 KSH-002, Rev 7: Internal Administration and Control of Procedures

4.2 Applicable Documents

4.2.1 KAA-688: The Corrective Action Process

4.2.2 KAH-014: Shift Activities, Handover and Coverage of Radiation Protection Shift Vacancies

5.0 REQUIREMENTS

5.1 Radiation Protection

5.1.1 Department Responsibilities:

Radiation Protection Professionals at Koeberg protect the workforce and the public against the harmful effects of radiation and contamination.

The different Sections in RP will have the following functions.

5.1.2 RP Development

- Technical research of all radiological aspects and compilation of position papers and reports to serve as basis for the RP programme.
- Investigation of all high level incidents.
- Ownership of the Human Performance and CAP Program for RP.
- Technical oversight and support to all areas of Radiation Protection.

5.1.3 Plant Shifts

- Routine surveillance and job cover for the NAB, Fuel Buildings and Reactor Buildings, and areas associated with these (RRI, Mx Galleries, PTR tank rooms, N040).
- Support for reactor building entries at power.
- Reacting to a contamination event in areas of responsibility.
- Maintains positive control of all radiological issues on the particular shifts.
- Ensure radiological control and plant housekeeping is upheld in area of responsibility.

5.1.4 Plant Days

- Routine surveillance and job cover for the radwaste areas and outside plant areas (Decon workshop, ISI, LLW, Chemistry, Cask Storage Building, ESL, Low Background building) including escort duties.
- Radiological decontamination of the controlled zones, which excludes chemicals or other hazardous matter.
- Radiological aspects of the shipment to and from site of radioactive material and radioactive waste.
- Effluent Management.
- Reacting to a contamination event in areas of responsibility.
- Ensure radiological control and plant housekeeping is upheld in area of responsibility.

5.1.5 Plant Services and Outage Prep

- Availability of functional, calibrated instrumentation including EPDs.
- RP Group Preparation for Outages.
- Co-ordination of RT work scope and compilation of RT work plans.
- Co-ordination during Outages between RP and other natural teams.
- Procurement, Stock Control.
- Source Control.
- Fulfill role of Document Custodian.
- Hot and Cold Laundry service and maintaining stocks of PPE (radiological at dress out areas).

5.1.6 ALARA

- Liaison with work control and RP Plant on all work to be performed and provision of RP input to the work planning.
- Management of dose for the station.
- Managing and co-ordinating all aspects of the station ALARA program.

5.1.7 Dosimetry

- Provision of a legal dosimetry service.

5.2 Human Performance

5.2.1 Any person involved in any work shall at all times use the Take-5 HP Tools. These five tools must be used on every task, every time.

The Take-5 HP Tools, include:

- 2 M – Situational Awareness
- Procedure and Work Instruction Use and Adherence
- Self-Check
- Effective Communication/Validate Assumptions
- Pre-Job Brief/Independent Review

Plant Workers	**Knowledge Workers**
2 M Rule	2 M Rule
Procedure Use & Adherence	Procedure Use & Adherence
Self-Check	Self-Check
Effective Communications	Validate Assumptions
Pre-Job Brief	Independent Review

Managers and Supervisors shall reinforce the proper use of the HP tools through observation and coaching.

5.2.2 The following are Radiation Protection fundamentals which should be evident in behaviours of all RP staff:

a) RP Staff, through decisions and actions, demonstrate a commitment to radiological safety. They prioritise radiological safety over production. Actions include the use of stop work authority, when faced with uncertain or unexpected plant radiological conditions, to protect workers and the environment.

b) RP staff understands the radiological principles necessary for the work to be performed.

c) RP staff understands the capabilities and limitations of radiological protection instruments used for personnel, material and area surveys. They select and use the appropriate radiological instruments for the task based on the type and expected quantity of radiation/contamination expected.

d) RP staff verifies that dosimetry is appropriate for the work expected, is worn properly and that alarm set-points provide early warning of unexpected or changing conditions.

e) RP staff understands the importance of documenting and reporting radiological information. They conduct and document radiation and contamination surveys with the detail necessary to depict work area conditions accurately. Signposting and worker information is updated as necessary to reflect current conditions in an easily understandable manner.

f) RP Staff monitors for all types of radiological hazards, including potential contributors to internal and external dose. Work activities and conditions are closely monitored and questioned for changing and unanticipated radiological conditions that could result in unplanned dose or contamination.

g) RP staff model correct behaviours by using personal protective clothing and equipment, including dosimetry, as prescribed. They also ensure that radworkers comply with these requirements and routinely monitor, challenge and coach radiation workers.

h) Radiologically controlled areas are kept clean and free of contamination as low as reasonably achievable.

i) Engineering controls, such as high-efficiency particulate filtration units, decontamination and containment systems, shielding are considered to minimise exposure and the spread/release of airborne radioactivity and the spread of contamination.

j) RP Staff knows and understands relevant significant operating experience and the importance of using significant operating experience and job-related operating experience to prevent events. The Defence in Depth principle of having multiple barriers to prevent events is included in the preparation and execution phase of the work.

5.2.3 Any work classified as having a high risk, either conventional, nuclear or radiological safety, shall have supervisory oversight, at least at SRPA level. The focus shall be on procedure compliance and the use of Human Performance Tools. The observation will be at direct line of sight as far as possible, but taking ALARA, safety and plant rules into consideration, where process oversight would be the only alternative.

5.2.4 The aim of a coaching observation (using any of the available coaching cards) is to identify shortfalls in the RP programme, ensure procedure compliance and application of best practise, use of HP tools, areas for improvement and showing support from RP Management to RP staff.

5.2.5 Coaching card information will be entered onto the Observation database for trending by the HP Champion for RP. Trend results are discussed monthly by RP Management.

5.2.6 Targets for observations by RP Development, Section Heads and Senior Supervisors are as follows:

Two coaching observations of which one is a paired observation.

One training observation per year.

5.2.7 Targets for SRPAs are as follows per month:

Four coaching observations.

NOTE: *The overriding importance is quality and trending to effect learning.*

5.2.8 Every shift (including RP Days) and RP Decon shall have a dedicated time slot where the following will be discussed:

a) The previous 24 hours

b) The expected work for the shift

c) RP or Human Performance Fundamental

d) Human Performance Tools

e) Conventional Safety

f) OE

g) Staff authorisation

h) New procedures or Work Instructions

Other sections will discuss items c) to h) on a weekly basis.

5.2.9 All controlled areas are divided among appropriate area owner, whose responsibility it is to maintain all radiological aspects in the area, such as signposting, barricading, access control, step-off pad and contamination control, radioactive material control and radiological equipment.

5.2.10 Each area will be inspected and scored by the assigned owner, as well as the independent person assigned for the inspection period, on a monthly basis. Issues identified must be logged and the area owner has the responsibility to resolve the identified issues timeously.

5.2.11 Each area inspection will be scored. Monthly scores and inspection results will be included in the HP Trend database, where emerging and cross area issues will be attempted to be identified.

5.3 Documentation

5.3.1 RP Personnel shall strictly adhere to procedures at all times. If a procedure is suspected to be incorrect, work shall be stopped and clarity obtained, on the interpretation of the procedure and the procedure has been corrected, unless Nuclear or conventional safety is threatened in which case a conservative approach shall be taken to ensure the work is stopped in a safe manner to a point where the necessary procedure changes can be made. The procedure shall be changed before the activity is resumed, either through a temporary change or a Redline change.

5.3.2 When checklists are used, they shall be followed in a step by step manner.

5.3.3 No-one may give directions, guidance or recommendations which conflict with approved procedures.

5.3.4 Where doubt exists in the interpretation of a procedure, the conservative approach shall be followed in any decision. The relevant supervisor or the RP Manager shall be notified and the applicable change process initiated.

5.3.5 It is not practical to provide a procedure for every situation that may occur. When such a situation does arise, conservative decision-making will be applied and shall include:

- Pausing to determine the appropriate course of action based upon plant and fundamental knowledge, available references, and consultation with technical experts.
- Employing effective teamwork, while also ensuring the RP Manager is informed and involved.
- Reach a state where authorised procedures can be used.

5.3.6 Work Instructions described in KAH-014 may only be used to compliment the requirements of a procedure; it shall never be used to supersede the requirements of an authorised procedure. When any new process is implemented which is not yet documented in a procedure, it should first be documented in a Work Instruction to formalise the process if initial implementation in an existing or new procedure is not practical or advisable. Work Instructions are periodically reviewed for applicability and to keep the number at an optimum low level. Work Instructions shall be reviewed by all affected RP Personnel and is administered by the Plant Shift Section.

5.3.7 Any procedure change affecting the manner in which a task is performed, shall have a review by a representation of the implementing staff.

5.4 Authorisation

5.4.1 All RP staff will ensure that their authorisations are valid. Any expired authorisation as a result of negligence, that is linked to a licensing requirement will be dealt with through the disciplinary process.

5.4.2 To ensure staff remain Authorised, their list of responsibilities are:

5.4.2.1 Staff are expected to verify their Authorisations on a weekly basis.

5.4.2.2 Supervisors are expected to ensure staff are Authorised for assigned tasks by regular confirmation using the Authorisation Database.

5.4.2.3 Section Heads and RP Management are expected to ensure the Task to Training Matrix is an accurate reflection of the required training and authorisation expected from each position.

5.4.2.4 Training is expected to administer the Task to Training Matrix and the Authorisation Database.

5.4.3 RP Monitors and above are exempt from the Radworkers course requal requirements provided the following are met:

- RP Monitors, RPAs and SRPA have had a successful credential review for their position.
- Senior Supervisors, Section Heads, Physicists, Engineers, RP Manager and any other position related to the RP function, have performed one radworker classroom and one simulator observation per year.

5.4.4 Any person found to have violated a procedure requirement will have their authorisation for that specific task withdrawn until an investigation has been performed into the incident. This investigation will be performed separately from the CR investigation, which will focus on the RP Programme and process improvement. Re-instatement of the authorisation may require redoing the relevant authorisation, depending on the severity of the situation. Negligence or wilful misconduct will be dealt with through the disciplinary process and re-instatement will require re-doing the authorisation, as a minimum.

5.5 CAP Management

5.5.1 The following instances will require the raising of a CR in addition to the required CRs as referenced in KAA-688:

a) Work stopped due to radiological concern. *

b) Unclear interpretation of a procedure.

c) Personnel Contamination (normally raised by line group) at EPRI action levels 1, 2, and 3.

d) Procedure non-compliance.

e) Detection of contamination above detection levels outside of a controlled zone.

f) Contamination above contamination zone limits detected in clean areas of the controlled zone.

g) Spills, leaks.

h) Equipment failure outside of normally expected wear and tear.

i) EPD dose alarms. *

j) Unexpected EPD dose rate alarms or dose rate alarms above 1000 micro Sievert per hour. *

k) Unexpected change in zone classification based on dose rate, surface or airborne contamination level. *

l) RPC dose exceeded.

m) Weekly/monthly dose targets exceeded.

n) Out of normal readings and discrepancies in legal dose.

o) RADPRO system problems affecting production.

p) Expired compulsory authorisations (including those for radworker authorisations) and work performed unsupervised by staff who are not authorised.

q) Expired procedures.

r) Any other event in the opinion of any person in RP that is regarded as a problem needing attention and formal notification through the station CAP process to management.

NOTE: *Items marked with * will reference applicable failed barriers and assess weaknesses to implement SOER 2001-1 recommendations in the investigation report.*

5.5.2 CR's should be raised as soon as possible by the person having the most information. CR information must be as complete as possible, ideally verified by a second person, to avoid ambiguity.

5.5.3 The assignment for the investigation lead will be determined within 2 work days, but should take the severity of the event into consideration (refer RP Development duties) as well as the level of independence required. A person at fault shall not be assigned the investigation. Independent review of the findings will be considered. Corrective action must be negotiated with leads before finalising.

5.5.4 The final decision for the classification and investigation type is with CAR, but the following guidelines may be used by the RP CAPCO at KEG:

a) EPRI action level 1 should be assessed, but if the information has been captured to identify the cause, and actions have been completed already, the event can be trended once the correct trend codes have been added.

b) EPRI level 2 shall be assessed, unless organisational weaknesses are identified that may result in further contamination events, in which case the event will be evaluated. Detailed comments shall be included in the CR on the reason why the CR is not evaluated.

c) EPRI level 3 shall be evaluated, but may be downgraded to assessment level with a CAR presentation, with identification of the apparent cause and extent of condition.

NOTE: *If several contamination events at the same time and with a similar cause result in several CR's, these can be linked to a common cause investigation. The linked CR's will reflect the causes individually to enable trending.*

d) Dose of any type exceeded will require an assessment when above 500 micro sievert and if the target has been exceeded by 20%.

e) All radiological type CRs investigated by other groups shall be reviewed by a person in RP who has done the required CAP training, prior to closing on the CAP system to ensure technical correctness and the proper identification of the cause, which shall include the identification of breakdowns in radiological control barriers and processes.

5.6 Work Control

5.6.1 ALARA is responsible for liaison with work control for the identification of routine work, Plan of the Day scheduling and emergent work scope. Communication will be with the appropriate section for the radiological cover, Pre-job survey and other aspects of the work. When work is required after hours, the applicable section will arrange the required resources for the necessary radiological oversight.

5.6.2 Any work for RP staff of whatever nature can only be assigned when approved by the relevant SRPA or Senior supervisor.

5.6.3 Emergent work outside of normal day shift working hours not arranged beforehand and of priority lower than 2, will not be covered by RP unless approved by the RP Manager or relevant Section Head. RP cover for work of priority 2 or higher may be approved by the SRPA. The following needs to be met for the work to be covered by RP in these cases:

- An assessment has been made of the impact on radiological or plant safety.
- All required reviews and risks have been done in full compliance with relevant procedures.
- Assessment of manpower requirements will not result in a downgrade of the normal scheduled radiological control and routine surveillance requirements.
- When it is required to call in additional personnel for overtime, it has been approved by the RP Manager or authorised delegate.

5.6.4 When manpower is needed in support of plant operations, that cannot for some reason be supplied by the responsible section, the necessary support shall be supplied by a different section, after liaison with the relevant section head and as long as it does not have a severe impact on the function of that section. The RP Manager will have the final call in this regard.

5.6.5 For work where PSR is involved, the RP (PSR) will only act as the Authorised Supervisor to meet all the requirements of the Plant Safety Regulations to ensure personnel safety.

5.6.6 During the preparation phase of the work, the risk assessment shall identify the following:

- Radiological impact of the work.
- Conventional safety risks.
- Concurrent work having an impact on the working conditions.
- Impact on station programs such as Foreign Material Exclusion, Chemical Controls, Plant Safety Regulations.
- Identification of nearby plant components and the impact of the work on those plant components.

5.7 Change Management

5.7.1 Any new initiative, product, tool or process to be implemented in Radiation Protection will be subject to an implementation plan.

5.7.2 The lead for the change will be assigned by RP Management.

5.7.3 The implementation plan will be subject to RP Management approval and will include reference to the following:

a) Timeline for implementation with target dates.

b) Affected areas within Radiation Protection.

c) Affected Departments and groups outside of Radiation Protection.

d) Procedure updates.

e) Maintenance / Testing / Calibration processes and responsibilities.

f) Training material updates.

g) Staff training requirements.

h) Involvement of affected staff in development of process associated with the change.

i) Reference to international practice.

j) Technical justification and independent review.

5.7.4 Change in process related to licensing requirements shall be assessed through a technical review, documented in an appropriate report. Any calculations shall be independently verified by an appropriately qualified individual.

5.8 Emergency/Urgent Situations

5.8.1 When a situation exists which is of importance to preserve life or the plant, relevant controls exist in the form of an Emergency Entry Radiation Protection Certificate. Relevant access controls exist to ensure legal monitoring of staff exposure and ensuring the radiological oversight of staff.

5.8.2 During a situation when the Emergency Plan is activated, the mandate of Radiation Protection is to ensure the radiological safety of plant staff and the public.

5.8.3 Unless specified and decided by the Emergency Control Centre, all necessary controls applied by Radiation Protection to provide oversight and ensuring staff safety during normal operational conditions, will still apply. The decision will be influenced by the Health Physics Controller, considering factors such as the preservation of life, reducing or stopping the release of radioactive material to the environment, recovery of the plant, the urgency of the resolution, relevant radiological oversight and the level of exposure.

5.9 General

5.9.1 RP will compile a monthly report to track relevant technical and other indicators. The following are trended:

a) Station and RP dose

b) EPD alarms

c) Radworkers non-compliance

d) Hot Spots

e) Compactable trash volume produced

f) Contamination Events

g) Public dose

h) Competency Index

i) Volume of stored processed radioactive waste

5.9.2 Detailed logs shall be kept by the following persons:

a) Decon SRPA

b) Instrumentation Technician

c) Shift SRPA

d) Radwaste SRPA

e) Laundries SRPA

f) Shipment SRPA

NOTE: *Logs shall be reviewed by the relevant Senior Supervisor before the RP Morning Meeting.*

5.10 External Stakeholder: Necsa

5.10.1 The following protocol is established with respect to communication with Necsa, on matters related to radioactive waste:

- The RP Manager is the single point contact for communication with Necsa related to strategic matters concerning radioactive waste.
- The SRPA shipping and the Head of Radwaste are the single point contact persons for communication with Necsa related to operational matters concerning the shipment and disposal of radioactive waste.
- The Radwaste Physicist is the single point contact person for communication with Necsa related to technical matters concerning radioactive waste.

6.0 ATTACHMENTS

Appendix 1 – Justification

APPENDIX 1

JUSTIFICATION

Revision 2

1. Align all HP Tool references to KSA-122. GA37077.

2. Change PN to CR.