Eskom	User Requirements Specification	Radiation Protection & Chemistry Management

Title: **User Requirements for the Upgrade of the Radwaste Tracking Program (RTP) Software**

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1. Introduction

This user requirements specification (URS) describes the upgrade of the existing Radwaste Tracking Program (RTP). It is intended to describe the functional and technical requirements for the design, supply of material, manufacturing, delivery, removal and disposal of existing, installation, testing and commissioning of the system change.

2. Supporting Clauses

2.1 Scope

The primary objective of this project is the replacement or configuration and modernization of the existing RTP software at Koeberg Nuclear Power Station (KNPS). The scope of the modification is the resolution of obsolescence and longstanding performance issues (GA 41287, CR 142501, QA Surveillance S209), configuration of RTP for shipment of waste packages as documented in TR-006-2022 and configuration of RTP to demonstrate compliance of KNPS waste packages with the derived limits using the alternative LLW criterion (Limited Scope Studies Report No. ASC 1004G). The scope comprises the following:

a) A detailed design document according to the template supplied by Eskom's Engineering Department,

b) Supply of material,

c) Delivery to Koeberg Nuclear Power Station,

d) Removal of existing software and/or equipment,

e) Installation of new software and/or equipment,

f) Testing and commissioning of the modified system and/or equipment,

g) Interfacing requirements i.e., design, configuration, and installation of the RTP system ready for interfacing. This includes but not limited to physical changes, cabling, hardware, programming, testing and commissioning associated with providing such interface,

h) Disposal of existing equipment,

i) All documents and document updates as required by this specification,

j) Qualification Documentation (e.g., test reports)

k) Providing support during National Nuclear Regulator (NNR) activities,

l) Training requirements for the station.

2.1.1 Purpose

Provision of user requirements associated with the replacement or configuration and modernization of the existing RTP software. The upgrade of the system will resolve the obsolescence risk, improve performance of the current system and result in the availability of more waste packages for shipment to Vaalputs which is imperative for the Long-Term Operation (LTO) of Koeberg Nuclear Power Station.

2.1.2 Applicability

This document shall apply throughout Koeberg Nuclear Power Station.

2.1.3 Effective date

This document shall be effective from authorisation date.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs unless otherwise specified.

2.2.1 Normative

[1]	ASME NQA-1	Quality Assurance Requirements for Nuclear Facility Applications
[2]	IEEE 1012	Standard for System and Software Verification and Validation
[3]	IEEE 730	Standard for Software Quality Assurance Processes
[4]	ISO 9001	Quality Management Systems Requirements
[5]	NRC RG 5.71	Regulatory Guide: Cyber Security Programs for Nuclear Facilities
[6]	NUREG 0700	Human-System Interface Design Review Guidelines
[7]	OHS Act	Occupational Health and Safety Act 85 of 1993
[8]	RD-0034	Quality and Safety Management Requirements for Nuclear Installations
[9]	RG-0014	Guidance on Implementation of Cyber or Computer Security for Nuclear Installations
[10]	SANS 60950	Information Technology Equipment – Safety

2.2.2 Informative

[11]	0013/14Q rev.1	Classification Radwaste Tracking System
[12]	240-127002040	Procurement Quality Engineering Requirements (KSA-089)
[13]	240-142639998	Safety Evaluation Process Guide (KGA-025)
[14]	240-143604773	Safety Evaluation Process
[15]	240-55410927	Cyber Security Standard for Operation Technology
[16]	240-89294359	Nuclear Safety, Seismic, Environmental, Quality, Importance and Management System Level Classification Standard
[17]	331-398	Software Listing (KLA-022)
[18]	331-399	Software Classification
[19]	331-91	Control of Equipment and Software Classifications
[20]	36-188	Quality Management Manual for Nuclear Generation

[21] DSG-318-087 Quality Requirements for the Procurement of Assets, Goods and Service

[22] KAA-500 Preparation, Review, Authorisation, Issue, Change Control and Withdrawal of Documents

[23] KAA-648 Administration and Responsibilities for Requalification Testing

[24] KAA-673 The Control of Change to Computer Hardware, Software and Electronic Information

[25] KSA-011 The Requirements for Controlled Documents

[26] KSA-020 Software Quality Assurance

[27] KSA-101 Software Requirement Specifications

[28] KSA-119 Management and Control of Supplemental Workers at Koeberg Nuclear Power Station

[29] TR-006-2022 Technical Report: Testing Method to Qualify Transport Packages of 210 L Metal Drums Containing NCW, Immobilised in Polyurethane Foam, as IP-2 Packages

[30]

2.3 Definitions

2.3.1. **Acceptance:** The *Employer*'s use of this word on the *Contractor's* documentation (including drawings, procedures, schedules, and so on) means that the *Employer* has observed no deviation from the requirements of this specification. The *Employer's* acceptance does not relieve the *Contractor* of its obligation to adhere to all the requirements of this specification and all applicable laws and regulations. The *Employer's* acceptance shall not relieve the *Contractor* of any responsibility for sufficiency, accuracy, or quality of workmanship.

2.3.2. **Accepted with Comments:** Indicates that changes or clarifications are required to the document in order to satisfy the requirements of this specification or the quality expectations of the *Employer*. The *Contractor* is expected to incorporate the *Employer's* comments and resubmit the document to the *Employer* for acceptance prior to implementation unless specifically identified by the *Employer* as approved with comments, The item can be used for its intended purpose (e.g. fabrication). The *Employer's* acceptance to proceed with fabrication does not relieve the *Contractor* of its obligation to adhere to all the requirements of this specification and all applicable laws and regulations. The *Employer's* acceptance to proceed with fabrication shall not relieve the *Contractor* of any responsibility for sufficiency, accuracy, or quality of workmanship.

2.3.3. **Confidential:** the classification given to information that may be used by malicious/opposing/hostile elements to harm the objectives and functions of Eskom Holdings Limited.

2.3.4. ***Contractor:*** service provider, consultant or supplier that has been deemed successful (via a tender process) to provide the required service.

2.3.5. **Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

2.3.6. **Cyber Security:** Cyber security is the collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment and organisation and user's assets. Organisation and user's assets include connected computing devices, personnel, infrastructure, applications, services, telecommunications systems, and the totality of transmitted and/or stored information in the cyber environment. Cyber security strives to ensure the attainment and maintenance of the security properties of the organisation and user's assets against relevant security risks in the cyber environment.

The general security objectives comprise the following:

- Availability
- Integrity, which may include authenticity and non-repudiation
- Confidentiality

(Source: 240-55410927)

2.3.7. **Designer:** The Person/company responsible for the detailed design of the KIS that employs professionally registered personnel in terms of the Engineering Professions Act of South Africa (or equivalent in terms of the Washington Accord) appointed by the *Contractor* to perform the design activities required by this TRS.

2.3.8. ***Employer:*** Eskom Holdings SOC Ltd

2.3.9. **Installer:** The person/company responsible for placing the KIS and associated equipment in place in accordance with all the design requirements.

2.3.10. **Not Accepted:** Indicates that the document as submitted does not satisfy the requirements of this specification or the quality expectations of the *Employer*. The *Employer* shall provide a reason (not necessarily specific comments) for not accepting the document. If the *Employer* requires the document, the document shall be revised and resubmitted for acceptance. The document cannot be used for its intended purpose (e.g., fabrication). until it has been dispositioned by the *Employer* as accepted or accepted with comments,

2.3.11. **Requirement:** A condition or capability needed by a user to solve a problem or achieve an objective.

2.3.12. **Scope of Supply:** The sum of the products, services, and results to be provided as a project.

2.3.13. **Shall, should, may:** "Shall" is used to denote a requirement, "should" a recommendation and "may" to denote permission.

2.3.14. **Trigramme:** Koeberg labelling system that generally consists of a unit number followed by three alphabetic characters identifying a system, followed by a three-digit number, followed by two letters (bigramme) indicating a component. Full details can be found in KBA0000G000036

2.4 Abbreviations

Abbreviation	Explanation
CR	Condition Report
FAT	Factory Acceptance Test
GA	General Action
IAEA	International Atomic Energy Agency
ISO	International Organization for Standardization
ITP	Inspection and Test Plan
KNPS	Koeberg Nuclear Power Station
LIMS	Laboratory Information Management System
LLW	Low-Level Waste
LTO	Long-Term Operation
NCW	Non-Compactable Waste
NECSA	South African Nuclear Energy Corporation
NNR	National Nuclear Regulator
NSF	No Safety Function
OE	Operating Experience
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
QMS	Quality Management System
RTP	Radwaste Tracking Programme
SAT	Site Acceptance Test
SI	Système International d'unités
SR	Safety-Related
TRS	Technical Requirements Specification
V&V	Verification & Validation
WAC	Waste Acceptance Criteria

2.5 Roles and Responsibilities

Not Applicable

2.6 Process for Monitoring

Not Applicable

2.7 Related/Supporting Documents

Not Applicable

3. Existing Design

Radwaste produced and processed at Koeberg Nuclear Power Station (KNPS) for shipment to Vaalputs must comply to the National Nuclear Regulator (NNR), Vaalputs Waste Acceptance Criteria (WAC) and International Atomic Energy Agency (IAEA) regulations. The existing Radwaste Tracking Program (RTP) is used for managing the activities associated with the drumming intermediate storage and shipment of all radiological waste packages on-site at Koeberg Nuclear Power Station (KNPS).

The RTP system:

a) Calculates radioactivity inside waste packages using NNR approved methodologies to determine compliance with the shipment regulations and the waste acceptance criteria.

b) Comprises a solid waste inventory management system.

c) Maintains historical survey records of waste packages.

The system interfaces with:

a) Laboratory Information Management System (LIMS)

b) Chemistry Access Database

Failure of RTP to correctly calculate the radioactivity inside waste packages can result in non-compliance to the regulatory requirements and potential exposure to public which will adversely affect KNPS license to ship and for long-term operation (LTO).

4. Problems with Existing Design

4.1. The existing RTP setup is not user-friendly. Simple actions such as editing, extraction or consolidation of data etc. for shipments can only be performed through source code manipulation (GA 41287 refers). Operating Experience (OE) suggests that these shortcomings were identified as early as 2014 however, the project initiated to correct these problems did not materialize due to contractual issues during development. The work-around practices implemented to-date have resulted in numerous issues as illustrated in CR 142501 and QA Surveillance Report S209.

4.2. The Limited Scope Studies (Report No. ASC 1004G) allows Koeberg to demonstrate compliance with the derived limits using the alternative LLW definition to. This will result in the availability of more waste packages for shipment to Vaalputs. However, RTP is currently not configured for use of this alternative LLW criterion.

4.3. Shipment of steel waste packages consisting of NCW immobilised in polyurethane as documented in TR-006-2022, requires RTP to be modified accordingly.

5. Design Change Requirements

The design requirements are based on improving performance / capabilities and eliminating the current obsolescence issue from the existing RTP system, The functionality is primarily the same as the current system.

a) The new system shall perform the same functions as the existing system, with improvements and additional functionality as described in this specification.

b) The new system shall be configured for as a minimum for shipment of concrete and steel drum waste packages (as documented in TR-006-2022).

c) The new system shall have the capability to add additional types of packages should the need arise.

d) The new system shall be configured to demonstrate compliance with the derived limits using alternative definition of Low-Level Waste (LLW) in terms of the intrusion dose criterion (Limited Scope Study Report No. ASC 1004G refers). All calculations related to the Vaalputs WAC, and LSA-II limit, using correct mass, shall be included in the functionality.

e) The user interface of the new system shall be improved to acceptable levels and functionality. See GA 41287, CR 142501, and QA Surveillance S209 for more information regarding issues with the existing RTP system.

f) The new system shall be enhanced to reduce the potential for human errors as illustrated in CR 142501 and QA Surveillance S209 refers.

i. Only the administrator role shall have elevated privileges on the operating system of the of the workstation and other infrastructure.

5.1 Design Classification

Classification No	: 0013/14Q rev.1
System Importance	: SR
Safety Class	: NSF
Quality Level	: Q3

5.2 Assumptions and Constraints

5.2.1. Regulatory requirements exist for each waste package.

5.3 General

5.3.1. All software applications and functionality of the existing RTP system shall be migrated/ported to and thoroughly tested on the new system, with all compatibility issues fully documented and resolved.

5.3.2. All software development tools used in this modification shall be provided to the *Employer* for use at Koeberg, with no limit on usage and licensing. This includes all software drivers and tools.

5.3.3. It shall be possible to view and modify any code developed specifically for this project.

5.3.4. Any additional improvements or enhancements that may be deemed necessary or beneficial shall be identified and submitted to the *Employer* for consideration for inclusion into the scope.

5.3.5. The new system shall conform in all respects with applicable International and National laws and regulations.

5.3.6. The requirements of this specification shall take precedence if they are more stringent than the requirements specified in the codes, standards, and regulations.

5.3.7. The new design shall not introduce additional risks to personnel or plant integrity.

5.4 Specific

5.4.1. All obsolete hardware and software shall be replaced.

5.4.2. The new system peripherals, including printers, keyboards, mice, and monitors shall be included in the scope. Where possible, the system peripherals and cabling shall be retained and re-used.

5.4.3. Ethernet and networking components for industrial environments is preferred.

5.4.4. The new system shall be designed in such a way that it can be virtualized to prevent future obsolescence. This shall be demonstrated during testing to prove code portability.

5.4.5. Virtual machine copies of the entire system shall be supplied to Eskom, including all required licenses.

5.4.6. A systematic approach to cyber security shall be adopted. 240-55410927, 'Cyber Security Standard for Operational Technology' shall be used as basis for industrial cyber security.

5.4.7. The system shall be tested for cyber security invasion, antivirus protection and prevention of unauthorised access to computer systems and terminals.

5.4.8. The *Contractor* shall disclose all backdoors created for software testing purposes, or any other purpose, with an understanding to remove all backdoors before commissioning.

5.4.9. All passwords shall be altered from the default, right from development stage or as soon as possible.

5.4.10. Passwords shall be supplied to designated persons only.

5.4.11. Passwords shall not be recorded in system documentation or procedures.

5.4.12. Role based permission shall be implemented.

5.4.13. System administrator, engineering and user role access shall be individualised and logged.

5.4.14. Only the administrator role shall have elevated privileges on the operating system of the workstation and other infrastructure. The *Contractor* may propose an alternative scheme subject to approval by the *Employer*.

5.4.15. Users shall not have any access to functionality other than that required to perform their duties.

5.4.16. A clear and secure strategy shall be developed and demonstrated, to perform weekly, monthly, or ad-hoc antivirus and security updates.

5.4.17. A suitable image restore option for the purposes of system backup and restore shall be included as part of the modification.

5.4.18. The new system shall include query builders to draw data based on set criteria or a selection of specific queries (e.g., total drums in storage per drum type, specific type of drums produced vs drums shipped for a period, activity of shipments etc.) for routine reports.

5.5 Manufacturing and Development

5.5.1. Software development shall enable the following:

5.5.1.1. Preservation of the investment in the original code development.

5.5.1.2. Reduced training and familiarisation overhead.

5.5.1.3. Confidence in the success of hardware upgrades.

5.5.1.4. Freedom to migrate to a different brand of hardware.

5.5.1.5. Freedom to combine several platforms in one system.

5.5.2. Software V&V shall be performed and governed by life cycle process acceptable to the *Employer*.

5.6 Installation

5.6.1. The modification shall be fully installed, tested, commissioned, and handed off to the *Employer*.

5.6.2. The *Contractor* shall perform a complete backup of the RTP systems to keep track of the pre-modification condition and any changes to the configuration.

5.7 Testing and Commissioning

5.7.1. The *Contractor* shall produce full factory acceptance test (FAT) and site acceptance test (SAT) procedures for acceptance by *Eskom*.

5.7.2. Prior to the performance of any test, the *Contractor* shall submit copies of the test procedures to the *Employer* for review and approval.

5.7.3. A comprehensive test report shall be generated and provided to the *Employer*.

5.7.4. The *Contractor* shall be responsible for performing the commissioning in accordance with the agreed procedures in the design document and to conform with this specification.

5.7.5. The *Contractor* shall submit a full testing and commissioning plan to the *Employer* for acceptance. The project commissioning policies and plans shall cover the following:

5.7.5.1. Approval of commissioning programs and procedures.

5.7.5.2. The coordination of the *Contractor*'s commissioning interfaces.

5.7.5.3. The scheduling and progressing of commissioning activities.

5.7.5.4. The availability of manpower, plant, material, and equipment resources.

5.7.5.5. Safety assurance and statutory requirements.

5.7.5.6. The completion of contractual obligations.

5.7.5.7. Any other relevant commissioning issues.

5.7.5.8. Review and integration of the *Employer*'s existing commissioning programs and procedures.

5.7.5.9. Plan, implement and control the applicable commissioning activities.

5.7.5.10. Conduct verifications and checks necessary for the issue of a completion certificate.

5.7.5.11. Ensure that defects are timeously rectified.

5.7.6. The *Contractor* shall provide factory and site acceptance testing procedures for review and acceptance by Eskom.

5.8 Quality Assurance and Inspection Requirements

5.8.1. The engineering classification assigned to the works is contained in Section 5.2. The *Contractor* shall implement and maintain a Quality Management System (QMS) that complies with the Eskom's Quality Specification DSG-318 087 [21].

5.8.2. The *Contractor*'s QMS shall be certified to ISO 9001:2015 and is subject to review and acceptance by the *Employer*.

5.8.3. The *Contractor* shall identify, in purchase documents to sub-contractors, all applicable quality and QA requirements imposed by the *Employer's* specification on the *Contractor* and shall ensure compliance thereto.

5.8.4. The *Contractor* shall provide Quality Control Plans (QCP's) as well as Inspection and Test Plans (ITP's) to the *Employer* for review and acceptance for various phases of all works carried out prior to commencement of the works. The *Employer* reserves the right to add hold and witness points.

5.8.5. The *Employer*, the *Employer* Quality Control (QC) representative and the *Contractor* shall review these QCP's/ITP's jointly and the actual scope of quality control and inspection required for the Contract agreed upon.

5.8.6. *Contractor* personnel performing the design and installation work shall be qualified by means of formal technical qualifications and have sufficient experience with work of similar nature. Qualifications and experience of key staff shall be provided by the *Contractor* during any tendering processes.

5.8.7. All test certificates and documentation shall be in English, using SI units.

5.9 Documentation

5.9.1. All existing documentation that will be affected by this modification shall be updated accordingly.

5.9.2. A complete installation, operating and maintenance manual shall be provided.

5.9.3. The following documentation shall be provided:

5.9.3.1. A detailed design document that includes all information relating to the design, supply, installation, testing and commissioning of the modified system.

5.9.3.2. System quality assurance plan

5.9.3.3. Software quality assurance plan.

5.9.3.4. Software requirements specification

5.9.3.5. V&V plan

5.9.3.6. System administration manuals

5.9.3.7. All software developed specifically for this project in executable form as well as in its source code form.

5.9.3.8. All OS software, tools and drivers with all required licenses.

5.9.3.9. User manuals

5.9.3.10. Engineering and Operator training manuals

5.9.3.11. Completed FATs and SATs

5.9.3.12. Test procedures and specifications

5.10 Training

5.10.1. Training shall be provided to Eskom Koeberg Engineering and Radiation Protection personnel.

5.10.2. Eskom reserves the right to appoint certain staff to the *Contractor's* team during the installation and testing phases. The aim of this will be to allow Eskom personnel to become familiar with the system.

6. Acceptance

This document has been seen and accepted by:

Name	Designation
Ugine Philander	Senior Technician (RP OPS - Radwaste Section)
Chris Kamfer	SRPA (RP OPS - Plant Days)
T Rossouw	System Engineer
R Maapola	Design Engineer

7. Revisions

Date	Rev.	Compiler	Remarks
February 2025	1	K Govender	Technical Requirements for the Configuration and Modernization of Radwaste Tracking Program Software

8. Development Team

N/A

9. Acknowledgements

N/A