Eskom	Report	Koeberg Operating Unit

Title: **Methodology for Documenting the Use of the LLWB**

Document Identifier: **NSIP04207**

Alternative Reference Number: **N/A**

Area of Applicability: **Nuclear Engineering**

Functional Area: **Nuclear Engineering**

Revision: **0B**

Total Pages: **14**

Next Review Date: **N/A**

Disclosure Classification: **Controlled Disclosure**

Compiled by	Functional Responsibility	Authorized by
P Thauge	**I Sekoko**	**S Touffie**
Engineer: Nuclear Back-End Management	**Middle Manager: Nuclear Analysis and Siting**	**Senior Manager: Nuclear Engineering**
Date: 2022-03-02	Date: 2022 -03-02	Date: 2024-03-05

Nuclear Additional Classification Information

Business Level:	**3**
Working Document:	**3**
Importance Classification:	**NSA**
NNR Approval:	**N/A**
Safety Committee Approval:	**N/A**
ALARA Review:	**N/A**
Functional Control Area:	**Nuclear Engineering**

Content

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1. Introduction

The Low Level Waste Building (LLWB) in Koeberg site was designed as a warehouse to facilitate the storage of radioactive waste on site. There is no separate licence for the LLWB to store waste and there is no documented basis for the design of the LLWB.

The National Nuclear Regulator (NNR) has instructed Eskom to produce a safety report documenting the safety of the building for the storage of radioactive waste [1].

In order to document the design basis for the LLWB, national and international regulations and guidelines will be considered.

This document therefore serves to provide a basis of the methodology for documenting the design basis of the LLWB.

2. Supporting Clauses

2.1 Scope

This methodology will be limited to the LLWB and its usage.

2.1.1 Purpose

This document provides a methodology for documenting the design basis of the LLWB.

2.1.2 Applicability

This document shall apply throughout the Koeberg Operating Unit.

2.1.3 Effective date

This document is effective from approval date.

2.2 Normative/Informative References

Parties using this document shall apply the authorised revision of the documents referenced at the time of authorization of this report unless a specific revision is shown or stipulated by Nuclear Installation License NIL-01 variation 19.

2.2.1 Normative

[1] NNR Letter k26184N: Project Plan for Legacy Waste in Storage at the Koeberg Low Level Waste Building.

[2] Nuclear Installation Licence, NIL-01 Variation 19.

[3] R.388: Regulations in Terms of Section 36, Read with Section 47 of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999), on Safety Standards and Regulatory Practices.

[4] RG-0019: Guidance on Safety Assessments of Nuclear Facilities.

[5] PP-0009: Position Paper on Authorisations for Nuclear Installations.

[6] IAEA GSR Part 4: Safety Assessment for Facilities and Activities.

[7] IAEA GSR Part 5: Predisposal Management of Radioactive Waste.

[8] IAEA Safety Guide WS-G-6.1: Storage of Radioactive Waste.

[9] IAEA General Safety Guide GSG-3: The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste for Protecting People and the Environment.

[10] 238-51: Radioactive Waste Management Standard.

2.2.2 Informative

[11] Koeberg Safety Analysis Report, Rev 5a.

2.3 Definitions

Term	Description
Historical waste	Radioactive waste that has accumulated in the LLWB over the years and has not been shipped for disposal and for which an endpoint has not been established yet (also referred to as legacy waste by the NNR).
Low and intermediate level waste – short lived	Radioactive waste with radiological characteristics between those of exempt waste and high level waste. The following requirements must be met: Thermal power (mainly due to shortlived radio nuclides (T ½ < 31 y)) < 2 kW/m3. AND Long-lived radio nuclide (T ½ > 31 y) concentrations. • Alpha: < 400 Bq/g • Beta and gamma: < 4000 Bq/g (Maximum per waste package up to 10x the concentration levels specified above). OR Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in inherent intrusion dose (the intrusion dose assuming the radioactive waste is spread on the surface) below 10 mSv per annum.
Storage	The holding of used fuel or of radioactive waste in a facility that provides for its containment, with the intention of retrieval. Storage is by definition an interim measure, and the term interim storage would therefore be appropriate only to refer to short-term temporary storage when contrasting this with the longer term fate of the waste. Storage as defined above should not be described as interim storage.

2.4 Abbreviations

Abbreviation	Explanation
IAEA	International Atomic Energy Agency
LILW-SL	Low and Intermediate Level Waste – Short Lived
NNR	National Nuclear Regulator

2.5 Process for Monitoring

N/A

2.6 Related/Supporting Documents

N/A

3. Legal and Regulatory Framework

3.1 Koeberg Licence and Standards

Koeberg is operated under the Nuclear Installation Licence NIL-01 Variation 19 [2], which stipulates the licence conditions on the implementation of programmes for the minimisation and safe management of radioactive waste on site. The following licence conditions are applicable to the storage of waste on plant site:

- 7.2 c) The radioactive waste management programme must - provide for the safe storage of radioactive waste between any waste management processes.
- 7.3 The safety of radioactive waste storage options must be assured for the envisaged period of storage.

The Eskom requirements for radioactive waste management are specified in 238-51 [10].

3.2 Regulatory Guides and Standards

The following regulatory documents were considered:

3.2.1 NNR Regulations R.388

The following clauses are applicable to the storage of radioactive waste in R.388 [3]:

- 4.6.1.4: A radioactive waste management programme must be established, implemented and maintained in order to – provide for the safe storage of radioactive waste between any waste management processes.
- 4.6.2: The safety of long-term radioactive waste storage options must be assured for the envisaged period of storage.

3.2.2 NNR RG-0019: Guidance on Safety Assessments of Nuclear Facilities

RG-0019 [4] provides guidance on safety assessments for nuclear facilities. Appendix 4 Part III was considered for the guidance on the structure and content of the safety report.

3.2.3 NNR PP-0009: Position Paper on Authorisations for Nuclear Installations

This paper [5] is intended to give clarity on the NNR position with respect to the issuance of authorisations relating to nuclear installations and also provide details on applicable requirements expected for different types of authorisations. According to PP-0009 [5], the following must be addressed in a NIL for the operation of a nuclear installation:

- A valid description of the installation
- Modification control procedure of safety related aspects
- Maintaining a valid and up-to-date safety case
- Limits on operation and use (such as dose or discharge limits or limits on the duration of the authorisation)
- Separate authorisations that the operator is required to obtain from the Regulator
- Establishment and compliance with operating technical specifications
- Maintenance and inspection program
- Operational radiation protection program
- Waste management program
- Transport of radioactive material
- Emergency plan where applicable
- Security plan
- Routine reporting
- Occurrence and incident reporting
- Record management
- Quality and safety management programme

Although the assessment for the LLWB is not for a NIL application, the above items will be considered in developing the structure of the safety report.

3.3 IAEA Guidance

3.3.1 IAEA GSR Part 5: Predisposal Management of Radioactive Waste

The following requirement in GSR Part 5 [7] is applicable to the storage of radioactive waste in the LLWB:

- Requirement 11: Storage of radioactive waste

  Waste shall be stored in such a manner that it can be inspected, monitored, retrieved and preserved in a condition suitable for its subsequent management. Due account shall be taken of the expected period of storage, and, to the extent possible, passive safety features shall be applied. For long term storage in particular, measures shall be taken to prevent degradation of the waste containment.

3.3.2 IAEA GSR Part 4: Safety Assessment for Facilities and Activities

This document [6] provides generally applicable requirements to be fulfilled in safety assessments for facilities and activities.

3.3.3 IAEA Safety Guide WS-G-6.1: Storage of Radioactive Waste

The guide [8] proposes the following to be included in the safety assessment for large storage facilities for radioactive waste:

(a) Description of the system (including an estimate of the maximum inventory of radioactive material) and a specification of the applicable regulations and guidance. The latter, for example, would indicate whether the facility should be seismically qualified.

(b) Systematic identification of conditions, processes and events associated with normal and abnormal conditions and external events (e.g. fires or handling accidents that involve the breach of waste containers).

(c) Hazard evaluation. Screening of combinations of conditions, processes and events that may result in the release of radioactive material from the waste storage facility, so as to eliminate from further consideration those of diminished likelihood or consequence.

(d) Risk calculation. The probabilities and consequences of the release(s) of radioactive material identified in the hazard evaluation are assessed by quantitative analysis and compared with regulatory limits.

(e) Establishment of limits, conditions and controls on the basis of the safety analysis. If necessary, the design of the facility is modified and the safety analysis is modified.

(f) Documentation of the safety assessment to support licensing of the facility.

3.3.4 IAEA General Safety Guide GSG-3: The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste for Protecting People and the Environment

The document [9] states that for an existing radioactive waste storage facility, it is necessary to assess whether this facility allows for safe and secure storage of waste. The document provides an assessment philosophy and guide for radioactive waste storage facilities in Table IV-7 [9].

4. Methodology for Documenting the Use of the LLWB

4.1 Purpose of Document

The purpose of this document is to:

- Document the safety of the waste storage in the LLWB, allowing for detailed planning; and
- Document limits, controls and conditions for waste storage in the LLWB.

4.2 Requirements

The following documents were considered in the methodology for assessing the LLWB:

- R.388 [3]
- RG-0019 [4]
- PP-0009 [5]
- NIL-01 (Var. 19): Koeberg Nuclear Installation License, Variation 19 [2]

- IAEA GSR Part 4 [6]
- IAEA GSR Part 5 [7]

Guidance provided in the following IAEA publications was considered:

- IAEA Safety Guide WS-G-6.1 [8]
- IAEA General Safety Guide GSG-3 [9]

4.3 Bounding Case

The document shall consider whether there are bounding conditions for storage of radioactive waste, and describe methodologies used to arrive at conclusions in this regard.

4.4 Approach

In order to inform conclusions about any possible limits of waste storage, an assessment of the current inventory and storage methods will form part of the report. Shielding, RP, dose and structural assessments will be performed for the LLWB. Once the assessments have been completed and analysed, any limiting conditions of storage (or methodologies to determine such) will be described.

An assessment on the management of radioactive waste on Koeberg site is currently being carried out as part of LTO preparations and the outcome of this assessment will be used to develop a plan for the management of radioactive waste on Koeberg site. The plan will address the challenges faced with radioactive waste management on site. The outcome of the LLWB documentation will be considered in the LTO assessment for radioactive waste management.

The flowchart for documenting the use of the LLWB and managing waste on site is illustrated in Figure 1.

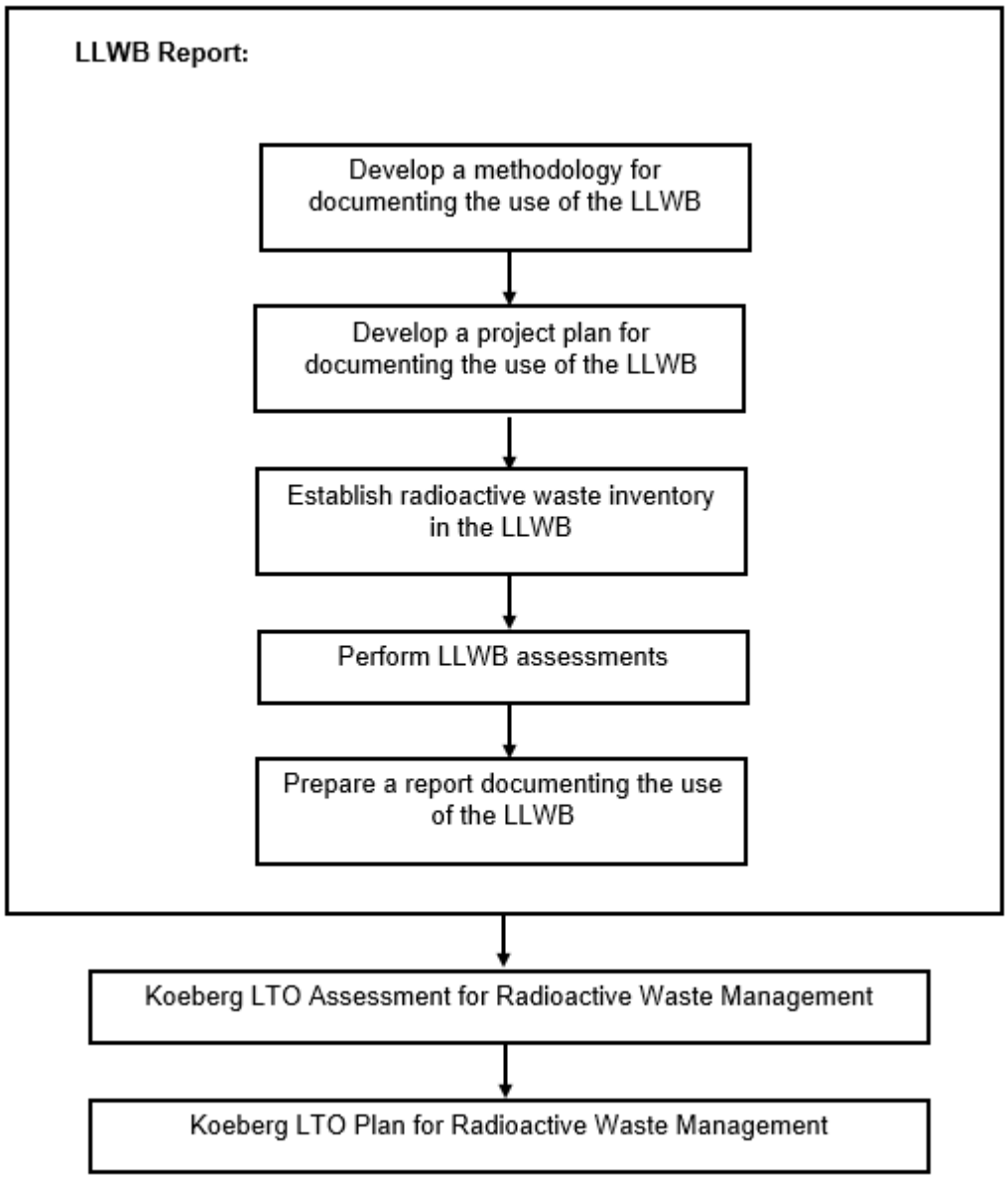

Figure 1: Methodology for documenting the use of the LLWB and managing waste on site.

4.5 LLWB Assessment Areas

The following areas will be considered in the assessment of the LLWB:

- Use cases of the building;
- Structural assessment;
- RP assessment;
- Shielding assessment; and
- Dose assessment.

A summary of the assessments for the LLWB provided in Table 1.

Table 1: Assessments for the LLWB

Activity	**Detail**
Structural Assessment	Describe the codes, standards, and regulations that governed the design and construction of the LLWB, and describe how these cater for the conditions of use of the building
RP Assessment	• Establish radioactive waste inventory (radioactive waste inventory to be established based on current waste) • Trending analysis from radiological survey data • ALARA analysis • Determine whether there are limiting conditions regards radioactive waste • Describe methods to establish RP practices in relation to radioactive waste storage
Shielding Assessment	Demonstrate sufficient shielding is provided by the waste packages
Dose Assessment under Normal Operations	• Identify activities in the LLWB • Calculate worker dose • Calculate public dose (if any)

4.6 LLWB Report

The proposed structure of the report documenting the use of the LLWB is provided in Appendix A. The structure of the report is based on PP-0009 [5].

5. Project Plan and Projected Schedule

Following approval of this methodology by Eskom and the NNR, the project will require interaction with various departments for information and preparation of the report documenting the use of the LLWB.

The project plan and LLWB report will be submitted to the NNR for review, discussion in a workshop if necessary, and approval. It should be noted that the project plan is subject to change depending on further Eskom and NNR interactions, i.e. discussion during workshops and the time and effort required to resolve any NNR comments received from formal document submittals.

6. Acceptance

This document has been seen and accepted by:

Name	**Designation**
Minette Minnaar	Radiation Protection
Ravid Goldstein	Nuclear Engineering
Tertius Karsten	Radiation Protection

7. Revisions

Date	Rev.	Compiler	Remarks
March 2022	0B	P Thauge	Draft updated to address NNR comments in letter k28057N.
September 2021	0A	P Thauge	First draft submitted to the NNR.

Appendix A: Elements of the LLWB Report

Table A1: Elements of the report documenting the use of the LLWB

Report Chapter	**Detail**
Chapter 1: Introduction	
Chapter 2:Supporting Clauses	
Chapter 3: Site Characteristics	
Chapter 4: Facility Description	4.1 LLWB Overview 4.2 LLWB Layout and Structure 4.3 Description and Use Cases 4.4 Utility Distribution Systems 4.5 Facility Security
Chapter 5: LLWB Assessments	5.1 Radioactive Waste Inventory 5.2 Dose Assessment under Normal Operations 5.2.1 Occupational Dose 5.2.2 Public Dose 5.3 RP Assessment 5.4 Shielding Assessment 5.5 Structural Assessment 5.6 Ageing Management
Chapter 6: Limits on Operation and Use	
Chapter 7: Operating Technical Specifications	7.1 Permitted waste containers 7.2 Maximum permitted inventory 7.3 Waste acceptance requirements 7.4 Handling equipment and lifting requirements 7.5 Container stacking and positioning 7.6 LLWB radiological classification 7.8 External dose rate and surface contamination
Chapter 8: Maintenance and Inspection Program	
Chapter 9: Operational Radiation Protection Program	
Chapter 10: Waste Management Program	
Chapter 11: Emergency Plan	
Chapter 12: Security Plan	
Chapter 13: Routine Reporting	
Chapter 14: Occurrence and Incident Reporting	
Chapter 15: Record Management	
Chapter 16: Quality and Safety Management Program	
Chapter 17: Decommissioning	
Chapter 18: Acceptance	
Chapter 19: Revisions	
Chapter 20: Development Team	