# **EXTERNAL EVENTS REVIEW INITIATIVE**

## Earthquake and Tsunami with Induced **Events**

Reference No. EERT-12-024-RPT

Revision

3

Date:

Date:

Compiled

Reviewed:

ITUMELENG KUNGOANE

2015-12-08

Date: TERRY CHOWLES

2015-12-08

Approved:

un **MVUSELELI HERMANUS** 

2015-12-08

December 2015

## **Table of Contents**

| Docu   | ment Revision History  | iv |
|--------|--|----|
| List o | f Abbreviations  | v  |
| 1      | Introduction   | 1  |
| 1.1    | Earthquake   | 1  |
| 1.2    | Tsunami  | 1  |
| 1.3    | Chemical Spill   | 2  |
| 1.4    | Explosion  | 2  |
| 1.5    | Fire   | 3  |
| 2      | Methodology  | 4  |
| 2.1    | Functional Requirements Diagram Methodology  | 6  |
| 3      | Proposed Modifications   | 8  |
| 4      | Seismic / Tsunami Hazard Assessment  | 10 |
| 4.1    | Introduction   | 10 |
| 4.2    | Design Basis (0.3 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level                | 10 |
| 4.2.1  | Potential Failure Identification   | 10 |
| 4.2.2  | Proposal Implementation  | 11 |
| 4.3    | Design Basis (0.3 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level        | 12 |
| 4.3.1  | Potential Failure Identification   | 12 |
| 4.3.2  | Proposal Implementation  | 17 |
| 4.4    | Beyond-Design-Basis (0.4 g) Earthquake inducing a Tsunami Wave up to the 0 m<br>Terrace Level      | 21 |
| 4.4.1  | Potential Failure Identification   | 21 |
| 4.4.2  | Proposal Implementation  | 22 |
| 4.5    | Beyond-Design-Basis (0.4 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level | 23 |
| 4.5.1  | Potential Failure Identification   | 24 |
|        | Proposal Implementation  |    |
| 4.6    | Beyond-Design-Basis (0.5 g) Earthquake inducing a Tsunami Wave up to the 0 m<br>Terrace Level      |    |
| 4.6.1  | Potential Failure Identification   | 26 |
|        | Proposal Implementation  |    |
| 4.7    | Beyond-Design-Basis (0.5 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level |    |
| 4.7.1  | Potential Failure Identification   | 28 |
| 4.7.2  | Proposal Implementation  | 30 |

## **Table of Contents**

| 4.8   | Beyond-Design-Basis (0.6 g) Earthquake inducing a Tsunami Wave up to the 0 m     |    |
|-------|--|----|
|       | Terrace Level  | 31 |
| 4.8.1 | Potential Failure Identification   | 31 |
| 4.8.2 | Proposal Implementation  | 33 |
| 4.9   | Beyond-Design-Basis (0.6 g) Earthquake inducing a Tsunami Wave up to 3.8 m above |    |
|       | the Terrace Level  | 33 |
| 4.9.1 | Potential Failure Identification   | 33 |
| 4.9.2 | Proposal Implementation  | 34 |
| 4.10  | Flooding Hazards in Excess of the 3.8 m Terrace Level                            | 34 |
| 5     | Conclusion   | 36 |
| 6     | Proposals  | 37 |
| 7     | References   | 38 |

## **List of Tables**

| Table 1: Potential failures identified during seismic events   | 4  |
|--|----|
| Table 2: Tsunami combination evaluation  | 5  |
| Table 3: Functional requirements diagram for a design basis (0.3 g) earthquake inducing atsunami wave up to 3.8 m above the terrace level (no modifications)                                     | 14 |
| Table 4: Functional requirements diagram for a design basis (0.3 g) earthquake inducing atsunami wave up to 3.8 m above the terrace level with proposed modificationsimplemented                 | 18 |
| Table 5: Functional requirements diagram for a design basis earthquake (0.3 g) inducing atsunami wave up to the 0 m terrace level (no modifications)   | 40 |
| Table 6: Functional requirements diagram for a design basis earthquake (0.3 g) inducing atsunami wave up to the 0 m terrace level with proposed modifications implemented                        | 43 |
| Table 7: Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)         inducing a tsunami wave up to the 0 m terrace level (no modifications)                             | 46 |
| Table 8: Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)<br>inducing a tsunami wave up to the 0 m terrace level with proposed modifications<br>implemented          | 49 |
| Table 9: Functional requirements diagram for a beyond-design-basis earthquake (0.4 g) inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)                             | 52 |
| Table 10: Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)<br>inducing a tsunami wave up to 3.8 m above the terrace level with proposed<br>modifications implemented | 55 |
| Table 11: Functional requirements diagram for a beyond-design-basis earthquake (0.5 g)         inducing a tsunami wave up to the 0 m terrace level (no modifications)                            | 58 |
| Table 12: Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented               |    |
| Table 13: Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)                            |    |
| Table 14: Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level with proposedmodifications implemented         | 67 |
| Table 15: Functional requirements diagram for a beyond-design-basis (0.6 g) earthquake         inducing a tsunami wave up to the 0 m terrace level (no modifications)                            | 70 |
| Table 16: Functional requirements diagram for a beyond-design-basis (0.6 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)                            | 73 |

## **DOCUMENT REVISION HISTORY**

| Rev. | Date       | Author         | Reason for Change   |
|------|------------|----------------|---|
| 0    | 2012-11-30 | J Bezuidenhout | Original compilation  |
| 1    | 2013-08-28 | J Bezuidenhout | Update with unit 2 containment building seismic assessment information.   |
| 2    | 2014-06-30 | J Bezuidenhout | Update with unit 1 containment building seismic assessment information.   |
| 3    | 2015-12-11 | I Kungoane     | <ul> <li>Proposal in § 1.2 and § 6 augmented according to NNR request.</li> <li>§ 3, 3<sup>rd</sup> bullet: The last sentence revised.</li> </ul> |

## LIST OF ABBREVIATIONS

| Abbreviation | Description                                       |
|--------------|---|
| ASG          | Auxiliary Feedwater System                        |
| CDFM         | Conservative Deterministic Failure Margin         |
| СМ           | Combination Mitigation                            |
| CRF          | Main Circulating Water System                     |
| EAS          | Containment Spray System                          |
| ECC          | Emergency Control Centre                          |
| EDG          | Emergency Diesel Generator                        |
| JPP          | Fire Fighting Water Production System             |
| JPS          | Mobile Fire Fighting System                       |
| KNPS         | Koeberg Nuclear Power Station                     |
| KRT          | Plant Radiation Monitoring System                 |
| LBC          | 125 V dc Equipment Control Supply                 |
| LBD          | 125 V dc Equipment Control Supply                 |
| LBE          | 125 V dc Equipment Control Supply                 |
| LBF          | 125 V dc Equipment Control Supply                 |
| LCB          | 48 V dc Relaying and Control Supplies             |
| LHA          | 6.6 kV Essential Switchboard (Train A)            |
| LHB          | 6.6 kV Essential Switchboard (Train B)            |
| LHC          | 6.6 kV Essential Switchboard (Common)             |
| LHS          | Emergency Diesel Generator (Common)               |
| LLA          | 380 V ac Essential Supply                         |
| LLB          | 380 V ac Essential Supply                         |
| LLC          | 380 V ac Essential Supply                         |
| LLD          | 380 V ac Essential Supply                         |
| LLE          | 380 V ac Essential Supply                         |
| LLI          | 380 V ac Essential Supply                         |
| LLJ          | 380 V ac Essential Supply                         |
| LNA          | 220 V ac Protection and Control Supply            |
| MSL          | Mean Sea Level                                    |
| PEE          | Portable Emergency Equipment                      |
| PO           | Pump  |
| PTR          | Reactor Cavity and Spent Fuel Pool Cooling System |
| RCP          | Reactor Coolant System                            |
| RCV          | Chemical and Volume Control System                |



| Abbreviation | Description   |
|--------------|---|
| REA          | Reactor Boron and Water Make-up System                      |
| RF           | Cooler  |
| RIC          | In-Core Instrumentation System                              |
| RIS          | Safety Injection System                                     |
| RRA          | Residual Heat Removal System                                |
| RRI          | Nuclear Island Component Cooling System                     |
| SBO          | Station Black-Out   |
| SEC          | Essential Service Water System                              |
| SED          | Nuclear Island Demineralised Water Distribution System      |
| SEP          | Potable Water System  |
| SER          | Conventional Island Demineralised Water Distribution System |
| SFP          | Spent Fuel Pool   |
| SG           | Steam Generator   |
| SSC          | Structures, Systems, and Components                         |

## 1 INTRODUCTION

The occurrence of a significant earthquake in close proximity to the coast is sometimes accompanied by a tsunami event. EERT-12-021 (*External Hazard Screening Assessment*) found that the combination of an earthquake generating a tsunami could also induce additional on-site hazards such as chemical spills, explosions, and fires [1].

This report assesses the robustness of Koeberg Nuclear Power Station (KNPS) to cope with an earthquake and subsequent tsunami and the simultaneous occurrence of a chemical spill, explosion, and fire event as stated in EERT-12-023-RPT (*On-site Induced Hazards*). Conservative analysis is used in the safety re-assessment. The implementation of several proposals made in EERT-11-013 (*External Events Safety Re-assessment Interim Report*) is simulated to illustrate the ability of the plant to shut down safely following a combination event. Proposed modifications are discussed in § 3 (*Proposed Modifications*). The combination study comprises the events described below.

### 1.1 EARTHQUAKE

EERT-11-015 (*Seismic Hazard Report*) assessed the robustness of the KNPS design to maintain its safety functions when challenged by a seismic hazard beyond the design basis [2]. The study enveloped geological hazards such as submarine landslides, liquefaction, and subsidence/upliftment. Potential cliff edges were identified where small deviations in plant behaviour could give rise to severe plant damages.

The nuclear safety related structures at KNPS are constructed on a common foundation referred to as the aseismic raft. The main function of the seismic raft is to decrease horizontal ground motion experienced by the nuclear safety related equipment. The KNPS seismic design basis is based on an earthquake, with an epicentre of 8 km at the postulated Milnerton-Hangklip fault zone that measures 7 on the Richter scale. The Dames and Moore method predicted that a safe shutdown earthquake is defined as 0.3 g zero-period horizontal acceleration and 0.2 g zero-period vertical acceleration.

The seismic hazard report includes several functional requirements diagrams for different magnitude seismic events. This method exposed potential vulnerabilities of structures, systems, and components (SSCs) during normal operating conditions due to a seismic event. The seismic event is used as the basis of this combination assessment using the functional requirements diagrams as explained in EERT-11-014 (*Minimal Needs to Prevent and Mitigate Fuel Melt*). The diagram indicating seismic failures is augmented with additional failures as described below.

### 1.2 TSUNAMI

EERT-11-016 (*Tsunami Hazard Report*) assessed the robustness of the facility's design to maintain its safety functions in the event of flooding as a result of a tsunami [3].

The tsunami assessment comprises three sections. The potential sources of a tsunami at KNPS were investigated first together with the risk posed by each of the initiating events. Secondly, the robustness of KNPS to mitigate a design-basis as well as a beyond-design-basis tsunami was evaluated for different levels of flooding. Potential vulnerabilities were highlighted and associated cliff edge effects identified. Finally, proposals were presented to increase the plant's robustness against tsunamis.

This study assumes the simultaneous occurrence of an earthquake and tsunami event as this is believed to be the most enveloping scenario. The so-called lag time between the earthquake and tsunami event is ignored to ensure the proposals made in this study are robust against extreme events.

There is currently no tsunami early warning system installed at Koeberg to provide an indication on possible tsunami formation following an earthquake event.

**CM 1**: It is proposed that Koeberg develop a tsunami early warning system to provide accurate early indication on possible tsunami formation following an earthquake event. Furthermore, it is proposed to develop a locally calibrated tsunami hazard assessment model/methodology.

The tsunami assessment used a similar method, i.e. a functional requirements diagram, as used in the earthquake assessment to identify potential failure of SSCs. The failures documented in the original tsunami study are used to augment the functional requirements diagram of the earthquake assessment in order to generate a combined earthquake and tsunami functional requirements diagram.

### 1.3 CHEMICAL SPILL

EERT-11-025 (*Chemical Spill Hazard Report*) assessed the risk of chemical spills to KNPS. The assessment concluded that the risk of chemical spills is limited to personnel safety [4]. Chemical spills do not have a direct consequence to nuclear safety.

This combination study compounds the chemical spills with an earthquake and induced tsunami event, as the earthquake and subsequent tsunami may result in damage to onsite chemical storage tanks (envelopes mobile chemical tankers). Although chemical spills do not cause additional damage to SSCs, failure of chemical tanks is presented as specified in EERT-12-023-RPT to indicate potential danger to plant operators due to the presence of toxic gases. The functional requirements diagram does not contain any chemical storage sources and as a result, these potential failures, due to the occurrence of an earthquake and subsequent tsunami, will be briefly discussed in the text.

#### 1.4 EXPLOSION

EERT-11-019 Rev 1 (*Explosion Hazard Report*) assessed the risk of explosions to KNPS from both on- and off-site sources. The study concluded that the locations of potential explosive sources outside of the access control point 2 are far enough to not induce a risk to nuclear safety [5].

All the potential on-site explosive sources documented in the explosion hazard report were analysed in EERT-12-023-RPT as on-site induced hazards [10]. The findings of this report are used to derive additional failures of SSCs which could possibly be induced by an earthquake and/or tsunami event. The earthquake and tsunami functional requirements diagram is augmented with the potential failures as a result of an explosion initiated by either an earthquake, tsunami, or fire event (no mechanism was found whereby a chemical spill could initiate an explosion).

### 1.5 FIRE

EERT-11-018 (*Fire Hazard Report*) analysed the risk of fires to KNPS. The safety reassessment showed that KNPS is sufficiently capable of detecting and mitigating an onsite fire [6].

This study considers the combination of an earthquake and subsequent tsunami inducing a fire on SSCs. EERT-12-023-RPT identified on-site induced fires as a result of an initiating event such as an earthquake, a tsunami, or an explosion (no mechanism was found whereby the chemicals used at KNPS could result in a fire). Failures of SSCs as a result of an initiating fire event are shown in the functional requirements diagram.

## 2 METHODOLOGY

Earthquakes, being geological events, cannot be prevented. The methodology followed in this combination study is that of identifying vulnerabilities during normal plant operating conditions due to a combination of external events and presenting applicable proposals to mitigate those events. This method ensures that core and spent fuel pool (SFP) cooling is continuously maintained and containment integrity is not compromised.

The safety re-assessment completed in EERT-11-015 (*Seismic Hazard Report*) is the cornerstone of the combination study, as this is the initiating event. Therefore, this study is used as the basis for the combination study. The functional requirements diagram generated in EERT-11-015 (*Seismic Hazard Report*) is augmented with the functional requirements diagram populated in EERT-11-016 (*Tsunami Hazard Report*) as the majority of failures are caused by these two events. The methodology of combining two safety re-assessments is discussed in § 2.1 (*Functional Requirements Diagram Methodology*).

Various combinations of magnitudes can be assessed. The study performed in EERT-11-015 (*Seismic Hazard Report*) found that a definite cliff edge (in terms of equipment failure) occurred between a 0.3 g and a 0.4 g earthquake. Table 1 illustrates the expected failures (includes SSC failure due to a supporting system) following seismic events of various magnitudes. The cells highlighted in grey illustrate the point where increased equipment loss is experienced due to the seismic magnitude increasing from designbasis to beyond-design-basis.

| Seismic Magnitude | Number of failures expected                 |
|-------------------|---|
| 0.2 g             | 6 potential failures identified             |
| 0.3 g             | 2 additional potential failures identified  |
| 0.4 g             | 61 additional potential failures identified |
| 0.5 g             | 4 additional potential failures identified  |
| 0.6 g             | 23 additional potential failures identified |

 Table 1:

 Potential failures identified during seismic events

Seismic walkdowns for equipment inside the unit 2 containment building were completed during outage 219. In addition, seismic walkdowns for unit 1 were subsequently completed during outage 120. The findings from the unit 2 walkdowns were incorporated into this report using the functional requirement diagram. Any discrepancies, in terms of additional equipment failure, found during the unit 1 seismic walkdowns will be briefly discussed.

The terrace level of KNPS is constructed 8 m above the mean sea level (MSL). Minimal damage to safety equipment is expected for a tsunami wave up to 8 m above MSL. The majority of water-caused damage occurs when the site is inundated up to a water level of 3.8 m above the terrace level (11.8 m MSL). By increasing the water level up to 6 m above the terrace level (14 m MSL) the only additional significant failure is the station batteries. By further increasing the water level up to 7 m (15 m MSL) above the terrace level, results in the failure of the SBO diesel generators. Water levels beyond the 7 m

terrace level (> 15 m tsunami) will cause failure of the electrical switchboards. The assumption is made that any SSC underneath the water surface will be unavailable. This assumption envelopes damage caused by water-borne debris and will therefore not be discussed further. The impact energy from a tsunami wave on buildings and SSCs was not considered in the tsunami hazard report, and is therefore not considered in this combination assessment.

**CM 2**: It is proposed that EERT-11-016 (Tsunami Hazard Report) be revised to include the potential damage to plant buildings and SSCs as a result of the impact energy from the tsunami waves.

The detailed combination of assessments, which includes functional requirements diagrams, is only performed for a tsunami wave height below the 0 m terrace level and a tsunami wave height less than 3.8 m above the terrace level (indicated in grey in Table 2) as this is where the significant cliff edges (regarding equipment loss) occur. Additional assessments were performed for a tsunami with wave height exceeding 3.8 m above the terrace level although this is limited to a brief discussion.

| Tsunami Height<br>(above/below<br>terrace level) | SSC failure  | Cumulative SSC failure   |
|--|--|--|
| > 7 m  | Electrical switchboards  | JPS connection<br>Most pumps on 0 m terrace<br>SER and SED tanks<br>Station and unit transformers<br>All five EDGs<br>30 V, 48 V, 125 V, 230 V batteries<br>supply to monitoring equipment.<br>Station black-out diesel generators |
| 6 m to < 7 m                                     | Station black-out diesel generators  | JPS connection<br>Most pumps on 0 m terrace<br>SER and SED tanks<br>Station and unit transformers<br>All five EDGs<br>30 V, 48 V, 125 V, 230 V batteries<br>supply to monitoring equipment   |
| 3.8 m to < 6 m                                   | 30 V, 48 V, 125 V, 230 V dc batteries supply to monitoring equipment   | JPS connection<br>Most pumps on 0 m terrace<br>SER and SED tanks<br>Station and unit transformers<br>All five EDGs   |
| 0 m to < 3.8 m                                   | All pumps on the 0 m terrace level (excludes<br>reactor building)<br>SER and SED tanks<br>Station and unit transformers<br>All five EDGs | JPS connection   |
| – 4 m to 0 m                                     | JPS connection   | -  |
| – 8 m to – 4 m                                   | -  | -  |

## Table 2: Tsunami combination evaluation

Based on the analysis above, the following combinations of seismic and tsunami magnitudes for unit 1 and 2 were assessed in detail using a functional requirements diagram comparison:

- Design basis earthquake (0.3 g) inducing a tsunami wave up to the 0 m terrace level;
- Design basis earthquake (0.3 g) inducing a tsunami wave up to 3.8 m above the terrace level;
- Beyond-design-basis earthquake (0.4 g) inducing a tsunami wave up to the 0 m terrace level;
- Beyond-design-basis earthquake (0.4 g) inducing a tsunami wave up to 3.8 m above the terrace level;
- Beyond-design-basis earthquake (0.5 g) inducing a tsunami wave up to the 0 m terrace level;
- Beyond-design-basis earthquake (0.5 g) inducing a tsunami wave up to 3.8 m above the terrace level;
- Beyond-design-basis earthquake (0.6 g) inducing a tsunami wave up to the 0 m terrace level;
- Beyond-design-basis earthquake (0.6 g) inducing a tsunami wave up to 3.8 m above the terrace level.

A common functional requirements diagram to represent both units 1 and 2 is completed for the combinations mentioned above. Failure of equipment identified is applicable to both units unless stated otherwise.

The on-site induced failures from chemical spills, explosions, and fires as documented in EERT-12-023-RPT are then presented to derive a comprehensive list of potential SSCs failure for this combination of events. The seismic and tsunami functional requirements diagram is augmented with these additional on-site induced failures (limited to fires and explosion as no mechanism could be found whereby a chemical spill could cause failure of SSCs).

As this document is identifying additional failures due to the combination of events, only additional proposals or amendments, where necessary, are made to the previous proposals in order to ensure continuous core and SFP cooling and maintaining containment integrity.

### 2.1 FUNCTIONAL REQUIREMENTS DIAGRAM METHODOLOGY

The functional requirements diagram is a summary of all the essential systems and subsystems that could be used to prevent and mitigate the effects of core melt, in line with the existing relevant incident and accident procedures and severe accident management guidelines. The functionality of the functional requirements diagram is comprehensively discussed and explained in EERT-11-014 (*Minimal Needs to Prevent and Mitigate Fuel Melt*) [7]. The functional requirements diagram uses unique colour coding to indicate the availability of different systems. Green illustrates that the system is functional following an event, red refers to a system being unavailable, and pink indicates a system is unavailable due to an on-site induced failure. Where a system is unavailable due to an initial event (either earthquake, tsunami, or both) together with an on-site induced hazard (explosion, fire, or both), the initial event always takes preference and is indicated in red. Orange colour coding is used to illustrate that a system is not available due to the loss of a supporting system. Grey colour coding illustrates the system was not assessed



(specific for seismic resilience) and subsequently no credit is taken for that system. Finally, yellow colour coding indicates the availability of a system; however the expected operational lifetime is less than 24 hours.

In EERT-11-015 (*Seismic Hazard Report*) and EERT-11-016 (*Tsunami Hazard Report*) the plant's ability to survive a single event was assessed using a functional requirements diagram.

A combined functional requirements diagram is completed for an earthquake inducing a tsunami. As previously mentioned, the seismic hazard report is used as the basis for the earthquake and induced tsunami assessment. The functional requirements diagram for the seismic event is augmented with additional failures caused by a tsunami event.

Different cell patterns were used to differentiate between the failure-causing event and the event that has no influence on the failure of a system. The cell patterns can be interpreted as follows:

- horizontal line pattern tsunami event is the cause for failure of a system or components;
- vertical line pattern seismic event is the cause for failure of a system or component;
- no line pattern both tsunami and earthquake events contribute to the failure of a system or component.

The combinations involving a tsunami wave height exceeding 3.8 m above the terrace level are assessed on a case-by-case basis as it was found that failure of additional systems above this point is limited. Functional requirements diagrams are not completed for these assessments and are only briefly discussed.

## **3 PROPOSED MODIFICATIONS**

Several vulnerabilities were documented in EERT-11-013 Rev.1 (*External Events Safety Re-assessment Interim Report*), which lead to numerous proposals being made for the mitigation of external events. To ensure the safe removal of decay heat while maintaining the integrity of the SFP, these proposals were prioritised for maximum benefit. The proposed modifications which are seismically qualified to 0.5 g are described below.

• Shutdown seals

Installation of shutdown seals on the primary pump shafts ensures the primary system inventory is not lost due to loss of seal cooling. With the shutdown seal installed, there will be negligible inventory loss from the RCP system, and therefore additional make-up is not required, as reflected in the functional requirements diagrams.

• Installation of an additional auxiliary feedwater system (on each unit)

It is proposed to install an additional hardened auxiliary feedwater system independent of ac power, to supply core cooling should all other pumps fail. This will provide sufficient core cooling to ensure that fuel integrity is not compromised.

• SEP tank and hardened line upgrade

The SEP potable water tank was found to be a reliable, alternative source of cooling water for KNPS plant reactor and SFP in the event of loss of cooling water supply through existing plant systems due to an extreme event. It is envisaged that the current SEP tanks will need to be replaced with hardened tanks and piping that can withstand a seismic loading of at least 0.5 g.

In order to ensure the SEP water is reliably delivered to the plant, it is proposed to install a hardened SEP pipe system to supply SEP water to the plant. A header with several connection points will be fitted to the end of the pipe to allow diesel-driven pumps to connect.

• Portable emergency equipment (PEE)

The procurement of several PEE diesel-driven pumps is proposed. These pumps, supplied by the hardened SEP line, will be used to supply the following:

- \* ASG tank make-up or direct to ASG 003 PO suction at 60 m<sup>3</sup>/h;
- \* EAS spray piping at 370 m<sup>3</sup>/h;
- \* SFP make-up line at 20 m<sup>3</sup>/h;
- \* PTR tank make-up line at 60 m<sup>3</sup>/h; and
- \* RCV charge flow piping at 60  $m^3/h$ .
- Hardened instrumentation

In order to ensure continuous monitoring of essential SSC, it is proposed to install hardened instrumentation for the following:

- core exit temperature indication;
- \* steam generator pressure indication;



- \* steam generator level indication;
- \* containment pressure indication; and
- \* SFP level indication.
- Mobile diesel generators

During a complete loss of off-site power, KNPS will require a reliable power source to ensure safe shutdown is maintained. The procurement of mobile diesel-driven generators is proposed to ensure critical equipment remains supplied. These mobile units will be connected into pre-installed connection points supplying the LHA and LHB switchboards.

The proposed modifications mentioned above are indicated on the functional requirements diagram, using a blue colour coding to illustrate the plant's ability to maintain SFP cooling and containment integrity.

## 4 SEISMIC / TSUNAMI HAZARD ASSESSMENT

### 4.1 INTRODUCTION

KNPS, being situated close to the coast, could be vulnerable to tsunamis caused by amongst others, an earthquake (envelopes submarine slumping). This section discusses the combination of an earthquake inducing a tsunami event. Furthermore, the potential on-site induced failures as a result of either the earthquake and/or tsunami are discussed. The functional requirements diagrams for the seismic and tsunami assessments are combined and any additional potential failures from on-site induced hazards are shown.

The combined functional requirements diagram is completed for the eight combinations stated in § 2 (*Methodology*). The combination assessments are constructively discussed, that is, as the magnitude of the seismic and tsunami hazard is increased, only additional potential failures are highlighted.

The functional requirements diagram is also updated with the proposals made in § 3 (*Proposed Modifications*). The success path to ensure critical plant functions is discussed.

## 4.2 DESIGN BASIS (0.3 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO THE 0 M TERRACE LEVEL

KNPS is robust against a tsunami wave of up to 8 m above MSL. As a result, minimal damage to SSCs can be expected in the event of a tsunami wave up to 8 m following a 0.3 g earthquake. The functional requirements diagram, which provides a graphical summary of all the essential systems affected during a combined event, is illustrated in Table 5 in Appendix 1.

#### 4.2.1 Potential Failure Identification

Damage to plant equipment is mostly caused by the occurrence of the seismic event. Critical components that could fail include:

- SEP tank and associated piping (failure at 0.2 g earthquake due to slope collapse);
- JPS piping connection (cracked suction and rusted discharge);
- Electrical cabinet drawers left unsecured; and
- REA water and SER tanks.

The potential failure of equipment following a tsunami wave with a height of less than 8 m is limited to the JPS pump connection point which is located next to the SEC pump house.

The power transformers and 6.6 kV non-essential switchboards were not assessed during the seismic margin assessment and as a result no credit is taken for the functionality of the equipment. The assumption is made that this combined event will result in a loss of off-site power. The functionality of the SER pumps, which are supplied by 380 V ac non-essential switchboards, will be lost as these switchboards are energised by the 6.6 kV non-essential switchboards.

EERT-12-023-RPT identifies additional on-site hazards (such as fire, explosion, and chemical release) that could also be initiated by off-site external hazards (and combinations), which could cause additional damage that must be considered [10].

The only credible additional compounding damage that is initiated by a design basis earthquake (0.3 g) is the possible failure of an ammonia tank in the demineralisation plant and a fire and/or explosion at the hydrogen storage facility. It is possible that a fire/explosion in the hydrogen storage facility could also damage the SEP tank (could also be caused by the earthquake) and the turbine hall.

**CM 3**: It is proposed that the seismically hardened SEP tank and associated pipework be robust against any overpressure generated by an explosion due to its proximity to the hydrogen storage facility, which could be vulnerable in the event of a seismic activity. An alternative solution would be the relocation of the hydrogen storage facility to a remote area not surrounded by critical equipment.

Damage to the SEP tank could lead to a flooding event at the south-side EDGs; however this is unlikely [9]. Due to the inherent uncertainty, a conservative approach is taken by making the assumption that the EDGs are not available following such a flooding event.

**CM 4**: It is proposed that a seismically qualified barrier be erected in front of the southside EDGs to protect these EDGs from possible water ingress in the event of an SEP tank rupture.

No credit is taken for any equipment inside the turbine hall and therefore any potential damage does not lead to any additional consequences.

The rupture of the ammonia tank at the demineralisation plant, could impact implementation of mitigation strategies, and necessary provision to either eliminate or deal with the consequences in the event of a seismic and tsunami combination event must be made.

**CM 5**: It is proposed that any preventative (such as tank strengthening) and/or mitigation strategies (such as protective clothing) to deal with a potential chemical release be robust against the sequential occurrence of an earthquake and a tsunami.

The CRF piping, which is not seismically designed, situated in the basement of the turbine hall below the normal seawater level, could potentially flood parts of this building in the event of seismic activity as a result of a pipe rupture. However, this does not result in additional failures as no credit is taken for any equipment inside the turbine hall.

As previously mentioned, the functional requirements diagram illustrating the critical equipment functionality following an earthquake, tsunami and on-site induced hazards is shown in Table 5 in Appendix 1.

#### 4.2.2 Proposal Implementation

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration at KNPS. The functional requirements diagram generated in § 4.2 (*Design Basis (0.3 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) indicates the potential failure of equipment in the event of a postulated 0.3 g earthquake inducing a tsunami wave with maximum height of 8 m. Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami) is also indicated.

The magnitude of the combined event is within the design basis of KNPS and therefore as expected, the majority of the conventional systems are still functional. In this case, the proposed modification serves a redundant purpose. By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirement could be maintained following the event described:

• Essential indications such as core exit temperature, SG level, SG pressure, containment pressure, and SFP level.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram Table 6 in Appendix 1.

## 4.3 DESIGN BASIS (0.3 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO 3.8 M ABOVE THE TERRACE LEVEL

Table 3 indicates the effect on the essential systems and critical functions if the site is inundated up to 3.8 m above the terrace level following a 0.3 g earthquake.

#### 4.3.1 Potential Failure Identification

The functionality of many SSCs will be lost primarily due to a tsunami causing a flooding hazard as most pumps and the EDGs are located either at or below the 0 m level. The potential damage caused by a 0.3 g earthquake hazard was discussed in the previous section and therefore only additional failures due to a tsunami hazard are discussed:

 Loss of primary system make-up due to the failure of the RCV, emergency seal supply, RIS and EAS pumps;

**CM 6**: It is proposed that a connection point, robust against earthquakes and tsunamis, be installed on the RCV charging line to allow connection of a permanent/portable pump to directly inject borated water into the RCP system (refer to EERT-11-026 (Loss of Off-Site Power Report) [11]). This will provide an emergency make-up path for the injection of borated water into the primary system to ensure sub criticality if other conventional means of injection are not available.

- Additional pumps situated outside the reactor building below a height of 3.8 m above the terrace level. Pumps that were assessed to potentially fail include the JPP, REA water and boron, SEC, JPS, RRI, PTR and ASG pumps;
- In addition to the SEP tank, the SED tanks located on 0 m terrace level were estimated to be unavailable when inundated up to a height of 3.8 m above terrace level;
- The station and unit transformers would become inoperable as these units are located on the 0 m terrace level. However, this does not result in any additional

failures as the original assumption of an immediate loss of off-site power following an earthquake event envelopes the failure of this equipment;

 The EDGs, located on the 0 m terrace level, are used to supply the station with power in the event of a loss of off-site power. Intake louvres are installed at the front of the EDG buildings to ensure filtered air is supplied to the EDGs for the combustion process. These louvres offer no resistance to water ingress. Therefore, once water moves over the 0 m terrace level, the EDGs will not be available as the fuel transfer pumps are likely to be flooded.

EERT-12-023-RPT showed that it is possible to experience additional damage as a result of water rapidly moving over the 0 m terrace level [10]. The kinetic energy embedded in the tsunami wave could cause damage to the hydrogen storage facility which could propagate into a fire and/or explosion. The explosion could cause damage to the SEP tank (refer to proposal **CM 3**) and the turbine hall (could also be vulnerable to a generator explosion due to the seismic event) which are located close by. However, damage to the SEP tank is enveloped by the seismic event and the flooding hazard posed by the SEP tank is enveloped by the tsunami wave. No credit is taken for equipment inside the turbine hall which is required for safe shutdown of the plant.

In addition, it is credible that the tsunami wave could cause damage to the ammonia tanks located on the 0 m level next to the demineralisation plant and result in a chemical release. However, the failure of the ammonia tanks is enveloped by the initiating event (earthquake) and they are therefore not considered for the tsunami event (refer to proposal **CM 5**).

Apart from those failures documented in the individual seismic and tsunami combination, no additional on-site failures were found. The functional requirements diagram indicating the estimated failure of safe shutdown equipment is shown in Table 3.

#### Table 3:

| Functional requirements diagram for a design basis (0.3 g) earthquake          |
|--|
| inducing a tsunami wave up to 3.8 m above the terrace level (no modifications) |

|              | Required F                      | unction                              | SSCs that provide Functional Requirement |   |                             |           |                                |          |              |         |             |      |  |
|--------------|---------------------------------|--------------------------------------|--|---|-----------------------------|-----------|--------------------------------|----------|--------------|---------|-------------|------|--|
|              | Functional<br>Requirement       | Sub-Function                         | Methods to fulfil Functional Req. (SSCs) |   |                             |           | Sub-SSC                        |          |              |         |             |      |  |
|              |                                 | Control Rods                         | C-S1                                     | Control Rod   | CRDMs                       | FL-ASS    | CNTL-ROD                       | CRDM     |              |         |             |      |  |
|              |                                 |                                      | C-L42                                    | REA Boration (direct or<br>normal)                  | REA/RCV/RCP                 | REA/B-TNK | REA/B-PO                       | REA      | -RCV         |         |             |      |  |
|              |                                 |                                      | C-L44                                    | Normal charging from PTR tank                       | PTR/RCV/RCP                 |           |                                | PTR-RCV  |              | RCV-PO  | RCV-CL      |      |  |
|              | C1. Sub-Criticality             | Boron Injection                      | C-L34                                    | Charging using Emergency<br>Seal Injection          | ESS/ESS-CL/RCP              | PTR-TNK   |                                |          |              |         |             | RCP  |  |
|              |                                 |                                      | C-L33                                    | Emergency Seal Injection                            | ESS/ESS-SI/RCP              | -         |                                | PTR-ESS  |              | ESS-PO  | ESS-SI      |      |  |
|              |                                 |                                      | C-L11                                    | Accumulators  | ACC/RCP                     | ACC       |                                |          | ACC-RCP      |         |             |      |  |
|              |                                 | RCP System                           | C-I21                                    | RCP Integrity                                       | RCP*                        | RCP*      | RCP                            | RCP      | RCP          | PORVs*  | Safety      |      |  |
|              |                                 | SG                                   | C-122                                    | SG Integrity  | SG*                         | SGs*      | Pumps*                         | Vessel*  | Pressuriser* |         | Valves*     |      |  |
|              | C2. Primary System<br>Integrity | RRA System Integrity                 | C-123                                    | RRA Integrity                                       | RCP*/RRA*/RCP*              | RCP*      | RRA-SL*                        | RRA-PO*  | RRA-Hx*      | RRA-DL* | RRA-SV*     |      |  |
|              |                                 | (SD)<br>RRA System Isolation         | C-124                                    | RRA Isolation                                       | RCP*                        | RCP*      | RRA-SL                         | RRA-DL   |              | - autor |             |      |  |
|              |                                 | (SD)                                 | C-L31                                    |   |                             |           | REA/B-PO                       |          | -RCV         |         |             |      |  |
|              | C3. RCP Seal                    | Normal Seal Injection                |  | Normal Seal Injection                               | REA/RCV/RCP                 | REA/B-TNK | READ-PU                        |          | -KGV         | RCV-PO  | RCV-SI      | 505  |  |
|              | injection                       | Emergency Seal                       | C-L32                                    | PTR Seal Injection                                  | PTR/RCV/RCP                 | PTR-TNK   |                                | PTR-RCV  |              |         |             | RCP  |  |
|              |                                 | Injection                            | C-L33                                    | Emergency Seal Injection<br>REA Boration (direct or | ESS/RCP                     |           |                                | PTR-ESS  |              | ESS-PO  | ESS-SI      |      |  |
|              |                                 |                                      | C-L42                                    | normal)<br>Normal charging from REA                 | REA/RCV/RCP                 | REA/B-TNK | REA/B-PO                       | REA      | -RCV         |         |             |      |  |
|              |                                 | RCV Normal charging                  | C-L43                                    | water system<br>Normal Charging from                | REA/RCV/RCP                 | REAW-TNK  | REAW-PO                        |          |              | RCV-PO  | RCV-CL      |      |  |
|              |                                 |                                      | C-L44                                    | PTR   | PTR/RCV/RCP                 |           | PTR-RCV                        |          |              |         |             |      |  |
|              |                                 | ESS Charging<br>Injection (Low Flow) | C-L34                                    | Charging using ESS<br>(6m3/hr)                      | ESS/ESS-CL/RCP              |           |                                | PTR-ESS  |              | ESS-PO  |             |      |  |
|              |                                 | ESS Seal injection<br>(Low Flow)     | C-L33                                    | Emergency Seal Injection<br>(6m3/hr)                | ESS/ESS-SI/RCP              | PTR-TNK   |                                |          |              | ESS-SI  | RCP         |      |  |
|              | C4. Primary System<br>Make-up   | HHSI - Direct Inj.                   | C-L45                                    | HHSI Direct Injection                               | PTR/RCV/BIT/RCP             | CNT-SMP   | PTR-RCV                        |          | RCV-PO       | RCV-HSI |             |      |  |
|              |                                 | LHSI - Direct Inj.                   | C-L46                                    | LHSI Direct Injection                               | PTR/RIS/RCP                 |           | PTR-RIS                        |          | RIS-PO       |         |             |      |  |
| 0            |                                 | LHSI - Recirculation                 | C-L47                                    | LHSI Recirculation                                  | SMP/RIS/RCP                 |           | SMP-RIS                        |          | 14010        | RIS-LSI |             |      |  |
| Keactor Core |                                 | EAS Back-up to RIS                   | C-L48                                    | EAS Back-up to RIS                                  | SMP/EAS/EAS-<br>4PO/RIS/RCP |           | SMP-EAS                        | EAS-PO   | EAS-RIS      | RIS-PO* | RI3-LOI     |      |  |
| 101          |                                 | EAS 004 Back-up to<br>RIS            | C-L49                                    | EAS Back-up to RIS                                  | SMP/EAS/EAS-<br>RIS/RIS/RCP |           | SMP-EAS                        | EAS-PO*  | EAS-4PO      | RIS-PO* |             |      |  |
| keac         |                                 | PTR Gravity Feed<br>(SD - Head Off)  | C-L61                                    | PTR Gravity Feed                                    | PTR/RIS*/RCP                | PTR-TNK   |                                | PTR-RIS  |              | RIS-PO* | RIS-LSI     | RCP  |  |
|              |                                 |                                      | C-L50                                    | GCTa Steam Dump                                     | SG/VVP/GCTa                 |           | WP-GCT<br>GCTs-STM<br>CEX-TNK- |          |              |         |             |      |  |
|              |                                 | SG Steam Dump                        | C-L51                                    | GCTc Steam Dump                                     | SGAMP/GCTc-                 | SGs       |                                |          | CEX-TNK-     | CEX-PO  |             |      |  |
|              |                                 |                                      | C-L52                                    | Turbine Driven ASG Pump                             | ASG/ASGt/SG                 |           | ASG-T/PO                       | ASG-T/SS | ASG          | -T/FL   |             |      |  |
|              |                                 | SG Feedwater                         | C-L53                                    | Motor Driven ASG Pumps                              | ASG/ASGm/SG                 | ASG-TNK   | ASG-                           | MPO      | ASG          | -M/FL   | ASG-SG/FL   | SGs  |  |
|              |                                 |                                      | G-L54                                    | ARE Main Feed                                       | CEX/APA/SG-                 | CEX-TNK-  | CEX-PO                         | ABP-HX*  | APA-PO-      | AHP-HX* | ARE-SG/FL   |      |  |
|              | C5. Core Cooling                |                                      | C-L55                                    | SER Make-up to ASG                                  | SER/ASG                     |           |                                | SER-PO   |              |         |             |      |  |
|              |                                 |                                      | C-L56                                    | SER gravity Make-up to                              | SER/ASG (gravity)           | SER       | -TNK                           | SER-BV   | SER-ASG      |         |             |      |  |
|              |                                 | SG Long term                         | C-L57                                    | ASG<br>JPP Make-up to ASG                           | JPP/JPD/ASG                 | JPP       | -TNK                           | JPP-PO   | JPD-ASG      | ASG-TNK |             |      |  |
|              |                                 | Feedwater Supply                     | C-L58                                    | JPS Make-up to ASG                                  | SEP/JPS/JPD/ASG             |           |                                | JPS-PO   | JPD-ASG      |         |             |      |  |
|              |                                 |                                      | C-L58                                    | SEP Make-up to JPP                                  | SEP/JPS/JPD/A3G             | SEP-TNK   | SEP-JPP/S                      | JPS-PU   | 01 D-A00     |         | J           |      |  |
|              |                                 | RRA Core Cooling                     |  |   |                             | BCCC      | 004.01                         |          | DD4 11       | DD4 DI  | DD4 OV      | DOD  |  |
|              |                                 | (SD)                                 | C-L60                                    | RRA Cooling   | RCP/RRA/RCP                 | RCP*      | RRA-SL                         | RRA-PO   | RRA-Hx       | RRA-DL  | RRA-SV      | RCP* |  |
|              |                                 | Containment Isolation                | B-1                                      | Containment Building                                | teres Marka e s             | B-CNT     |                                |          |              |         |             |      |  |
|              |                                 | Direct Core Injection                |  | *See C4. Primary Sys<br>Containment Spray - EAS     |                             |           |                                |          |              |         |             |      |  |
|              |                                 |                                      | C-L61                                    | Direct Injection<br>Containment Spray - EAS         | PTR/EAS/CNT                 | PTR-TNK   | PTR-EAS                        |          | S-PO         |         |             |      |  |
|              |                                 | Containment<br>Pressure Control      | C-L62                                    | Recirculation<br>Containment Spray - JPP            | SMP/EAS/CNT                 | CNT-SMP   | SMP-EAS                        | EAS-PO   | EAS-Hx       | EAS-SPR | CONT        |      |  |
|              | C6. Containment                 |                                      | C-L63                                    | Emergency Back-up                                   | JPP/EAS/CNT                 | JPP-TNK   | JPP-PO                         | JPP-JPC  | JPC-EAS      |         |             |      |  |
|              | Integrity                       |                                      | C-L64                                    | Containment Venting                                 |                             |           |                                |          |              |         |             |      |  |
|              |                                 | Hydrogen Reduction                   | C-L65                                    | Hydrogen PARS                                       | ETY (PARS)                  | PARs      |                                |          |              |         |             |      |  |
|              |                                 | SG Creep Rupture                     | C-L52                                    | Turbine Driven ASG Pump                             | ASG/ASGt/SG                 | ASG-TNK   | ASG-T/PO                       | ASG-T/SS | ASG          | -T/FL   | ASG-SG/FL   | SGs  |  |
|              |                                 | Prevention                           | C-L53                                    | Motor Driven ASG Pumps                              | ASG/ASGm/SG                 | ASG-TNK   | ASG-                           | MPO      | ASG          | -M/FL   | S S S S N E | SGs  |  |
|              |                                 | Basemat Melt-thro                    | _  |   |                             |           |                                |          |              |         |             |      |  |



#### Table 3:

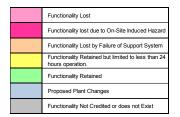
Functional requirements diagram for a design basis (0.3 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                  | Required I                                      | Function                          |          |  | SSCs th                    | at provide           | Functio   | nal Requ | irement     |          |           |        |   |
|------------------|---|-----------------------------------|----------|--|----------------------------|----------------------|-----------|----------|-------------|----------|-----------|--------|---|
|                  | Functional<br>Requirement                       | Sub-Function                      | Me       | thods to fulfil Funct                        |                            | Sub-SSC              |           |          |             |          |           |        |   |
|                  |   | Core Exit<br>Temperature          | C-l1     | Core Exit Temperature<br>Indication          |                            | RICxxxMT             |           |          |             | [LNi]    |           |        |   |
|                  |   | RCP Level                         | C-12     | Pressuriser Level<br>Indication              |                            | RCPxxxMN             |           |          |             | [LNi]    |           |        |   |
|                  |   | Reactor Level<br>Indication       | C-124    | RVLIS  |                            |                      |           |          |             |          |           |        |   |
|                  |   | RCP pressure                      | C-13     | RCP Pressure Indication                      |                            | RCPxxxMP             |           |          |             | [LNi]    |           |        |   |
|                  |   | RRA Pressure                      | C-15     | RRA Pressure Indication                      |                            | RRAxxMP              |           |          |             | [LNi]    |           |        |   |
|                  |   | SG Level                          | C-16     | SG WR Level Indication                       |                            | ARExxxMN             |           |          |             | [LNi]    |           |        |   |
| ore              |   | SG Pressure                       | C-17     | SG Pressure Indication                       |                            | WPxxxMP              |           |          |             | [LNi]    |           |        |   |
| Reactor Core     |   | ASG Tank Level                    | C-18     | ASG Tank Level Indication                    |                            | ASG002LN             |           |          |             |          |           |        |   |
| eact             | C7. Essential<br>Indication                     | Diesel Tank Level                 | C-19     | Diesel Tank Level                            |                            | LHixxxLN             |           |          |             |          |           |        |   |
| Ř                |   | Containment                       | C-120    | Indications<br>Containment WR Pressure       |                            | ETYxxxMP             |           |          |             | [LNi]    |           |        |   |
|                  |   | Pressure<br>Containment           | C-21     | Indication<br>Containment Radiation          |                            | KRT022-              |           |          |             | KRT001AR | [LBA]     |        |   |
|                  |   | Radiation<br>Containment Sump     | C-122    | Levels<br>Containment Sump Level             |                            | 23MA<br>RISxxxSL     |           |          |             | [LCA/B]  | [LD/I]    |        |   |
|                  |   | Level<br>BaseMat                  | C-122    | Basemat Thermo-couples                       |                            | EASxxxSL<br>KSBxxxMT |           |          |             | [LOAD]   |           |        |   |
|                  |   | Thermocouples<br>Containment Sump | C-123    | Basema: mermo-couples                        |                            | KSBXXXIVII           |           |          |             |          |           |        |   |
|                  |   | Temperature<br>Containment        |          |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | Hydrogen Sampling<br>Reactor Pit  | C-152    |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | Temperature                       | C-153    |  |                            |                      |           |          |             |          |           |        |   |
|                  | S1. SFP Integrity S2. SFP Cooling               | SFP Pool                          | S-S1     | SFP Pool Integrity<br>PTR Normal SFP Cooling | SFP                        | SFP-PL               | B-SFP     |          |             |          |           |        | 1 |
|                  |   | PTR 1/2 PO                        | S-S1     | Integrity                                    | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |   |
|                  |   | PTR 6 PO                          | S-S2     | PTR 3rd Train Integrity                      | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |   |
|                  |   | PTR 1/2 PO                        | S-L1     | PTR Normal Cooling                           | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO   | PTR-HX      |          | R-DL      | SFP-PL |   |
|                  |   | PTR 6 PO                          | S-L2     | PTR 3rd Train Cooling                        | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTR      | 3-DL      |        |   |
| -                | S3. Bulk Boiling                                | SFP Steam Release                 | S-L3     | Open Vent Doors                              |                            | SFP-VD               |           |          | 1           |          | 1         |        |   |
| Poc              |   | 055 5                             | S-L4     | SED Make-up                                  | SED/SFP                    | SED-TNK              | SED       | 0-PO     | SED-SFP     |          |           |        |   |
| leu <sup>-</sup> |   | SFP Emergency<br>Make-up          | S-L5     | JPP Make-up                                  | JPP/JPD/SFP                | JPP-TNK              |           |          | JPD-SFP     | SFP-PL   |           |        |   |
| Spent Fuel Pool  |   |                                   | S-L6     | JPS Make-up                                  | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO   |             |          |           |        |   |
| Spe              |   | SFP Level                         | S-I1     | SFP Level Indication                         |                            | PTRxxxMN             |           |          |             | [LNi]    | [SAR-ACC] |        |   |
|                  |   | SFP Temperature                   | S-12     | SFP Temperature<br>Indication                |                            | PTRxxxMT             |           |          |             | [LNi]    |           |        |   |
|                  |   | Fuel Rack<br>Temperature          | S-13     |  |                            |                      |           |          |             |          |           |        |   |
|                  | S4. Indication                                  | SFP Boron<br>Concentration        | S-14     |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | SFP Building<br>Pressure          | S-15     |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | SFP Hydrogen<br>Concentration     | S-16     |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | SFP Building<br>Humidity          | S-17     |  |                            |                      |           | 1        |             |          |           |        |   |
|                  |   |                                   | V-L01    | JPP Make-up to Seismic<br>Vault              | JPP/JPD/VLT                | JPP-                 | TNK       | JPP-PO   | JPP-JPD     | JPD-VLT  |           |        |   |
| Seismic Vault    | V1. Seismic Vault                               | Flooding of Seismic<br>Vault      | V-L02    | JPS Make-up to Seismic<br>Vault              | SEP/JPS/JPD/VLT            | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPS-JPD     |          | VLT       |        |   |
| ic <             |   |                                   | V-L03    | SEP Gravity Feed to<br>Seismic Vault         | SEP/JPD/VLT                |                      |           | SEP      | -VLT        |          |           |        |   |
| ism              |   | Seismic Vault<br>Temperature      | VI-1     |  |                            |                      |           |          |             |          |           |        |   |
| Se               | V.2 Indication                                  | Seismic Vault Water<br>Level      | VI-2     |  |                            |                      |           |          |             |          |           |        |   |
|                  |   | Seismic Vault<br>Pressure         | VI-3     |  |                            |                      |           |          |             |          |           |        |   |
| Dry<br>Casks     | D1. Cask Integrity                              | Cask Remain Leak<br>Tight         | D-S1     | Cask integrity                               | CASK                       | CASK*                |           | -        |             |          |           |        |   |
| са               | D2. Cask Cooling                                | Cask Air cooling<br>maintained    | D-L1     | Cask Cooling                                 | Cask building and Air Flow | B-LLW                | CASK-AIR  |          |             |          |           |        |   |
|                  | B1. Containment                                 |                                   | B1       | Containment Building                         |                            | B-CNT                | Building  | Hatch    | Penetration | Airlocks |           |        |   |
|                  | B2. NAB   |                                   | B2       | Nuclear Auxiliary Building                   |                            | B-NAB                |           |          |             |          |           |        |   |
| st               | B3. Electrical Building<br>B4. Diesel buildings | 9                                 | B3<br>B4 | Electrical Building<br>Unit Diesel Building  |                            | B-ELE<br>B-DSL       |           |          |             |          |           |        |   |
| Buildings        | B4. Diesel buildings<br>B5. SBO Diesel Build    | ing                               | В4<br>В5 | SBO Diesel Building                          |                            | B-SBO                |           |          |             |          |           |        |   |
| Buil             | B6. SEC pump-house                              |                                   | B6       | SEC Pumphouse Building                       |                            | B-SEC                |           |          |             |          |           |        |   |
|                  | B7. Turbine Hall                                |                                   | B7       | Turbine Hall                                 |                            | B-TUR                |           |          |             |          |           |        |   |
|                  | B8. LLW Building                                |                                   | B8       | Low Level Waste Building                     |                            | B-LLW                |           |          |             |          |           |        |   |
|                  | B9. ECC   |                                   | B9       | Emergency Control Centre                     |                            | B-ECC                |           |          |             |          |           |        |   |

#### Table 3:

| Functional requirements diagram for a design basis (0.3 g) earthquake          |
|--|
| inducing a tsunami wave up to 3.8 m above the terrace level (no modifications) |

|                           | Required I   | Required Function                           |  | SSCs that provide Functional Requirement   |  |   |  |  |  |  |  |  |  |
|---------------------------|--|---|--|--|--|---|--|--|--|--|--|--|--|
|                           | Functional<br>Requirement                              | Sub-Function                                | Methods to fulfil Functional Req. (SSCs) |  |  | Sub-SSC   |  |  |  |  |  |  |  |
|                           | E1. Essential 6.6kV<br>Switchboard Supply              | LHA Switchboard<br>Supply<br>[LHA]          | E-1<br>E-2<br>E-3                        | 400 KV LHA Supply<br>132 KV LHA Supply<br>LHP Diesel LHA Supply  | 400KV/LHA<br>132KV/LHA<br>LHP/LHA                                | 400KV         GEN-TRX         UNT-TRX         LGA-SWB         LGB-SWB                   |  |  |  |  |  |  |  |
|                           |  |   | E-4<br>E-5                               | LHS Diesel LHA Supply<br>400 KV LHB Supply   | LHS/LHA<br>400KV/LHB   | LHS-DSL         LHS-LHC         LHC-SWB         LHC-LHA           400KV         GEN-TRX         UNT-TRX         LGD-SWB         LGC-SWB   |  |  |  |  |  |  |  |
|                           |  | LHB Switchboard<br>Supply<br>[LHB]          | E-6<br>E-7<br>E-8                        | 132 KV LHB Supply<br>LHQ Diesel LHB Supply<br>LHS Diesel LHB Supply  | 132KV/LHB<br>LHQ/LHB<br>LHS/LHB                                  | 132KV         STN-TRX         LGE/F-SWB         LHB-SWB         LLB-SWB         LLB-SWB <t< th=""></t<> |  |  |  |  |  |  |  |
|                           | E2. SBO Diesel<br>Supply                               | LLY SBO Diesel<br>Supply<br>[LLY]           | E-10                                     | LLY Switchboard Supply   | LLS/LLX/LLY  | LLS-DSL LLX-SWB LLX-LLY LLY-SWB   |  |  |  |  |  |  |  |
|                           | E2 49 V Eccential                                      | LCA 48V Switchboard<br>Supply [LCA]         | E-21<br>E-22<br>E-23                     | LCA Switchboard - LHA<br>LCA Switchboard - LLS<br>LCA Switchboard - Battery  | LCAILLIILHA<br>LCAILLY<br>LCAIBAT                                | [LHA]     LLARD       [LLY]     LCARD       LCABAT  |  |  |  |  |  |  |  |
|                           | E3. 48 V Essential<br>Switchboard Supply               | LCB 48V<br>Switchboard Supply<br>[LCB]      | E-24<br>E-25                             | LCB Switchboard - LHB<br>LCB Switchboard - LLS   | LCBVLLINLHB  | [LH8]     LL8/D-SWB       [LLY]     LCB-RD  |  |  |  |  |  |  |  |
| Electrical Support System | E4. 125 V Essential<br>Switchboard Supply              | LBA 125V<br>Switchboard Supply              | E-26<br>E-31<br>E-32                     | LCB Switchboard - Battery<br>LBA Switchboard - LHA<br>LBA Switchboard - LLS  | LCB\BAT<br>LBA\LLI\LHA<br>LBA\LLY                                | ICB-BAT     ICE-SWB       ILCE-SWB     IBA-RD       ILLY     IBA-RD   |  |  |  |  |  |  |  |
| Support                   |  | [LBA]                                       | E-33<br>E-34                             | LBA Switchboard - Battery<br>LBB Switchboard - LHA   | LBA\BAT<br>LBB\LLI\LHB   | LBABAT<br>LBD-SWB<br>LBD-SWB<br>LBB-RD  |  |  |  |  |  |  |  |
| ectrical                  |  | Switchboard Supply<br>[LBB]                 | E-35<br>E-36                             | LBB Switchboard - LLS<br>LBB Switchboard - Battery   | LBB\LLY<br>LBB\BAT   | [LLY]     LBB-SWB       LBB-BAT     LBB-SWB   |  |  |  |  |  |  |  |
| ū                         | E5. Essential<br>Instrumentation<br>Switchboard Supply | LNA 220V Essential<br>Switchboards<br>[LNA] | E-41<br>E-42<br>E-43<br>E-44             | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA<br>SIP I Supply from LSS<br>SIP I Battery Supply           | LNA/LBC/LLA/LHA<br>LNA/LBC/LLA/LHA<br>LNA/LBC/LLY<br>LNA/LBC/BAT | ILC-SWB     LNA-RD       ILA-SWB     LBC-RD       ILL-SWB     LBC-RD       LBC-BAT     LBC-SWB  |  |  |  |  |  |  |  |
|                           |  | LNB 220V Essential<br>Switchboards<br>[LNB] | E-45<br>E-46<br>E-47                     | SIP II Dirty Supply from<br>LHB<br>SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS                             | LNB/LLD/LHB<br>LNB/LBD/LLB/LHB<br>LNB/LBD/LLY                    | ILD-SWB         LNB-RD           ILB-SWB         LBD-RD           ILL-Y         LBD-RD  |  |  |  |  |  |  |  |
|                           |  | LNC 220V Essential<br>Switchboards<br>[LNC] | E-48<br>E-49<br>E-50<br>E-51             | SIP II Battery Supply<br>SIP III Dirty Supply from<br>LHA<br>SIP III Clean Supply from<br>LHA<br>SIP III Supply from LSS | LNB/LBD/BAT<br>LNC/LLC/LHA<br>LNC/LBE/LLA/LHA<br>LNC/LBE/LLY     | LBD-BAT         LNC-RD           [LLA]         LBE-RD           [LLY]         LBE-RD  |  |  |  |  |  |  |  |
|                           |  | LND 220V Essential<br>Switchboards          | E-53                                     | SIP III Battery Supply<br>SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from<br>LHB                             | LNC/LBE/BAT<br>LND/LLD/LHB<br>LND/LBF/LLB/LHB                    | LBE-BAT     LLD-SWB     LND-RD       LLB-SWB     LBF-RD     LND-SWB   |  |  |  |  |  |  |  |
|                           |  | [LND]<br>SEC Train A Cooling                | E-55<br>E-56<br>U-1                      | SIP IV Supply from LSS<br>SIP IV Battery Supply<br>SEC Train A Cooling   | LND/LBF/LLY<br>LND/LBF/BAT<br>SEA/SEC-A/SEA                      | [LLY]         LBF-SWB           LBF-BAT         SEC-APS           SEC-ARS         SEC-APO           RRIAHX  |  |  |  |  |  |  |  |
| łeatsink                  | U1. Essential<br>Cooling                               | SEC Train B Cooling Alternative Heatsink    | U-2<br>U-3                               | SEC Train B Cooling Alternative Heatsink   | SEA/SEC-B/SEA  | [Sea]     SEC-B-RS     SEC-B-DS     SEC-B-PO     RRI-B-HX     [Sea]   |  |  |  |  |  |  |  |
| Ultimate Heatsink         | U2. Component<br>Cooling                               | RRI Train A Cooling<br>RRI Train B Cooling  | U-11<br>U-12<br>U-13                     | RRI Train A Cooling<br>RRI Train B Cooling<br>RRI Commons cooling  | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA<br>SEC/RRI-A/HXC                  | HXA         RRIA-PO         [RRI-A-HX]           HXB         RRI-B-PO         [RRI-B-HX]           RRIA-BO         [RRI-B-HX]           RRIA-BO         [RRI-B-HX]  |  |  |  |  |  |  |  |
| 5                         |  | RRI Commons<br>Cooling                      | U-13                                     | (Train A)<br>RRI Commons cooling<br>(Train B)  | SEC/RRI-B/HXC  | HX-COM RR-B-PO [RR-B-HX]  |  |  |  |  |  |  |  |





Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

#### 4.3.2 Proposal Implementation

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration for implementation at KNPS. The functional requirements diagram generated in § 4.3 (*Design Basis (0.3 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) indicates the potential failure of equipment in the event of a postulated 0.3 g earthquake inducing a tsunami wave with maximum height of 11.8 m (3.8 m above the terrace level). Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami), is also indicated.

By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirements could be maintained following the event described:

• RCP seal injection

By installing the shutdown seals, the water inventory inside the primary system can be maintained to ensure the functionality of primary system seal injection is not required.

Core cooling

The installation of a hardened SEP tank and associated piping to provide cooling water to the core following a seismic event together with the installation of a fourth ASG pump would ensure the core cooling functionality is not lost.

• Containment integrity

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the EAS spray system. This pump will inject water into the EAS sprays. High-temperature steam will condense into water and subsequently reduce the pressure inside the containment.

Essential indication

Hardened instrumentation to indicate core exit temperature, SG level, SG pressure, containment pressure, and SFP level will be installed.

• SFP bulk boiling

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the SFP. In the event that no cooling is available, the SFP water will be allowed to boil and make-up will be provided from the SEP tank.

• Essential 6.6 kV switchboard supply

It is proposed to procure mobile diesel generators to supply power to the plant following a combined event. The mobile EDGs will be connected to the LHA and LHB switchboards to supply power to available equipment.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram in Table 4.



#### Table 4:

Functional requirements diagram for a design basis (0.3 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|   | Required Function                      |  | SSCs that provide Functional Requirement |   |  |                 |                       |                  |                     |                    |                   |      |   |
|---|--|--|--|---|--|-----------------|-----------------------|------------------|---------------------|--------------------|-------------------|------|---|
|   | Functional<br>Requirement Sub-Function |  |  | hods to fulfil Funct                        | Sub-SSC                                  |                 |                       |                  |                     |                    |                   |      |   |
|   |  | Control Rods   | C-S1                                     | Control Rod                                 | CRDMs                                    | FL-ASS          | CNTL-ROD              | CRDM             |                     |                    |                   |      |   |
|   |  |  | C-L42                                    | REA Boration (direct or<br>normal)          | REA/RCV/RCP                              | REA/B-TNK       | REA/B-PO              | REA              | RCV                 |                    |                   |      |   |
|   |  |  | C-L44                                    | Normal charging from PTR                    | PTR/RCV/RCP                              |                 |                       | PTR-RCV          |                     | RCV-PO             | RCV-CL            |      |   |
|   | C1. Sub-Criticality                    | Boron Injection                                      | C-L34                                    | tank<br>Charging using Emergency            | ESS/ESS-CL/RCP                           | PTR-TNK         |                       |                  |                     |                    |                   | RCP  |   |
|   |  | Doron injection                                      |  | Seal Injection                              |  |                 |                       | PTR-ESS          |                     | ESS-PO             |                   | 1101 |   |
|   |  |  | C-L33                                    | Emergency Seal Injection                    | ESS/ESS-SI/RCP                           |                 |                       |                  |                     |                    | ESS-SI            |      |   |
| _ |  |  | C-L11                                    | Accumulators                                | ACC/RCP                                  | ACC             | 202                   | 202              | ACC-RCP             |                    | 0.64              |      |   |
|   |  | RCP System   | C-I21                                    | RCP Integrity                               | RCP*                                     | RCP*            | RCP<br>Pumps*         | RCP<br>Vessel*   | RCP<br>Pressuriser* | PORVs*             | Safety<br>Valves* |      |   |
|   | C2. Primary System<br>Integrity        | SG   | C-122                                    | SG Integrity                                | SG*                                      | SGs*            |                       |                  | -                   | -                  |                   |      |   |
|   | integrity                              | RRA System Integrity<br>(SD)                         | C-123                                    | RRA Integrity                               | RCP*/RRA*/RCP*                           | RCP*            | RRA-SL*               | RRA-PO*          | RRA-Hx*             | RRA-DL*            | RRA-SV*           |      |   |
|   |  | RRA System Isolation<br>(SD)                         | C-124                                    | RRA Isolation                               | RCP*                                     | RCP*            | RRA-SL                | RRA-DL           |                     |                    |                   |      |   |
|   |  | Name Cool biostics                                   | C-L31                                    | Normal Seal Injection                       | REA/RCV/RCP                              | REA/B-TNK       | REA/B-PO              | REA              | -RCV                | DOVIDO             | DOV OL            |      |   |
|   | C3. RCP Seal                           | Normal Seal Injection                                | C-L32                                    | PTR Seal Injection                          | PTR/RCV/RCP                              |                 |                       | PTR-RCV          |                     | RCV-PO             | RCV-SI            | RCP  |   |
|   | injection                              | Emergency Seal<br>Injection                          | C-L33                                    | Emergency Seal Injection                    | ESS/RCP                                  | PTR-TNK         |                       | PTR-ESS          |                     | ESS-PO             | ESS-SI            |      |   |
|   |  | Shutdown Seal  | C-125                                    | Emergency Shutdown Seal                     | RCP                                      |                 |                       | SD-              | Seal                |                    |                   |      |   |
|   |  |  | C-L42                                    | REA Boration (direct or<br>normal)          | REA/RCV/RCP                              | REA/B-TNK       | REA/B-PO              |                  |                     |                    |                   |      |   |
|   |  | RCV Normal charging                                  | C-L43                                    | Normal charging from REA                    | REA/RCV/RCP                              | REA/W-TNK       | REAW-PO               | REA              | RCV                 | RCV-PO             |                   |      |   |
|   |  |  | C-L44                                    | water system<br>Normal Charging from        | PTR/RCV/RCP                              |                 |                       | PTR-RCV          |                     |                    | RCV-CL            |      |   |
|   |  | ESS Charging   | C-L34                                    | PTR<br>Charging using ESS                   | ESS/ESS-CL/RCP                           | -               |                       |                  |                     |                    |                   |      |   |
|   | C4. Primary System                     | Injection (Low Flow)<br>ESS Seal injection           |  | (6m3/hr)<br>Emergency Seal Injection        |  | PTR-TNK         |                       | PTR-ESS          |                     | ESS-PO             |                   |      |   |
|   |  | (Low Flow)   | C-L33                                    | (6m3/hr)                                    | ESS/ESS-SI/RCP                           |                 |                       |                  |                     |                    | ESS-SI            | RCP  |   |
|   | Make-up                                | HHSI - Direct Inj.                                   | C-L45                                    | HHSI Direct Injection                       | PTR/RCV/BIT/RCP                          | -               | PTR-RCV               |                  | RCV-PO              | RCV-HSI<br>RIS-LSI |                   |      |   |
|   |  | LHSI - Direct Inj.                                   | C-L46                                    | LHSI Direct Injection                       | PTR/RIS/RCP                              |                 | PTR-RIS               |                  | RIS-PO              |                    |                   |      |   |
|   |  | LHSI - Recirculation                                 | C-L47                                    | LHSI Recirculation                          | SMP/RIS/RCP                              | _               | SMP-RIS               |                  |                     |                    |                   |      |   |
| 5 |  | EAS Back-up to RIS                                   | C-L48                                    | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP              |                 | SMP-EAS               | EAS-PO           | EAS-RIS             | RIS-PO*            |                   |      |   |
|   |  | EAS 004 Back-up to<br>RIS                            | C-L49                                    | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP              |                 | EAS-PO*               | EAS-4PO          | RIS-PO*             |                    |                   |      |   |
|   |  | PTR Gravity Feed<br>(SD - Head Off)                  | C-L61                                    | PTR Gravity Feed                            | PTR/RIS*/RCP                             | PTR-TNK         |                       | PTR-RIS          |                     | RIS-PO*            | RIS-LSI           | RCP  |   |
|   |  | 00.01  | C-L50                                    | GCTa Steam Dump                             | SG/VVP/GCTa                              |                 |                       |                  | GCTa-STM            |                    |                   |      |   |
|   |  | SG Steam Dump  | C-L51                                    | GCTc Steam Dump                             | SGAMP/GCTc-                              | SGs             | WP-GCT                | GCTc-STM         | CEX-TNK-            | CEX-PO             |                   |      |   |
|   |  |  | C-L52                                    | Turbine Driven ASG Pump                     | ASG/ASGt/SG                              |                 | ASG-T/PO ASG-T/SS ASG |                  | S-T/FL              |                    |                   |      |   |
|   |  | SG Feedwater   | C-L53                                    | Motor Driven ASG Pumps                      | ASG/ASGm/SG                              | ASG-TNK         | ASG-M/PO              |                  | ASG-MFL             |                    | ASG-SG/FL         | SGs  |   |
|   |  |  | C-L54                                    | ARE Main Feed                               | CEX/APA/SG                               | CEX-TNK-        | CEX-PO                | ABP-HX*          | APA-PO-             | AHP-HX*            | ARE-SG/FL         |      |   |
|   |  |  | C-L55                                    | SER Make-up to ASG                          | SER/ASG                                  |                 |                       | SER-PO           |                     |                    |                   |      |   |
|   | C5. Core Cooling                       |  |  | SER gravity Make-up to                      |  | SER             | -TNK                  |                  | SER-ASG             |                    |                   |      |   |
|   |  |  | C-L56                                    | ASG   | SER/ASG (gravity)                        |                 |                       | SER-BV           |                     | ASG-TNK            |                   |      |   |
|   |  | SG Long term<br>Feedwater Supply                     | C-L57                                    | JPP Make-up to ASG                          | JPP/JPD/ASG                              | JPP             | -TNK                  | JPP-PO           | JPD-ASG             |                    |                   |      |   |
|   |  | ,  | C-L58                                    | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG                          | SEP-TNK         | SEP-JPP/S             | JPS-PO           | JPD-ASG             |                    | l                 |      |   |
|   |  |  | C-L59                                    | SEP Make-up to JPP                          | SEP/JPP                                  |                 |                       | JPP-TNK          | J                   |                    |                   |      |   |
|   |  |  | C-L67                                    | 4th SG Injection                            | SEP/ASGx/SG                              | SEP-TNK         | ASG-4PO               |                  |                     | -                  | 1                 |      |   |
| _ |  | RRA Core Cooling<br>(SD)                             | C-L60                                    | RRA Cooling                                 | RCP/RRA/RCP                              | RCP*            | RRA-SL                | RRA-PO           | RRA-Hx              | RRA-DL             | RRA-SV            | RCP* |   |
|   |  | Containment Isolation                                | B-1                                      | Containment Building                        |  | B-CNT           |                       |                  |                     |                    |                   |      |   |
|   |  | Direct Core Injection                                |  | *See C4. Primary Sys                        | tem Make-up                              |                 |                       |                  |                     |                    |                   |      |   |
|   |  |  | C-L61                                    | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                              | PTR-TNK         | PTR-EAS               | EAS              | -PO                 |                    |                   |      |   |
|   |  |  | C-L62                                    | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                              | CNT-SMP         | SMP-EAS               | EAS-PO           | EAS-Hx              |                    |                   |      |   |
|   | C6. Containment                        | Containment<br>Pressure Control                      | C-L63                                    | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                              | JPP-TNK         | JPP-PO                | JPP-JPC          | JPC-EAS             | EAS-SPR            | CONT              |      |   |
|   |  |  |  | EAS Emergency Backup                        | SEP/EASx/CNT                             | SEP-TNK         | SEP-EAS               | PEE              | -PO                 |                    |                   |      |   |
|   |  |  | C-L68                                    | Eno Energency backup                        |  |                 |                       | I                |                     |                    |                   |      |   |
|   | C6. Containment<br>Integrity           |  | C-L68<br>C-L64                           | Containment Venting                         |  |                 |                       |                  |                     |                    |                   |      |   |
|   |  | Hydrogen Reduction                                   | C-L64                                    | Containment Venting                         | ETY (PARS)                               | PARs            |                       |                  |                     |                    |                   |      |   |
|   |  | Hydrogen Reduction                                   | C-L64<br>C-L65                           | Containment Venting<br>Hydrogen PARS        | ETY (PARS)                               | PARs            | ASC-TRO               | ASC.T/CC         | 100                 | T/FI               |                   |      | 1 |
|   |  | Hydrogen Reduction<br>SG Creep Rupture<br>Prevention | C-L64                                    | Containment Venting                         | ETY (PARS)<br>ASG/ASGI/SG<br>ASG/ASGm/SG | PARs<br>ASG-TNK | ASG-T/PO              | ASG-T/SS<br>M/PO | ASG                 | -T/FL              | ASG-SG/FL         | SGs  | 1 |



#### Table 4:

## Functional requirements diagram for a design basis (0.3 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                 | Required Function                  |                                    | SSCs that provide Functional Requirement |   |                            |                      |                        |               |             |                   |           |        |   |
|-----------------|------------------------------------|------------------------------------|--|---|----------------------------|----------------------|------------------------|---------------|-------------|-------------------|-----------|--------|---|
|                 | Functional<br>Requirement          | Sub-Function                       | Met                                      | hods to fulfil Funct                              | ional Req. (SSCs)          | Sub-SSC              |                        |               |             |                   |           |        |   |
|                 |                                    | Core Exit<br>Temperature           | C-l1                                     | Core Exit Temperature<br>Indication               |                            | RICxxxMT             |                        |               |             | [LNi]             |           |        |   |
|                 |                                    | RCP Level                          | C-l2                                     | Pressuriser Level<br>Indication                   |                            | RCPxxxMN             |                        |               |             | [LNi]             |           |        |   |
|                 |                                    | Reactor Level                      | C-124                                    | RVLIS   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Indication<br>RCP pressure         | C-I3                                     | RCP Pressure Indication                           |                            | RCPxxxMP             |                        |               |             | [LNi]             |           |        |   |
|                 |                                    |                                    |  |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | RRA Pressure                       | C-15                                     | RRA Pressure Indication                           |                            | RRAxxxMP             |                        |               |             | [LNi]             |           |        |   |
| e               |                                    | SG Level                           | C-16                                     | SG WR Level Indication                            |                            | ARExxxMN             |                        |               |             | [LNi]             |           |        |   |
| Co              |                                    | SG Pressure                        | C-17                                     | SG Pressure Indication                            |                            | WPxxxMP              |                        |               |             | [LNi]             |           |        |   |
| ctor            | C7. Essential                      | ASG Tank Level                     | C-I8                                     | ASG Tank Level Indication                         |                            | ASG002LN             |                        |               |             |                   |           |        |   |
| Reactor Core    | Indication                         | Diesel Tank Level                  | C-19                                     | Diesel Tank Level<br>Indications                  |                            | LHixxxLN             |                        |               |             |                   |           |        |   |
|                 |                                    | Containment<br>Pressure            | C-120                                    | Containment WR Pressure<br>Indication             |                            | ETYxxxMP             |                        |               |             | [LNi]             |           |        |   |
|                 |                                    | Containment<br>Radiation           | C-21                                     | Containment Radiation<br>Levels                   |                            | KRT022-<br>23MA      |                        |               |             | KRT001AR          | [LBA]     |        |   |
|                 |                                    | Containment Sump<br>Level          | C-122                                    | Containment Sump Level                            |                            | RISxxxSL<br>EASxxxSL |                        |               |             | [LCA/B]           |           |        |   |
|                 |                                    | BaseMat<br>Thermocouples           | C-123                                    | Basemat Thermo-couples                            |                            | KSBxxxMT             |                        |               |             |                   |           |        |   |
|                 |                                    | Containment Sump                   | C-151                                    |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Temperature<br>Containment         | C-152                                    |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Hydrogen Sampling<br>Reactor Pit   |  |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Temperature<br>SFP Pool            | C-I53<br>S-S1                            | SFP Pool Integrity                                | SFP                        | SFP-PL               | B-SFP                  |               |             |                   |           |        |   |
|                 |                                    |                                    |  | PTR Normal SFP Cooling                            |                            | SFP-PL               |                        |               |             | I                 |           |        | 1 |
|                 | S1. SFP Integrity                  | PTR 1/2 PO                         | S-S1                                     | Integrity   | SFP\PTR\SFP                | SFP-PL               | PTR-SL                 | PTR-PO*       | PTR-HX*     | PTR-DL<br>PTR3-DL | PTR-SPHN  | SFP-PL |   |
|                 |                                    | PTR 6 PO                           | S-S2                                     | PTR 3rd Train Integrity                           | SFP\PTR3\SFP               |                      | PTR3-SL                | PTR3-PO*      | PTR3-HX*    |                   | PTR3-SPHN |        |   |
|                 | S2. SFP Cooling                    | PTR 1/2 PO                         | S-L1                                     | PTR Normal Cooling                                | SFP\PTR\SFP                | SFP-PL               | PTR-SL                 | PTR-PO        | PTR-HX      | PTF               | PTR-DL    |        |   |
|                 |                                    | PTR 6 PO                           | S-L2                                     | PTR 3rd Train Cooling                             | SFP\PTR3\SFP               |                      | PTR3-SL                | PTR3-PO       | PTR3-HX     | PTR               | 3-DL      |        |   |
|                 | S3. Bulk Boiling                   | SFP Steam Release                  | S-L3                                     | Open Vent Doors                                   |                            | SFP-VD               |                        |               |             |                   | 1         |        |   |
| ō               |                                    | SFP Emergency<br>Make-up           | S-L4                                     | SED Make-up                                       | SED/SFP                    | SED-TNK              | SED-TNK SED-PO SED-SFP |               |             |                   |           |        |   |
| el Po           |                                    |                                    | S-L5                                     | JPP Make-up                                       | JPP/JPD/SFP                | JPP-TNK              | JPF                    | P-PO          | JPD-SFP     | SFP-PL            |           |        |   |
| Fue             |                                    |                                    | S-L6                                     | JPS Make-up                                       | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S              | JPS-PO        | JFD-SFF     | JFF-FL            |           |        |   |
| Spent Fuel Pool |                                    |                                    | S-L7                                     | SEP Make-up                                       | SEP/SFPx                   | SEP-TNK              | SEP/SFPx               | PEE           | -PO         |                   |           |        |   |
| SF              |                                    | SFP Level                          | S-l1                                     | SFP Level Indication                              |                            | PTRxxxMN             |                        |               |             | [LNi]             | [SAR-ACC] |        |   |
|                 |                                    | SFP Temperature                    | S-I2                                     | SFP Temperature<br>Indication                     |                            | PTRxxxMT             |                        |               |             | [LNi]             |           |        |   |
|                 |                                    | Fuel Rack<br>Temperature           | S-13                                     |   |                            |                      |                        |               |             |                   |           |        |   |
|                 | S4. Indication                     | SFP Boron<br>Concentration         | S-14                                     |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | SFP Building<br>Pressure           | S-15                                     |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | SFP Hydrogen                       | S-16                                     |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Concentration<br>SFP Building      | S-17                                     |   |                            |                      |                        |               |             |                   |           |        |   |
|                 |                                    | Humidity                           | V-L01                                    | JPP Make-up to Seismic                            | JPP/JPD/VLT                | .IPP                 | TNK                    | JPP-PO        | JPP-JPD     |                   |           |        |   |
| Ŧ               | V1. Seismic Vault                  | Flooding of Seismic                | V-L01                                    | Vault<br>JPS Make-up to Seismic                   | SEP/JPS/JPD/VLT            |                      | SEP-JPP/S              | JPS-PO        | JPS-JPD     | JPD-VLT           | VLT       |        |   |
| Seismic Vault   |                                    | Vault                              | V-L02                                    | Vault<br>SEP Gravity Feed to                      | SEP/JPS/JPD/VLT            | SEP-TNK              | JEI -JFF/3             | JPS-PU<br>SEP |             |                   |           |        |   |
| nic             |                                    | Seismic Vault                      |  | Seismic Vault                                     | SEPJPD/VLI                 |                      |                        | SEP           | VLI         |                   |           |        |   |
| eisr            |                                    | Temperature<br>Seismic Vault Water | VI-1                                     |   |                            | -                    |                        |               |             |                   |           |        |   |
| s               | V.2 Indication                     | Level<br>Seismic Vault             | VI-2                                     |   |                            | -                    |                        |               |             |                   |           |        |   |
|                 |                                    | Pressure<br>Cask Remain Leak       | V⊦3                                      |   |                            |                      |                        |               |             |                   |           |        |   |
| Dry<br>Casks    | D1. Cask Integrity                 | Tight<br>Cask Air cooling          | D-S1                                     | Cask integrity                                    | CASK                       | CASK*                |                        |               |             |                   |           |        |   |
| - ö             | D2. Cask Cooling                   | maintained                         | D-L1                                     | Cask Cooling                                      | Cask building and Air Flow | B-LLW                | CASK-AIR               |               |             |                   |           |        |   |
|                 | B1. Containment<br>B2. NAB         |                                    | B1<br>B2                                 | Containment Building                              |                            | B-CNT<br>B-NAB       | Building               | Hatch         | Penetration | Airlocks          |           |        |   |
|                 | B2. NAB<br>B3. Electrical Building | q                                  | B2<br>B3                                 | Nuclear Auxiliary Building<br>Electrical Building |                            | B-NAB<br>B-ELE       |                        |               |             |                   |           |        |   |
| sß              | B4. Diesel buildings               |                                    | B4                                       | Unit Diesel Building                              |                            | B-DSL                |                        |               |             |                   |           |        |   |
| Buildings       | B5. SBO Diesel Build               | ling                               | B5                                       | SBO Diesel Building                               |                            | B-SBO                |                        |               |             |                   |           |        |   |
| Buil            | B6. SEC pump-house                 | 8                                  | B6                                       | SEC Pumphouse Building                            |                            | B-SEC                |                        |               |             |                   |           |        |   |
|                 | B7. Turbine Hall                   |                                    | B7                                       | Turbine Hall                                      |                            | B-TUR                |                        |               |             |                   |           |        |   |
|                 | B8. LLW Building                   |                                    | B8                                       | Low Level Waste Building                          |                            | B-LLW                |                        |               |             |                   |           |        |   |
|                 | B9. ECC                            |                                    | B9                                       | Emergency Control Centre                          |                            | B-ECC                |                        |               |             |                   |           |        |   |



#### Table 4:

Functional requirements diagram for a design basis (0.3 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                           | Required Function                         |   | SSCs that provide Functional Requirement |  |                        |                |          |              |           |          |          |       |       |
|---------------------------|---|---|--|--|------------------------|----------------|----------|--------------|-----------|----------|----------|-------|-------|
|                           | Functional<br>Requirement                 | Sub-Function                                | Met                                      | thods to fulfil Funct                  | ional Req. (SSCs)      | Sub-SSC        |          |              |           |          |          |       |       |
|                           |   |   | E-1<br>E-2                               | 400 KV LHA Supply<br>132 KV LHA Supply | 400KV/LHA<br>132KV/LHA | 400KV<br>132KV | GEN-TRX  | UNT-TRX      | LGA-SWB   | LGB-SWB  |          |       |       |
|                           |   | LHA Switchboard<br>Supply                   | E-3                                      | LHP Diesel LHA Supply                  | LHP/LHA                | LHP-DSL        | 0114     | LHP          |           |          | LHA-SWB  | [LCA] | [LBA] |
|                           |   | [LHA]                                       | E-3                                      | LHS Diesel LHA Supply                  | LHS/LHA                | LHS-DSL        | LHS      |              | LHC-SWB   | LHC-LHA  | LIN-SWB  | [LCA] | [LDA] |
|                           |   |   | E-60                                     | MBL Diesel LHA Supply                  | MBL-DSL/LHA            | MBL-DSL        | L'IO     |              | SL-CON    | Eno-Enk  |          |       |       |
|                           | E1. Essential 6.6kV<br>Switchboard Supply |   | E-5                                      | 400 KV LHB Supply                      | 400KV/LHB              | 400KV          | GEN-TRX  | UNT-TRX      | LGD-SWB   |          |          |       |       |
|                           |   |   | E-6                                      | 132 KV LHB Supply                      | 132KV/LHB              | 132KV          | STN      |              | LGE/F-SWB | LGC-SWB  |          |       |       |
|                           |   | LHB Switchboard<br>Supply                   | E-7                                      | LHQ Diesel LHB Supply                  | LHQ/LHB                | LHQ-DSL        | 3114     | LHQ          |           |          | LHB-SWB  | [LCB] | [LBB] |
|                           |   | [LHB]                                       | E-8                                      | LHS Diesel LHB Supply                  | LHS/LHB                | LHS-DSL        | LHS      |              | LHC-SWB   | LHC-LHB  | CIID-OWD | [LOD] | [200] |
|                           |   |   |  | MBL Diesel LHB Supply                  |                        | MBL-DSL        | 115      |              | SL-CON    | Enc-EnB  |          |       |       |
|                           | E2. SBO Diesel<br>Supply                  | LLY SBO Diesel<br>Supply<br>[LLY]           | E-61<br>E-10                             | LLY Switchboard Supply                 | MBL-DSL/LHB            | LLS-DSL        | LLX-SWB  | LLX-LLY      | LLY-SWB   |          |          |       |       |
|                           |   |   | E-21                                     | LCA Switchboard - LHA                  | LCA\LLi\LHA            | [LHA]          | _        | LLA\E-SWB    |           |          |          |       |       |
|                           |   | LCA 48V Switchboard                         | E-22                                     | LCA Switchboard - LLS                  | LCAILLY                | [LLY]          |          |              | LCA-RD    | LCA-SWB  |          |       |       |
|                           |   | Supply [LCA]                                | E-23                                     | LCA Switchboard - Battery              | LCA\BAT                | LCA-BA         | r        |              |           |          |          |       |       |
|                           | E3. 48 V Essential<br>Switchboard Supply  |   | E-24                                     | LCB Switchboard - LHB                  | LCB/LLI/LHB            | [LHB]          |          | LLB\D-SWB    |           |          |          |       |       |
| E                         |   | LCB 48V<br>Switchboard Supply<br>[LCB]      | E-25                                     | LCB Switchboard - LLS                  | LCB\LLY                | [LLY]          |          |              | LCB-RD    | LCB-SWB  |          |       |       |
| stel                      |   |   | E-26                                     | LCB Switchboard - Battery              | LCB\BAT                | LCB-BA         | r        |              |           |          |          |       |       |
| Electrical Support System |   | LBA 125V<br>Switchboard Supply<br>[LBA]     | E-31                                     | LBA Switchboard - LHA                  | LBA\LLi\LHA            | [LHA]          |          | LLC\E-SWB    |           |          |          |       |       |
| POC                       |   |   | E-32                                     | LBA Switchboard - LLS                  | LBAILLY                | [LLY]          |          |              | LBA-RD    | LBA-SWB  |          |       |       |
| ddn                       | E4. 125 V Essential<br>Switchboard Supply |   | E-33                                     | LBA Switchboard - Battery              | LBA\BAT                | LBA-BA         | r        |              |           |          |          |       |       |
| al S                      |   | LBB 125V<br>Switchboard Supply<br>[LBB]     | E-34                                     | LBB Switchboard - LHA                  | LBB\LLi\LHB            | [LHB]          |          | LLB\D-SWB    |           |          |          |       |       |
| Li či                     |   |   | E-35                                     | LBB Switchboard - LLS                  | LBB\LLY                | [LLY]          |          |              | LBB-RD    | LBB-SWB  |          |       |       |
| lect                      |   |   | E-36                                     | LBB Switchboard - Battery              | LBB\BAT                | LBB-BA         | г        | _            |           |          |          |       |       |
| ш                         |   | LNA 220V Essential<br>Switchboards<br>[LNA] | E-41                                     | SIP I Dirty Supply from LHA            | LNA/LLC/LHA            |                | LLC-SWB  | LNA          | -RD       |          |          |       |       |
|                           |   |   | E-42                                     | SIP I Clean Supply from                | LNA/LBC/LLA/LHA        | [LHA]          | LLA-SWB  |              |           | ł        |          |       |       |
|                           |   |   | E-43                                     | LHA<br>SIP I Supply from LSS           | LNA/LBC/LLY            | [LLY]          |          | LBC-RD       | LBC-SWB   | LNA-SWB  |          |       |       |
|                           |   |   | E-44                                     | SIP I Battery Supply                   | LNA/LBC/BAT            | LBC-BA         | T        |              |           |          |          |       |       |
|                           |   | LNB 220V Essential<br>Switchboards<br>[LNB] | E-45                                     | SIP II Dirty Supply from               | LNB/LLD/LHB            |                | LLD-SWB  | LNE          | IB-RD     |          |          |       |       |
|                           |   |   | E-46                                     | LHB<br>SIP II Clean Supply from        | LNB/LBD/LLB/LHB        | [LHB]          | LLB-SWB  |              | LBD-SWB   | ł        |          |       |       |
|                           |   |   | E-47                                     | LHB<br>SIP II Supply from LSS          | LNB/LBD/LLY            | [LLY]          |          | LBD-RD       |           | LNB-SWB  |          |       |       |
|                           | E5. Essential                             |   | E-48                                     | SIP II Battery Supply                  | LNB/LBD/BAT            | LBD-BA         | г        |              |           |          |          |       |       |
|                           | Instrumentation<br>Switchboard Supply     |   | E-49                                     | SIP III Dirty Supply from              | LNC/LLC/LHA            |                | LLC-SWB  | LNC          | C-RD      |          |          |       |       |
|                           |   | LNC 220V Essential                          | E-50                                     | LHA<br>SIP III Clean Supply from       | LNC/LBE/LLA/LHA        | [LHA]          | LLA-SWB  |              |           |          |          |       |       |
|                           |   | Switchboards<br>[LNC]                       | E-51                                     | LHA<br>SIP III Supply from LSS         | LNC/LBE/LLY            | [LLY]          |          | LBE-RD       | LBE-SWB   | LNC-SWB  |          |       |       |
|                           |   |   | E-52                                     | SIP III Battery Supply                 | LNC/LBE/BAT            | LBE-BA         | r        |              |           |          |          |       |       |
|                           |   |   | E-53                                     | SIP IV Dirty Supply from               | LND/LLD/LHB            |                | LLD-SWB  | LNE          | -RD       |          |          |       |       |
|                           |   | LND 220V Essential                          | E-54                                     | LHB<br>SIP IV Clean Supply from        | LND/LBF/LLB/LHB        | [LHB]          | LLB-SWB  |              |           | ł        |          |       |       |
|                           |   | Switchboards<br>[LND]                       | E-55                                     | LHB<br>SIP IV Supply from LSS          | LND/LBF/LLY            | [LLY]          |          | LBF-RD       | LBF-SWB   | LND-SWB  |          |       |       |
|                           |   |   | E-56                                     | SIP IV Battery Supply                  | LND/LBF/BAT            | LBF-BA         | r        |              |           |          |          |       |       |
|                           |   | SEC Train A Cooling                         | U-1                                      | SEC Train A Cooling                    | SEA/SEC-A/SEA          |                | SEC-A-RS | SEC-A-DS     | SEC-A-PO  | RRI-A-HX |          |       |       |
| ,<br>K                    | U1. Essential                             | SEC Train B Cooling                         | U-2                                      | SEC Train B Cooling                    | SEA/SEC-B/SEA          | [Sea]          | SEC-B-RS | SEC-B-DS     | SEC-B-PO  | RRI-B-HX | [Sea]    |       |       |
| Ultimate Heatsink         | Cooling                                   | Alternative Heatsink                        | U-3                                      | Alternative Heatsink                   | L                      |                |          |              |           |          |          |       |       |
| He                        |   | RRI Train A Cooling                         | U-11                                     | RRI Train A Cooling                    | SEC/RRI-A/HXA          | HX-A           | RRI-A-PO | [RRI-A-HX]   |           |          |          |       |       |
| nate                      | U2. Component                             | RRI Train B Cooling                         | U-12                                     | RRI Train B Cooling                    | SEC/RRI-B/HXA          | нх-в           | RRI-B-PO | [RRI-B-HX]   |           |          |          |       |       |
| ltim                      | Cooling                                   |   | U-13                                     | RRI Commons cooling                    | SEC/RRI-A/HXC          |                | RRI-A-PO | [RRI-A-HX]   |           |          |          |       |       |
| Ĵ                         |   | RRI Commons<br>Cooling                      | U-14                                     | (Train A)<br>RRI Commons cooling       | SEC/RRI-B/HXC          | нх-сом         | RRI-B-PO | [RRI-B-HX]   |           |          |          |       |       |
| L                         |   |   | 0.14                                     | (Train B)                              |                        |                |          | [rate bit N] |           |          |          |       |       |



|  | Tsunami event results in damage |
|--|---------------------------------|
|  | Seismic event results in damage |
|  |                                 |

Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

## 4.4 BEYOND-DESIGN-BASIS (0.4 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO THE 0 M TERRACE LEVEL

A beyond-design-basis assessment is performed by increasing the seismic loading experienced by SSCs to a 0.4 g earthquake causing a tsunami wave up to 8 m above MSL (below the 0 m terrace level).

#### 4.4.1 Potential Failure Identification

As expected, failure of equipment is predominantly caused by the seismic event as most of the equipment can only be inundated once water moves over the 0 m level.

Tsunami-induced failures are limited to the JPS water connection point located next to the SEC pump house and were discussed earlier.

The cumulative potential failure of critical equipment as a result of a 0.4 g earthquake includes [11]:

- Possible failure of fuel assemblies and control rods;
- Possible failure of the unit 2 pipework connecting the accumulator and RCP system. During the unit 1 seismic walkdown it was found that these components have a conservative deterministic failure margin (CDFM) capacity in excess of 0.5 g PGA;
- Potential failure of the unit 2 pipework connecting the RCV and Safety Injection system due to a collapsed support. Unit 1 pipework was found to be robust;
- Possible failure of the unit 2 pipework between the RCV and High Head Safety Injection system due to a loose support. Unit 1 pipework was found to be robust;
- Multiple electrical cabinets were assessed in the seismic walkdowns and were found to be vulnerable during a beyond-design-basis earthquake. Minor problems include unsecured racked-out 6.6 kV breakers, interaction with surrounding equipment (primarily hanging lamps), and taut connecting cables. Electrical systems affected include LHC, LLA, LLB, LLC, LLD, LLE, LLI, and LLJ switchboards;
- The REA boron and PTR tanks were assessed to be vulnerable to failure beyond 0.3 g;
- The REA water pump and RIS and EAS isolation piping are vulnerable; these vulnerabilities must be resolved before credit can be taken for their integrity beyond 0.3 g;
- Unit 1 VVP-GCT (pipework from main steam supply system to steam dump system) found to be vulnerable to a 0.4 g earthquake due to poor support;
- EAS mini-flow line was found to be not robustly supported. The seismic walkdown revealed that the line is not robust against a 0.4 g earthquake;
- The exhaust stacks for the five EDGs have limited allowable displacement. This is
  primarily due to the movement of both the turbine hall and the aseismic raft.
  Additionally, the glass level column of the fuel tanks, oil tanks and the water circuit
  header tanks for the five EDGs were assessed and found to be vulnerable during a
  beyond-design-basis seismic event;

- The PTR third train heat exchanger was assessed to be vulnerable to a beyonddesign-basis earthquake. This is primarily due to the RRI feed-pipe to PTR 004 RF which is long and not adequately supported. This could result in considerable strain being induced on the heat exchanger;
- Containment penetrations on unit 2 were found to be vulnerable for an earthquake beyond 0.4 g due to several cable tray lids not being tied down and/or resting on cables. Unit 1 containment penetrations were found to be robust; and
- The Emergency Control Centre (ECC) was found to be vulnerable to a beyonddesign-basis earthquake. However, this is limited to the superterranean structure. According to the seismic walkdown experts, the lower level of the ECC, where the technical support team will be stationed, will still be operable.

EERT-12-023-RPT found that it is possible to incur additional damage as a result of a 0.4 g seismic activity. No additional on-site damage is expected as a result of a tsunami wave up to the 0 m terrace level [10].

The hydrogen storage facility and turbine alternator are regarded as potential fire/explosion sources in the event of an earthquake due to the presence of hydrogen gas. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal **CM 3**) and turbine hall, does not result in additional failures as the SEP tank is expected to be unavailable due to the seismic event. The potential flooding risk posed by the SEP tank to the south-side EDGs could result in their unavailability, however, this is unlikely as it is estimated that this system has already failed due to the seismic event (refer to proposal **CM 4**). No credit is taken for equipment inside the turbine hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from either the hydrogen storage facility or turbine alternator explosion or the initiating seismic event. However, an immediate loss of off-site power is assumed and the unavailability of this equipment does not cause additional consequences.

It is possible for the seismic activity to cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The CRF piping situated in the basement of the turbine hall could potentially flood parts of this building in the event of seismic activity. However, this does not result in additional failures as no credit is taken for any equipment inside the turbine hall.

The functional requirements diagram indicating the potential failure of equipment in the event of an earthquake, tsunami, and on-site induced failures is shown in Table 7 in Appendix 1.

#### 4.4.2 Proposal Implementation

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration for implementation at KNPS. The functional requirements diagram generated in § 4.4 (*Beyond-Design-Basis (0.4 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) indicates the potential failure of equipment in the event of a postulated

0.4 g earthquake inducing a tsunami wave with maximum height not higher than 8 m (below the 0 m terrace level). Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami) is also indicated.

By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirements could be maintained following the event described:

RCP seal injection

By installing the shutdown seals, the water inventory inside the primary system can be maintained to ensure the functionality of primary system seal injection is not required.

• Core cooling

The installation of a hardened SEP tank and associated piping to provide cooling water to the core following a seismic event together with the installation of a fourth ASG pump would ensure the core cooling functionality is not lost.

• Containment integrity

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the EAS spray system. This pump will inject water into the EAS sprays. High-temperature steam will condense into water and subsequently reduce the pressure inside the containment.

Essential indication

Hardened instrumentation to indicate core exit temperature, SG level, SG pressure, containment pressure, and SFP level, will be installed.

• SFP bulk boiling

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the SFP. Should no cooling be available, the SFP water will be allowed to boil and make-up will be provided from the SEP tank.

• Essential 6.6 kV switchboard supply

It is proposed to procure mobile diesel generators to supply power to the plant following a combined event. The mobile EDGs will be connected to the LHA and LHB switchboards to supply power to available equipment.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram in Table 8 in Appendix 1.

## 4.5 BEYOND-DESIGN-BASIS (0.4 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO 3.8 M ABOVE THE TERRACE LEVEL

An assessment was completed on the plant's robustness following a 0.4 g earthquake causing a tsunami wave up to 3.8 m above the terrace level. The functional requirements diagram is illustrated in Table 9 in Appendix 1. The water from the tsunami will project over the 0 m terrace level and inundate the plant up to the 3.8 m level above the terrace

level. The assessment does not include a tsunami wave in excess of 11.8 m (3.8 m above the terrace level).

#### 4.5.1 Potential Failure Identification

Damage to plant equipment is caused by both the seismic and subsequent tsunami event. § 4.4 (*Beyond-Design-Basis (0.4 g*) *Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) assessed the damage caused to equipment experiencing a combined event of a 0.4 g earthquake causing a tsunami up to 8 m. The failure of plant equipment as a result of a seismic event was discussed and therefore, the seismic damage caused by this combination will not be discussed as this is similar to that of § 4.4 (*Beyond-Design-Basis (0.4 g*) *Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*).

§ 4.3 (*Design Basis (0.3 g*) *Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) discussed the damage caused to equipment from a tsunami wave with a height of up to 3.8 m above the terrace level. Tsunami damage simulated in this combination would be similar and is also not discussed.

EERT-12-023-RPT found that it is possible to incur additional damage as a result of a 0.4 g seismic activity and tsunami wave up to the 3.8 m above the terrace level [10].

The hydrogen storage facility is vulnerable to seismic activity and a tsunami wave due to the presence of hydrogen gas in the system. Furthermore, the turbine alternator could be vulnerable to seismic activity for similar reasons. Oxygen ingress into the system could result in a fire and/or explosion. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal **CM 4**) and turbine hall (could also be damaged in the seismic event), however this does not result in additional failures as the SEP tank is estimated to be unavailable due to the seismic event. The flooding risk posed by the SEP tank is not considered as the assumption is made that this quantity of water is enveloped by the water from the tsunami wave. No credit is taken for equipment inside the turbine hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from either the hydrogen storage facility or turbine alternator explosion or the initiating seismic event. However, an immediate loss of off-site power is assumed following a seismic event and the unavailability of this equipment has no additional consequences.

It is possible for seismic activity to cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The potential seismically-induced CRF pipe rupture resulting in a flooding event in the turbine hall basement is not considered as the assumption is made that the quantity of water is enveloped by the extent of tsunami water.

The failure of the equipment as a result the seismic, tsunami, and on-site induced hazards is graphically shown in the functional requirements diagrams in Table 9 in Appendix 1.

#### 4.5.2 Proposal Implementation

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration for implementation at KNPS. The functional requirements diagram generated in § 4.5 (*Beyond-Design-Basis (0.4 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) indicates the potential failure of equipment in the event of a postulated 0.4 g earthquake inducing a tsunami wave above the terrace level up to a level of 3.8 m. Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami) is also indicated.

By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirements could be maintained following the event described:

• RCP seal injection

By installing the shutdown seals, the water inventory inside the primary system can be maintained to ensure the functionality of primary system seal injection is not required.

Core cooling

The installation of a hardened SEP tank and associated piping to provide cooling water to the core following a seismic event together with the installation of a fourth ASG pump would ensure the core cooling functionality is not lost.

• Containment integrity

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the EAS spray system. This pump will inject water into the EAS sprays. High-temperature steam will condense into water and subsequently reduce the pressure inside containment.

Essential indication

Hardened instrumentation to indicate core exit temperature, SG level, SG pressure, containment pressure, and SFP level will be installed.

• SFP bulk boiling

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the SFP. Should no cooling be available, the SFP water will be allowed to boil and make-up will be provided from the SEP tank.

• Essential 6.6 kV switchboard supply

It is proposed to procure mobile diesel generators to supply power to the plant following a combined event. The mobile EDGs will be connected to the LHA and LHB switchboards to supply power to available equipment.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram in Table 10 in Appendix 1.

## 4.6 BEYOND-DESIGN-BASIS (0.5 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO THE 0 M TERRACE LEVEL

This assessment analyses the plant's robustness following a 0.5 g earthquake causing a tsunami wave up to the 0 m terrace level.

#### 4.6.1 Potential Failure Identification

As previously mentioned, most KNPS equipment is not vulnerable to a tsunami with a maximum wave height of 8 m (0 m terrace level). The water will not breach the terrace level and will not pose a flooding risk to the plant. With the occurrence of an 8 m tsunami, damage is limited to the JPS pump connection point, which is located next to the SEC pump house.

Damage to the plant is predominantly caused by the 0.5 g seismic activity. § 4.4 (*Beyond-Design-Basis (0.4 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) describe the cumulative estimated damage as a result of a 0.4 g earthquake. Increasing the magnitude of seismic activity to 0.5 g, the following could result:

- Failure of the JPP tank at 0.49 g;
- Failure of unit 2 RRA suction line due to an unrestrained cable junction box;
- Failure of unit 2 low head safety injection pipework into reactor coolant system due to possible interaction between the outlet valves RIS 001, 002, and 003 VP and the electrical control box;
- Potential failure of unit 2 containment radiation KRT 003 AR due to exposed wiring; and
- Failure of the EDG, SEC, and turbine hall buildings.

EERT-12-023-RPT found that it is possible to incur additional damage as a result of a 0.5 g seismic activity and tsunami wave up to the 0 m terrace level [10].

The hydrogen storage facility and turbine alternator are potential fire/explosion sources in the event of an earthquake due to the presence of hydrogen gas. A rupture in the system could lead to oxygen ingress which could result in a fire/explosion. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal **CM 3**) and turbine hall (could also be damaged by seismic activity), does not result in additional failures as the SEP tank is expected to be unavailable due to the seismic event. The flooding risk posed by the SEP tank to the south-side EDGs does not result in their being unavailable as the EDG buildings were assessed and found to be vulnerable to a 0.5 g seismic activity. No credit is taken for equipment inside the turbine hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from either the overpressure created by the explosion of the hydrogen storage facility or turbine alternator or the initiating seismic event. However, an immediate loss of off-site power is assumed and the unavailability of this equipment has no additional consequences.

The SBO diesel generators were assessed and found to be vulnerable to fire following a 0.5 g earthquake. However, these systems were not analysed during the seismic margin

assessment and hence no credit is taken for their availability. The fire at the SBO diesel generators will not spread to affect any other critical systems; therefore, the potential fire at the SBO diesel generators does not result in additional consequences.

It is possible for the seismic activity to cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The CRF piping, situated in the basement of the turbine hall, could potentially flood parts of this building in the event of seismic activity. However, this does not result in additional failures as no credit is taken for any equipment inside the turbine hall. The RIS / EAS, RRI / SEC, and RCV piping is vulnerable to shearing as a result of seismic activity, which could lead to the internal flooding of equipment. An RIS / EAS pipe rupture could cause the inventory of the PTR tank (if still intact following an earthquake event) to flood the basement of the fuel building. In extreme cases, this water can flood above the 0 m level causing the PTR pumps to be unavailable. This however, does not result in any further consequences as the pumps are only required if the PTR tank and water inventory is still available. Internal flooding as a result of an RRI / SEC pipe rupture would result in the unavailability of the RRA, PTR, and EAS heat exchangers and the EAS and RRI pumps as these systems are cooled by the RRI system. Flooding inside the RRI / SEC rooms would not yield additional failure of critical equipment. Flooding due to an RCV pipe rupture could cause water ingress into the RCV pump itself and the emergency seal supply pump (ESS), however, the RCV pumps were assessed and found to be vulnerable to the earthquake event and the ESS pump was not assessed and hence, no credit is taken for its availability [9].

The functional requirements diagram showing the estimated failures as a result of a combined seismic and tsunami with on-site induced failures is illustrated in Table 11 in Appendix 1.

#### 4.6.2 **Proposal Implementation**

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration for implementation at KNPS. The functional requirements diagram generated in § 4.6 (*Beyond-Design-Basis (0.5 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) indicates the potential failure of equipment in the event of a postulated 0.5 g earthquake inducing a tsunami wave not higher than the 0 m terrace level. Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami) is also indicated.

By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirements could be maintained following the event described:

RCP seal injection

By installing the shutdown seals, the water inventory inside the primary system can be maintained to ensure the functionality of primary system seal injection is not required. Core cooling

The installation of a hardened SEP tank and associated piping to provide cooling water to the core following a seismic event together with the installation of a fourth ASG pump would ensure the core cooling functionality is not lost.

• Containment integrity

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the EAS spray system. This pump will inject water into the EAS sprays. High-temperature steam will condense into water and subsequently reduce the pressure inside the containment.

Essential indication

Hardened instrumentation to indicate core exit temperature, SG level, SG pressure, containment pressure, and SFP level will be installed.

• SFP bulk boiling

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the SFP. In the event that no cooling is available, the SFP water will be allowed to boil and make-up will be provided from the SEP tank.

• Essential 6.6 kV switchboard supply

It is proposed to procure mobile diesel generators to supply power to the plant following a combined event. The mobile EDGs will be connected to the LHA and LHB switchboards to supply power to available equipment.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram in Table 12 in Appendix 1.

## 4.7 BEYOND-DESIGN-BASIS (0.5 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO 3.8 M ABOVE THE TERRACE LEVEL

This assessment analyses the plant's robustness following a 0.5 g earthquake causing a tsunami wave that moves over the terrace level up to 3.8 m.

#### 4.7.1 Potential Failure Identification

Damage to the plant is caused by both the seismic and subsequent tsunami events. § 4.6 (*Beyond-Design-Basis* (0.5 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level) assessed the damage caused to equipment experiencing a combined event of a 0.5 g earthquake and a tsunami wave up to 8 m (0 m terrace level). Seismic damage to plant equipment is similar to that discussed in § 4.6 (*Beyond-Design-Basis* (0.5 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level) and is therefore not discussed again.

§ 4.3 (*Design Basis (0.3 g*) *Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) discussed damage to equipment caused by a tsunami wave with a height of up to 3.8 m above the terrace level. Tsunami damage simulated in this combination is similar and is therefore not discussed. The combined functional requirements diagram for

a 0.5 g earthquake inducing a tsunami wave up to 3.8 m above the terrace level is shown in Table 13 in Appendix 1.

EERT-12-023-RPT found that it is possible to experience additional damage as a result of a 0.5 g seismic event and tsunami wave of up to 3.8 m above the terrace level [10].

The hydrogen storage facility could potentially be vulnerable to fire/explosion in the event of a 0.5 g earthquake and/or tsunami wave. Both initiating events could rupture pipework, which could result in oxygen ingress leading to a fire and/or an explosion due to a hydrogen/oxygen mixture. The turbine alternator is also vulnerable to a seismic event, which could lead to a fire/explosion event. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal CM 3) and the turbine hall, which could also be damaged by alternator explosion, does not result in additional failures as the SEP tank is estimated to be damaged in the seismic event. The flooding risk posed by the SEP tank to the south-side EDG does not result in any further consequences as the assumption is made that the SEP tank water quantity is enveloped by that of the tsunami wave. No credit is taken for equipment inside the turbine hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from the turbine alternator or hydrogen storage facility explosion, tsunami wave, or seismic activity. However, an immediate loss of off-site power is assumed and the unavailability of this equipment does not cause additional consequences.

The SBO diesel generators were assessed and found to be vulnerable to fire following a 0.5 g earthquake. However, these systems were not analysed during the seismic margin assessment and hence no credit is taken for their availability. The potential fire at the SBO diesel generators would not propagate to any critical equipment and therefore, it does not result in additional consequences.

It is possible for the seismic activity or subsequent tsunami wave to cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The CRF piping situated in the basement of the turbine hall below the normal seawater level could potentially flood parts of this building in the event of seismic activity. However, the potential internal flooding hazard posed by the CRF system is not considered, as the assumption is made that the water from the tsunami wave will envelope the water from the CRF rupture. Furthermore, no credit is taken for any equipment inside the turbine hall. The RIS / EAS, RRI / SEC, and RCV piping is vulnerable to shearing as a result of the seismic activity; however, this is not considered as it is assumed that the water released from these systems would be enveloped by the tsunami wave.

No additional on-site induced failures were found and failure of systems is therefore limited to the damage caused by the seismic activity and subsequent tsunami. The functional requirements diagram indicating the estimated damage to plant equipment as a result of the earthquake, tsunami and on-site induced hazards is shown in Table 13 in Appendix 1.

### 4.7.2 **Proposal Implementation**

§ 3 (*Proposed Modifications*) lists proposed modifications under consideration for implementation at KNPS. The functional requirements diagram generated in § 4.7 (*Beyond-Design-Basis (0.5 g) Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) indicates the potential failure of equipment in the event of a postulated 0.5 g earthquake inducing a tsunami wave up to a height of 3.8 m above the terrace level. Furthermore, the potential failure of on-site equipment due to on-site hazards induced by the combined event (earthquake and tsunami) is also indicated.

By implementing the proposals as set out in § 3 (*Proposed Modifications*), the following functional requirements could be maintained following the event described.

• RCP seal injection

By installing the shutdown seals, the water inventory inside the primary system can be maintained to ensure that the functionality of primary system seal injection is not required.

Core cooling

The installation of a hardened SEP tank and associated piping to provide cooling water to the core following a seismic event together with the installation of a fourth ASG pump would ensure that the core cooling functionality is not lost.

• Containment integrity

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the EAS spray system. This pump will inject water into the EAS sprays. High-temperature steam will condense into water and subsequently reduce the pressure inside the containment.

Essential indication

Hardened instrumentation to indicate core exit temperature, SG level, SG pressure, containment pressure, and SFP level will be installed.

• SFP bulk boiling

The installation of the hardened SEP tank and associated piping will provide water to a portable pump connected to the SFP. In the event that no cooling is available, the SFP water will be allowed to boil and make-up will be provided from the SEP tank.

• Essential 6.6 kV switchboard supply

It is proposed to procure mobile diesel generators to supply power to the plant following a combined event. The mobile EDGs will be connected to the LHA and LHB switchboards to supply power to available equipment.

The implementation of the proposed modifications is graphically shown in the functional requirements diagram in Table 14 in Appendix 1.

## 4.8 BEYOND-DESIGN-BASIS (0.6 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO THE 0 M TERRACE LEVEL

This assessment analyses the plant's robustness following a 0.6 g earthquake causing a tsunami wave up to the 0 m terrace level.

### 4.8.1 Potential Failure Identification

As previously mentioned, most KNPS equipment is not vulnerable to a tsunami with a maximum wave height of 8 m (up to the 0 m terrace level). The water will not move over the terrace level and pose no flooding risk to the plant. With the occurrence of an 8 m tsunami, damage is limited to the JPS pump connection point, which is located next to the SEC pump house.

Damage to the plant is predominantly caused by the 0.6 g seismic activity. § 4.2 (*Design Basis* (0.3 g) *Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*), § 4.4 (*Beyond-Design-Basis* (0.4 g) *Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*), and § 4.6 (*Beyond-Design-Basis* (0.5 g) *Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level*) describe the cumulative estimated damage as a result of 0.3 g, 0.4 g, and 0.5 g earthquakes respectively. Increasing the magnitude of seismic activity to 0.6 g could yield the following additional failures:

- the JPP-, and REA boron pumps;
- the residual heat removal system safety valves;
- the RCP system integrity (vessel, pumps, and pressuriser);
- steam generators including all relevant valves, flanges and fittings;
- the containment sump functionality. This includes filters and piping inside the containment for sump water collection for supply to low-head safety injection and containment spray systems;
- ASG tank, due to compression buckling of the tank wall at 0.55 g;
- the KRT monitors located on the + 20 m level inside the containment building;
- in-core temperature indication (RIC);
- containment airlocks integrity could be vulnerable; and
- the following switchboards:
  - \* 6.6 kV train A essential switchboard (LHA);
  - \* 220 V train A essential switchboard (LNA);
  - \* 48 V train B relaying supply switchboard (LCB);
  - \* 220 V train A switchboard (LBC and LBD);
  - \* 220 V train B switchboard (LBE and LBF).

EERT-12-023-RPT found that it is possible to incur additional damage as a result of a 0.6 g seismic event and tsunami wave up to the 0 m terrace level [10].



The hydrogen storage facility and the turbine alternator are regarded as potential fire/explosion sources in the event of an earthquake due to the presence of hydrogen gas. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal **CM 3**) and turbine hall, does not result in additional failures as the SEP tank is expected to be vulnerable to the seismic event. The unlikely flooding risk posed by the SEP tank to the south-side EDGs does not result in their potential unavailability as it is estimated that these systems have failed already due to the seismic event. No credit is taken for equipment inside the turbine hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from either the overpressure generated by the hydrogen storage facility or turbine alternator explosion or the initiating seismic event. However, an immediate loss of off-site power is assumed and the unavailability of this equipment does not have additional consequences.

The SBO and EDG diesel generators were assessed and found to be vulnerable to fire following a 0.6 g earthquake. However, the SBO diesel generators were not analysed during the seismic margin assessment and hence no credit is taken for their availability. The EDGs were found not to be robust against a 0.6 g earthquake and would have failed already due to the seismic event. The potential fire inside the SBOs and EDGs is not likely to propagate to areas outside the building and does not pose a risk to surrounding equipment. Therefore, the potential fire at the SBO and EDG diesel generators does not result in additional consequences.

It is likely that the seismic activity would cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The CRF piping situated in the basement of the turbine hall is likely to rupture during a 0.6 g earthquake, which could potentially flood parts of this building. However, this does not result in additional failures as no credit is taken for any equipment inside the turbine hall. The RIS / EAS, RRI / SEC, and RCV piping is vulnerable to shearing as a result of seismic activity which could lead to the internal flooding of equipment. Flooding due to an RCV pipe rupture could cause water ingress into the RCV pump itself and the ESS pump, however the RCV pumps were assessed and found to be vulnerable to the earthquake event; the ESS pump was not assessed and hence no credit is taken for its availability. Therefore, this does not result in further consequences. The RIS / EAS pipe rupture could cause the inventory of the PTR tank to flood the basement of the fuel building. In extreme cases, this water can flood above the 0 m level causing the PTR pumps to be unavailable. This however, does not result in any further consequences as the PTR tank is only qualified up to a 0.3 g earthquake and it is likely that the water inventory would be lost. In this case, the PTR pumps would not be required. Internal flooding as a result of an RRI / SEC pipe rupture could result in the unavailability of the RRA, PTR, and EAS heat exchangers and the EAS and RRI pumps as these systems are cooled by RRI. Flooding inside the RRI / SEC rooms would not yield additional failure of critical equipment. The ASG tanks are likely to fail in the event of a 0.6 g earthquake. The consequence of the unit 2 ASG tank failure is limited to the loss of the tank's water inventory. This is because the tank is situated inside its own building and poses no risk to surrounding equipment. The consequence of the unit 1 ASG tank failure is the flooding of adjacent rooms

containing the ASG motor and steam-driven pumps. This would result in the unavailability of these pumps [9].

The functional requirements diagram showing the combined seismic and tsunami with onsite induced failures is illustrated in Table 15 in Appendix 1.

### 4.8.2 **Proposal Implementation**

The functional requirements diagram for the implementation of the proposed modification is not performed as the proposals are only qualified up to a 0.5 g earthquake. Although the modifications are likely to be robust beyond 0.5 g, it is currently not possible to quantify this.

## 4.9 BEYOND-DESIGN-BASIS (0.6 G) EARTHQUAKE INDUCING A TSUNAMI WAVE UP TO 3.8 M ABOVE THE TERRACE LEVEL

This assessment analyses the plant's robustness following a 0.6 g earthquake causing a tsunami wave that moves over the terrace level up to 3.8 m.

### 4.9.1 Potential Failure Identification

Damage to the plant is caused by both the seismic and subsequent tsunami events. § 4.8 (*Beyond-Design-Basis* (0.6 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level) assessed the damage caused to equipment experiencing a combined event of a 0.6 g earthquake causing a tsunami up to 8 m. Seismic damage to the plant in this assessment is similar as highlighted in § 4.8 (*Beyond-Design-Basis* (0.6 g) Earthquake inducing a Tsunami Wave up to the 0 m Terrace Level) and therefore is not discussed again.

§ 4.3 (*Design Basis (0.3 g*) *Earthquake inducing a Tsunami Wave up to 3.8 m above the Terrace Level*) discussed damage caused to equipment from a tsunami wave with a height of up to 3.8 m above the terrace level. Tsunami damage simulated in this combination would be similar and is therefore not discussed. The combined functional requirements diagram for a 0.6 g earthquake inducing a tsunami wave up to 3.8 m above the terrace level is shown in Table 16 in Appendix 1.

EERT-12-023-RPT found that it is possible to experience additional damage as a result of a 0.6 g seismic activity and tsunami wave up to 11.8 m (3.8 m above the terrace level) [10].

The hydrogen storage facility could potentially be vulnerable to fire/explosion in the event of a 0.6 g earthquake and tsunami wave. Both initiating events could rupture pipework, which could result in oxygen ingress leading to a fire and/or explosive hydrogen/oxygen mixture. The turbine alternator is also vulnerable to a seismic event, which could lead to a fire/explosion event. The fire/explosion of the hydrogen storage facility, which could cause damage to the SEP tank (refer to proposal **CM 3**) and turbine hall, does not result in additional consequences as the SEP tank is estimated to be unavailable due to the seismic event. The flooding risk posed by the SEP tank to the south-side EDGs does not result in any further consequences as it is believed that the SEP tank water quantity is enveloped by that of the tsunami wave. No credit is taken for equipment inside the turbine

hall and the fire/explosion of the turbine alternator will predominantly cause damage to equipment inside this building. Furthermore, it is possible that the power transformers could be damaged from either the turbine alternator or hydrogen storage facility explosion, initiating seismic event or subsequent tsunami. However, an immediate loss of off-site power is assumed and the unavailability of this equipment does not have additional consequences.

The SBO and EDG diesel generators were assessed and found to be vulnerable to fire following a 0.6 g earthquake. However, the SBO diesel generators were not analysed during the seismic margin assessment and hence no credit is taken for their availability. The EDGs are not robust against a 0.6 g earthquake, and it is estimated that they would have failed already due to the seismic event. The potential fire inside the EDGs and SBOs is not likely to propagate to areas outside the building and does not pose a risk to surrounding equipment. Therefore, the potential fire at the SBO and EDG diesel generators does not result in additional consequences.

It is possible for the seismic activity or subsequent tsunami wave to cause damage to the ammonia tanks situated close to the demineralisation plant. Although this will not result in any additional failures, it could hamper corrective actions by plant personnel in the event of an accident by virtue of the site being uninhabitable as a result of the chemical release (refer to proposal **CM 5**).

The CRF piping situated in the basement of the turbine hall below the normal seawater level could potentially flood parts of this building in the event of seismic activity. However, this water is not considered, as the assumption is made that the water from the tsunami wave will envelop the water from the CRF rupture. Furthermore, no credit is taken for any equipment inside the turbine hall. The RIS / EAS, RRI / SEC, and RCV piping and the ASG tank are vulnerable as a result of the seismic activity; however this is not considered as the water released from these systems would be enveloped by the tsunami event.

No additional on-site induced failures were found and failure of systems is therefore limited to the damage caused by the seismic activity and subsequent tsunami. The functional requirements diagram for a 0.6 g seismic event inducing a tsunami wave up to a 3.8 m level above the terrace level is shown in Table 16 in Appendix 1.

### 4.9.2 **Proposal Implementation**

The functional requirements diagram for the implementation of the proposed modification was not performed as the proposals are only qualified up to a 0.5 g earthquake. Although the modifications are likely to be robust beyond the 0.5 g point, it is currently not possible to quantify this.

# 4.10 FLOODING HAZARDS IN EXCESS OF THE 3.8 M TERRACE LEVEL

In the event of an earthquake inducing a tsunami wave greater than 11.8 m (3.8 m above the 0 m terrace level), it is estimated that additional systems would be unavailable. The functional requirements diagrams are not illustrated and additional failures are only discussed.



Increasing the water height that inundates the site area up to a level of 14 m (6 m above the 0 m terrace level) results in the flooding of the battery rooms on the 3.8 m level (11.8 m above MSL). This will cause failure of the station batteries and yield any battery-powered equipment such as the essential instrumentation for monitoring purposes unavailable, highlighting the need for a robust, hardened indication system as proposed.

By increasing the tsunami wave height up to 15 m (7 m above the terrace level) the only additional failure is the station black-out (SBO) diesel generators. The SBO diesel generators were installed as a back-up system to supply two functions; charging of the station batteries, and supplying power to an emergency seal injection pump. Failure of the SBO diesel generators yields no additional system failures as the station batteries (3.8 m level) and emergency seal injection pump (0 m terrace level) are located below the level of the SBO diesel generators (14 m above MSL). These systems would already be unavailable as they are submerged in water and therefore no additional failures were found.

Flooding levels exceeding 15 m above MSL (7 m above the terrace level) will result in the failure of the station's electrical switchboards. In this event, total reliance on the external mobile pumps would be required [8].

## 5 CONCLUSION

The occurrence of an earthquake with subsequent tsunami at KNPS is unlikely. However, if such an event had to occur; it is plausible that the earthquake and/or tsunami could induce events such as chemical spills, explosions, and fire. This study completed an assessment on the combination of these events.

This assessment is comprehensive for seismic activity up to 0.6 g for both unit 1 and 2.

The most equipment failures would occur due to the occurrence of an earthquake and/or tsunami. The risks and mitigations were documented in EERT-11-015 (*Seismic Hazard Report*) and EERT-11-016 (*Tsunami Hazard Report*).

This assessment assumes the installation of the following modifications as detailed in § 3:

- shutdown seals;
- installation of an additional auxiliary feedwater system (on each unit);
- hardened SEP tank and associated piping;
- portable emergency equipment (PEE);
- hardened instrumentation; and
- mobile diesel generators and connection points.

The functional requirements diagram highlighted the plant's ability to ensure core and SFP cooling and to maintain containment integrity. With the installation of the modifications proposed in this report, Koeberg should maintain critical functional requirements required to survive a beyond-design-basis earthquake with a subsequent tsunami event. In addition, Koeberg will also be able to survive the occurrence of on-site failures due to seismic/tsunami induced on-site hazards (explosion, fire, and chemical spill).

The only significant additional damage and failures found are:

- An explosion at the hydrogen storage facility could result in a loss of integrity of the SEP tank and associated piping. If this is combined with station black-out conditions, which could be caused by an earthquake and induced tsunami, such an explosion would affect the proposed mitigative strategy of using the SEP tank as an ultimate water source.
- In the event that the explosion of the hydrogen storage facility causes damage to the SEP tank, the water inventory of this tank could pose a flooding risk to the south-side EDGs. The diesel transfer pumps are located at the lowest point in the diesel building and are vulnerable to water ingress.
- The possible vulnerability of the ammonia tanks could hamper the implementation of mitigative strategies to prevent or mitigate core melt.
- Internal flooding from the ASG tanks and RRI / SEC piping could result in additional failure of equipment.

Other induced failures such as fires or explosions in the turbine hall, unit and generator transformer fires, and flooding by CRF do not lead to additional failure as the loss of offsite power and the loss of ultimate heat sink have already been identified. Based on the results derived in this assessment, additional proposals are made in the following section.

## 6 **PROPOSALS**

The combination assessment completed in this report yielded the following proposals to increase the robustness of the plant against external events such as earthquakes and tsunamis:

- It is proposed that Koeberg develop a tsunami early warning system to provide accurate early indication on possible tsunami formation following an earthquake event;
- It is proposed to develop a locally calibrated tsunami hazard assessment model/methodology;
- It is proposed that EERT-11-016 (*Tsunami Hazard Report*) be revised to include the potential damage to plant buildings and SSCs as a result of the impact energy from the tsunami waves;
- It is proposed that the seismically hardened SEP tank and associated pipework be robust against any overpressure generated by an explosion due to its proximity to the hydrogen storage facility, which could be vulnerable in the event of a seismic activity. An alternative solution would be the relocation of the hydrogen storage facility to a remote area not surrounded by critical equipment;
- It is proposed that a seismically qualified barrier be erected in front of the south-side EDGs to protect these EDGs from possible water ingress in the event of an SEP tank rupture; and
- It is proposed that any preventative measures (such as tank strengthening) and/or mitigation strategies (such as protective clothing) to deal with a potential chemical release be robust against the sequential occurrence of an earthquake and tsunami. An alternative solution would be to investigate the use of alternative non-toxic chemicals to replace the existing ammonia on site.
- It is proposed that a connection point, robust against earthquakes and tsunamis, be installed on the RCV charging line to allow connection of a permanent/portable pump to directly inject borated water into the RCP system (refer to EERT-11-026 (*Loss of Off-Site Power Report*) [11]). This will provide an emergency make-up path for the injection of borated water into the primary system to ensure sub criticality if other conventional means of injection is not available.

## 7 **REFERENCES**

- [1] FOSTER, N. 2012. EERT-12-021-RPT: External Hazard Screening Assessment Individual Hazards and Combinations. Revision 0.
- [2] KUNGOANE, I. FOSTER, N. 2011. EERT-11-015-RPT: Seismic Hazard Report. Revision 0.
- [3] NEL, R. 2011. EERT-11-016-RPT: Tsunami Hazard Report. Revision 0.
- [4] CASSIM, R. 2011. EERT-11-025-RPT: Chemical Spill Hazard Report. Revision 0.
- [5] BEZUIDENHOUT, J. 2012. EERT-11-019-RPT: Explosion Hazard Report. Revision 1.
- [6] JACOBS, T. 2011. EERT-11-018-RPT: Fire Hazard Report. Revision 0.
- [7] AUSTIN, J. 2011. EERT-11-014-RPT: Minimal Needs to Prevent and Mitigate Fuel Melt. Revision 0.
- [8] BEZUIDENHOUT, J. 2012. EERT-12-002-STY: Fuel Management Strategy. Revision 0.
- [9] BOWLES, D. 2011. EERT-11-017: Flooding Hazard Report. Revision 0.
- [10] BEZUIDENHOUT, J. 2012. EERT-12-023-RPT: On-Site Induced Hazards. Revision 0.
- [11] FOSTER, N. 2011, EERT-11-026: Loss of Off-Site Power Report, Revision 0



# **APPENDIX 1:** FUNCTIONAL REQUIREMENTS DIAGRAMS

|                               |                                      |                   |   | iagram for a d<br>ıp to the 0 m t |           |               |                  |                     |          |                   |       |          |  |           |
|-------------------------------|--------------------------------------|-------------------|---|-----------------------------------|-----------|---------------|------------------|---------------------|----------|-------------------|-------|----------|--|-----------|
| Required                      | Function                             |                   |   | SSCs th                           | at provid | e Functio     | nal Requ         | irement             |          |                   |       |          |  |           |
| Functional<br>Requirement     | Sub-Function                         | Met               | hods to fulfil Funct                        | ional Req. (SSCs)                 |           | Sub-SSC       |                  |                     |          |                   |       |          |  |           |
|                               | Control Rods                         | C-S1              | Control Rod                                 | CRDMs                             | FL-ASS    | CNTL-ROD      | CRDM             |                     |          |                   |       |          |  |           |
|                               |                                      | C-L42             | REA Boration (direct or<br>normal)          | REA/RCV/RCP                       | REA/B-TNK | REA/B-PO      | REA              | -RCV                | 501/50   |                   |       |          |  |           |
|                               |                                      | C-L44             | Normal charging from PTR tank               | PTR/RCV/RCP                       |           |               | PTR-RCV          |                     | RCV-PO   | RCV-CL            |       |          |  |           |
| C1. Sub-Criticality           | Boron Injection                      | C-L34             | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP                    | PTR-TNK   |               | DTD 500          |                     | 500 00   |                   | RCP   |          |  |           |
|                               |                                      | C-L33             | Emergency Seal Injection                    | ESS/ESS-SI/RCP                    |           |               | PTR-ESS          |                     | ESS-PO   | ESS-SI            |       |          |  |           |
|                               |                                      | C-L11             | Accumulators                                | ACC/RCP                           | ACC       |               |                  | ACC-RCP             |          |                   |       |          |  |           |
|                               | RCP System                           | C-121             | RCP Integrity                               | RCP*                              | RCP*      | RCP<br>Pumps* | RCP<br>Vessel*   | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |       |          |  |           |
| C2. Primary System            | SG                                   | C-122             | SG Integrity                                | SG*                               | SGs*      |               |                  |                     |          |                   |       |          |  |           |
| Integrity                     | RRA System Integrity<br>(SD)         | C-123             | RRA Integrity                               | RCP*/RRA*/RCP*                    | RCP*      | RRA-SL*       | RRA-PO*          | RRA-Hx*             | RRA-DL*  | RRA-SV*           |       |          |  |           |
|                               | RRA System Isolation<br>(SD)         | C-124             | RRA Isolation                               | RCP*                              | RCP*      | RRA-SL        | RRA-DL           |                     |          |                   |       |          |  |           |
|                               | Nernel Coal biostics                 | C-L31             | Normal Seal Injection                       | REA/RCV/RCP                       | REA/B-TNK | REA/B-PO      | REA-RCV          |                     | RCV-PO   | RCV-SI            |       |          |  |           |
| C3. RCP Seal<br>injection     | Normal Seal Injection                | C-L32             | PTR Seal Injection                          | PTR/RCV/RCP                       |           |               | PTR-RCV          |                     | RCV-PU   | RGV-SI            | RCP   |          |  |           |
|                               | Emergency Seal<br>Injection          | C-L33             | Emergency Seal Injection                    | ESS/RCP                           | PTR-TNK   |               | PTR-ESS          |                     | ESS-PO   | ESS-SI            |       |          |  |           |
|                               |                                      | C-L42             | REA Boration (direct or<br>normal)          | REARCV/RCP                        | REA/B-TNK | REA/B-PO      | 05.              | DOV                 |          |                   |       |          |  |           |
|                               | RCV Normal charging                  | C-L43             | Normal charging from REA water system       | REA/RCV/RCP                       | REAW-TNK  | REA/W-PO      | REA              | -RCV                | RCV-PO   | DOVICE            |       |          |  |           |
|                               |                                      | C-L44             | Normal Charging from<br>PTR                 | PTR/RCV/RCP                       |           |               | PTR-RCV          |                     |          | RCV-CL            |       |          |  |           |
|                               | ESS Charging<br>Injection (Low Flow) | C-L34             | Charging using ESS<br>(6m3/hr)              | ESS/ESS-CL/RCP                    |           |               |                  |                     |          |                   |       |          |  |           |
|                               | ESS Seal injection<br>(Low Flow)     | C-L33             | Emergency Seal Injection<br>(6m3/hr)        | ESS/ESS-SI/RCP                    | PTR-TNK   |               | PTR-ESS          |                     | ESS-PO   | ESS-SI            |       |          |  |           |
| C4. Primary System<br>Make-up | HHSI - Direct Inj.                   | C-L45             | HHSI Direct Injection                       | PTR/RCV/BIT/RCP                   |           | PTR-RCV       |                  | RCV-PO              | RCV-HSI  | RCP               |       |          |  |           |
|                               | LHSI - Direct Inj.                   | C-L46             | LHSI Direct Injection                       | PTR/RIS/RCP                       |           |               | PTR-RIS          |                     |          |                   |       |          |  |           |
|                               | LHSI - Recirculation                 | C-L47             | LHSI Recirculation                          | SMP/RIS/RCP                       | CNT-SMP   |               | SMP-RIS          |                     | RIS-PO   |                   |       |          |  |           |
|                               | EAS Back-up to RIS                   | C-L48             | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP       |           | SMP-EAS       | EAS-PO           | EAS-RIS             | RIS-PO*  | RIS-LSI           |       |          |  |           |
|                               | EAS 004 Back-up to<br>RIS            | C-L49             | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP       |           | SMP-EAS       | EAS-PO*          | EAS-4PO             | RIS-PO*  |                   |       |          |  |           |
|                               | PTR Gravity Feed<br>(SD - Head Off)  | C-L61             | PTR Gravity Feed                            | PTR/RIS*/RCP                      | PTR-TNK   |               | PTR-RIS          |                     | RIS-PO*  | RIS-LSI           | RCP   | 1        |  |           |
|                               |                                      | C-L50             | GCTa Steam Dump                             | SG/VVP/GCTa                       |           |               |                  | GCTa-STM            |          |                   |       |          |  |           |
|                               | SG Steam Dump                        | <del>C-L5</del> 1 | GCTc Steam Dump                             | SGAMP/GCTc-                       | SGs V     | WP-GCT        | GCTC-STM CEX-TNK |                     | CEX-PO   |                   |       |          |  |           |
|                               |                                      | C-L52             | Turbine Driven ASG Pump                     | ASG/ASGt/SG                       |           | ASG-T/PO      | ASG-T/SS AS      |                     | ASG-T/FL |                   |       |          |  |           |
|                               | SG Feedwater                         | C-L53             | Motor Driven ASG Pumps                      | ASG/ASGm/SG                       | ASG-TNK   | ASG-          | ļ                |                     | ASG-WFL  |                   | SGs   |          |  |           |
|                               |                                      | <del>C-L54</del>  | ARE Main Feed                               | CEX/APA/SG-                       | CEX-TNK-  | CEX-PO        | ABP-HX*          | APA-PO-             | AHP-HX*  | ARE-SG/FL         |       |          |  |           |
| C5. Core Cooling              |                                      | C-L55             | SER Make-up to ASG                          | SER/ASG                           |           |               | SER-PO           |                     |          |                   |       | <b>!</b> |  |           |
|                               |                                      | C-L56             | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)                 | SEF       | S-TNK         | SER-BV           | SER-ASG             |          |                   |       |          |  |           |
|                               | SG Long term<br>Feedwater Supply     | C-L57             | JPP Make-up to ASG                          | JPP/JPD/ASG                       | JPP       | -TNK          | JPP-PO           | JPD-ASG             | ASG-TNK  |                   |       |          |  |           |
|                               | coppy                                | C-L58             | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG                   |           |               | JPS-PO           | JPD-ASG             |          |                   |       |          |  |           |
|                               |                                      | C-L59             | SEP Make-up to JPP                          | SEP/JPP                           | SEP-TNK   | SEP-JPP/S     | JPP-TNK          |                     |          | 1                 |       |          |  |           |
|                               | RRA Core Cooling<br>(SD)             | C-L60             | RRA Cooling                                 | RCP/RRA/RCP                       | RCP*      | RRA-SL        | RRA-PO           | RRA-Hx              | RRA-DL   | RRA-SV            | RCP*  |          |  |           |
|                               | Containment Isolation                | B-1               | Containment Building                        |                                   | B-CNT     |               |                  |                     |          |                   |       |          |  |           |
|                               | Direct Core Injection                |                   | *See C4. Primary Sys                        | stem Make-up                      |           |               |                  |                     |          |                   |       |          |  |           |
|                               |                                      | C-L61             | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                       | PTR-TNK   | PTR-EAS       | EAS              | S-PO                |          |                   |       |          |  |           |
|                               | Containment                          | C-L62             | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                       | CNT-SMP   | SMP-EAS       | EAS-PO           | EAS-Hx              | EAS-SPR  | CONT              |       |          |  |           |
| C6. Containment               | Containment<br>Pressure Control      | C-L63             | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                       | JPP-TNK   | JPP-PO        | JPP-JPC          | JPC-EAS             |          |                   |       |          |  |           |
| Integrity                     |                                      | C-L64             | Containment Venting                         |                                   |           |               |                  |                     |          |                   |       |          |  |           |
|                               | Hydrogen Reduction                   | C-L65             | Hydrogen PARS                               | ETY (PARS)                        | PARs      | ]             |                  |                     |          |                   |       |          |  |           |
|                               |                                      | C-L52             | Turbine Driven ASG Pump                     | ASG/ASGt/SG                       |           |               | ASG-TNK          | ASG-T/PO            | ASG-T/SS | ASG               | FT/FL |          |  |           |
|                               | SG Creep Rupture<br>Prevention       |                   |   |                                   |           |               |                  |                     |          |                   |       |          |  | ASG-SG/FL |
|                               | Flevenuon                            | C-L53             | Motor Driven ASG Pumps                      | ASG/ASGm/SG                       |           | ASG-          | -M/PO            | ASG                 | -WFL     |                   |       |          |  |           |

# Table 5: Functional requirements diagram for a design basis earthquake (0.3 g) inducing a tsunami wave up to the 0 m terrace level (no modifications)

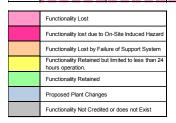
Table 5:Functional requirements diagram for a design basis earthquake (0.3 g)inducing a tsunami wave up to the 0 m terrace level (no modifications)

|                 | Required                    | Function                           |            |  | SSCs th                    | at provide           | e Functio                      | nal Requ | irement     |          |           |        |   |
|-----------------|-----------------------------|------------------------------------|------------|--|----------------------------|----------------------|--------------------------------|----------|-------------|----------|-----------|--------|---|
|                 | Functional<br>Requirement   | Sub-Function                       | Met        | thods to fulfil Funct                                | ional Req. (SSCs)          |                      |                                |          | Sub         | -SSC     |           |        |   |
|                 |                             | Core Exit<br>Temperature           | C-I1       | Core Exit Temperature<br>Indication                  |                            | RICxxxMT             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | RCP Level                          | C-l2       | Pressuriser Level<br>Indication                      |                            | RCPxxxMN             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | Reactor Level<br>Indication        | C-124      | RVLIS  |                            |                      |                                |          |             |          |           |        |   |
|                 |                             | RCP pressure                       | C-I3       | RCP Pressure Indication                              |                            | RCPxxxMP             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | RRA Pressure                       | C-15       | RRA Pressure Indication                              |                            | RRAxxxMP             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | SG Level                           | C-16       | SG WR Level Indication                               |                            | ARExxxMN             |                                |          |             | [LNi]    |           |        |   |
| ore             |                             | SG Pressure                        | C-17       | SG Pressure Indication                               |                            | VVPxxxMP             |                                |          |             | [LNi]    |           |        |   |
| or C            |                             | ASG Tank Level                     | C-18       | ASG Tank Level Indication                            |                            | ASG002LN             |                                |          |             |          |           |        |   |
| Reactor Core    | C7. Essential<br>Indication | Diesel Tank Level                  | C-19       | Diesel Tank Level                                    |                            | LHixxxLN             |                                |          |             |          |           |        |   |
| ž               |                             | Containment                        | C-120      | Indications<br>Containment WR Pressure               |                            | ETYxxxMP             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | Pressure<br>Containment            | C-21       | Indication<br>Containment Radiation                  |                            | KRT022-              |                                |          |             | KRT001AR | [LBA]     |        |   |
|                 |                             | Radiation<br>Containment Sump      | C-122      | Levels<br>Containment Sump Level                     |                            | 23MA<br>RISxxxSL     |                                |          |             | [LCA/B]  | [207.9    |        |   |
|                 |                             | Level<br>BaseMat                   | C-122      | Basemat Thermo-couples                               |                            | EASxxxSL<br>KSBxxxMT |                                |          |             | [LCA/B]  |           |        |   |
|                 |                             | Thermocouples<br>Containment Sump  | C-I51      | Basemat mermo-couples                                |                            | TODAXAMI             |                                |          |             |          |           |        |   |
|                 |                             | Temperature<br>Containment         | C-152      |  |                            |                      |                                |          |             |          |           |        |   |
|                 |                             | Hydrogen Sampling<br>Reactor Pit   |            |  |                            |                      |                                |          |             |          |           |        |   |
|                 |                             | Temperature                        | C-153      | CED Deal Intervity                                   | 250                        |                      | D OFD                          |          |             |          |           |        |   |
|                 | C4 CED Integrity            | SFP Pool                           | S-S1       | SFP Pool Integrity<br>PTR Normal SFP Cooling         | SFP                        | SFP-PL               | B-SFP                          | DTD 001  | DTD 11/4    |          |           |        | 1 |
|                 | S1. SFP Integrity           | PTR 1/2 PO                         | S-S1       | Integrity  | SFP\PTR\SFP                | SFP-PL               | PTR-SL                         | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |   |
|                 | S2. SFP Cooling             | PTR 6 PO                           | S-S2       | PTR 3rd Train Integrity                              | SFP\PTR3\SFP               |                      | PTR3-SL                        | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |   |
|                 |                             | PTR 1/2 PO                         | S-L1       | PTR Normal Cooling                                   | SFP\PTR\SFP                | SFP-PL               | PTR-SL                         | PTR-PO   | PTR-HX      |          | R-DL      | SFP-PL |   |
|                 | S3. Bulk Boiling            | PTR 6 PO                           | S-L2       | PTR 3rd Train Cooling                                | SFP\PTR3\SFP               |                      | PTR3-SL PTR3-PO PTR3-HX PTR3-E |          |             |          | :3-DL     |        |   |
| -               |                             | SFP Steam Release                  | S-L3       | Open Vent Doors                                      |                            | SFP-VD               |                                |          | _           |          | 1         |        |   |
| Ъ               |                             | <ul> <li>SFP Emergency</li> </ul>  | S-L4       | SED Make-up  | SED/SFP                    | SED-TNK              |                                | -PO      | SED-SFP     |          |           |        |   |
| Fue             |                             | Make-up                            | S-L5       | JPP Make-up  | JPP/JPD/SFP                | JPP-TNK              |                                | -PO      | JPD-SFP     | SFP-PL   |           |        |   |
| Spent Fuel Pool |                             |                                    | S-L6       | JPS Make-up  | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S                      | JPS-PO   |             |          |           |        |   |
| sp              |                             | SFP Level                          | S-I1       | SFP Level Indication<br>SFP Temperature              |                            | PTRxxxMN             |                                |          |             | [LNi]    | [SAR-ACC] |        |   |
|                 |                             | SFP Temperature<br>Fuel Rack       | S-12       | Indication   |                            | PTRxxxMT             |                                |          |             | [LNi]    |           |        |   |
|                 |                             | Temperature<br>SFP Boron           | S-13       |  |                            | -                    |                                |          |             |          |           |        |   |
|                 | S4. Indication              | Concentration<br>SFP Building      | S-14       |  |                            | -                    |                                |          |             |          |           |        |   |
|                 |                             | Pressure<br>SFP Hydrogen           | S-15       |  |                            | -                    |                                |          |             |          |           |        |   |
|                 |                             | Concentration<br>SFP Building      | S-16       |  |                            | -                    |                                |          |             |          |           |        |   |
|                 |                             | Humidity                           | S-17       | JPP Make-up to Seismic                               |                            |                      |                                |          |             |          |           |        |   |
| <b>.</b>        | V4 Selected in              | Flooding of Seismic                | V-L01      | Vault<br>JPS Make-up to Seismic                      | JPP/JPD/VLT                | JPP.                 |                                | JPP-PO   | JPP-JPD     | JPD-VLT  |           |        |   |
| Seismic Vault   | V1. Seismic Vault           | Vault                              | V-L02      | Vault<br>SEP Gravity Feed to                         | SEP/JPS/JPD/VLT            | SEP-TNK              | SEP-JPP/S                      | JPS-PO   | JPS-JPD     |          | VLT       |        |   |
| nic /           |                             | Seismic Vault                      | V-L03      | Seismic Vault  | SEP/JPD/VLT                |                      |                                | SEP      | P-VLT       |          |           |        |   |
| eisr            |                             | Temperature<br>Seismic Vault Water | VI-1       |  |                            | -                    |                                |          |             |          |           |        |   |
| S               | V.2 Indication              | Level<br>Seismic Vault             | VI-2       |  |                            | -                    |                                |          |             |          |           |        |   |
| 6               |                             | Pressure<br>Cask Remain Leak       | VI-3       |  |                            |                      |                                |          |             |          |           |        |   |
| Dry<br>Casks    | D1. Cask Integrity          | Tight<br>Cask Air cooling          | D-S1       | Cask integrity                                       | CASK                       | CASK*                |                                |          |             |          |           |        |   |
| 0               | D2. Cask Cooling            | maintained                         | D-L1<br>B1 | Cask Cooling   | Cask building and Air Flow | B-LLW<br>B-CNT       | CASK-AIR                       | Hatab    | Penetrotica | Airlocko |           |        |   |
|                 | B1. Containment<br>B2. NAB  |                                    | B1<br>B2   | Containment Building<br>Nuclear Auxiliary Building   |                            | B-CNT<br>B-NAB       | Building                       | Hatch    | Penetration | Airlocks | J         |        |   |
|                 | B3. Electrical Building     | g                                  | B3         | Electrical Building                                  |                            | B-ELE                |                                |          |             |          |           |        |   |
| sɓu             | B4. Diesel buildings        |                                    | B4         | Unit Diesel Building                                 |                            | B-DSL                |                                |          |             |          |           |        |   |
| Buildings       | B5. SBO Diesel Build        | ing                                | B5         | SBO Diesel Building                                  |                            | B-SBO                |                                |          |             |          |           |        |   |
| Bu              | B6. SEC pump-house          | 9                                  | B6         | SEC Pumphouse Building                               |                            | B-SEC                |                                |          |             |          |           |        |   |
|                 | B7. Turbine Hall            |                                    | B7         | Turbine Hall   |                            | B-TUR                |                                |          |             |          |           |        |   |
|                 | B8. LLW Building            |                                    | B8<br>B9   | Low Level Waste Building<br>Emergency Control Centre |                            | B-LLW<br>B-ECC       |                                |          |             |          |           |        |   |
| L               | B9. ECC                     |                                    | 89         | Emergency control centre                             |                            | B-200                |                                |          |             |          |           |        |   |

### Table 5:

Functional requirements diagram for a design basis earthquake (0.3 g) inducing a tsunami wave up to the 0 m terrace level (no modifications)

| Required I   | Function   |   |  | SSCs th  | at provide  | Functio  | nal Requ  | irement   |  | SSCs that provide Functional Requirement   |   |  |  |  |  |  |  |  |  |  |  |
|--|--|---|--|--|---|--|---|---|--|--|---|--|--|--|--|--|--|--|--|--|--|
| Functional<br>Requirement                              | Sub-Function   | Met   | thods to fulfil Functi   | onal Req. (SSCs)   |   |  | SSC   |   |  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | LHA Switchboard<br>Supply<br>[LHA]   | E-1<br>E-2<br>E-3   | 400 KV LHA Supply<br>132 KV LHA Supply<br>LHP Diesel LHA Supply  | 400KV/LHA<br>132KV/LHA<br>LHP/LHA  | 400KV<br>132KV<br>LHP-DSL   |  | LHP   |   | LGB-SWB  | LHA-SWB  | [LCA]   | [LBA]  |  |  |  |  |  |  |  |  |  |
| E1. Essential 6.6kV<br>Switchboard Supply              | LHB Switchboard<br>Supply<br>[LHB]   | E-5<br>E-6<br>E-7   | 400 KV LHB Supply<br>132 KV LHB Supply<br>LHQ Diesel LHB Supply  | 400KV/LHB<br>132KV/LHB<br>LHQ/LHB  | 400KV<br>132KV<br>LHQ-DSL   | GEN-TRX<br>STN   | UNT-TRX<br>-TRX<br>LHQ  | LGD-SWB<br>LGE/F-SWB<br>-LHB  | LGC-SWB  | LHB-SWB  | [LCB]   | [LBB]  |  |  |  |  |  |  |  |  |  |
| E2. SBO Diesel<br>Supply                               | LLY SBO Diesel<br>Supply<br>[LLY]  | E-8   | LHS Diesei LHB Supply  | LLSILLXILLY  | LLS-DSL   | LLX-SWB  | LLX-LLY   | LHC-SWB   | LHC-LHB  |  |   |  |  |  |  |  |  |  |  |  |  |
| E3. 48 V Essential                                     | LCA 48V Switchboard<br>Supply [LCA]  | E-21<br>E-22<br>E-23  | LCA Switchboard - LHA<br>LCA Switchboard - LLS<br>LCA Switchboard - Battery  | LCAILLÌLHA<br>LCAILLY<br>LCAIBAT   | [LHA]<br>[LLY]<br>LCA-BAT   |  | LLA\E-SWB   | LCA-RD  | LCA-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
| Switchboard Supply                                     | LCB 48V<br>Switchboard Supply<br>[LCB]   | E-24<br>E-25<br>E-26  | LCB Switchboard - LHB<br>LCB Switchboard - LLS<br>LCB Switchboard - Battery  | LCB\LLI\LHB<br>LCB\LLY<br>LCB\BAT  | (LHB)<br>(LLY)<br>LCB-BAT   |  | LLB\D-SWB   | LCB-RD  | LCB-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
| E4. 125 V Essential<br>Switchboard Supply              | LBA 125V<br>Switchboard Supply<br>[LBA]  | E-31<br>E-32<br>E-33  | LBA Switchboard - LHA<br>LBA Switchboard - LLS<br>LBA Switchboard - Battery  | LBAILLIILHA<br>LBAILLY<br>LBAIBAT  | [LHA]<br>[LLY]<br>LBA-BAT   |  | LLC\E-SWB   | LBA-RD  | LBA-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | LBB 125V<br>Switchboard Supply<br>[LBB]  | E-34<br>E-35<br>E-36  | LBB Switchboard - LHA<br>LBB Switchboard - LLS<br>LBB Switchboard - Battery  | LBB\LLI\LHB<br>LBB\LLY<br>LBB\BAT  | [LHB]<br>[LLY]<br>LBB-BA  |  | LLB\D-SWB   | LBB-RD  | LBB-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | LNA 220V Essential<br>Switchboards<br>[LNA]  | E-41<br>E-42<br>E-43  | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA<br>SIP I Supply from LSS   | LNA/LLC/LHA<br>LNA/LBC/LLA/LHA<br>LNA/LBC/LLY  | [LHA]   | LLC-SWB  | LNA<br>LBC-RD   | LBC-SWB   | LNA-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | LNB 220V Essential<br>Switchboards<br>[LNB]  | E-44<br>E-45<br>E-46<br>E-47  | SIP II Battery Supply<br>SIP II Dirty Supply from<br>LHB<br>SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS  | LNB/LLD/LHB<br>LNB/LLD/LLB/LHB<br>LNB/LBD/LLY  | (LHB)   | LLD-SWB<br>LLB-SWB   | LNB   | B-RD<br>LBD-SWB   | LNB-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
| E5. Essential<br>Instrumentation<br>Switchboard Supply | LNC 220V Essential<br>Switchboards<br>[LNC]  | E-48<br>E-49<br>E-50<br>E-51  | SIP II Battery Supply<br>SIP III Dirty Supply from<br>LHA<br>SIP III Clean Supply from<br>LHA<br>SIP III Supply from LSS   | LNB/LBD/BAT<br>LNC/LLC/LHA<br>LNC/LBE/LLA/LHA<br>LNC/LBE/LLA/LHA   | LBD-BAT   | LLC-SWB  | LNC<br>LBE-RD   | LBE-SWB   | LNC-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | LND 220V Essential<br>Switchboards   | E-52<br>E-53<br>E-54  | SIP III Battery Supply<br>SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from<br>LHB<br>SIP IV Supply from LSS   | LNC/LBE/BAT<br>LND/LLD/LHB<br>LND/LBF/LLB/LHB  | [LHB]   | LLD-SWB<br>LLB-SWB   | LND<br>LBF-RD   |   | LND-SWB  |  |   |  |  |  |  |  |  |  |  |  |  |
| U1. Essential<br>Cooling                               | SEC Train A Cooling<br>SEC Train B Cooling   | E-55<br>E-56<br>U-1<br>U-2  | SIP IV Supply from LSS<br>SIP IV Battery Supply<br>SEC Train A Cooling<br>SEC Train B Cooling  | LND/LBF/BAT<br>SEA/SEC-A/SEA<br>SEA/SEC-B/SEA  |   | SEC-A-RS<br>SEC-B-RS   | SEC-A-DS<br>SEC-B-DS  | SEC-A-PO<br>SEC-B-PO  | RRI-A-HX<br>RRI-B-HX   | [Sea]  |   |  |  |  |  |  |  |  |  |  |  |
| U2. Component<br>Cooling                               | Alternative Heatsink<br>RRI Train A Cooling<br>RRI Train B Cooling   | U-3<br>U-11<br>U-12   | Alternative Heatsink<br>RRI Train A Cooling<br>RRI Train B Cooling<br>RRI Commons cooling  | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA<br>SEC/RRI-A/HXC  | HX-A<br>HX-B  | RRI-A-PO<br>RRI-B-PO   | [RRI-A-HX]<br>[RRI-B-HX]  |   |  |  |   |  |  |  |  |  |  |  |  |  |  |
|  | Functional<br>Requirement         E1. Essential 6.6kV<br>Switchboard Supply         E2. SBO Diesel<br>Supply         E3. 48 V Essential<br>Switchboard Supply         E4. 125 V Essential<br>Switchboard Supply         E4. 125 V Essential<br>Switchboard Supply         E5. Essential<br>Switchboard Supply         U1. Essential<br>Cooling | Requirement         Sub-Function           Et. Essential 6.6kV<br>Switchboard Supply         LHA Switchboard<br>Supply<br>LHB Switchboard           E2. SBO Diesel         LLY SBO Diesel<br>Supply<br>[LHB]           E3.48 V Essential<br>Switchboard Supply         LCA 48V Switchboard<br>Supply [LCA]           E4.125 V Essential<br>Switchboard Supply         LCB 48V<br>Switchboard Supply<br>[LBB]           E5. Essential<br>Switchboard Supply         LBA 125V<br>Switchboard Supply<br>[LBA]           LBA 125V<br>Switchboard Supply         LBA 125V<br>Switchboard Supply<br>[LBA]           LBA 125V<br>Switchboard Supply         LBA 125V<br>Switchboard Supply           LNA 220V Essential<br>Switchboard Supply         LNC 220V Essential<br>Switchboard Supply           LND 220V Essential<br>Switchboard Supply         LND 220V Essential<br>Switchboard Supply           U1. Essential<br>Cooling         SEC Train A Cooling<br>SEC Train B Cooling | Functional<br>Requirement         Sub-Function         Merician           Requirement         Sub-Function         Fermion           LHA Switchboard<br>Supply<br>(LHA)         Fermion         Fermion           E1. Essential 6.647         Fermion         Fermion           Switchboard Supply<br>(LHB)         Fermion         Fermion           E2. 3B0 Disel         L/Y SISO Disel         Fermion           E2. 3B0 Disel         L/Y SISO Disel         Fermion           Switchboard Supply<br>(LCA)         Fermion         Fermion           E3. 48 V Essential<br>Switchboard Supply         Fermion         Fermion           LCA 48V Switchboard Supply<br>(LCA)         Fermion         Fermion           Fermion         Fermion         Fermion           LCA 48V Switchboard Supply<br>(LBB)         Fermion         Fermion           Switchboard Supply<br>(LBB)         Fermion         Fermion           B125V<br>Switchboard Supply<br>Switchboard Supply<br>(LBB)         Fermion         Fermion           B125V<br>Switchboard Supply<br>Switchboard Supply         Fermion         Fermion           B125V<br>Switchboard Supply<br>Switchboard Supply         Fermion         Fermion           B1215V<br>Switchboard Supply         Fermion         Fermion           Fermion         Fermion         Fermion | Functional<br>RequirementSub-FunctionMettods to fulfil FunctionRequirementSub-FunctionE-1400 KV LHA SupplyLHA Switchboard<br>SupplyE-2132 KV LHA SupplyE1. Essential 6.6kVE-2122 KV LHA SupplySwitchboard SupplyE-4LHS Diesel LHA SupplyE3. BO Diesel<br>SupplyLHS Switchboard<br>SupplyE-6400 KV LHB SupplyE3. BO Diesel<br>SupplyLLY Sbo Diesel<br>LHS Diesel LHS SupplyE-6122 KV LHB SupplyE3. 48 V Essential<br>Switchboard SupplyLLY Sbo Diesel<br>LCA 48V SwitchboardE-10LLY Switchboard SupplyE3. 48 V Essential<br>Switchboard SupplyLLA 48V SwitchboardE-22LCA Switchboard - LHAE4. 125 V Essential<br>Switchboard SupplyE-3LCA Switchboard - LHBLCA 48V Switchboard SupplyE-3LCA Switchboard - LHAE4. 125 V Essential<br>Switchboard SupplyE-3LCA Switchboard - LHALBA 125V<br>Switchboard SupplyE-3LBA Switchboard - LHALBA 125V<br>Switchboard SupplyE-3LBA Switchboard - LHALBA 125V<br>Switchboard SupplyE-3LBA Switchboard - LHALBA 125V<br>Switchboard SupplyE-4SP I Clean Supply from LHALBA 125V<br>Switchboard SupplyE-4SP I Clean Supply from LHALBA 2020 Essential<br>LBB 125V<br>Switchboard SupplyE-4SP I Supply from LHALBA 2020 Essential<br>LND 2202 | Functional<br>Requirement         Sub-Function         Metbods to fulfil Functional Req. (SSCs)           I.M. Switchboard<br>Supply         I.M. Switchboard<br>Supply         E-1         400 KV LMA Supply         400 KV LMA Supply           E.S. Essential Sky<br>Switchboard Supply         I.M. Switchboard<br>Supply         E-2         132 KV LMA Supply         LIPA Supply           E.S. BO Deeal         Switchboard<br>Supply         LIPA Supply         LIPA Supply         LIPA Supply           E.S. BO Deeal         Switchboard<br>Supply         E-4         LIPA Supply         LIPA Supply           E.S. BO Deeal         Switchboard<br>Supply         E-4         LIPA Supply         LIPA Supply           E.A. Sto Deeal         Switchboard Supply         LIPA Supply         LIPA Supply         LIPA Supply           E.A. Sto Deeal         Supply Supply         E-2         LCA Switchboard Supply         LIPA Supply           E.A. Sto Deeal         Supply LCA         E-2         LCA Switchboard - LHA         LCARLY           E.A. Sto Deeal         E-2         LCA Switchboard - LHA         LCARLY           Supply         E-2         LCA Switchboard - LHA         LCARLY           E.A. Sto Deeal         E-2         LCA Switchboard - LHA         LCARLY           LCA SWitchboard Supply         E-2         LCA Switchboa | Functional<br>Requirement         Sub-Function         Methods to fulfil Functional Req. (SSCs)           Functional<br>Requirement         LHA Supply         400 KV LHA Supply         400 KV LHA<br>400 KV LHA<br>Supply         132 KV LHA<br>125 KV LHA<br>125 KV LHA<br>Supply         132 KV LHA<br>125 KV LH | Functional<br>Requirement         Sub-Function         Met-Uot of fulfi Functional Req. (SSCs)           F1 Executional<br>Switchboard Suppl<br>E1 Execution Suppl<br>E2 Execution Suppl<br>E | Functional<br>Requirement         Sub-Function         Methods to fuffil Functional Req. (SSCs)           E4         400 VUHA Supply         400 VUHA         100 V         400 VUHA         100 VUHA | Functional<br>Requirement         Sub-Function         Methods to fulfit Functional Req. (SSCs)         SUB-Function         Sub-Funcion         Sub-Function         Sub-Fu | Functional<br>Requirement         Sub-Function<br>Sub-Sub-Sub-Sub-Sub-Sub-Sub-Sub-Sub-Sub- | Functional<br>Requirement       Sub-Functional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Selectional<br>Select | Functional<br>Requirement<br>Negligement<br>Self-Sectional<br>Self-Sectional<br>No.97         Sub-Functional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Self-Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional<br>Sectional |  |  |  |  |  |  |  |  |  |





Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

### Table 6:

| Functional requirements diagram for a design basis earthquake (0.3 g)                       |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|              | Required F                      | unction                                    | SSCs that provide Functional Requirement |   |                                |             |                  |           |                                       |                                 |           |      |           |     |  |
|--------------|---------------------------------|--|--|---|--------------------------------|-------------|------------------|-----------|---------------------------------------|---------------------------------|-----------|------|-----------|-----|--|
| Ī            | Functional<br>Requirement       | Sub-Function                               | Met                                      | hods to fulfil Funct                                | ional Req. (SSCs)              |             |                  |           | Sub                                   | -ssc                            |           |      |           |     |  |
|              | Requirement                     | Control Rods                               | C-S1                                     | Control Rod   | CRDMs                          | FL-ASS      | CNTL-ROD         | CRDM      |                                       |                                 |           |      |           |     |  |
|              |                                 |  | C-L42                                    | REA Boration (direct or                             | REA/RCV/RCP                    | REA/B-TNK   | REA/B-PO         | REA       | -RCV                                  |                                 |           |      |           |     |  |
|              |                                 |  | C-L44                                    | normal)<br>Normal charging from PTR                 | PTR/RCV/RCP                    |             |                  | PTR-RCV   |                                       | RCV-PO                          | RCV-CL    |      |           |     |  |
|              | C1. Sub-Criticality             | Boron Injection                            | C-L34                                    | tank<br>Charging using Emergency                    | ESS/ESS-CL/RCP                 | PTR-TNK     |                  |           |                                       |                                 |           | RCP  |           |     |  |
|              |                                 |  | C-L33                                    | Seal Injection<br>Emergency Seal Injection          | ESS/ESS-SI/RCP                 |             |                  | PTR-ESS   |                                       | ESS-PO                          | ESS-SI    |      |           |     |  |
|              |                                 |  | C-L11                                    | Accumulators  | ACC/RCP                        | ACC         |                  |           | ACC-RCP                               |                                 | 200 0.    |      |           |     |  |
|              |                                 | RCP System                                 | C-121                                    | RCP Integrity                                       | RCP*                           | RCP*        | RCP              | RCP       | RCP                                   | PORVs*                          | Safety    |      |           |     |  |
|              |                                 | SG   | C-122                                    | SG Integrity  | SG*                            | SGs*        | Pumps*           | Vessel*   | Pressuriser*                          | - onto                          | Valves*   |      |           |     |  |
|              | C2. Primary System<br>Integrity | RRA System Integrity                       | C-123                                    | RRA Integrity                                       | RCP*/RRA*/RCP*                 | RCP*        | RRA-SL*          | RRA-PO*   | RRA-Hx*                               | RRA-DL*                         | RRA-SV*   |      |           |     |  |
|              |                                 | (SD)<br>RRA System Isolation               | C-124                                    | RRA Isolation                                       | RCP*                           | RCP*        | RRA-SL           | RRA-DL    | TUUTIA                                | - autor                         |           |      |           |     |  |
|              |                                 | (SD)                                       | C-L31                                    | Normal Seal Injection                               | REA/RCV/RCP                    | REA/B-TNK   | REA/B-PO         |           | -RCV                                  |                                 |           |      | <u> </u>  |     |  |
|              |                                 | Normal Seal Injection                      | C-L32                                    | PTR Seal Injection                                  | PTR/RCV/RCP                    | INEPUD-THIN | KEAD-I U         | PTR-RCV   |                                       | RCV-PO                          | RCV-SI    |      |           |     |  |
|              | C3. RCP Seal<br>injection       | Emergency Seal                             | C-L32                                    |   | ESS/RCP                        | PTR-TNK     |                  | PTR-ESS   |                                       | ESS-PO                          | ESS-SI    | RCP  |           |     |  |
|              |                                 | Injection<br>Shutdown Seal                 | C-L33                                    | Emergency Seal Injection<br>Emergency Shutdown Seal | RCP                            |             |                  |           | -Seal                                 | 233-PU                          | 200-51    |      |           |     |  |
|              |                                 | onatuown oear                              | C-125                                    | REA Boration (direct or                             | REA/RCV/RCP                    | REA/B-TNK   | REA/B-PO         | 30.       | - Sai                                 |                                 |           |      |           |     |  |
|              |                                 | RCV Normal charging                        | C-L42                                    | normal)<br>Normal charging from REA                 | REA/RCV/RCP                    | REAW-TNK    | REAW-PO          | REA       | RCV                                   | RCV-PO                          |           |      |           |     |  |
|              |                                 | Kev Normal Charging                        | C-L43                                    | water system<br>Normal Charging from                | PTR/RCV/RCP                    | REAW-INK    | REAW-PO          | PTR-RCV   |                                       | KCV-FO                          | RCV-CL    |      |           |     |  |
|              |                                 | ESS Charging                               |  | PTR<br>Charging using ESS                           |                                | -           |                  | FIR-ROV   |                                       |                                 |           |      |           |     |  |
|              | C4. Primary System              | Injection (Low Flow)<br>ESS Seal injection | C-L34<br>C-L33                           | (6m3/hr)<br>Emergency Seal Injection                | ESS/ESS-CL/RCP                 | PTR-TNK     |                  | PTR-ESS   |                                       | ESS-PO                          | ESS-SI    |      |           |     |  |
|              |                                 | (Low Flow)                                 |  | (6m3/hr)  | ESS/ESS-SI/RCP                 | PTR-INK     |                  | PTR-RCV   |                                       | DOVIDO                          |           | RCP  |           |     |  |
| æ            | Make-up                         | HHSI - Direct Inj.                         | C-L45                                    | HHSI Direct Injection                               | PTR/RCV/BIT/RCP                | -           |                  | PTR-RCV   |                                       | RCV-PO                          | RCV-HSI   |      |           |     |  |
|              |                                 | LHSI - Direct Inj.                         | C-L46                                    | LHSI Direct Injection                               | PTR/RIS/RCP                    |             |                  | SMP-RIS   |                                       | RIS-PO                          |           |      |           |     |  |
|              | -                               | LHSI - Recirculation                       | C-L47                                    | LHSI Recirculation                                  | SMP/RIS/RCP<br>SMP/EAS/EAS-    | CNT-SMP     | SMP-EAS          |           | EAS-RIS                               | RIS-PO*                         | RIS-LSI   |      |           |     |  |
| Reactor Core |                                 | EAS Back-up to RIS<br>EAS 004 Back-up to   | C-L48                                    | EAS Back-up to RIS                                  | 4PO/RIS/RCP<br>SMP/EAS/EAS-    | CIVI-SIMP   |                  | EAS-PO    |                                       |                                 | -         |      |           |     |  |
| ţo           |                                 | RIS<br>PTR Gravity Feed                    | C-L49                                    | EAS Back-up to RIS                                  | RIS/RIS/RCP<br>PTR/RIS*/RCP    | PTR-TNK     | SMP-EAS          | EAS-PO*   | EAS-4PO                               | RIS-PO*                         | RIS-LSI   | RCP  | -         |     |  |
| Read         |                                 | (SD - Head Off)                            | C-L61                                    | PTR Gravity Feed                                    |                                | PTR-INK     |                  | F IK-Kio  | GCTa-STM                              | RIS-PU                          | RIS-LSI   | RUP  |           |     |  |
| ۳ (          |                                 | SG Steam Dump                              | C-L50                                    | GCTa Steam Dump                                     | SG/VVP/GCTa                    | SGs         |                  | WP-GCT    |                                       | -                               | CEX-PO-   | -    |           |     |  |
|              |                                 |  |  | GCTc Steam Dump                                     |                                |             | ASG-T/PO ASG-T/S |           |                                       | ASG-T/FL                        |           |      | <u> </u>  |     |  |
|              |                                 | SG Feedwater                               | C-L52                                    | Turbine Driven ASG Pump<br>Motor Driven ASG Pumps   | ASG/ASGI/SG<br>ASG/ASGm/SG     | ASG-TNK     |                  |           |                                       |                                 | ASG-SG/FL | SGs  |           |     |  |
|              |                                 | 30 Feedwater                               | C-L53                                    |   |                                | CEX-TNK     | ASG-MPO          |           |                                       |                                 |           | 305  |           |     |  |
|              |                                 |  | G-L54                                    | ARE Main Feed                                       | CEXAPA/SG-                     | GEX-INK     | CEX-PO-          | ABP-HX*   | APA-PO-                               | AHP-HX*                         | ARE-SG/FL |      | <u> </u>  |     |  |
|              | C5. Core Cooling                |  | C-L55                                    | SER Make-up to ASG<br>SER gravity Make-up to        | SER/ASG                        | SER         | -TNK             | SER-PO    | SER-ASG                               |                                 |           |      |           |     |  |
|              |                                 |  | C-L56                                    | ASG   | SER/ASG (gravity)              |             | -TNK             | SER-BV    |                                       | ASG-TNK                         |           |      |           |     |  |
|              |                                 | SG Long term<br>Feedwater Supply           | C-L57<br>C-L58                           | JPP Make-up to ASG                                  | JPP/JPD/ASG<br>SEP/JPS/JPD/ASG | JPP.        | - TNK            | JPP-PO    | JPD-ASG                               |                                 |           |      |           |     |  |
|              |                                 |  | C-L58<br>C-L59                           | SEP Make-up to JPP                                  | SEP/JPS/JPD/ASG                | SEP-TNK     | SEP-JPP/S        | JPS-PO    | JFD-ASG                               |                                 | ]         |      |           |     |  |
|              |                                 |  | C-L59<br>C-L67                           | 4th SG Injection                                    | SEP/JPP<br>SEP/ASGx/SG         | SEP-TNK     | ASG-4PO          | JI P-TINK | J                                     |                                 |           |      |           |     |  |
|              |                                 | RRA Core Cooling                           | C-L67                                    | Ath SG Injection                                    | RCP/RRA/RCP                    | RCP*        | RRA-SL           | RRA-PO    | RRA-Hx                                | RRA-DL                          | RRA-SV    | RCP* |           |     |  |
| -            |                                 | (SD)<br>Containment Isolation              | B-1                                      | Containment Building                                | Nor Minister                   | B-CNT       | TRAVOL           | NO OF O   | T T T T T T T T T T T T T T T T T T T | RIGHDE                          | 110400    | KOP  |           |     |  |
|              |                                 |  | 5-1                                      | *See C4. Primary Sys                                | tem Makeun                     | D-ONT       |                  |           |                                       |                                 |           |      |           |     |  |
|              |                                 | Direct Core Injection                      | C-L61                                    | Containment Spray - EAS                             | PTR/EAS/CNT                    | PTR-TNK     | PTR-EAS          | FAS       | S-PO                                  |                                 |           |      |           |     |  |
|              |                                 |  | C-L61                                    | Direct Injection<br>Containment Spray - EAS         | SMP/EAS/CNT                    | CNT-SMP     | SMP-EAS          | EAS-PO    | EAS-Hx                                |                                 |           |      |           |     |  |
|              |                                 | Containment                                | C-L62                                    | Recirculation<br>Containment Spray -JPP             | JPP/EAS/CNT                    | JPP-TNK     | JPP-PO           | JPP-JPC   | JPC-EAS                               | EAS-SPR                         | CONT      |      |           |     |  |
|              | C6. Containment                 | Pressure Control                           | C-L63                                    | Emergency Back-up<br>EAS Emergency Backup           | SEP/EAS/CNT                    | SEP-TNK     | SEP-EAS          |           | E-PO                                  |                                 |           |      |           |     |  |
|              | Integrity                       |  | C-L68                                    | Containment Venting                                 | JEF/EA3X/UNI                   | SEP-INK     | SEP-EAS          | PE        |                                       |                                 |           |      |           |     |  |
|              |                                 | Hydrogen Bodustics                         |  |   |                                | PARs        | 1                |           |                                       |                                 |           |      |           |     |  |
|              |                                 | Hydrogen Reduction                         |  | Hydrogen PARS                                       | ETY (PARS)<br>ASG/ASGI/SG      | PARS        | ASC TIDO         | ASC TOO   | 480                                   | -T/FL                           |           |      | 1         |     |  |
|              |                                 | SG Creep Rupture<br>Prevention             | C-L52                                    | Turbine Driven ASG Pump                             |                                | ASG-TNK     |                  |           |                                       | G-TNK ASG-T/PO ASG-T/SS ASG-MPO |           |      | ASG-SG/FL | SGs |  |
|              |                                 | Basemat Melt-thro                          | C-L53                                    | Motor Driven ASG Pumps                              | ASG/ASGm/SG                    |             | ASG              | WPU       | ASG                                   | -WFL                            |           |      |           |     |  |
|              |                                 | Prevention                                 | C-L66                                    | Reactor Pit Flooding                                |                                |             |                  |           |                                       |                                 |           |      |           |     |  |

### Table 6:

| Functional requirements diagram for a design basis earthquake (0.3 g)                       |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|                 | <b>Required Function</b>            |                                       |          | SSCs that provide Functional Requirement           |                            |                      |           |          |             |          |            |        |  |  |  |
|-----------------|-------------------------------------|---------------------------------------|----------|--|----------------------------|----------------------|-----------|----------|-------------|----------|------------|--------|--|--|--|
|                 | Functional                          | Sub-Function                          | Met      | thods to fulfil Funct                              |                            |                      |           |          |             | -ssc     |            |        |  |  |  |
|                 | Requirement                         | Core Exit                             |          | Core Exit Temperature                              | ional Req. (3303)          |                      |           |          | Sub         |          |            | _      |  |  |  |
|                 |                                     | Temperature                           | C-I1     | Indication<br>Pressuriser Level                    |                            | RICxxxMT             |           |          |             | [LNi]    |            |        |  |  |  |
|                 |                                     | RCP Level                             | C-12     | Indication   |                            | RCPxxxMN             |           |          |             | [LNi]    |            |        |  |  |  |
|                 |                                     | Reactor Level<br>Indication           | C-124    | RVLIS  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 |                                     | RCP pressure                          | C-13     | RCP Pressure Indication                            |                            | RCPxxxMP             |           |          |             | [LNi]    |            |        |  |  |  |
|                 |                                     | RRA Pressure                          | C-15     | RRA Pressure Indication                            |                            | RRAxxxMP             |           |          |             | [LNi]    |            |        |  |  |  |
| Ð               |                                     | SG Level                              | C-16     | SG WR Level Indication                             |                            | ARExxxMN             |           |          |             | [LNi]    |            |        |  |  |  |
| Cor             |                                     | SG Pressure                           | C-17     | SG Pressure Indication                             |                            | VVPxxxMP             |           |          |             | [LNi]    |            |        |  |  |  |
| tor             | C7. Essential                       | ASG Tank Level                        | C-18     | ASG Tank Level Indication                          |                            | ASG002LN             |           |          |             |          |            |        |  |  |  |
| Reactor Core    | Indication                          | Diesel Tank Level                     | C-19     | Diesel Tank Level<br>Indications                   |                            | LHixxxLN             |           |          |             |          |            |        |  |  |  |
| -               |                                     | Containment<br>Pressure               | C-120    | Containment WR Pressure<br>Indication              |                            | ETYxxxMP             |           |          |             | [LNi]    |            |        |  |  |  |
|                 |                                     | Containment<br>Radiation              | C-21     | Containment Radiation<br>Levels                    |                            | KRT022-<br>23MA      |           |          |             | KRT001AR | [LBA]      |        |  |  |  |
|                 |                                     | Containment Sump<br>Level             | C-122    | Containment Sump Level                             |                            | RISxxxSL<br>EASxxxSL |           |          |             | [LCA/B]  |            |        |  |  |  |
|                 |                                     | BaseMat<br>Thermocouples              | C-123    | Basemat Thermo-couples                             |                            | KSBxxxMT             |           |          |             |          |            |        |  |  |  |
|                 |                                     | Containment Sump<br>Temperature       | C-I51    |  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 |                                     | Containment<br>Hydrogen Sampling      | C-152    |  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 |                                     | Reactor Pit                           | C-153    |  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 |                                     | Temperature<br>SFP Pool               | S-S1     | SFP Pool Integrity                                 | SFP                        | SFP-PL               | B-SFP     |          |             |          |            |        |  |  |  |
|                 | S1. SFP Integrity                   | PTR 1/2 PO                            | S-S1     | PTR Normal SFP Cooling                             | SFP\PTR\SFP                |                      | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN   |        |  |  |  |
|                 |                                     | PTR 6 PO                              | S-S2     | Integrity<br>PTR 3rd Train Integrity               | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN  | SFP-PL |  |  |  |
| _               |                                     | PTR 1/2 PO                            | S-L1     | PTR Normal Cooling                                 | SFP\PTR\SFP                |                      | PTR-SL    | PTR-PO   | PTR-HX      |          | R-DL       |        |  |  |  |
|                 | S2. SFP Cooling                     | PTR 6 PO                              | S-L2     | PTR 3rd Train Cooling                              | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO  | PTR3-HX     |          | 3-DL       | SFP-PL |  |  |  |
|                 |                                     | SFP Steam Release                     | S-L3     | Open Vent Doors                                    |                            | SFP-VD               |           |          |             |          |            |        |  |  |  |
|                 | S3. Bulk Boiling                    |                                       | S-L4     | SED Make-up  | SED/SFP                    |                      |           | -PO      | SED-SFP     |          | 1          |        |  |  |  |
| Poo             |                                     | B. Bulk Boiling SFP Emergency Make-up | S-L5     | JPP Make-up  | JPP/JPD/SFP                | JPP-TNK              | JPP       |          | 020 011     |          |            |        |  |  |  |
| nel             |                                     |                                       | S-L6     | JPS Make-up  | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPD-SFP     | SFP-PL   |            |        |  |  |  |
| Spent Fuel Pool |                                     |                                       | S-L7     | SEP Make-up  | SEP/SFPx                   | SEP-TNK              | SEP/SFPx  | PEE      | -PO         |          |            |        |  |  |  |
| Spe             |                                     | SFP Level                             | S-I1     | SFP Level Indication                               | SENSITX                    | PTRxxxMN             | GENOITX   |          |             | [LNi]    | [SAR-ACC]  |        |  |  |  |
|                 |                                     | SFP Temperature                       | S-12     | SFP Temperature                                    |                            | PTRxxxMT             |           |          |             | [LNi]    | [c/at/ico] |        |  |  |  |
|                 |                                     | Fuel Rack                             | S-13     | Indication   |                            | TTTCCC               |           |          |             | [LIN]    |            |        |  |  |  |
|                 | S4. Indication                      | Temperature<br>SFP Boron              |          |  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 | 34. Indication                      | Concentration<br>SFP Building         | S-14     |  |                            | -                    |           |          |             |          |            |        |  |  |  |
|                 |                                     | Pressure<br>SFP Hydrogen              | S-15     |  |                            | -                    |           |          |             |          |            |        |  |  |  |
|                 |                                     | Concentration<br>SFP Building         | S-16     |  |                            |                      |           |          |             |          |            |        |  |  |  |
|                 |                                     | Humidity                              | S-17     | JPP Make-up to Seismic                             |                            |                      | 75.02     |          |             |          |            |        |  |  |  |
| L.              | M 0-1                               | Flooding of Seismic                   | V-L01    | Vault<br>JPS Make-up to Seismic                    | JPP/JPD/VLT                | JPP                  | -TNK      | JPP-PO   | JPP-JPD     | JPD-VLT  |            |        |  |  |  |
| Seismic Vault   | V1. Seismic Vault                   | Vault                                 | V-L02    | Vault<br>SEP Gravity Feed to                       | SEP/JPS/JPD/VLT            | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPS-JPD     |          | VLT        |        |  |  |  |
| lic /           |                                     | Seismic Vault                         | V-L03    | Seismic Vault                                      | SEP/JPD/VLT                |                      |           | SEP      | -VLT        |          |            |        |  |  |  |
| eisn            |                                     | Temperature<br>Seismic Vault Water    | VI-1     |  |                            |                      |           |          |             |          |            |        |  |  |  |
| S               | V.2 Indication                      | Level<br>Seismic Vault                | VI-2     |  |                            | -                    |           |          |             |          |            |        |  |  |  |
|                 |                                     | Pressure<br>Cask Remain Leak          | VI-3     |  |                            |                      |           |          |             |          |            |        |  |  |  |
| Dry<br>Casks    | D1. Cask Integrity                  | Tight<br>Cask Air cooling             | D-S1     | Cask integrity                                     | CASK                       | CASK*                |           |          |             |          |            |        |  |  |  |
| - U             | D2. Cask Cooling<br>B1. Containment | maintained                            | D-L1     | Cask Cooling                                       | Cask building and Air Flow | B-LLW                | CASK-AIR  |          | Dente       |          |            |        |  |  |  |
|                 | B1. Containment<br>B2. NAB          |                                       | B1<br>B2 | Containment Building<br>Nuclear Auxiliary Building |                            | B-CNT<br>B-NAB       | Building  | Hatch    | Penetration | Airlocks |            |        |  |  |  |
|                 | B3. Electrical Buildin              | g                                     | B3       | Electrical Building                                |                            | B-ELE                |           |          |             |          |            |        |  |  |  |
| sõi             | B4. Diesel buildings                |                                       | B4       | Unit Diesel Building                               |                            | B-DSL                |           |          |             |          |            |        |  |  |  |
| Buildings       | B5. SBO Diesel Build                | ing                                   | B5       | SBO Diesel Building                                |                            | B-SBO                |           |          |             |          |            |        |  |  |  |
| Bu              | B6. SEC pump-house                  | •                                     | B6       | SEC Pumphouse Building                             |                            | B-SEC                |           |          |             |          |            |        |  |  |  |
|                 | B7. Turbine Hall                    |                                       | B7       | Turbine Hall                                       |                            | B-TUR                |           |          |             |          |            |        |  |  |  |
|                 | B8. LLW Building                    |                                       | B8       | Low Level Waste Building                           |                            | B-LLW                |           |          |             |          |            |        |  |  |  |
| L               | B9. ECC                             |                                       | B9       | Emergency Control Centre                           |                            | B-ECC                |           |          |             |          |            |        |  |  |  |

### Table 6:

| Functional requirements diagram for a design basis earthquake (0.3 g)                       |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|                   | Required F                       | Function                            |      |  | SSCs th          | at provide | Functio   | nal Requ   | irement   |          |         |       |       |
|-------------------|----------------------------------|-------------------------------------|------|--|------------------|------------|-----------|------------|-----------|----------|---------|-------|-------|
|                   | Functional<br>Requirement        | Sub-Function                        | Met  | thods to fulfil Functi                             | onal Req. (SSCs) |            |           |            | -SSC      |          |         |       |       |
|                   |                                  |                                     | E-1  | 400 KV LHA Supply                                  | 400KV/LHA        | 400KV      | GEN-TRX   | UNT-TRX    | LGA-SWB   | LGB-SWB  |         |       |       |
|                   |                                  |                                     | E-2  | 132 KV LHA Supply                                  | 132KV/LHA        | 132KV      | STN       | TRX        | LGE/F-SWB | LGB-SWB  |         |       |       |
|                   |                                  | LHA Switchboard<br>Supply           | E-3  | LHP Diesel LHA Supply                              | LHP/LHA          | LHP-DSL    |           | LHP        | -LHA      |          | LHA-SWB | [LCA] | [LBA] |
|                   |                                  | [LHA]                               | E-4  | LHS Diesel LHA Supply                              | LHS/LHA          | LHS-DSL    | LHS       | LHC        | LHC-SWB   | LHC-LHA  |         |       |       |
|                   | E1. Essential 6.6kV              |                                     | E-60 | MBL Diesel LHA Supply                              | MBL-DSL/LHA      | MBL-DSL    |           | MBL-DS     | SL-CON    |          |         |       |       |
|                   | Switchboard Supply               |                                     | E-5  | 400 KV LHB Supply                                  | 400KV/LHB        | 400KV      | GEN-TRX   | UNT-TRX    | LGD-SWB   |          |         |       |       |
|                   |                                  |                                     | E-6  | 132 KV LHB Supply                                  | 132KV/LHB        | 132KV      | STN       | TRX        | LGE/F-SWB | LGC-SWB  |         |       |       |
|                   |                                  | LHB Switchboard<br>Supply           | E-7  | LHQ Diesel LHB Supply                              | LHQ/LHB          | LHQ-DSL    |           | LHQ        | -LHB      |          | LHB-SWB | [LCB] | [LBB] |
|                   |                                  | [LHB]                               | E-8  | LHS Diesel LHB Supply                              | LHS/LHB          | LHS-DSL    | LHS       | LHC        | LHC-SWB   | LHC-LHB  |         |       |       |
|                   |                                  |                                     | E-61 | MBL Diesel LHB Supply                              | MBL-DSL/LHB      | MBL-DSL    |           | MBL-DS     | SL-CON    |          |         |       |       |
|                   | E2. SBO Diesel<br>Supply         | LLY SBO Diesel<br>Supply<br>[LLY]   | E-10 | LLY Switchboard Supply                             | LLS\LLX\LLY      | LLS-DSL    | LLX-SWB   | LLX-LLY    | LLY-SWB   |          |         |       |       |
|                   |                                  |                                     | E-21 | LCA Switchboard - LHA                              | LCA\LLi\LHA      | [LHA]      |           | LLA\E-SWB  |           |          |         |       |       |
|                   |                                  | LCA 48V Switchboard<br>Supply [LCA] | E-22 | LCA Switchboard - LLS                              | LCAILLY          | [LLY]      |           |            | LCA-RD    | LCA-SWB  |         |       |       |
|                   | E3. 48 V Essential               |                                     | E-23 | LCA Switchboard - Battery                          | LCA\BAT          | LCA-BAT    |           |            |           |          |         |       |       |
|                   | Switchboard Supply               | LCB 48V                             | E-24 | LCB Switchboard - LHB                              | LCB/LLI/LHB      | [LHB]      |           | LLB\D-SWB  |           |          |         |       |       |
| E                 |                                  | Switchboard Supply                  | E-25 | LCB Switchboard - LLS                              | LCB\LLY          | [LLY]      |           |            | LCB-RD    | LCB-SWB  |         |       |       |
| yste              |                                  | [LCB]                               | E-26 | LCB Switchboard - Battery                          | LCB\BAT          | LCB-BAT    | r 👘       |            |           |          |         |       |       |
| Ś                 |                                  | 104.40514                           | E-31 | LBA Switchboard - LHA                              | LBA\LLi\LHA      | [LHA]      |           | LLC\E-SWB  |           |          |         |       |       |
| odo               |                                  | LBA 125V<br>Switchboard Supply      | E-32 | LBA Switchboard - LLS                              | LBAILLY          | [LLY]      |           |            | LBA-RD    | LBA-SWB  |         |       |       |
| Support System    | E4. 125 V Essential              | [LBA]                               | E-33 | LBA Switchboard - Battery                          | LBA\BAT          | LBA-BAT    | •         |            |           |          |         |       |       |
| cal               | Switchboard Supply               | LBB 125V                            | E-34 | LBB Switchboard - LHA                              | LBB/LLI/LHB      | [LHB]      | LLB\D-SWB |            | LBB-RD    |          |         |       |       |
| Electrical        |                                  | Switchboard Supply<br>[LBB]         | E-35 | LBB Switchboard - LLS                              | LBB\LLY          | [LLY]      |           |            | LBB-RD    | LBB-SWB  |         |       |       |
| Ele               |                                  | [LBB]                               | E-36 | LBB Switchboard - Battery                          | LBB\BAT          | LBB-BA     | r         |            |           |          |         |       |       |
|                   |                                  |                                     | E-41 | SIP I Dirty Supply from LHA                        | LNA/LLC/LHA      | [LHA]      | LLC-SWB   | LNA        | RD        |          |         |       |       |
|                   |                                  | LNA 220V Essential<br>Switchboards  | E-42 | SIP I Clean Supply from<br>LHA                     | LNA/LBC/LLA/LHA  |            | LLA-SWB   | LBC-RD     |           | LNA-SWB  |         |       |       |
|                   |                                  | [LNA]                               | E-43 | SIP I Supply from LSS                              | LNA/LBC/LLY      | [LLY]      |           |            | LBC-SWB   |          |         |       |       |
|                   |                                  |                                     | E-44 | SIP I Battery Supply                               | LNA/LBC/BAT      |            | r         |            |           |          |         |       |       |
|                   |                                  |                                     | E-45 | SIP II Dirty Supply from<br>LHB                    | LNB/LLD/LHB      | [LHB]      | LLD-SWB   | LNB        | I-RD      |          |         |       |       |
|                   |                                  | LNB 220V Essential<br>Switchboards  | E-46 | SIP II Clean Supply from<br>LHB                    | LNB/LBD/LLB/LHB  |            | LLB-SWB   | LBD-RD     |           | LNB-SWB  |         |       |       |
|                   |                                  | [LNB]                               | E-47 | SIP II Supply from LSS                             | LNB/LBD/LLY      | [LLY]      |           |            | LBD-SWB   |          |         |       |       |
|                   | E5. Essential<br>Instrumentation |                                     | E-48 | SIP II Battery Supply                              | LNB/LBD/BAT      | LBD-BAT    |           |            |           |          |         |       |       |
|                   | Switchboard Supply               |                                     | E-49 | SIP III Dirty Supply from<br>LHA                   | LNC/LLC/LHA      | [LHA]      | LLC-SWB   | LNC        | -RD       |          |         |       |       |
|                   |                                  | LNC 220V Essential<br>Switchboards  | E-50 | SIP III Clean Supply from<br>LHA                   | LNC/LBE/LLA/LHA  |            | LLA-SWB   | LBE-RD     |           | LNC-SWB  |         |       |       |
|                   |                                  | [LNC]                               | E-51 | SIP III Supply from LSS                            | LNC/LBE/LLY      | [LLY]      |           |            | LBE-SWB   |          |         |       |       |
|                   |                                  |                                     | E-52 | SIP III Battery Supply<br>SIP IV Dirty Supply from | LNC/LBE/BAT      | LBE-BAT    |           |            |           |          |         |       |       |
|                   |                                  |                                     | E-53 | LHB<br>SIP IV Clean Supply from                    | LND/LLD/LHB      | [LHB]      | LLD-SWB   | LND        | I-RD      | -        |         |       |       |
|                   |                                  | LND 220V Essential<br>Switchboards  | E-54 | LHB  | LND/LBF/LLB/LHB  |            | LLB-SWB   | LBF-RD     |           | LND-SWB  |         |       |       |
|                   |                                  | [LND]                               | E-55 | SIP IV Supply from LSS                             | LND/LBF/LLY      | [LLY]      |           |            | LBF-SWB   |          |         |       |       |
|                   |                                  |                                     | E-56 | SIP IV Battery Supply                              | LND/LBF/BAT      | LBF-BAT    |           | 050 4 00   | SEC-A-PO  |          |         |       |       |
| ¥                 | U1. Essential                    | SEC Train A Cooling                 | U-1  | SEC Train A Cooling                                | SEA/SEC-A/SEA    | [Sea]      | SEC-A-RS  | SEC-A-DS   |           | RRI-A-HX | [Sea]   |       |       |
| Ultimate Heatsink | Cooling                          | SEC Train B Cooling                 | U-2  | SEC Train B Cooling                                | SEA/SEC-B/SEA    |            | SEC-B-RS  | SEC-B-DS   | SEC-B-PO  | ккі-в-нх |         |       |       |
| Hea               |                                  | Alternative Heatsink                | U-3  | Alternative Heatsink                               |                  |            |           |            |           |          |         |       |       |
| ate               |                                  | RRI Train A Cooling                 | U-11 | RRI Train A Cooling                                | SEC/RRI-A/HXA    | HX-A       | RRI-A-PO  | [RRI-A-HX] |           |          |         |       |       |
| ti                | U2. Component<br>Cooling         | RRI Train B Cooling                 | U-12 | RRI Train B Cooling<br>RRI Commons cooling         | SEC/RRI-B/HXA    | HX-B       | RRI-B-PO  | [RRI-B-HX] |           |          |         |       |       |
| 5                 |                                  | RRI Commons<br>Cooling              | U-13 | (Train A)<br>RRI Commons cooling                   | SEC/RRI-A/HXC    | нх-сом     | RRI-A-PO  | [RRI-A-HX] |           |          |         |       |       |
|                   |                                  |                                     | U-14 | (Train B)  | SEC/RRI-B/HXC    |            | RRI-B-PO  | [RRI-B-HX] |           |          |         |       |       |

Tsunami event results in damage

Seismic event results in damage



Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

| Table 7:   |
|--|
| Functional requirements diagram for a beyond-design-basis earthquake (0.4 g) |
| inducing a tsunami wave up to the 0 m terrace level (no modifications)       |

|              | Required I                    | Function                             |                  |   | SSCs th                     | atı     | orovide  | Functio                | nal Requ       | irement             |          |                   |            |     |  |  |
|--------------|-------------------------------|--------------------------------------|------------------|---|-----------------------------|---------|----------|------------------------|----------------|---------------------|----------|-------------------|------------|-----|--|--|
|              | Functional<br>Requirement     | Sub-Function                         | Met              | hods to fulfil Funct                        | ional Req. (SSCs)           |         |          |                        |                | Sub-                | -SSC     |                   |            |     |  |  |
|              |                               | Control Rods                         | C-S1             | Control Rod                                 | CRDMs                       | 1       | FL-ASS   | CNTL-ROD               | CRDM           |                     |          |                   |            |     |  |  |
|              |                               |                                      | C-L42            | REA Boration (direct or normal)             | REA/RCV/RCP                 | R       | AB-TNK   | REA/B-PO               | REA            | RCV                 |          |                   |            |     |  |  |
|              |                               |                                      | C-L44            | Normal charging from PTR tank               | PTR/RCV/RCP                 |         |          |                        | PTR-RCV        |                     | RCV-PO   | RCV-CL            |            |     |  |  |
|              | C1. Sub-Criticality           | Boron Injection                      | C-L34            | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | P       | TR-TNK   |                        |                |                     |          |                   | RCP        |     |  |  |
|              |                               |                                      | C-L33            | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |         |          |                        | PTR-ESS        |                     | ESS-PO   | ESS-SI            |            |     |  |  |
|              |                               |                                      | C-L11            | Accumulators                                | ACC/RCP                     |         | ACC      |                        |                | ACC-RCP             |          |                   |            |     |  |  |
|              |                               | RCP System                           | C-121            | RCP Integrity                               | RCP*                        |         | RCP*     | RCP<br>Pumps*          | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |            |     |  |  |
|              | C2. Primary System            | SG                                   | C-122            | SG Integrity                                | SG*                         |         | SGs*     |                        |                |                     |          |                   |            |     |  |  |
|              | Integrity                     | RRA System Integrity<br>(SD)         | C-123            | RRA Integrity                               | RCP*/RRA*/RCP*              |         | RCP*     | RRA-SL*                | RRA-PO*        | RRA-Hx*             | RRA-DL*  | RRA-SV*           |            |     |  |  |
|              |                               | RRA System Isolation<br>(SD)         | C-124            | RRA Isolation                               | RCP*                        |         | RCP*     | RRA-SL                 | RRA-DL         |                     |          |                   |            |     |  |  |
|              |                               |                                      | C-L31            | Normal Seal Injection                       | REA/RCV/RCP                 | R       | EA/B-TNK | REA/B-PO               | REA            | RCV                 |          |                   |            |     |  |  |
|              | C3. RCP Seal<br>injection     | Normal Seal Injection                | C-L32            | PTR Seal Injection                          | PTR/RCV/RCP                 |         |          |                        | PTR-RCV        |                     | RCV-PO   | RCV-SI            | RCP        |     |  |  |
|              |                               | Emergency Seal                       | C-L33            | Emergency Seal Injection                    | ESS/RCP                     | P       | TR-TNK   |                        | PTR-ESS        |                     | ESS-PO   | ESS-SI            |            |     |  |  |
|              |                               |                                      | C-L42            | REA Boration (direct or<br>normal)          | REA/RCV/RCP                 | R       | A/B-TNK  | REA/B-PO               |                |                     |          |                   |            |     |  |  |
|              |                               | RCV Normal charging                  | C-L43            | Normal charging from REA<br>water system    | REA/RCV/RCP                 | RE      | AW-TNK   | REAW-PO                | REA-RCV        |                     | RCV-PO   |                   |            |     |  |  |
|              |                               |                                      | C-L44            | Normal Charging from<br>PTR                 | PTR/RCV/RCP                 | Î       |          |                        | PTR-RCV        |                     |          | RCV-CL            |            |     |  |  |
|              |                               | ESS Charging<br>Injection (Low Flow) | C-L34            | Charging using ESS<br>(6m3/hr)              | ESS/ESS-CL/RCP              |         |          |                        |                |                     |          |                   |            |     |  |  |
|              | C4. Primary System<br>Make-up | ESS Seal injection<br>(Low Flow)     | C-L33            | Emergency Seal Injection<br>(6m3/hr)        | ESS/ESS-SI/RCP              | P       | TR-TNK   |                        | PTR-ESS        |                     | ESS-PO   | ESS-SI            |            |     |  |  |
|              |                               | HHSI - Direct Inj.                   | C-L45            | HHSI Direct Injection                       | PTR/RCV/BIT/RCP             |         |          |                        | PTR-RCV        |                     | RCV-PO   | RCV-HSI           | RCP        |     |  |  |
|              |                               | LHSI - Direct Inj.                   | C-L46            | LHSI Direct Injection                       | PTR/RIS/RCP                 |         |          |                        | PTR-RIS        |                     |          |                   |            |     |  |  |
|              |                               | LHSI - Recirculation                 | C-L47            | LHSI Recirculation                          | SMP/RIS/RCP                 | T       | CNT-SMP  |                        | SMP-RIS        |                     | RIS-PO   |                   |            |     |  |  |
| Core         |                               | EAS Back-up to RIS                   | C-L48            | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP | С       |          | SMP-EAS                | EAS-PO         | EAS-RIS             | RIS-PO*  | RIS-LSI           |            |     |  |  |
| tor          |                               | EAS 004 Back-up to<br>RIS            | C-L49            | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP |         |          | SMP-EAS                | EAS-PO*        | EAS-4PO             | RIS-PO*  |                   |            |     |  |  |
| Reactor Core |                               | PTR Gravity Feed<br>(SD - Head Off)  | C-L61            | PTR Gravity Feed                            | PTR/RIS*/RCP                | P       | TR-TNK   |                        | PTR-RIS        |                     | RIS-PO*  | RIS-LSI           | RCP        |     |  |  |
|              |                               | SG Steam Dump                        | C-L50            | GCTa Steam Dump                             | SG/VVP/GCTa                 | 505     |          | WP-GCT                 | GCTa-STM       |                     |          |                   |            |     |  |  |
|              |                               | SG Steam Dump                        | C-L51            | GCTc Steam Dump                             | SGAA/P/GCTc-                |         | SGs      | GCTC                   |                | CEX-TNK             | CEX-PO-  |                   |            |     |  |  |
|              |                               |                                      | C-L52            | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 | ۵       | SG-TNK   | ASG-T/PO               | ASG-T/SS ASG   |                     | -T/FL    | ASG-SG/FL         |            |     |  |  |
|              |                               | SG Feedwater                         | C-L53            | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | ſ       | 50-114K  | ASG-MPO                |                | ASG-MFL             |          | 7.50-00ii E       | SGs        |     |  |  |
|              |                               |                                      | <del>C-L54</del> | ARE Main Feed                               | CEX/APA/SG                  | e       | EX-TNK   | CEX-PO                 | ABP-HX*        | APA-PO              | AHP-HX*- | ARE-SG/FL         |            |     |  |  |
|              | C5. Core Cooling              |                                      | C-L55            | SER Make-up to ASG                          | SER/ASG                     |         | SED      | -TNK                   | SER-PO         | SER-ASG             |          |                   |            |     |  |  |
|              |                               |                                      | C-L56            | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)           |         | OLIV     | - 11 41 X              | SER-BV         | OLIVADO             | ASG-TNK  |                   |            |     |  |  |
|              |                               | SG Long term<br>Feedwater Supply     | C-L57            | JPP Make-up to ASG                          | JPP/JPD/ASG                 |         | JPP      | TNK                    | JPP-PO         | JPD-ASG             | ADO-MIK  |                   |            |     |  |  |
|              |                               |                                      | C-L58            | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             |         | EP-TNK   | SEP-JPP/S              | JPS-PO         | JPD-ASG             |          |                   |            |     |  |  |
|              |                               |                                      | C-L59            | SEP Make-up to JPP                          | SEP/JPP                     | 0       | EP-TINK  | SEP-JPP/S              | JPP-TNK        |                     |          |                   |            |     |  |  |
|              |                               | RRA Core Cooling<br>(SD)             | C-L60            | RRA Cooling                                 | RCP/RRA/RCP                 |         | RCP*     | RRA-SL                 | RRA-PO         | RRA-Hx              | RRA-DL   | RRA-SV            | RCP*       |     |  |  |
|              |                               | Containment Isolation                | B-1              | Containment Building                        |                             |         | B-CNT    |                        |                |                     |          |                   |            |     |  |  |
|              |                               | Direct Core Injection                |                  | *See C4. Primary Sys                        | stem Make-up                |         |          |                        |                |                     |          |                   |            |     |  |  |
|              |                               |                                      | C-L61            | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                 | P       | TR-TNK   | PTR-EAS                | EAS            | -PO                 |          |                   |            |     |  |  |
|              |                               | Containment                          | C-L62            | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                 | C       | NT-SMP   | SMP-EAS                | EAS-PO         | EAS-Hx              | EAS-SPR  | CONT              |            |     |  |  |
|              | C6. Containment               | Pressure Control                     | C-L63            | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                 | J       | PP-TNK   | JPP-PO JPP-JPC JPC-EAS |                |                     |          |                   |            |     |  |  |
|              | Integrity                     |                                      | C-L64            | Containment Venting                         |                             |         |          |                        |                |                     |          |                   |            |     |  |  |
|              |                               | Hydrogen Reduction                   | C-L65            | Hydrogen PARS                               | ETY (PARS)                  |         | PARs     |                        |                |                     |          |                   |            |     |  |  |
|              |                               | SG Creep Rupture                     | C-L52            | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 |         | SGITNK   | ASG-T/PO               | ASG-T/SS       | ASG                 | -T/FL    | ASG-SG/FL         | SGs        |     |  |  |
|              |                               | SG Creep Rupture<br>Prevention       | C-L53            | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | ASG-TNK |          |                        | ASG-           | WPO                 | ASG-     | WFL               | , Southern | 503 |  |  |
|              |                               | Basemat Melt-thro<br>Prevention      | C-L66            | Reactor Pit Flooding                        |                             |         |          |                        |                |                     |          |                   | - <b>I</b> |     |  |  |

### Table 7:

| Functional requirements diagram for a beyond-design-basis earthquake (0.4 g) |  |
|--|--|
| inducing a tsunami wave up to the 0 m terrace level (no modifications)       |  |

|                 | Required I                                   | Function                           |          |   | SSCs tha                   | at provide           | Functio   | nal Requ | irement     |          |           |        |   |
|-----------------|--|------------------------------------|----------|---|----------------------------|----------------------|-----------|----------|-------------|----------|-----------|--------|---|
|                 | Functional<br>Requirement                    | Sub-Function                       | Met      | hods to fulfil Funct                        | ional Req. (SSCs)          |                      |           |          | Sub         | -SSC     |           |        |   |
|                 |  | Core Exit<br>Temperature           | C-11     | Core Exit Temperature<br>Indication         |                            | RICxxxMT             |           |          |             | [LNi]    |           |        |   |
|                 |  | RCP Level                          | C-12     | Pressuriser Level<br>Indication             |                            | RCPxxxMN             |           |          |             | [LNi]    |           |        |   |
|                 |  | Reactor Level                      | C-124    | RVLIS                                       |                            |                      |           |          |             |          |           |        |   |
|                 |  | Indication<br>RCP pressure         | C-13     | RCP Pressure Indication                     |                            | RCPxxxMP             |           |          |             | [LNi]    |           |        |   |
|                 |  |                                    |          |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | RRA Pressure                       | C-15     | RRA Pressure Indication                     |                            | RRAxxxMP             |           |          |             | [LNi]    |           |        |   |
| e               |  | SG Level                           | C-16     | SG WR Level Indication                      |                            | ARExxXMN             |           |          |             | [LNi]    |           |        |   |
| ပိ              |  | SG Pressure                        | C-17     | SG Pressure Indication                      |                            | VVPxxxMP             |           |          |             | [LNi]    |           |        |   |
| Reactor Core    | C7. Essential                                | ASG Tank Level                     | C-18     | ASG Tank Level Indication                   |                            | ASG002LN             |           |          |             |          |           |        |   |
| Rea             | Indication                                   | Diesel Tank Level                  | C-19     | Diesel Tank Level<br>Indications            |                            | LHixxxLN             |           |          |             |          |           |        |   |
|                 |  | Containment<br>Pressure            | C-120    | Containment WR Pressure<br>Indication       |                            | ETYxxxMP             |           |          |             | [LNi]    |           |        |   |
|                 |  | Containment<br>Radiation           | C-21     | Containment Radiation<br>Levels             |                            | KRT022-<br>23MA      |           |          |             | KRT001AR | [LBA]     |        |   |
|                 |  | Containment Sump<br>Level          | C-122    | Containment Sump Level                      |                            | RISxxxSL<br>EASxxxSL |           |          |             | [LCA/B]  |           |        |   |
|                 |  | BaseMat<br>Thermocouples           | C-123    | Basemat Thermo-couples                      |                            | KSBxxxMT             |           |          |             |          |           |        |   |
|                 |  | Containment Sump<br>Temperature    | C-151    |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Containment                        | C-152    |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Hydrogen Sampling<br>Reactor Pit   | C-153    |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Temperature<br>SFP Pool            | S-S1     | SFP Pool Integrity                          | SFP                        | SFP-PL               | B-SFP     |          |             |          |           |        |   |
|                 | S1. SFP Integrity                            |                                    |          | PTR Normal SFP Cooling                      | SFP\PTR\SFP                | OIT-IL               |           | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  |        | 1 |
|                 | ST. SPP Integrity                            | PTR 1/2 PO                         | S-S1     | Integrity                                   |                            | SFP-PL               | PTR-SL    |          |             |          |           | SFP-PL |   |
|                 |  | PTR 6 PO                           | S-S2     | PTR 3rd Train Integrity                     | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |   |
|                 | S2. SFP Cooling                              | PTR 1/2 PO                         | S-L1     | PTR Normal Cooling                          | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO   | PTR-HX      |          | R-DL      | SFP-PL |   |
|                 |  | PTR 6 PO                           | S-L2     | PTR 3rd Train Cooling                       | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTR      | 3-DL      |        |   |
| Spent Fuel Pool |  | SFP Steam Release                  | S-L3     | Open Vent Doors                             |                            | SFP-VD               |           | _        |             | •        | -         |        |   |
|                 | S3. Bulk Boiling                             |                                    | S-L4     | SED Make-up                                 | SED/SFP                    | SED-TNK              | SED       | )-PO     | SED-SFP     |          |           |        |   |
|                 | S3. Bulk Boiling                             | SFP Emergency<br>Make-up           | S-L5     | JPP Make-up                                 | JPP/JPD/SFP                | JPP-TNK              | JPF       | P-PO     |             | SFP-PL   |           |        |   |
| it Fi           |  |                                    | S-L6     | JPS Make-up                                 | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPD-SFP     |          |           |        |   |
| Spent Fuel Poc  |  | SFP Level                          | S-I1     | SFP Level Indication                        |                            | PTRxxxMN             |           |          |             | [LNi]    | [SAR-ACC] |        |   |
|                 |  | SFP Temperature                    | S-12     | SFP Temperature<br>Indication               |                            | PTRxxxMT             |           |          |             | [LNi]    |           |        |   |
|                 |  | Fuel Rack<br>Temperature           | S-13     |   |                            |                      |           |          |             |          | <u>.</u>  |        |   |
|                 | S4. Indication                               | SFP Boron<br>Concentration         | S-14     |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | SFP Building                       | S-15     |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Pressure<br>SFP Hydrogen           | S-16     |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Concentration<br>SFP Building      | S-17     |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Humidity                           |          | JPP Make-up to Seismic                      |                            |                      | 75.07     |          |             |          |           |        |   |
| <b>4</b>        | VA Selected in                               | Flooding of Seismic                | V-L01    | Vault<br>JPS Make-up to Seismic             | JPP/JPD/VLT                | JPP                  |           | JPP-PO   | JPP-JPD     | JPD-VLT  |           |        |   |
| /aul            | V1. Seismic Vault                            | Vault                              | V-L02    | Vault<br>SEP Gravity Feed to                | SEP/JPS/JPD/VLT            | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPS-JPD     |          | VLT       |        |   |
| Seismic Vault   |  | Seismic Vault                      | V-L03    | Seismic Vault                               | SEP/JPD/VLT                |                      |           | SEP      | -VLT        |          |           |        |   |
| eisn            |  | Temperature<br>Seismic Vault Water | VI-1     |   |                            |                      |           |          |             |          |           |        |   |
| Ň               | V.2 Indication                               | Level                              | VI-2     |   |                            |                      |           |          |             |          |           |        |   |
|                 |  | Seismic Vault<br>Pressure          | VI-3     |   |                            |                      |           |          |             |          |           |        |   |
| Dry<br>Casks    | D1. Cask Integrity                           | Cask Remain Leak<br>Tight          | D-S1     | Cask integrity                              | CASK                       | CASK*                |           |          |             |          |           |        |   |
| Са              | D2. Cask Cooling                             | Cask Air cooling<br>maintained     | D-L1     | Cask Cooling                                | Cask building and Air Flow | B-LLW                | CASK-AIR  |          |             |          |           |        |   |
|                 | B1. Containment                              |                                    | B1       | Containment Building                        |                            | B-CNT                | Building  | Hatch    | Penetration | Airlocks |           |        |   |
|                 | B2. NAB                                      |                                    | B2       | Nuclear Auxiliary Building                  |                            | B-NAB                |           |          |             |          |           |        |   |
| <u>s</u>        | B3. Electrical Building                      | 9                                  | B3       | Electrical Building                         |                            | B-ELE                |           |          |             |          |           |        |   |
| Buildings       | B4. Diesel buildings<br>B5. SBO Diesel Build | ing                                | B4<br>B5 | Unit Diesel Building<br>SBO Diesel Building |                            | B-DSL<br>B-SBO       |           |          |             |          |           |        |   |
| Builc           | B6. SEC pump-house                           |                                    | B5<br>B6 | SEC Pumphouse Building                      |                            | B-SEC                |           |          |             |          |           |        |   |
| ш               | B7. Turbine Hall                             |                                    | B7       | Turbine Hall                                |                            | B-TUR                |           |          |             |          |           |        |   |
|                 | B8. LLW Building                             |                                    | B8       | Low Level Waste Building                    |                            | B-LLW                |           |          |             |          |           |        |   |
|                 | B9. ECC                                      |                                    | В9       | Emergency Control Centre                    |                            | B-ECC                |           |          |             |          |           |        |   |
| L               |  |                                    |          |   |                            |                      |           |          |             |          |           |        |   |

| Table 7:   |
|--|
| Functional requirements diagram for a beyond-design-basis earthquake (0.4 g) |
| inducing a tsunami wave up to the 0 m terrace level (no modifications)       |

|                   | Required F   | unction  |                              |  | SSCs th  | at provid                     | e Functio                                    | nal Requ   | irement                         |          |         |       |       |
|-------------------|--|--|------------------------------|--|--|-------------------------------|--|--|---------------------------------|----------|---------|-------|-------|
|                   | Functional<br>Requirement                              | Sub-Function   | Met                          | hods to fulfil Functi  | onal Req. (SSCs)   |                               |  |  | Sub                             | -SSC     |         |       |       |
|                   |  | LHA Switchboard<br>Supply<br>[LHA]                                   | E-1<br>E-2<br>E-3            | 400 KV LHA Supply<br>132 KV LHA Supply<br>LHP Diesel LHA Supply  | 400KV/LHA<br>132KV/LHA<br>LHP/LHA                                | 400KV<br>132KV<br>LHP-DSL     | GEN-TRX                                      | UNT-TRX<br>-TRX<br>LHP                               | LGA-SWB<br>LGE/F-SWB<br>-LHA    | LGB-SWB  | LHA-SWB | [LCA] | [LBA] |
|                   | E1. Essential 6.6kV<br>Switchboard Supply              | LHB Switchboard<br>Supply  | E-4<br>E-5<br>E-6            | LHS Diesel LHA Supply<br>400 KV LHB Supply<br>132 KV LHB Supply  | LHS/LHA<br>400KV/LHB<br>132KV/LHB                                | LHS-DSL<br>400KV<br>132KV     | GEN-TRX                                      | -LHC<br>UNT-TRX<br>-TRX                              | LHC-SWB<br>LGD-SWB<br>LGE/F-SWB | LHC-LHA  | LHB-SWB | [LCB] | [LBB] |
|                   | E2. SBO Diesel<br>Supply                               | LLY SBO Diesel<br>Supply<br>[LLY]                                    | E-7<br>E-8<br>E-10           | LHQ Diesel LHB Supply LHS Diesel LHB Supply LLY Switchboard Supply   | LHQ/LHB<br>LHS/LHB<br>LLS/LLXLLY                                 | LHQ-DSL<br>LHS-DSL<br>LLS-DSL | LHS-<br>LLX-SWB                              |  | -LHB<br>LHC-SWB<br>LLY-SWB      | LHC-LHB  |         |       |       |
|                   | E3. 48 V Essential                                     | LCA 48V Switchboard<br>Supply [LCA]                                  | E-21<br>E-22<br>E-23         | LCA Switchboard - LHA<br>LCA Switchboard - LLS<br>LCA Switchboard - Battery                                      | LCAILLIILHA<br>LCAILLY<br>LCAIBAT                                | [LHA]<br>[LLY]                | r  | LLA\E-SWB  | LCA-RD                          | LCA-SWB  |         |       |       |
| m                 | Switchboard Supply                                     | LCB 48V<br>Switchboard Supply<br>[LCB]                               | E-24<br>E-25<br>E-26         | LCB Switchboard - LHB<br>LCB Switchboard - LLS<br>LCB Switchboard - Battery                                      | LCB\LLI\LHB<br>LCB\LLY<br>LCB\BAT                                | [LHB]<br>[LLY]<br>LCB-BA      | π  | LLB\D-SWB  | LCB-RD                          | LCB-SWB  |         |       |       |
| Support System    | E4. 125 V Essential                                    | LBA 125V<br>Switchboard Supply<br>[LBA]                              | E-31<br>E-32<br>E-33         | LBA Switchboard - LHA<br>LBA Switchboard - LLS<br>LBA Switchboard - Battery                                      | LBAILLILHA<br>LBAILLY<br>LBAIBAT                                 | [LHA]<br>[LLY]                | π  | LLC\E-SWB  | LBA-RD                          | LBA-SWB  |         |       |       |
| Electrical Su     | Switchboard Supply                                     | LBB 125V<br>Switchboard Supply<br>[LBB]                              | E-34<br>E-35<br>E-36         | LBB Switchboard - LHA<br>LBB Switchboard - LLS<br>LBB Switchboard - Battery                                      | LBB\LLI\LHB<br>LBB\LLY<br>LBB\BAT                                | [LHB]<br>[LLY]<br>LBB-BA      | 7  | LLB\D-SWB  | LBB-RD                          | LBB-SWB  |         |       |       |
| Ë                 |  | LNA 220V Essential<br>Switchboards<br>[LNA]                          | E-41<br>E-42<br>E-43<br>E-44 | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA<br>SIP I Supply from LSS<br>SIP I Battery Supply   | LNA/LBC/LLA/LHA<br>LNA/LBC/LLA/LHA<br>LNA/LBC/LLY<br>LNA/LBC/BAT | [LHA]                         | LLC-SWB<br>LLA-SWB                           | LNA<br>LBC-RD  | LBC-SWB                         | LNA-SWB  |         |       |       |
|                   |  | LNB 220V Essential<br>Switchboards<br>[LNB]                          | E-45<br>E-46<br>E-47         | SIP II Dirty Supply from<br>LHB<br>SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS                     | LNB/LLD/LHB<br>LNB/LBD/LLB/LHB<br>LNB/LBD/LLY                    | [LHB]<br>[LLY]                | LLD-SWB<br>LLB-SWB                           | LNE<br>LBD-RD  | LBD-SWB                         | LNB-SWB  |         |       |       |
|                   | E5. Essential<br>Instrumentation<br>Switchboard Supply | LNC 220V Essential<br>Switchboards                                   | E-48<br>E-49<br>E-50         | SIP II Battery Supply<br>SIP III Dirty Supply from<br>LHA<br>SIP III Clean Supply from<br>LHA                    | LNB/LBD/BAT<br>LNC/LLC/LHA<br>LNC/LBE/LLA/LHA                    | LBD-BA                        | LLC-SWB                                      | LNC<br>LBE-RD  |                                 | LNC-SWB  | -       |       |       |
|                   |  | [LNC]  | E-51<br>E-52<br>E-53<br>E-54 | SIP III Supply from LSS<br>SIP III Battery Supply<br>SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from | LNC/LBE/LLY<br>LNC/LBE/BAT<br>LND/LLD/LHB<br>LND/LBF/LLB/LHB     | [LLY]<br>LBE-BA<br>[LHB]      | T<br>LLD-SWB<br>LLB-SWB                      |  | LBE-SWB                         |          |         |       |       |
|                   |  | Switchboards<br>[LND]  | E-54<br>E-55<br>E-56<br>U-1  | LHB<br>SIP IV Supply from LSS<br>SIP IV Battery Supply<br>SEC Train A Cooling                                    | LND/LBF/LLY<br>LND/LBF/BAT<br>SEA/SEC-A/SEA                      | [LLY]                         |  | LBF-RD<br>SEC-A-DS                                   | LBF-SWB                         | LND-SWB  |         |       |       |
| Heatsink          | U1. Essential<br>Cooling                               | SEC Train B Cooling<br>Alternative Heatsink                          | U-2<br>U-3                   | SEC Train B Cooling Alternative Heatsink   | SEA/SEC-B/SEA  | [Sea]                         | SEC-B-RS                                     | SEC-B-DS   | SEC-B-PO                        | RRI-B-HX | [Sea]   |       |       |
| Ultimate Heatsink | U2. Component<br>Cooling                               | RRI Train A Cooling<br>RRI Train B Cooling<br>RRI Commons<br>Cooling | U-11<br>U-12<br>U-13<br>U-14 | RRI Train A Cooling<br>RRI Train B Cooling<br>(Train A)<br>RRI Commons cooling<br>(Train A)<br>(Train B)         | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA<br>SEC/RRI-A/HXC<br>SEC/RRI-B/HXC | HX-A<br>HX-B<br>HX-COM        | RRI-A-PO<br>RRI-B-PO<br>RRI-A-PO<br>RRI-B-PO | [RRI-A-HX]<br>[RRI-B-HX]<br>[RRI-A-HX]<br>[RRI-B-HX] |                                 |          |         |       |       |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |



Note \* indicates integrity not active function

 $\textit{\textit{Note}}\xspace$  [XXX] indicates as system support dependency

 Table 8:

 Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)

 inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented

| I | Required I                | unction                                    |        |   | SSCs th                     | at provide Functional Requirement |          |                  |                  |                     |          |                   |      |   |
|---|---------------------------|--|--------|---|-----------------------------|-----------------------------------|----------|------------------|------------------|---------------------|----------|-------------------|------|---|
| ſ | Functional<br>Requirement | Sub-Function                               | Met    | hods to fulfil Funct                        | ional Req. (SSCs)           |                                   |          |                  |                  | Sub                 | -SSC     |                   |      |   |
|   | Requirement               | Control Rods                               | C-S1   | Control Rod                                 | CRDMs                       |                                   | FL-ASS   | CNTL-ROD         | CRDM             |                     |          |                   |      |   |
|   |                           |  | C-L42  | REA Boration (direct or normal)             | REA/RCV/RCP                 | R                                 | EA/B-TNK | REA/B-PO         | REA              | RCV                 |          |                   |      |   |
|   |                           |  | C-L44  | Normal charging from PTR tank               | PTR/RCV/RCP                 |                                   |          |                  | PTR-RCV          |                     | RCV-PO   | RCV-CL            |      |   |
|   | C1. Sub-Criticality       | Boron Injection                            | C-L34  | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | P                                 | TR-TNK   |                  |                  |                     |          |                   | RCP  |   |
|   |                           |  | C-L33  | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |                                   |          |                  | PTR-ESS          |                     | ESS-PO   | ESS-SI            |      |   |
|   |                           |  | C-L11  | Accumulators                                | ACC/RCP                     |                                   | ACC      |                  |                  | ACC-RCP             |          |                   |      |   |
|   |                           | RCP System                                 | C-121  | RCP Integrity                               | RCP*                        |                                   | RCP*     | RCP<br>Pumps*    | RCP<br>Vessel*   | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |      |   |
|   | C2. Primary System        | SG   | C-122  | SG Integrity                                | SG*                         |                                   | SGs*     | Fullips          | Vessei           | Flessuisei          |          | valves            |      |   |
|   | Integrity                 | RRA System Integrity<br>(SD)               | C-123  | RRA Integrity                               | RCP*/RRA*/RCP*              |                                   | RCP*     | RRA-SL*          | RRA-PO*          | RRA-Hx*             | RRA-DL*  | RRA-SV*           |      |   |
|   |                           | (SD)<br>RRA System Isolation<br>(SD)       | C-124  | RRA Isolation                               | RCP*                        |                                   | RCP*     | RRA-SL           | RRA-DL           |                     |          |                   |      |   |
|   |                           | (65)                                       | C-L31  | Normal Seal Injection                       | REA/RCV/RCP                 | R                                 | A/B-TNK  | REA/B-PO         | REA              | -RCV                |          |                   |      | T |
|   | C2 BCB Seel               | Normal Seal Injection                      | C-L32  | PTR Seal Injection                          | PTR/RCV/RCP                 |                                   |          |                  | PTR-RCV          |                     | RCV-PO   | RCV-SI            | RCP  |   |
|   | C3. RCP Seal<br>injection | Emergency Seal                             | C-L33  | Emergency Seal Injection                    | ESS/RCP                     | P                                 | TR-TNK   |                  | PTR-ESS          |                     | ESS-PO   | ESS-SI            |      |   |
|   |                           | Shutdown Seal                              | C-125  | Emergency Shutdown Seal                     | RCP                         |                                   |          |                  | SD               | -Seal               |          |                   |      |   |
|   |                           |  | C-L42  | REA Boration (direct or normal)             | REA/RCV/RCP                 | R                                 | AB-TNK   | REA/B-PO         |                  |                     |          |                   |      |   |
|   |                           | RCV Normal charging                        | C-L43  | Normal charging from REA<br>water system    | REA/RCV/RCP                 |                                   | A/W-TNK  | REAW-PO          | REA              | -RCV                | RCV-PO   |                   |      |   |
|   |                           |  | C-L44  | Normal Charging from<br>PTR                 | PTR/RCV/RCP                 | t                                 |          |                  | PTR-RCV          |                     |          | RCV-CL            |      |   |
|   |                           | ESS Charging                               | C-L34  | Charging using ESS                          | ESS/ESS-CL/RCP              |                                   |          |                  |                  |                     |          |                   |      |   |
|   |                           | Injection (Low Flow)<br>ESS Seal injection | C-L33  | (6m3/hr)<br>Emergency Seal Injection        | ESS/ESS-SI/RCP              | - <sub>P</sub>                    | TR-TNK   |                  | PTR-ESS          |                     | ESS-PO   | ESS-SI            |      |   |
|   | C4. Primary System        | (Low Flow)<br>HHSI - Direct Inj.           | C-L45  | (6m3/hr)<br>HHSI Direct Injection           | PTR/RCV/BIT/RCP             |                                   |          |                  | PTR-RCV          |                     | RCV-PO   | RCV-HSI           | RCP  |   |
|   | Make-up                   | LHSI - Direct Inj.                         | C-L46  | LHSI Direct Injection                       | PTR/RIS/RCP                 |                                   |          |                  | PTR-RIS          |                     |          |                   |      |   |
|   |                           | LHSI - Recirculation                       | C-L47  | LHSI Recirculation                          | SMP/RIS/RCP                 |                                   |          |                  | SMP-RIS          |                     | RIS-PO   |                   |      |   |
| , |                           | EAS Back-up to RIS                         | C-L48  | EAS Back-up to RIS                          | SMP/EAS/EAS-                | - 0                               | NT-SMP   | SMP-EAS          | EAS-PO           | EAS-RIS             | RIS-PO*  | RIS-LSI           |      |   |
|   |                           | EAS 004 Back-up to                         | C-L49  | EAS Back-up to RIS                          | 4PO/RIS/RCP<br>SMP/EAS/EAS- |                                   |          | SMP-EAS          | EAS-PO*          | EAS-4PO             | RIS-PO*  |                   |      |   |
| _ |                           | RIS<br>PTR Gravity Feed                    | C-L61  | PTR Gravity Feed                            | RIS/RIS/RCP<br>PTR/RIS*/RCP | Р                                 | TR-TNK   |                  | PTR-RIS          |                     | RIS-PO*  | RIS-LSI           | RCP  |   |
|   |                           | (SD - Head Off)                            | C-L50  | GCTa Steam Dump                             | SG/VVP/GCTa                 |                                   |          |                  |                  | GCTa-STM            |          |                   |      |   |
|   |                           | SG Steam Dump                              | C-1.51 | GCTc Steam Dump                             | SGAAP/GCT6-                 |                                   | SGs      | WP-GCT           | GCTG-STM CEX-TNK |                     |          |                   |      |   |
|   |                           |  | C-L52  | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 |                                   |          | ASG-T/PO ASG-T/S |                  | ASG-T/FL            |          |                   |      | Г |
|   |                           | SG Feedwater                               | C-L53  | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | A                                 | SG-TNK   |                  | ASG-MPO          |                     | -WFL     | ASG-SG/FL         | SGs  |   |
|   |                           |  | C-L54  | ARE Main Feed                               | CEX/APA/SG                  | G                                 | EX-TNK   | CEX-PO-          | ABP-HX*          | APA-PO-             | AHP-HX*- | ARE-SG/FL         |      |   |
|   |                           |  | C-L55  | SER Make-up to ASG                          | SER/ASG                     |                                   |          |                  | SER-PO           |                     |          |                   |      |   |
|   | C5. Core Cooling          |  | C-L56  | SER gravity Make-up to                      | SER/ASG (gravity)           |                                   | SER      | TNK              | SER-BV           | SER-ASG             |          |                   |      |   |
|   |                           |  | C-L57  | ASG<br>JPP Make-up to ASG                   | JPP/JPD/ASG                 |                                   | JPP-     | TNK              | JPP-PO           | JPD-ASG             | ASG-TNK  |                   |      |   |
|   |                           | SG Long term<br>Feedwater Supply           | C-L58  | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             |                                   |          |                  | JPS-PO           | JPD-ASG             |          |                   |      |   |
|   |                           |  | C-L59  | SEP Make-up to JPP                          | SEP/JPP                     | s                                 | EP-TNK   | SEP-JPP/S        | JPP-TNK          |                     |          | J                 |      |   |
|   |                           |  | C-L67  | 4th SG Injection                            | SEP/ASGx/SG                 | ş                                 | EP-TNK   | ASG-4PO          |                  | J                   |          |                   |      |   |
|   |                           | RRA Core Cooling                           | C-L60  | RRA Cooling                                 | RCP/RRA/RCP                 |                                   | RCP*     | RRA-SL           | RRA-PO           | RRA-Hx              | RRA-DL   | RRA-SV            | RCP* | Т |
|   |                           | (SD)<br>Containment Isolation              | B-1    | Containment Building                        |                             |                                   | B-CNT    |                  |                  |                     |          |                   |      | - |
|   |                           | Direct Core Injection                      |        | *See C4. Primary Sys                        | tem Make-up                 |                                   |          |                  |                  |                     |          |                   |      |   |
|   |                           |  | C-L61  | Containment Spray - EAS                     | PTR/EAS/CNT                 | P                                 | TR-TNK   | PTR-EAS          | EAS              | S-PO                |          |                   |      |   |
|   |                           |  | C-L62  | Direct Injection<br>Containment Spray - EAS | SMP/EAS/CNT                 |                                   | NT-SMP   | SMP-EAS          | EAS-PO           | EAS-Hx              |          |                   |      |   |
|   |                           | Containment                                | C-L63  | Recirculation<br>Containment Spray -JPP     | JPP/EAS/CNT                 |                                   | PP-TNK   | JPP-PO           | JPP-JPC          | JPC-EAS             | EAS-SPR  | CONT              |      |   |
|   | C6. Containment           | Pressure Control                           | C-L68  | Emergency Back-up<br>EAS Emergency Backup   | SEP/EASx/CNT                |                                   | EP-TNK   | SEP-EAS          |                  | E-PO                |          |                   |      |   |
|   | Integrity                 |  | C-L64  | Containment Venting                         |                             |                                   |          | 21. LAU          |                  |                     |          |                   |      |   |
|   |                           | Hydrogen Reduction                         | C-L04  | Hydrogen PARS                               | ETY (PARS)                  |                                   | PARs     |                  |                  |                     |          |                   |      |   |
|   |                           |  | C-L65  | Turbine Driven ASG Pump                     | ASG/ASGI/SG                 |                                   | . 7013   | ASG-T/PO         | ASG-T/SS         | 480                 | -T/FL    |                   |      |   |
|   |                           | SG Creep Rupture                           | 0-202  | . arome priven moto Fullip                  | Borodribon,                 | ASG-TNK                           | 0.0 71.0 | .100-1/FU        | 100-1/05         | A36                 |          | 100 00/51         | SGs  |   |
|   |                           | Prevention                                 | C-L53  | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 |                                   | ASG-TNK  | 100              | MPO              | ASG-WFL             | -M/EI    | ASG-SG/FL         | SGS  |   |

### Table 8:

| Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)                |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|                 | De austre -t I  | Function                                      |          |  | 000- 4                     | t needel             | - Eurot'- | nal Baarr | leamant     |          |           |        |  |
|-----------------|---|---|----------|--|----------------------------|----------------------|-----------|-----------|-------------|----------|-----------|--------|--|
|                 |   | runction                                      |          |  | SSUS the                   | at provide           | e Functio | nal Requ  | nement      |          |           |        |  |
|                 | Functional<br>Requirement   | Sub-Function                                  | Met      | thods to fulfil Funct                                  | ional Req. (SSCs)          |                      |           |           | Sub         | -SSC     |           |        |  |
|                 |   | Core Exit<br>Temperature                      | C-l1     | Core Exit Temperature<br>Indication                    |                            | RICxxxMT             |           |           |             | [LNi]    |           |        |  |
|                 |   | RCP Level                                     | C-12     | Pressuriser Level<br>Indication                        |                            | RCPxxxMN             |           |           |             | [LNi]    |           |        |  |
|                 |   | Reactor Level<br>Indication                   | C-124    | RVLIS  |                            |                      |           |           |             |          |           |        |  |
|                 |   | RCP pressure                                  | C-I3     | RCP Pressure Indication                                |                            | RCPxxxMP             |           |           |             | [LNi]    |           |        |  |
|                 |   | RRA Pressure                                  | C-15     | RRA Pressure Indication                                |                            | RRAxxxMP             |           |           |             | [LNi]    |           |        |  |
|                 |   | SG Level                                      | C-16     | SG WR Level Indication                                 |                            | ARExxxMN             |           |           |             | [LNi]    |           |        |  |
| Reactor Core    |   | SG Pressure                                   | C-17     | SG Pressure Indication                                 |                            | VVPxxxMP             |           |           |             | [LNi]    |           |        |  |
| orC             | 07. 5   | ASG Tank Level                                | C-18     | ASG Tank Level Indication                              |                            | ASG002LN             |           |           |             |          |           |        |  |
| eact            | Indication  | Diesel Tank Level                             | C-19     | Diesel Tank Level                                      |                            | LHixxxLN             |           |           |             |          |           |        |  |
| Ř               |   | Containment                                   | C-120    | Indications<br>Containment WR Pressure                 |                            | ETYxxxMP             |           |           |             | [LNi]    |           |        |  |
|                 |   | Pressure<br>Containment                       | C-21     | Indication<br>Containment Radiation                    |                            | KRT022-              |           |           |             | KRT001AR | [LBA]     |        |  |
|                 |   | Radiation<br>Containment Sump                 | C-122    | Levels<br>Containment Sump Level                       |                            | 23MA<br>RISxxxSL     |           |           |             | [LCA/B]  | 1 9       |        |  |
|                 |   | Level<br>BaseMat                              | C-123    | Basemat Thermo-couples                                 |                            | EASxxxSL<br>KSBxxxMT |           |           |             | [20/12]  |           |        |  |
|                 | C7. Essential<br>Indication<br>S1. SFP Integrity<br>S2. SFP Cooling<br>S3. Bulk Boiling<br>S3. Bulk Boiling<br>S4. Indication<br>S4. Indication<br>V1. Seismic Vault<br>V2. Indication<br>V2. Indication<br>V3. Seismic Vault<br>V2. Indication<br>S4. Indication<br>S5. SBC Diesei Build<br>B5. SBC Diesei Build<br>B6. SEC pump-house | Thermocouples<br>Containment Sump             | C-I51    | Basemat menno-couples                                  |                            | INSERTION INT        |           |           |             |          |           |        |  |
|                 |   | Temperature<br>Containment                    |          |  |                            |                      |           |           |             |          |           |        |  |
|                 |   | Hydrogen Sampling<br>Reactor Pit              | C-152    |  |                            |                      |           |           |             |          |           |        |  |
|                 |   | Temperature<br>SFP Pool                       | C-153    | SFP Pool Integrity                                     | 050                        | SFP-PL               | 0.050     |           |             |          |           |        |  |
|                 | S4 SED Integrity  |   | S-S1     | PTR Normal SFP Cooling                                 | SFP                        | SFP-PL               | B-SFP     |           | DTD 104     |          |           |        |  |
|                 | ST. SPP Integrity   | PTR 1/2 PO                                    | S-S1     | Integrity  | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO*   | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |  |
|                 |   | PTR 6 PO                                      | S-S2     | PTR 3rd Train Integrity                                | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO*  | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |  |
|                 | S2. SFP Cooling   | PTR 1/2 PO                                    | S-L1     | PTR Normal Cooling                                     | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO    | PTR-HX      |          | R-DL      | SFP-PL |  |
|                 |   | PTR 6 PO                                      | S-L2     | PTR 3rd Train Cooling                                  | SFP\PTR3\SFP               |                      | PTR3-SL   | PTR3-PO   | PTR3-HX     | PIR      | 3-DL      |        |  |
|                 |   | SFP Steam Release                             | S-L3     | Open Vent Doors  |                            | SFP-VD               |           |           |             |          | 1         |        |  |
| 00              |   |   | S-L4     | SED Make-up  | SED/SFP                    | SED-TNK              |           | D-PO      | SED-SFP     |          |           |        |  |
| el P            | S3. Bulk Boiling  | SFP Emergency<br>Make-up                      | S-L5     | JPP Make-up  | JPP/JPD/SFP                | JPP-TNK              | JPF       | -PO       | JPD-SFP     | SFP-PL   |           |        |  |
| it Fu           |   |   | S-L6     | JPS Make-up  | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO    |             |          |           |        |  |
| Spent Fuel Pool |   |   | S-L7     | SEP Make-up  | SEP/SFPx                   | SEP-TNK              | SEP/SFPx  | PEE       | E-PO        |          |           |        |  |
|                 |   | SFP Level                                     | S-I1     | SFP Level Indication<br>SFP Temperature                |                            | PTRxxxMN             | -         |           |             | [LNī]    | [SAR-ACC] |        |  |
|                 |   | SFP Temperature<br>Fuel Rack                  | S-12     | Indication   |                            | PTRxxxMT             |           |           |             | [LNi]    |           |        |  |
|                 |   | Temperature<br>SFP Boron                      | S-13     |  |                            | -                    |           |           |             |          |           |        |  |
|                 | S4. Indication  | Concentration<br>SFP Building                 | S-14     |  |                            |                      |           |           |             |          |           |        |  |
|                 |   | Pressure                                      | S-15     |  |                            |                      |           |           |             |          |           |        |  |
|                 |   | SFP Hydrogen<br>Concentration                 | S-16     |  |                            | -                    |           |           |             |          |           |        |  |
|                 |   | SFP Building<br>Humidity                      | S-17     | JPP Make-up to Seismic                                 |                            |                      |           |           |             |          |           |        |  |
|                 |   | Elooding of Colom's                           | V-L01    | Vault  | JPP/JPD/VLT                | JPP                  | -TNK      | JPP-PO    | JPP-JPD     | JPD-VLT  |           |        |  |
| ault            | V1. Seismic Vault   | Flooding of Seismic<br>Vault                  | V-L02    | JPS Make-up to Seismic<br>Vault<br>SEP Gravity Feed to | SEP/JPS/JPD/VLT            | SEP-TNK              | SEP-JPP/S | JPS-PO    | JPS-JPD     |          | VLT       |        |  |
| Seismic Vault   |   | Seismic Vault                                 | V-L03    | SEP Gravity Feed to<br>Seismic Vault                   | SEP/JPD/VLT                |                      |           | SEP       | -VLT        |          |           |        |  |
| eism            |   | Temperature                                   | VI-1     |  |                            |                      |           |           |             |          |           |        |  |
| Š               | V.2 Indication  | Seismic Vault Water<br>Level                  | VI-2     |  |                            |                      |           |           |             |          |           |        |  |
|                 |   | Seismic Vault<br>Pressure<br>Cask Remain Leak | VI-3     |  |                            |                      |           |           |             |          |           |        |  |
| Dry<br>Casks    |   | Tight   | D-S1     | Cask integrity   | CASK                       | CASK*                |           |           |             |          |           |        |  |
| - ü             |   | Cask Air cooling<br>maintained                | D-L1     | Cask Cooling   | Cask building and Air Flow | B-LLW                | CASK-AIR  |           |             |          |           | _      |  |
|                 |   |   | B1<br>B2 | Containment Building<br>Nuclear Auxiliary Building     |                            | B-CNT<br>B-NAB       | Building  | Hatch     | Penetration | Airlocks | I         |        |  |
|                 | B3. Electrical Building   | g   | B2<br>B3 | Electrical Building                                    |                            | B-ELE                |           |           |             |          |           |        |  |
| sßi             |   |   | B4       | Unit Diesel Building                                   |                            | B-DSL                |           |           |             |          |           |        |  |
| Buildings       | B5. SBO Diesel Build  | ling  | B5       | SBO Diesel Building                                    |                            | B-SBO                |           |           |             |          |           |        |  |
| Bui             | B6. SEC pump-house  | 9   | B6       | SEC Pumphouse Building                                 |                            | B-SEC                |           |           |             |          |           |        |  |
|                 | B7. Turbine Hall  |   | B7       | Turbine Hall   |                            | B-TUR                |           |           |             |          |           |        |  |
|                 | B8. LLW Building<br>B9. ECC   |   | B8<br>B9 | Low Level Waste Building                               |                            | B-LLW<br>B-ECC       |           |           |             |          |           |        |  |
|                 | 35.200  |   | 69       | Emergency Control Centre                               |                            | B-EUU                |           |           |             |          |           |        |  |

### Table 8:

| Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)                |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|                           | Required F                                | Function                            |              |  | SSCs th                | at provid      | e Functio | nal Requ   | irement   |          |         |       |       |
|---------------------------|---|-------------------------------------|--------------|--|------------------------|----------------|-----------|------------|-----------|----------|---------|-------|-------|
|                           | Functional<br>Requirement                 | Sub-Function                        | Me           | thods to fulfil Funct                                  | ional Req. (SSCs)      |                |           |            | Sub       | -SSC     |         |       |       |
|                           |   |                                     | E-1<br>E-2   | 400 KV LHA Supply<br>132 KV LHA Supply                 | 400KV/LHA<br>132KV/LHA | 400KV<br>132KV | GEN-TRX   | UNT-TRX    | LGA-SWB   | LGB-SWB  |         |       |       |
|                           |   | LHA Switchboard<br>Supply           | E-3          | LHP Diesel LHA Supply                                  | LHP/LHA                | LHP-DSL        | 011       | LHP        |           |          | LHA-SWB | [LCA] | [LBA] |
|                           |   | [LHA]                               | E-4          | LHS Diesel LHA Supply                                  | LHS/LHA                | LHS-DSL        | LHS       | LHC        | LHC-SWB   | LHC-LHA  | ł       |       |       |
|                           | E1. Essential 6.6kV<br>Switchboard Supply |                                     | E-60         | MBL Diesel LHA Supply                                  | MBL-DSL/LHA            | MBL-DSL        |           | MBL-DS     | SL-CON    |          | 1       |       |       |
|                           | Switchboard Supply                        |                                     | E-5          | 400 KV LHB Supply                                      | 400KV/LHB              | 400KV          | GEN-TRX   | UNT-TRX    | LGD-SWB   |          |         |       |       |
|                           |   |                                     | E-6          | 132 KV LHB Supply                                      | 132KV/LHB              | 132KV          | STN       | -TRX       | LGE/F-SWB | LGC-SWB  |         |       |       |
|                           |   | LHB Switchboard<br>Supply           | E-7          | LHQ Diesel LHB Supply                                  | LHQ/LHB                | LHQ-DSL        |           | LHQ        | -LHB      |          | LHB-SWB | [LCB] | [LBB] |
|                           |   | [LHB]                               | E-8          | LHS Diesel LHB Supply                                  | LHS/LHB                | LHS-DSL        | LHS       | LHC        | LHC-SWB   | LHC-LHB  | 1       |       |       |
|                           |   |                                     | E-61         | MBL Diesel LHB Supply                                  | MBL-DSL/LHB            | MBL-DSL        |           | MBL-DS     | SL-CON    |          | 1       |       |       |
|                           | E2. SBO Diesel<br>Supply                  | LLY SBO Diesel<br>Supply<br>[LLY]   | E-10         | LLY Switchboard Supply                                 | LLS\LLX\LLY            | LLS-DSL        | LLX-SWB   | LLX-LLY    | LLY-SWB   |          |         |       |       |
|                           |   |                                     | E-21         | LCA Switchboard - LHA                                  | LCA\LLi\LHA            | [LHA]          |           | LLA\E-SWB  | LCA-RD    |          |         |       |       |
|                           |   | LCA 48V Switchboard<br>Supply [LCA] | E-22         | LCA Switchboard - LLS                                  | LCAILLY                | [LLY]          |           |            | LOARD     | LCA-SWB  |         |       |       |
|                           | E3. 48 V Essential                        |                                     | E-23         | LCA Switchboard - Battery                              | LCA\BAT                | LCA-BAT        |           |            |           |          |         |       |       |
|                           | Switchboard Supply                        | LCB 48V                             | E-24         | LCB Switchboard - LHB                                  | LCB\LLI\LHB            | [LHB]          |           | LLB\D-SWB  | LCB-RD    |          |         |       |       |
| em                        |   | Switchboard Supply<br>[LCB]         | E-25         | LCB Switchboard - LLS                                  | LCB\LLY                | [LLY]          |           |            | 200110    | LCB-SWB  |         |       |       |
| òyst                      |   |                                     | E-26         | LCB Switchboard - Battery                              | LCB\BAT                | LCB-BA         | r         |            |           |          |         |       |       |
| t o                       |   | LBA 125V                            | E-31         | LBA Switchboard - LHA                                  | LBA\LLI\LHA            | [LHA]          |           | LLC\E-SWB  | LBA-RD    |          |         |       |       |
| odd                       |   | Switchboard Supply<br>[LBA]         | E-32         | LBA Switchboard - LLS                                  | LBAILLY                | [LLY]          |           |            |           | LBA-SWB  |         |       |       |
| Su                        | E4. 125 V Essential<br>Switchboard Supply |                                     | E-33         | LBA Switchboard - Battery                              | LBA\BAT                | LBA-BAT        |           |            |           |          |         |       |       |
| Electrical Support System | Switchboard Supply                        | LBB 125V                            | E-34         | LBB Switchboard - LHA                                  | LBB\LLi\LHB            | [LHB]          | _         | LLB\D-SWB  | LBB-RD    |          |         |       |       |
| ectr                      |   | Switchboard Supply<br>[LBB]         | E-35         | LBB Switchboard - LLS                                  | LBB\LLY                | [LLY]          |           |            |           | LBB-SWB  |         |       |       |
| Ē                         |   |                                     | E-36         | LBB Switchboard - Battery                              | LBB\BAT                | LBB-BA         |           |            |           |          |         |       |       |
|                           |   |                                     | E-41         | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from | LNA/LLC/LHA            | [LHA]          | LLC-SWB   | LNA        | -RD       |          |         |       |       |
|                           |   | LNA 220V Essential<br>Switchboards  | E-42         | LHA  | LNA/LBC/LLA/LHA        |                | LLA-SWB   | LBC-RD     |           | LNA-SWB  |         |       |       |
|                           |   | [LNA]                               | E-43         | SIP I Supply from LSS                                  | LNA/LBC/LLY            | [LLY]          | -         |            | LBC-SWB   |          |         |       |       |
|                           |   |                                     | E-44<br>E-45 | SIP I Battery Supply<br>SIP II Dirty Supply from       | LNA/LBC/BAT            | LBC-BA         |           |            |           |          | -       |       |       |
|                           |   | LNB 220V Essential                  | E-45<br>E-46 | LHB<br>SIP II Clean Supply from                        | LNB/LLD/LHB            | [LHB]          | LLD-SWB   | LNE        | -RD       |          |         |       |       |
|                           |   | Switchboards<br>[LNB]               | E-47         | LHB<br>SIP II Supply from LSS                          | LNB/LBD/LLY            | [LLY]          | LLB-SWB   | LBD-RD     | LBD-SWB   | LNB-SWB  |         |       |       |
|                           | E5. Essential                             | [2:10]                              | E-48         | SIP II Battery Supply                                  | LNB/LBD/BAT            | LBD-BA         | r         |            | LBD-OWD   |          |         |       |       |
|                           | Instrumentation<br>Switchboard Supply     |                                     | E-49         | SIP III Dirty Supply from                              | LNC/LLC/LHA            |                | LLC-SWB   | LNC        | -RD       |          |         |       |       |
|                           | and capping                               | LNC 220V Essential                  | E-50         | LHA<br>SIP III Clean Supply from                       | LNC/LBE/LLA/LHA        | [LHA]          | LLA-SWB   |            |           |          |         |       |       |
|                           |   | Switchboards<br>[LNC]               | E-51         | LHA<br>SIP III Supply from LSS                         | LNC/LBE/LLY            | [LLY]          |           | LBE-RD     | LBE-SWB   | LNC-SWB  |         |       |       |
|                           |   |                                     | E-52         | SIP III Battery Supply                                 | LNC/LBE/BAT            | LBE-BA         | r         |            |           |          |         |       |       |
|                           |   |                                     | E-53         | SIP IV Dirty Supply from                               | LND/LLD/LHB            |                | LLD-SWB   | LND        | I-RD      |          |         |       |       |
|                           |   | LND 220V Essential                  | E-54         | SIP IV Clean Supply from<br>LHB                        | LND/LBF/LLB/LHB        | [LHB]          | LLB-SWB   |            |           |          |         |       |       |
|                           |   | Switchboards<br>[LND]               | E-55         | SIP IV Supply from LSS                                 | LND/LBF/LLY            | [LLY]          |           | LBF-RD     | LBF-SWB   | LND-SWB  |         |       |       |
|                           |   |                                     | E-56         | SIP IV Battery Supply                                  | LND/LBF/BAT            | LBF-BAT        |           |            |           |          |         |       |       |
|                           |   | SEC Train A Cooling                 | U-1          | SEC Train A Cooling                                    | SEA/SEC-A/SEA          | 10.1           | SEC-A-RS  | SEC-A-DS   | SEC-A-PO  | RRI-A-HX |         |       |       |
| sink                      | U1. Essential<br>Cooling                  | SEC Train B Cooling                 | U-2          | SEC Train B Cooling                                    | SEA/SEC-B/SEA          | [Sea]          | SEC-B-RS  | SEC-B-DS   | SEC-B-PO  | RRI-B-HX | [Sea]   |       |       |
| Ultimate Heatsink         |   | Alternative Heatsink                | U-3          | Alternative Heatsink                                   |                        |                |           |            |           |          |         |       |       |
| e H                       |   | RRI Train A Cooling                 | U-11         | RRI Train A Cooling                                    | SEC/RRI-A/HXA          | HX-A           | RRI-A-PO  | [RRI-A-HX] |           |          |         |       |       |
| mat                       | U2. Component                             | RRI Train B Cooling                 | U-12         | RRI Train B Cooling                                    | SEC/RRI-B/HXA          | HX-B           | RRI-B-PO  | [RRI-B-HX] |           |          |         |       |       |
| Ulti                      | Cooling                                   | RRI Commons                         | U-13         | RRI Commons cooling<br>(Train A)                       | SEC/RRI-A/HXC          | нх-сом         | RRI-A-PO  | [RRI-A-HX] |           |          |         |       |       |
| _                         |   | Cooling                             | U-14         | RRI Commons cooling<br>(Train B)                       | SEC/RRI-B/HXC          | I DOGOWI       | RRI-B-PO  | [RRI-B-HX] |           |          |         |       |       |





Note \* indicates integrity not active function

 $\textit{\textit{Note}}~[XXX]$  indicates as system support dependency

Table 9:Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|              | Required I                | Function   |       |   | SSCs th                     | at pr   | ovide            | Functio           | nal Requ       | irement             |          |                   |      |   |  |  |
|--------------|---------------------------|--|-------|---|-----------------------------|---------|------------------|-------------------|----------------|---------------------|----------|-------------------|------|---|--|--|
|              | Functional<br>Requirement | Sub-Function   | Met   | thods to fulfil Funct                       | ional Req. (SSCs)           |         |                  |                   |                | Sub                 | -SSC     |                   |      |   |  |  |
|              |                           | Control Rods   | C-S1  | Control Rod                                 | CRDMs                       | FL      | ASS              | CNTL-ROD          | CRDM           |                     |          |                   |      |   |  |  |
|              |                           |  | C-L42 | REA Boration (direct or<br>normal)          | REA/RCV/RCP                 | REA     | /B-TNK           | REA/B-PO          | REA            | -RCV                |          |                   |      |   |  |  |
|              |                           |  | C-L44 | Normal charging from PTR tank               | PTR/RCV/RCP                 |         |                  |                   | PTR-RCV        |                     | RCV-PO   | RCV-CL            |      |   |  |  |
|              | C1. Sub-Criticality       | Boron Injection                                      | C-L34 | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | PTF     | R-TNK            |                   |                |                     |          |                   | RCP  |   |  |  |
|              |                           |  | C-L33 | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |         |                  |                   | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |   |  |  |
|              |                           |  | C-L11 | Accumulators                                | ACC/RCP                     | А       | .cc              |                   |                | ACC-RCP             |          |                   |      |   |  |  |
| ľ            |                           | RCP System   | C-121 | RCP Integrity                               | RCP*                        | R       | CP*              | RCP<br>Pumps*     | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |      |   |  |  |
|              | C2. Primary System        | SG   | C-122 | SG Integrity                                | SG*                         | s       | Gs*              |                   |                |                     |          |                   |      |   |  |  |
|              | Integrity                 | RRA System Integrity<br>(SD)                         | C-123 | RRA Integrity                               | RCP*/RRA*/RCP*              | R       | CP*              | RRA-SL*           | RRA-PO*        | RRA-Hx*             | RRA-DL*  | RRA-SV*           |      |   |  |  |
|              |                           | (SD)<br>(SD)   | C-124 | RRA Isolation                               | RCP*                        | R       | CP*              | RRA-SL            | RRA-DL         |                     | <u> </u> | <u> </u>          |      |   |  |  |
|              |                           | (60)   | C-L31 | Normal Seal Injection                       | REA/RCV/RCP                 | REA     | /B-TNK           | REA/B-PO          | REA            | -RCV                |          |                   |      |   |  |  |
|              | C3. RCP Seal              | Normal Seal Injection                                | C-L32 | PTR Seal Injection                          | PTR/RCV/RCP                 |         |                  |                   | PTR-RCV        |                     | RCV-PO   | RCV-SI            | RCP  |   |  |  |
|              | injection                 | Emergency Seal                                       | C-L33 | Emergency Seal Injection                    | ESS/RCP                     | РТР     | R-TNK            |                   | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |   |  |  |
|              |                           | Injection  | C-L42 | REA Boration (direct or                     | REA/RCV/RCP                 | REA     | /B-TNK           | REA/B-PO          |                |                     |          |                   |      |   |  |  |
|              |                           | RCV Normal charging                                  | C-L43 | normal)<br>Normal charging from REA         | REA/RCV/RCP                 |         | W-TNK            | REAW-PO           | REA            | -RCV                | RCV-PO   |                   |      |   |  |  |
|              |                           |  | C-L44 | water system<br>Normal Charging from        | PTR/RCV/RCP                 |         |                  |                   | PTR-RCV        |                     |          | RCV-CL            |      |   |  |  |
|              |                           | ESS Charging   | C-L34 | PTR<br>Charging using ESS                   | ESS/ESS-CL/RCP              |         |                  |                   |                |                     |          |                   |      |   |  |  |
|              |                           | Injection (Low Flow)<br>ESS Seal injection           | C-L33 | (6m3/hr)<br>Emergency Seal Injection        | ESS/ESS-SI/RCP              | PTE     | R-TNK            |                   | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |   |  |  |
|              | C4. Primary System        | (Low Flow)<br>HHSI - Direct Inj.                     | C-L45 | (6m3/hr)<br>HHSI Direct Injection           | PTR/RCV/BIT/RCP             | -11     | x-11 <b>x</b> ix |                   | PTR-RCV        |                     | RCV-PO   | RCV-HSI           | RCP  |   |  |  |
|              | Make-up                   | ,  |       |   |                             | -       |                  |                   | PTR-RIS        |                     | KGV-FO   | NOV-051           |      |   |  |  |
|              |                           | LHSI - Direct Inj.                                   | C-L46 | LHSI Direct Injection                       | PTR/RIS/RCP                 |         |                  |                   |                |                     | RIS-PO   |                   |      |   |  |  |
| e            |                           | LHSI - Recirculation                                 | C-L47 | LHSI Recirculation                          | SMP/RIS/RCP<br>SMP/EAS/EAS- | -       |                  |                   | SMP-RIS        |                     |          | RIS-LSI           |      |   |  |  |
| Reactor Core |                           | EAS Back-up to RIS<br>EAS 004 Back-up to             | C-L48 | EAS Back-up to RIS                          | 4PO/RIS/RCP<br>SMP/EAS/EAS- | CNT-SMP | SMP-EAS          | EAS-PO            | EAS-RIS        | RIS-PO*             |          |                   |      |   |  |  |
| acto         |                           | RIS<br>PTR Gravity Feed                              | C-L49 | EAS Back-up to RIS                          | RIS/RIS/RCP                 | PTR-TNK |                  | SMP-EAS           | EAS-PO*        |                     |          | EAS-4PO RIS-PO*   |      |   |  |  |
| Ч.           |                           | (SD - Head Off)                                      | C-L61 | PTR Gravity Feed                            | PTR/RIS*/RCP                | PTF     | R-TNK            |                   | PTR-RIS        |                     | RIS-PO*  | RIS-LSI           | RCP  |   |  |  |
|              |                           | SG Steam Dump  | C-L50 | GCTa Steam Dump                             | SG/VVP/GCTa                 | s       | Gs               | WP-GCT            |                |                     |          |                   |      |   |  |  |
|              |                           |  | C-L51 | GCTc Steam Dump                             | SGAAP/GCTc-                 |         |                  | GCTc-STM          |                |                     |          |                   |      | 1 |  |  |
|              |                           |  | C-L52 | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 | ASC     | G-TNK            | ASG-T/PO ASG-T/SS |                |                     | -T/FL    | ASG-SG/FL         |      |   |  |  |
|              |                           | SG Feedwater   | C-L53 | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 |         |                  | ASG-              | WPO            | ASG                 | -WFL     |                   | SGs  |   |  |  |
|              |                           |  | G-L54 | ARE Main Feed                               | CEX/APA/SC                  | GE)     | <del>K-TNK</del> | CEX-PO            | ABP-HX*        | APA-PO              | AHP-HX*- | ARE-SG/FL         |      |   |  |  |
|              | C5. Core Cooling          |  | C-L55 | SER Make-up to ASG                          | SER/ASG                     |         | SER              | TNK               | SER-PO         | SER-ASG             |          |                   |      |   |  |  |
|              |                           |  | C-L56 | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)           |         |                  |                   | SER-BV         |                     | ASG-TNK  |                   |      |   |  |  |
|              |                           | SG Long term<br>Feedwater Supply                     | C-L57 | JPP Make-up to ASG                          | JPP/JPD/ASG                 |         | JPP              | TNK               | JPP-PO         | JPD-ASG             |          |                   |      |   |  |  |
|              |                           |  | C-L58 | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             | SEF     | P-TNK            | SEP-JPP/S         | JPS-PO         | JPD-ASG             |          |                   |      |   |  |  |
|              |                           |  | C-L59 | SEP Make-up to JPP                          | SEP/JPP                     |         |                  |                   | JPP-TNK        |                     |          |                   |      |   |  |  |
|              |                           | RRA Core Cooling<br>(SD)                             | C-L60 | RRA Cooling                                 | RCP/RRA/RCP                 | R       | CP*              | RRA-SL            | RRA-PO         | RRA-Hx              | RRA-DL   | RRA-SV            | RCP* |   |  |  |
|              |                           | Containment Isolation                                | B-1   | Containment Building                        |                             | B-      | CNT              |                   |                |                     |          |                   |      |   |  |  |
|              |                           | Direct Core Injection                                |       | *See C4. Primary Sys                        | tem Make-up                 |         |                  |                   |                |                     | -        |                   |      |   |  |  |
|              |                           |  | C-L61 | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                 | PTF     | R-TNK            | PTR-EAS           | EAS            | -PO                 |          |                   |      |   |  |  |
|              |                           | Containment  | C-L62 | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                 | CNT     | r-SMP            | SMP-EAS           | EAS-PO         | EAS-Hx              | EAS-SPR  | CONT              |      |   |  |  |
|              | C6. Containment           | Pressure Control                                     | C-L63 | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                 | JPF     | P-TNK            | JPP-PO            | JPP-JPC        | JPC-EAS             |          |                   |      |   |  |  |
|              |                           |  | C-L64 | Containment Venting                         |                             |         |                  |                   |                |                     |          |                   |      |   |  |  |
|              | Integrity                 |  | C=L04 |   |                             |         |                  |                   |                |                     |          |                   |      |   |  |  |
|              |                           | Hydrogen Reduction                                   | C-L65 | Hydrogen PARS                               | ETY (PARS)                  | P       | ARs              |                   |                |                     |          |                   |      |   |  |  |
|              |                           |  |       | Hydrogen PARS<br>Turbine Driven ASG Pump    | ETY (PARS)<br>ASG/ASGt/SG   |         |                  | ASG-T/PO          | ASG-T/SS       | ASG                 | -T/FL    |                   |      | 1 |  |  |
|              |                           | Hydrogen Reduction<br>SG Creep Rupture<br>Prevention | C-L65 |   | . ,                         |         | ARs<br>G-TNK     | ASG-T/PO<br>ASG-  |                | ASG<br>ASG          |          | ASG-SG/FL         | SGs  | ] |  |  |

Table 9:Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|               | Required                          | Function                           |                 |   | SSCs th                       | at provide            | e Functio | nal Requ | irement     |          |           |        |  |  |
|---------------|-----------------------------------|------------------------------------|-----------------|---|-------------------------------|-----------------------|-----------|----------|-------------|----------|-----------|--------|--|--|
|               | Functional<br>Requirement         | Sub-Function                       | Met             | hods to fulfil Funct                              |                               |                       |           |          |             | -SSC     |           |        |  |  |
|               | Requirement                       | Core Exit                          | C-I1            | Core Exit Temperature                             |                               | RICxxxMT              |           |          |             | [LNi]    |           |        |  |  |
|               |                                   | Temperature<br>RCP Level           | C-12            | Indication<br>Pressuriser Level                   |                               | RCPxxxMN              |           |          |             | [LNi]    |           |        |  |  |
|               |                                   | Reactor Level                      |                 | Indication  |                               |                       |           |          |             | [27.1]   |           |        |  |  |
|               |                                   | Indication                         | C-124           | RVLIS   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | RCP pressure                       | C-13            | RCP Pressure Indication                           |                               | RCPxxxMP              |           |          |             | [LNi]    |           |        |  |  |
|               |                                   | RRA Pressure                       | C-15            | RRA Pressure Indication                           |                               | RRAxxxMP              |           |          |             | [LNi]    |           |        |  |  |
| e             |                                   | SG Level                           | C-16            | SG WR Level Indication                            |                               | ARExxXMN              |           |          |             | [LNi]    |           |        |  |  |
| Reactor Core  |                                   | SG Pressure                        | C-17            | SG Pressure Indication                            |                               | VVPxxxMP              |           |          |             | [LNi]    |           |        |  |  |
| to            | C7. Essential                     | ASG Tank Level                     | C-18            | ASG Tank Level Indication                         |                               | ASG002LN              |           |          |             |          |           |        |  |  |
| teac          | Indication                        | Diesel Tank Level                  | C-19            | Diesel Tank Level<br>Indications                  |                               | LHixxxLN              |           |          |             |          |           |        |  |  |
| Ľ.            |                                   | Containment<br>Pressure            | C-120           | Containment WR Pressure<br>Indication             |                               | ETYxxxMP              |           |          |             | [LNi]    |           |        |  |  |
|               |                                   | Containment<br>Radiation           | C-21            | Containment Radiation                             |                               | KRT022-<br>23MA       |           |          |             | KRT001AR | [LBA]     |        |  |  |
|               |                                   | Containment Sump                   | C-122           | Levels<br>Containment Sump Level                  |                               | RISxxxSL              |           |          |             | [LCA/B]  |           |        |  |  |
|               |                                   | Level<br>BaseMat                   | C-123           | Basemat Thermo-couples                            |                               | EASxxxSL<br>KSBxxxMT  |           |          |             |          |           |        |  |  |
|               |                                   | Thermocouples<br>Containment Sump  |                 | Basemat mermo-couples                             |                               | KSBXXMI               |           |          |             |          |           |        |  |  |
|               |                                   | Temperature<br>Containment         | C-I51           |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | Hydrogen Sampling                  | C-152           |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | Reactor Pit<br>Temperature         | C-153           |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | SFP Pool                           | S-S1            | SFP Pool Integrity                                | SFP                           | SFP-PL                | B-SFP     |          |             |          |           |        |  |  |
|               | S1. SFP Integrity                 | PTR 1/2 PO                         | S-S1            | PTR Normal SFP Cooling<br>Integrity               | SFP\PTR\SFP                   | 055 51                | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | 050 0  |  |  |
|               |                                   | PTR 6 PO                           | S-S2            | PTR 3rd Train Integrity                           | SFP\PTR3\SFP                  | SFP-PL                | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |  |  |
|               |                                   | PTR 1/2 PO                         | S-L1            | PTR Normal Cooling                                | SFP\PTR\SFP                   |                       | PTR-SL    | PTR-PO   | PTR-HX      | PTF      | R-DL      |        |  |  |
|               | S2. SFP Cooling                   | PTR 6 PO                           | S-L2            | PTR 3rd Train Cooling                             | SFP\PTR3\SFP                  | SFP-PL                | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTR      | 3-DL      | SFP-PL |  |  |
| -             |                                   | SFP Steam Release                  | S-L3            | Open Vent Doors                                   |                               | SFP-VD                |           |          |             |          |           |        |  |  |
| ō             |                                   |                                    | S-L4            | SED Make-up                                       | SED/SFP                       | SED-TNK               | SEC       | )-PO     | SED-SFP     |          | 1         |        |  |  |
| Po            | S3. Bulk Boiling                  | SFP Emergency                      |                 |   |                               | JPP-TNK               |           | -PO      |             |          |           |        |  |  |
| Fue           | S3. Bulk Boiling                  | Make-up                            | S-L5            | JPP Make-up                                       | JPP/JPD/SFP                   |                       |           | 1        | JPD-SFP     | SFP-PL   |           |        |  |  |
| ent           |                                   |                                    | S-L6            | JPS Make-up                                       | SEP/JPS/SFP                   | SEP-TNK               | SEP-JPP/S | JPS-PO   |             |          |           |        |  |  |
| Sp            |                                   | SFP Level                          | S-I1            | SFP Level Indication                              |                               | PTRxxxMN              |           |          |             | [LNi]    | [SAR-ACC] |        |  |  |
|               |                                   |                                    | SFP Temperature | S-12  | SFP Temperature<br>Indication |                       | PTRxxMT   | ļ        |             |          | [LNi]     |        |  |  |
|               |                                   | Fuel Rack<br>Temperature           | S-13            |   |                               |                       |           |          |             |          |           |        |  |  |
|               | S4. Indication                    | SFP Boron<br>Concentration         | S-14            |   |                               | _                     |           |          |             |          |           |        |  |  |
|               |                                   | SFP Building<br>Pressure           | S-15            |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | SFP Hydrogen<br>Concentration      | S-16            |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   | SFP Building<br>Humidity           | S-17            |   |                               |                       |           |          |             |          |           |        |  |  |
|               |                                   |                                    | V-L01           | JPP Make-up to Seismic<br>Vault                   | JPP/JPD/VLT                   | JPP                   | -TNK      | JPP-PO   | JPP-JPD     |          |           |        |  |  |
| Ħ             | V1. Seismic Vault                 | Flooding of Seismic<br>Vault       | V-L02           | JPS Make-up to Seismic<br>Vault                   | SEP/JPS/JPD/VLT               |                       | SEP-JPP/S | JPS-PO   | JPS-JPD     | JPD-VLT  | VLT       |        |  |  |
| Vaı           |                                   |                                    | V-L03           | SEP Gravity Feed to                               | SEP/JPD/VLT                   | SEP-TNK               |           |          | -VLT        |          | 1         |        |  |  |
| Seismic Vault |                                   | Seismic Vault                      | VI-1            | Seismic Vault                                     |                               |                       |           |          |             |          |           |        |  |  |
| Seis          | V.2 Indication                    | Temperature<br>Seismic Vault Water | VI-2            |   |                               |                       |           |          |             |          |           |        |  |  |
| 55            |                                   | Level<br>Seismic Vault             |                 |   |                               |                       |           |          |             |          |           |        |  |  |
| 6             |                                   | Pressure<br>Cask Remain Leak       | VI-3            |   |                               |                       |           |          | _           |          |           | _      |  |  |
| Dry<br>Casks  | D1. Cask Integrity                | Tight<br>Cask Air cooling          | D-S1            | Cask integrity                                    | CASK                          | CASK*                 |           |          |             |          |           |        |  |  |
| U U           | D2. Cask Cooling                  | maintained                         | D-L1            | Cask Cooling                                      | Cask building and Air Flow    | B-LLW                 | CASK-AIR  |          |             |          | T         |        |  |  |
|               | B1. Containment                   |                                    | B1              | Containment Building                              |                               | B-CNT                 | Building  | Hatch    | Penetration | Airlocks | J         |        |  |  |
|               | B2. NAB<br>B3. Electrical Buildin | a                                  | B2<br>B3        | Nuclear Auxiliary Building<br>Electrical Building |                               | B-NAB<br>B-ELE        |           |          |             |          |           |        |  |  |
| S             | B3. Electrical Buildings          | 9                                  | В3<br>В4        | Unit Diesel Building                              |                               | B-ELE<br>B-DSL        |           |          |             |          |           |        |  |  |
| dinç          | B5. SBO Diesel Build              | ling                               | B5              | SBO Diesel Building                               |                               | B-SBO                 |           |          |             |          |           |        |  |  |
| Buildings     | B6. SEC pump-house                |                                    | B6              | SEC Pumphouse Building                            |                               | B-SEC                 |           |          |             |          |           |        |  |  |
|               | B7. Turbine Hall                  |                                    | B7              | Turbine Hall                                      |                               | B-TUR                 |           |          |             |          |           |        |  |  |
|               | B8. LLW Building                  |                                    | B8              | Low Level Waste Building                          |                               | B-LLW                 |           |          |             |          |           |        |  |  |
|               | B9. ECC                           |                                    | B9              | Emergency Control Centre                          |                               | B-ECC                 |           |          |             |          |           |        |  |  |
|               |                                   |                                    |                 |   |                               | and the second second |           |          |             |          |           |        |  |  |

Table 9:Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)inducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                           | Required I                | Function                            |              |  | SSCs th           | at pro           | vide          | Functio  | nal Requ   | irement   |          |         |      |    |       |
|---------------------------|---------------------------|-------------------------------------|--------------|--|-------------------|------------------|---------------|----------|------------|-----------|----------|---------|------|----|-------|
|                           | Functional<br>Requirement | Sub-Function                        | Met          | thods to fulfil Functi                                 | ional Req. (SSCs) |                  |               |          |            | Sub       | -SSC     |         |      |    |       |
|                           |                           |                                     | E-1          | 400 KV LHA Supply                                      | 400KV/LHA         | 400              | ۲V            | GEN-TRX  | UNT-TRX    | LGA-SWB   | LGB-SWB  |         |      |    |       |
|                           |                           | LHA Switchboard<br>Supply           | E-2          | 132 KV LHA Supply                                      | 132KV/LHA         | 132              | «٧            | STN      | TRX        | LGE/F-SWB | LOD-GWD  | LHA-SWB | [LCA | ., | [LBA] |
|                           |                           | [LHA]                               | E-3          | LHP Diesel LHA Supply                                  | LHP/LHA           | LHP-0            | DSL           |          | LHP        | P-LHA     |          | LINGWE  | [207 | v  | [LDA] |
|                           | E1. Essential 6.6kV       |                                     | E-4          | LHS Diesel LHA Supply                                  | LHS/LHA           | LHS-D            | DSL           | LHS      | LHC        | LHC-SWB   | LHC-LHA  |         |      |    |       |
|                           | Switchboard Supply        |                                     | E-5          | 400 KV LHB Supply                                      | 400KV/LHB         | 400              | ٢V            | GEN-TRX  | UNT-TRX    | LGD-SWB   | LGC-SWB  |         |      |    |       |
|                           |                           | LHB Switchboard<br>Supply           | E-6          | 132 KV LHB Supply                                      | 132KV/LHB         | 132              | ٢V            | STN      | TRX        | LGE/F-SWB | 200 0110 | LHB-SWB | [LCE | 37 | (LBB) |
|                           |                           | [LHB]                               | E-7          | LHQ Diesel LHB Supply                                  | LHQ/LHB           | LHQ-             | DSL           |          | LHC        | )-LHB     |          |         |      | ·  | ,     |
|                           |                           |                                     | E-8          | LHS Diesel LHB Supply                                  | LHS/LHB           | LHS-D            | DSL           | LHS-     | LHC        | LHC-SWB   | LHC-LHB  |         |      |    |       |
|                           | E2. SBO Diesel<br>Supply  | LLY SBO Diesel<br>Supply<br>[LLY]   | E-10         | LLY Switchboard Supply                                 | LLS\LLX\LLY       | LLS-D            | DSL           | LLX-SWB  | LLX-LLY    | LLY-SWB   |          |         |      |    |       |
|                           |                           |                                     | E-21         | LCA Switchboard - LHA                                  | LCA\LLi\LHA       | [LH              | A]            |          | LLA\E-SWB  | LCA-RD    |          |         |      |    |       |
|                           |                           | LCA 48V Switchboard<br>Supply [LCA] | E-22         | LCA Switchboard - LLS                                  | LCAILLY           | נוני             | Y]            |          |            | LCA-RD    | LCA-SWB  |         |      |    |       |
|                           | E3. 48 V Essential        |                                     | E-23         | LCA Switchboard - Battery                              | LCA\BAT           | LCA              | <b>4-BA</b> T |          |            |           |          |         |      |    |       |
|                           | Switchboard Supply        | LCB 48V                             | E-24         | LCB Switchboard - LHB                                  | LCB/LLI/LHB       | [LH              | в]            |          | LLB\D-SWB  | LCB-RD    |          |         |      |    |       |
|                           |                           | Switchboard Supply<br>[LCB]         | E-25         | LCB Switchboard - LLS                                  | LCB\LLY           | ננגי             | Y]            |          |            | LOD-IND   | LCB-SWB  |         |      |    |       |
| en                        |                           | ,                                   | E-26         | LCB Switchboard - Battery                              | LCB\BAT           | LCE              | B-BAT         | ·        |            |           |          |         |      |    |       |
| iyst                      |                           | LBA 125V                            | E-31         | LBA Switchboard - LHA                                  | LBA\LLI\LHA       | [LH              | A]            |          | LLC\E-SWB  | LBA-RD    |          |         |      |    |       |
| Ę                         |                           | Switchboard Supply<br>[LBA]         | E-32         | LBA Switchboard - LLS                                  | LBAILLY           | [LL              | Y]            |          |            |           | LBA-SWB  |         |      |    |       |
| odd                       | E4. 125 V Essential       |                                     | E-33         | LBA Switchboard - Battery                              | LBA\BAT           | LBA              | 4-BAT         |          |            |           |          |         |      |    |       |
| Electrical Support System | Switchboard Supply        | LBB 125V                            | E-34         | LBB Switchboard - LHA                                  | LBB\LLi\LHB       | [LH              | в]            |          | LLB\D-SWB  | LBB-RD    |          |         |      |    |       |
| ca                        |                           | Switchboard Supply<br>[LBB]         | E-35         | LBB Switchboard - LLS                                  | LBB\LLY           | [LL              | Y]            |          |            |           | LBB-SWB  |         |      |    |       |
| ščtr                      |                           |                                     | E-36         | LBB Switchboard - Battery                              | LBB\BAT           | LBE              | B-BAT         |          |            |           |          |         |      |    |       |
| Ť                         |                           |                                     | E-41         | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from | LNA/LLC/LHA       | (LH              | A]            | LLC-SWB  | LN/        | 4-RD      |          |         |      |    |       |
|                           |                           | LNA 220V Essential<br>Switchboards  | E-42         | LHA  | LNA/LBC/LLA/LHA   |                  |               | LLA-SWB  | LBC-RD     |           | LNA-SWB  |         |      |    |       |
|                           |                           | [LNA]                               | E-43         | SIP I Supply from LSS                                  | LNA/LBC/LLY       | [LL <sup>·</sup> |               |          |            | LBC-SWB   |          |         |      |    |       |
|                           |                           |                                     | E-44         | SIP I Battery Supply<br>SIP II Dirty Supply from       | LNA/LBC/BAT       | LBC              | C-BAT         |          |            |           |          | -       |      |    |       |
|                           |                           |                                     | E-45         | LHB<br>SIP II Clean Supply from                        | LNB/LLD/LHB       | (LH              | в]            | LLD-SWB  | LNE        | 3-RD      |          |         |      |    |       |
|                           |                           | LNB 220V Essential<br>Switchboards  | E-46         | LHB  | LNB/LBD/LLB/LHB   |                  |               | LLB-SWB  | LBD-RD     |           | LNB-SWB  |         |      |    |       |
|                           | E5. Essential             | [LNB]                               | E-47         | SIP II Supply from LSS                                 | LNB/LBD/LLY       |                  | -             |          |            | LBD-SWB   |          |         |      |    |       |
|                           | Instrumentation           |                                     | E-48         | SIP II Battery Supply<br>SIP III Dirty Supply from     | LNB/LBD/BAT       | LBC              | D-BAT         |          |            |           |          |         |      |    |       |
|                           | Switchboard Supply        | LNC 220V Essential                  | E-49         | LHA<br>SIP III Clean Supply from                       | LNC/LLC/LHA       | [LH              | A]            | LLC-SWB  | LNC        | C-RD      |          |         |      |    |       |
|                           |                           | Switchboards<br>[LNC]               | E-50<br>E-51 | LHA<br>SIP III Supply from LSS                         | LNC/LBE/LLA/LHA   | լլլ              | Y1            | LLA-SVVB | LBE-RD     | LBE-SWB   | LNC-SWB  |         |      |    |       |
|                           |                           | [200]                               | E-51<br>E-52 | SIP III Supply from LSS                                | LNC/LBE/LLY       | -                | •J<br>-BAT    |          |            | LDE-SWB   |          |         |      |    |       |
|                           |                           |                                     | E-52<br>E-53 | SIP IV Dirty Supply from                               | LNC/LBE/BAI       | LDI              | - 0,41        | LLD-SWB  | LNI        | D-RD      |          |         |      |    |       |
|                           |                           | LND 220V Essential                  | E-54         | LHB<br>SIP IV Clean Supply from                        | LND/LBF/LLB/LHB   | [LH              | В]            | LLB-SWB  | LINE       | -         |          |         |      |    |       |
|                           |                           | Switchboards<br>[LND]               | E-55         | LHB<br>SIP IV Supply from LSS                          | LND/LBF/LLY       | [LL <sup>·</sup> | Y]            |          | LBF-RD     | LBF-SWB   | LND-SWB  |         |      |    |       |
|                           |                           |                                     | E-56         | SIP IV Battery Supply                                  | LND/LBF/BAT       |                  | -BAT          |          |            |           |          |         |      |    |       |
|                           |                           | SEC Train A Cooling                 | U-1          | SEC Train A Cooling                                    | SEA/SEC-A/SEA     |                  |               | SEC-A-RS | SEC-A-DS   | SEC-A-PO  | RRI-A-HX |         |      |    |       |
| Ě                         | U1. Essential             | SEC Train B Cooling                 | U-2          | SEC Train B Cooling                                    | SEA/SEC-B/SEA     | [Sea             | a]            | SEC-B-RS | SEC-B-DS   |           | RRI-B-HX | [Sea]   |      |    |       |
| Ultimate Heatsink         | Cooling                   | Alternative Heatsink                | U-3          | Alternative Heatsink                                   |                   |                  |               |          |            |           |          |         |      |    |       |
| ž                         |                           | RRI Train A Cooling                 | U-11         | RRI Train A Cooling                                    | SEC/RRI-A/HXA     | HX-              | A             | RRI-A-PO | [RRI-A-HX] |           |          |         |      |    |       |
| nate                      | U2. Component             | RRI Train B Cooling                 | U-12         | RRI Train B Cooling                                    | SEC/RRI-B/HXA     | HX-              | в             | RRI-B-PO | [RRI-B-HX] |           |          |         |      |    |       |
| lt n                      | Cooling                   | RRI Commons                         | U-13         | RRI Commons cooling<br>(Train A)                       | SEC/RRI-A/HXC     |                  |               | RRI-A-PO | [RRI-A-HX] |           |          |         |      |    |       |
| 2                         |                           | Cooling                             | U-14         | (Train A)<br>RRI Commons cooling<br>(Train B)          | SEC/RRI-B/HXC     | HX-C             | ОМ            | RRI-B-PO | [RRI-B-HX] |           |          |         |      |    |       |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |

| Tsunami event results in damage |
|---------------------------------|
| Seismic event results in damage |

Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

Table 10:Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|   | Required I                | unction                                    | SSCs that provide Functional Requirement |   |                              |   |          |               |                |                     |         |                   |      |   |  |
|---|---------------------------|--|--|---|------------------------------|---|----------|---------------|----------------|---------------------|---------|-------------------|------|---|--|
|   | Functional<br>Requirement | Sub-Function                               | Met                                      | thods to fulfil Functi                          | onal Req. (SSCs)             |   |          |               |                | Sub                 | -SSC    |                   |      |   |  |
|   |                           | Control Rods                               | C-S1                                     | Control Rod                                     | CRDMs                        |   | FL-ASS   | CNTL-ROD      | CRDM           |                     |         |                   |      |   |  |
|   |                           |  | C-L42                                    | REA Boration (direct or<br>normal)              | REA/RCV/RCP                  | R | EA/B-TNK | REA/B-PO      | RE             | A-RCV               |         |                   |      |   |  |
|   |                           |  | C-L44                                    | Normal charging from PTR tank                   | PTR/RCV/RCP                  |   |          |               | PTR-RCV        |                     | RCV-PO  | RCV-CL            |      |   |  |
|   | C1. Sub-Criticality       | Boron Injection                            | C-L34                                    | Charging using Emergency<br>Seal Injection      | ESS/ESS-CL/RCP               | F | PTR-TNK  |               |                |                     |         |                   | RCP  |   |  |
|   |                           |  | C-L33                                    | Emergency Seal Injection                        | ESS/ESS-SI/RCP               |   |          |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |   |  |
|   |                           |  | C-L11                                    | Accumulators                                    | ACC/RCP                      |   | ACC      |               |                | ACC-RCP             |         |                   |      |   |  |
|   |                           | RCP System                                 | C-121                                    | RCP Integrity                                   | RCP*                         |   | RCP*     | RCP<br>Pumps* | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*  | Safety<br>Valves* |      |   |  |
|   | C2. Primary System        | SG   | C-122                                    | SG Integrity                                    | SG*                          |   | SGs*     | T dilipo      | 10000          | riccounter          | I       | Tailoo            |      |   |  |
|   | Integrity                 | RRA System Integrity<br>(SD)               | C-123                                    | RRA Integrity                                   | RCP*/RRA*/RCP*               |   | RCP*     | RRA-SL*       | RRA-PO*        | RRA-Hx*             | RRA-DL* | RRA-SV*           |      |   |  |
|   |                           | (SD)<br>RRA System Isolation<br>(SD)       | C-124                                    | RRA Isolation                                   | RCP*                         |   | RCP*     | RRA-SL        | RRA-DL         |                     |         |                   |      |   |  |
|   |                           | (30)                                       | C-L31                                    | Normal Seal Injection                           | REA/RCV/RCP                  | R | EA/B-TNK | REA/B-PO      | RE             | A-RCV               |         |                   |      |   |  |
|   |                           | Normal Seal Injection                      | C-L32                                    | PTR Seal Injection                              | PTR/RCV/RCP                  |   |          |               | PTR-RCV        |                     | RCV-PO  | RCV-SI            |      |   |  |
|   | C3. RCP Seal<br>injection | Emergency Seal                             | C-L33                                    | Emergency Seal Injection                        | ESS/RCP                      | F | PTR-TNK  |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            | RCP  |   |  |
|   |                           | Injection<br>Shutdown Seal                 | C-125                                    | Emergency Shutdown Seal                         | RCP                          |   |          |               | SE             | -Seal               |         |                   |      |   |  |
|   |                           |  | C-L42                                    | REA Boration (direct or                         | REA/RCV/RCP                  | R | EA/B-TNK | REA/B-PO      | 1              |                     |         |                   |      |   |  |
|   |                           | RCV Normal charging                        | C-L43                                    | normal)<br>Normal charging from REA             | REA/RCV/RCP                  |   | AW-TNK   | REAW-PO       | RE             | A-RCV               | RCV-PO  |                   |      |   |  |
|   |                           |  | C-L44                                    | Normal Charging from                            | PTR/RCV/RCP                  |   |          |               | PTR-RCV        |                     |         | RCV-CL            |      |   |  |
|   |                           | ESS Charging                               | C-L34                                    | PTR<br>Charging using ESS                       | ESS/ESS-CL/RCP               |   |          |               |                |                     |         | -                 |      |   |  |
|   |                           | Injection (Low Flow)<br>ESS Seal injection | C-L33                                    | (6m3/hr)<br>Emergency Seal Injection            | ESS/ESS-SI/RCP               | - | PTR-TNK  |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |   |  |
|   | C4. Primary System        | (Low Flow)<br>HHSI - Direct Inj.           | C-L45                                    | (6m3/hr)<br>HHSI Direct Injection               | PTR/RCV/BIT/RCP              | - |          |               | PTR-RCV        |                     | RCV-PO  | RCV-HSI           | RCP  |   |  |
|   | Make-up                   | LHSI - Direct Inj.                         | C-L46                                    | LHSI Direct Injection                           | PTR/RIS/RCP                  |   |          |               | PTR-RIS        |                     |         |                   |      |   |  |
|   |                           | LHSI - Recirculation                       | C-L47                                    | LHSI Recirculation                              | SMP/RIS/RCP                  |   |          |               | SMP-RIS        |                     | RIS-PO  |                   |      |   |  |
| ь |                           | EAS Back-up to RIS                         | C-L48                                    | EAS Back-up to RIS                              | SMP/EAS/EAS-                 | - | ONT-SMP  | SMP-EAS       | EAS-PO         | EAS-RIS             | RIS-PO* | RIS-LSI           |      |   |  |
|   |                           | EAS 004 Back-up to                         | C-L49                                    | EAS Back-up to RIS                              | 4PO/RIS/RCP<br>SMP/EAS/EAS-  | - |          | SMP-EAS       | EAS-PO*        | EAS-4PO             | RIS-PO* |                   |      |   |  |
| Į |                           | RIS<br>PTR Gravity Feed                    | C-L61                                    | PTR Gravity Feed                                | RIS/RIS/RCP<br>PTR/RIS*/RCP  |   | PTR-TNK  |               | PTR-RIS        | END-41 0            | RIS-PO* | RIS-LSI           | RCP  | - |  |
|   |                           | (SD - Head Off)                            | C-L01                                    | GCTa Steam Dump                                 | SG/WP/GCTa                   |   |          |               | THERE          | GCTa-STM            | KIS-FU  | Rio-Loi           | KUP  |   |  |
| - |                           | SG Steam Dump                              | C-L50                                    | GCTc Steam Dump                                 | SGAAP/GCTo-                  |   | SGs      | WP-GCT        | GCTc-STN       | 1                   | CEX-PO- |                   |      |   |  |
|   |                           |  | C-L52                                    | Turbine Driven ASG Pump                         | ASG/ASGt/SG                  | ┢ |          | ASG-T/PO      |                |                     | -T/FL   |                   |      |   |  |
|   |                           | SG Feedwater                               | C-L53                                    | Motor Driven ASG Pumps                          | ASG/ASGm/SG                  | 4 | ASG-TNK  |               | HMPO           |                     | -WFL    | ASG-SG/FL         | SGs  |   |  |
|   |                           |  | G-L54                                    | ARE Main Feed                                   | CEX/APA/SG-                  |   | CEX-TNK  | CEX-PO        | ABP-HX*        | APA-PO              | AHP-HX* | ARE-SG/FL         | 000  |   |  |
|   |                           |  |  |   | SER/ASG                      | • | SEA HINK | OEATO         | SER-PO         | AATO                | ~~~~    | ARE BOILE         |      |   |  |
|   | C5. Core Cooling          |  | C-L55<br>C-L56                           | SER Make-up to ASG<br>SER gravity Make-up to    | SER/ASG<br>SER/ASG (gravity) |   | SER      | -TNK          | SER-PU         | SER-ASG             |         |                   |      |   |  |
|   |                           |  | C-L56<br>C-L57                           | ASG<br>JPP Make-up to ASG                       | JPP/JPD/ASG                  |   | 100      | -TNK          | JPP-PO         | JPD-ASG             | ASG-TNK |                   |      |   |  |
|   |                           | SG Long term<br>Feedwater Supply           | C-L57                                    | JPP Make-up to ASG                              | SEP/JPD/ASG                  |   | SEP-TNK  |               | JPP-PO         | JPD-ASG             |         |                   |      |   |  |
|   |                           |  | C-L58<br>C-L59                           | SEP Make-up to JPP                              | SEP/JPS/JPD/ASG              |   | JEF-TINK | SEP-JPP/S     |                | JF D-AGG            |         |                   |      |   |  |
|   |                           |  | C-L59<br>C-L67                           | SEP Make-up to JPP<br>4th SG Injection          | SEP/JPP<br>SEP/ASGx/SG       |   | SEP-TNK  | ASG-4PO       | JPP-INK        |                     |         |                   |      |   |  |
|   |                           | RRA Core Cooling                           | C-L67                                    | Ath SG Injection                                | RCP/RRA/RCP                  |   | RCP*     | RRA-SL        | RRA-PO         | RRA-Hx              | RRA-DL  | RRA-SV            | RCP* |   |  |
| - |                           | (SD)<br>Containment Isolation              | C-L60<br>B-1                             | Containment Building                            | NUTINNARUP                   |   | B-CNT    | RRA-SL        | RRA-PU         | INRA-HX             | RRA-DL  | RRA-SV            | RGP- |   |  |
|   |                           |  | B-1                                      |   | tom Maka un                  |   | B-CINI   |               |                |                     |         |                   |      |   |  |
|   |                           | Direct Core Injection                      | 0.101                                    | *See C4. Primary Sys<br>Containment Spray - EAS |                              |   |          | DTD 540       |                | 6 PO                |         |                   |      |   |  |
|   |                           |  | C-L61                                    | Direct Injection<br>Containment Spray - EAS     | PTR/EAS/CNT                  |   |          | PTR-EAS       |                | S-PO                |         |                   |      |   |  |
|   |                           | Containment                                | C-L62                                    | Recirculation<br>Containment Spray -JPP         | SMP/EAS/CNT                  |   | CNT-SMP  | SMP-EAS       | EAS-PO         | EAS-Hx              | EAS-SPR | CONT              |      |   |  |
|   | C6. Containment           | Pressure Control                           | C-L63                                    | Emergency Back-up                               | JPP/EAS/CNT                  |   | JPP-TNK  | JPP-PO        | JPP-JPC        | JPC-EAS             |         |                   |      |   |  |
|   | Integrity                 |  | C-L68                                    | EAS Emergency Backup                            | SEP/EASx/CNT                 | 5 | SEP-TNK  | SEP-EAS       | PE             | E-PO                |         |                   |      |   |  |
|   |                           |  | C-L64                                    | Containment Venting                             |                              |   |          | 1             |                |                     |         |                   |      |   |  |
|   |                           | Hydrogen Reduction                         | C-L65                                    |   |                              |   |          |               |                |                     |         |                   |      |   |  |
|   |                           | SG Creep Rupture<br>Prevention             | C-L52                                    | Turbine Driven ASG Pump                         | ASG/ASGt/SG                  | , | ASG-TNK  | ASG-T/PO      |                |                     | FT/FL   | ASG-SG/FL         | SGs  |   |  |
|   |                           | Basemat Melt-thro                          | C-L53                                    | Motor Driven ASG Pumps                          | ASG/ASGm/SG                  |   |          | ASG           | -MPO           | ASG                 | -WFL    |                   |      |   |  |
|   |                           | Basemat Melt-thro<br>Prevention            | C-L66                                    | Reactor Pit Flooding                            |                              |   |          |               |                |                     |         |                   |      |   |  |

Table 10:Functional requirements diagram for a beyond-design-basis earthquake (0.4 g)inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                 | Required I                         | Function                                    |          |   | SSCs that provide Functional Requirement |                      |                     |          |             |          |           |        |  |
|-----------------|------------------------------------|---|----------|---|--|----------------------|---------------------|----------|-------------|----------|-----------|--------|--|
|                 | Functional<br>Requirement          | Sub-Function                                | Met      | thods to fulfil Funct                             | ional Req. (SSCs)                        |                      |                     |          | Sub         | -SSC     |           |        |  |
|                 |                                    | Core Exit<br>Temperature                    | C-I1     | Core Exit Temperature<br>Indication               |  | RICxxxMT             |                     |          |             | [LNi]    |           |        |  |
|                 |                                    | RCP Level                                   | C-12     | Pressuriser Level<br>Indication                   |  | RCPxxxMN             |                     |          |             | [LNi]    |           |        |  |
|                 |                                    | Reactor Level                               | C-124    | RVLIS   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Indication                                  | C-13     |   |  | RCPxxxMP             |                     |          |             | n Na     |           |        |  |
|                 |                                    | RCP pressure                                | _        | RCP Pressure Indication                           |  |                      |                     |          |             | [LNi]    |           |        |  |
|                 |                                    | RRA Pressure                                | C-15     | RRA Pressure Indication                           |  | RRAxxxMP             |                     |          |             | [LNi]    |           |        |  |
| e               |                                    | SG Level                                    | C-16     | SG WR Level Indication                            |  | ARExxxMN             |                     |          |             | [LNi]    |           |        |  |
| Co              |                                    | SG Pressure                                 | C-17     | SG Pressure Indication                            |  | VVPxxxMP             |                     |          |             | [LNi]    |           |        |  |
| ctor            | C7. Essential                      | ASG Tank Level                              | C-18     | ASG Tank Level Indication                         |  | ASG002LN             |                     |          |             |          |           |        |  |
| Reactor Core    | Indication                         | Diesel Tank Level                           | C-19     | Diesel Tank Level<br>Indications                  |  | LHixxxLN             |                     |          |             |          |           |        |  |
| -               |                                    | Containment<br>Pressure                     | C-120    | Containment WR Pressure<br>Indication             |  | ETYxxxMP             |                     |          |             | [LNi]    |           |        |  |
|                 |                                    | Containment<br>Radiation                    | C-21     | Containment Radiation<br>Levels                   |  | KRT022-<br>23MA      |                     |          |             | KRT001AR | [LBA]     |        |  |
|                 |                                    | Containment Sump<br>Level                   | C-122    | Containment Sump Level                            |  | RISxxxSL<br>EASxxxSL |                     |          |             | [LCA/B]  |           |        |  |
|                 |                                    | BaseMat<br>Thermocouples                    | C-123    | Basemat Thermo-couples                            |  | KSBxxxMT             |                     |          |             |          |           |        |  |
|                 |                                    | Containment Sump                            | C-I51    |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Temperature<br>Containment                  | C-I52    |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Hydrogen Sampling<br>Reactor Pit            |          |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Temperature                                 | C-153    | OED Death to a f                                  | 050                                      | 050 51               | D. OF T             |          |             |          |           |        |  |
|                 |                                    | SFP Pool                                    | S-S1     | SFP Pool Integrity<br>PTR Normal SFP Cooling      | SFP                                      | SFP-PL               | B-SFP               |          |             |          | DTC -     |        |  |
|                 | S1. SFP Integrity                  | PTR 1/2 PO                                  | S-S1     | Integrity   | SFP\PTR\SFP                              | SFP-PL               | PTR-SL              | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |  |
|                 |                                    | PTR 6 PO                                    | S-S2     | PTR 3rd Train Integrity                           | SFP\PTR3\SFP                             |                      | PTR3-SL             | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |  |
|                 | S2. SFP Cooling                    | PTR 1/2 PO                                  | S-L1     | PTR Normal Cooling                                | SFP\PTR\SFP                              | SFP-PL               | PTR-SL              | PTR-PO   | PTR-HX      | PTF      | R-DL      | SFP-PL |  |
|                 |                                    | PTR 6 PO                                    | S-L2     | PTR 3rd Train Cooling                             | SFP\PTR3\SFP                             |                      | PTR3-SL PTR3-PO PTR |          | PTR3-HX     | PTR      | 3-DL      |        |  |
|                 |                                    | SFP Steam Release                           | S-L3     | Open Vent Doors                                   |  | SFP-VD               |                     |          |             |          | i         |        |  |
| lo              |                                    |   | S-L4     | SED Make-up                                       | SED/SFP                                  | SED-TNK              | SED                 | D-PO     | SED-SFP     |          |           |        |  |
| I Po            | S3. Bulk Boiling                   | 3. Bulk Boiling<br>SFP Emergency<br>Make-up | S-L5     | JPP Make-up                                       | JPP/JPD/SFP                              | JPP-TNK              | JPF                 | P-PO     | JPD-SFP     | SFP-PL   |           |        |  |
| Fue             |                                    |   | S-L6     | JPS Make-up                                       | SEP/JPS/SFP                              | SEP-TNK              | SEP-JPP/S           | JPS-PO   | 51 2-511    | 011-12   |           |        |  |
| Spent Fuel Pool |                                    |   | S-L7     | SEP Make-up                                       | SEP/SFPx                                 | SEP-TNK              | SEP/SFPx            | PEE      | -PO         |          |           |        |  |
| SF              |                                    | SFP Level                                   | S-I1     | SFP Level Indication                              |  | PTRxxxMN             |                     |          |             | [LNi]    | [SAR-ACC] |        |  |
|                 |                                    | SFP Temperature                             | S-12     | SFP Temperature<br>Indication                     |  | PTRxxxMT             |                     |          |             | [LNi]    |           |        |  |
|                 |                                    | Fuel Rack<br>Temperature                    | S-13     |   |  |                      |                     |          |             |          |           |        |  |
|                 | S4. Indication                     | SFP Boron<br>Concentration                  | S-14     |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | SFP Building                                | S-15     |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Pressure<br>SFP Hydrogen                    | S-16     |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Concentration<br>SFP Building               | S-17     |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Humidity                                    | V-L01    | JPP Make-up to Seismic                            | JPP/JPD/VLT                              |                      | TNK                 | JPP-PO   | JPP-JPD     |          |           |        |  |
| ±               | V1. Seismic Vault                  | Flooding of Seismic                         | V-L01    | Vault<br>JPS Make-up to Seismic                   | SEP/JPS/JPD/VLT                          |                      | SEP-JPP/S           | JPS-PO   | JPS-JPD     | JPD-VLT  | VLT       |        |  |
| Vaul            | . I. Ocidillo Vault                | Vault                                       |          | Vault<br>SEP Gravity Feed to                      |  | SEP-TNK              | SEF-JPP/S           |          |             |          | ¥2'       |        |  |
| Seismic Vault   |                                    | Seismic Vault                               | V-L03    | Seismic Vault                                     | SEP/JPD/VLT                              |                      |                     | SEP      | VL1         |          |           |        |  |
| eisn            |                                    | Temperature<br>Seismic Vault Water          | VI-1     |   |  |                      |                     |          |             |          |           |        |  |
| S               | V.2 Indication                     | Level<br>Seismic Vault                      | VI-2     |   |  |                      |                     |          |             |          |           |        |  |
|                 |                                    | Pressure<br>Cask Remain Leak                | VI-3     |   |  |                      |                     |          |             |          |           |        |  |
| Dry<br>Casks    | D1. Cask Integrity                 | Tight<br>Cask Air cooling                   | D-S1     | Cask integrity                                    | CASK                                     | CASK*                |                     | 1        |             |          |           |        |  |
| - ö             | D2. Cask Cooling                   | maintained                                  | D-L1     | Cask Cooling                                      | Cask building and Air Flow               | B-LLW                | CASK-AIR            |          |             |          |           |        |  |
|                 | B1. Containment<br>B2. NAB         |   | B1       | Containment Building                              |  | B-CNT                | Building            | Hatch    | Penetration | Airlocks |           |        |  |
|                 | B2. NAB<br>B3. Electrical Building | a   | B2<br>B3 | Nuclear Auxiliary Building<br>Electrical Building |  | B-NAB<br>B-ELE       |                     |          |             |          |           |        |  |
| sť              | B3. Electrical Buildings           | 9   | В3<br>В4 | Unit Diesel Building                              |  | B-ELE<br>B-DSL       |                     |          |             |          |           |        |  |
| dinç            | B5. SBO Diesel Build               | ling  | B4<br>B5 | SBO Diesel Building                               |  | B-SBO                |                     |          |             |          |           |        |  |
| Buildings       | B6. SEC pump-house                 |   | B6       | SEC Pumphouse Building                            |  | B-SEC                |                     |          |             |          |           |        |  |
|                 | B7. Turbine Hall                   |   | B7       | Turbine Hall                                      |  | B-TUR                |                     |          |             |          |           |        |  |
|                 | B8. LLW Building                   |   | B8       | Low Level Waste Building                          |  | B-LLW                |                     |          |             |          |           |        |  |
|                 | B9. ECC                            |   | B9       | Emergency Control Centre                          |  | B-ECC                |                     |          |             |          |           |        |  |

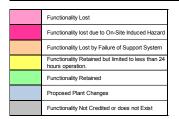
### Table 10:

Functional requirements diagram for a beyond-design-basis earthquake (0.4 g) inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                           | Required F                       | Function                                | SSCs that provide Functional Requirement |   |                   |            |          |            |           |          |         |       |       |  |
|---------------------------|----------------------------------|---|--|---|-------------------|------------|----------|------------|-----------|----------|---------|-------|-------|--|
|                           | Functional<br>Requirement        | Sub-Function                            | Me                                       | thods to fulfil Functi                                      | ional Req. (SSCs) |            |          |            | Sub       | -SSC     |         |       |       |  |
|                           |                                  |   | E-1                                      | 400 KV LHA Supply   | 400KV/LHA         | 400KV      | GEN-TRX  | UNT-TRX    | LGA-SWB   | LGB-SWB  |         |       |       |  |
|                           |                                  | LHA Switchboard                         | E-2                                      | 132 KV LHA Supply   | 132KV/LHA         | 132KV      | STN      | -TRX       | LGE/F-SWB | LGB-SWB  |         |       |       |  |
|                           |                                  | Supply<br>[LHA]                         | E-3                                      | LHP Diesel LHA Supply                                       | LHP/LHA           | LHP-DSL    |          | LHP        | -LHA      | •        | LHA-SWB | [LCA] | [LBA] |  |
|                           |                                  | [LINA]                                  | E-4                                      | LHS Diesel LHA Supply                                       | LHS/LHA           | LHS-DSL    | LHS      | -LHC       | LHC-SWB   | LHC-LHA  |         |       |       |  |
|                           | E1. Essential 6.6kV              |   | E-60                                     | MBL Diesel LHA Supply                                       | MBL-DSL/LHA       | MBL-DSL    |          | MBL-D      | SL-CON    |          |         |       |       |  |
|                           | Switchboard Supply               |   | E-5                                      | 400 KV LHB Supply   | 400KV/LHB         | 400KV      | GEN-TRX  | UNT-TRX    | LGD-SWB   |          |         |       |       |  |
|                           |                                  | LHB Switchboard                         | E-6                                      | 132 KV LHB Supply   | 132KV/LHB         | 132KV      | STN      | -TRX       | LGE/F-SWB | LGC-SWB  |         |       |       |  |
|                           |                                  | Supply<br>[LHB]                         | E-7                                      | LHQ Diesel LHB Supply                                       | LHQ/LHB           | LHQ-DSL    |          | LHQ        | -LHB      |          | LHB-SWB | [LCB] | [LBB] |  |
|                           |                                  | [LIID]                                  | E-8                                      | LHS Diesel LHB Supply                                       | LHS/LHB           | LHS-DSL    | LHS      | -LHC       | LHC-SWB   | LHC-LHB  |         |       |       |  |
|                           |                                  |   | E-61                                     | MBL Diesel LHB Supply                                       | MBL-DSL/LHB       | MBL-DSL    |          | MBL-D      | SL-CON    | -<br>-   |         |       |       |  |
|                           | E2. SBO Diesel<br>Supply         | LLY SBO Diesel<br>Supply<br>[LLY]       | E-10                                     | LLY Switchboard Supply                                      | LLS\LLX\LLY       | LLS-DSL    | LLX-SWB  | LLX-LLY    | LLY-SWB   |          |         |       |       |  |
|                           |                                  |   | E-21                                     | LCA Switchboard - LHA                                       | LCA\LLi\LHA       | [LHA]      |          | LLA\E-SWB  | LCA-RD    |          |         |       |       |  |
|                           |                                  | LCA 48V Switchboard<br>Supply [LCA]     | E-22                                     | LCA Switchboard - LLS                                       | LCAILLY           | [LLY]      |          |            | LCA-RD    | LCA-SWB  |         |       |       |  |
|                           | E3. 48 V Essential               |   | E-23                                     | LCA Switchboard - Battery                                   | LCA\BAT           | LCA-BAT    | r        |            |           |          |         |       |       |  |
|                           | Switchboard Supply               | LCB 48V                                 | E-24                                     | LCB Switchboard - LHB                                       | LCB\LLI\LHB       | [LHB]      |          | LLB\D-SWB  | LCB-RD    |          |         |       |       |  |
| em                        |                                  | Switchboard Supply                      | E-25                                     | LCB Switchboard - LLS                                       | LCB/LLY           | [LLY]      |          |            | LOB-RD    | LCB-SWB  |         |       |       |  |
| yste                      |                                  | [[0]]                                   | E-26                                     | LCB Switchboard - Battery                                   | LCB\BAT           | LCB-BA     | r        |            |           |          |         |       |       |  |
| Electrical Support System |                                  | LBA 125V                                | E-31                                     | LBA Switchboard - LHA                                       | LBA\LLi\LHA       | [LHA]      |          | LLC\E-SWB  | LBA-RD    |          |         |       |       |  |
| odo                       |                                  | Switchboard Supply                      | E-32                                     | LBA Switchboard - LLS                                       | LBA\LLY           | [LLY]      |          |            | LBA-RD    | LBA-SWB  |         |       |       |  |
| Sup                       | E4. 125 V Essential              | [-54]                                   | E-33                                     | LBA Switchboard - Battery                                   | LBA\BAT           | LBA-BAT    | r 🛛      |            |           |          |         |       |       |  |
| cal                       | Switchboard Supply               | LBB 125V<br>Switchboard Supply<br>[LBB] | E-34                                     | LBB Switchboard - LHA                                       | LBB\LLi\LHB       | (LHB)      |          | LLB\D-SWB  | LBB-RD    |          |         |       |       |  |
| ctri                      |                                  |   | E-35                                     | LBB Switchboard - LLS                                       | LBB\LLY           |            |          |            |           | LBB-SWB  |         |       |       |  |
| Ele                       |                                  | [-50]                                   | E-36                                     | LBB Switchboard - Battery                                   | LBB\BAT           | LBB-BA     | r        |            |           |          |         |       |       |  |
|                           |                                  |   | E-41                                     | SIP I Dirty Supply from LHA                                 | LNA/LLC/LHA       | [LHA]      | LLC-SWB  | LNA        | RD        |          |         |       |       |  |
|                           |                                  | LNA 220V Essential<br>Switchboards      | E-42                                     | SIP I Clean Supply from<br>LHA                              | LNA/LBC/LLA/LHA   | <b>1 1</b> | LLA-SWB  | LBC-RD     |           | LNA-SWB  |         |       |       |  |
|                           |                                  | [LNA]                                   | E-43                                     | SIP I Supply from LSS                                       | LNA/LBC/LLY       | [LLY]      |          | 200110     | LBC-SWB   |          |         |       |       |  |
|                           |                                  |   | E-44                                     | SIP I Battery Supply  | LNA/LBC/BAT       | LBC-BA     | r        |            |           |          |         |       |       |  |
|                           |                                  |   | E-45                                     | SIP II Dirty Supply from<br>LHB                             | LNB/LLD/LHB       | [LHB]      | LLD-SWB  | LNE        | I-RD      |          |         |       |       |  |
|                           |                                  | LNB 220V Essential<br>Switchboards      | E-46                                     | SIP II Clean Supply from<br>LHB                             | LNB/LBD/LLB/LHB   |            | LLB-SWB  | LBD-RD     |           | LNB-SWB  |         |       |       |  |
|                           |                                  | [LNB]                                   | E-47                                     | SIP II Supply from LSS                                      | LNB/LBD/LLY       | [LLY]      |          |            | LBD-SWB   |          |         |       |       |  |
|                           | E5. Essential<br>Instrumentation |   | E-48                                     | SIP II Battery Supply                                       | LNB/LBD/BAT       | LBD-BA     |          |            |           |          |         |       |       |  |
|                           | Switchboard Supply               |   | E-49                                     | SIP III Dirty Supply from<br>LHA                            | LNC/LLC/LHA       | [LHA]      | LLC-SWB  | LNC        | -RD       |          |         |       |       |  |
|                           |                                  | LNC 220V Essential<br>Switchboards      | E-50                                     | SIP III Clean Supply from<br>LHA                            | LNC/LBE/LLA/LHA   |            | LLA-SWB  | LBE-RD     |           | LNC-SWB  |         |       |       |  |
|                           |                                  | [LNC]                                   | E-51                                     | SIP III Supply from LSS                                     | LNC/LBE/LLY       | [LLY]      |          |            | LBE-SWB   |          |         |       |       |  |
|                           |                                  |   | E-52                                     | SIP III Battery Supply                                      | LNC/LBE/BAT       | LBE-BAT    |          |            |           |          |         |       |       |  |
|                           |                                  |   | E-53                                     | SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from | LND/LLD/LHB       | [LHB]      | LLD-SWB  | LND        | -RD       | ļ        |         |       |       |  |
|                           |                                  | LND 220V Essential<br>Switchboards      | E-54                                     | LHB   | LND/LBF/LLB/LHB   |            | LLB-SWB  | LBF-RD     |           | LND-SWB  |         |       |       |  |
|                           |                                  | [LND]                                   | E-55                                     | SIP IV Supply from LSS                                      | LND/LBF/LLY       | [LLY]      |          |            | LBF-SWB   |          |         |       |       |  |
|                           |                                  |   | E-56                                     | SIP IV Battery Supply                                       | LND/LBF/BAT       | LBF-BAT    |          |            |           |          |         |       | _     |  |
| ¥                         | U1. Essential                    | SEC Train A Cooling                     | U-1                                      | SEC Train A Cooling   | SEA/SEC-A/SEA     | [Sea]      | SEC-A-RS | SEC-A-DS   | SEC-A-PO  | RRI-A-HX | [Sea]   |       |       |  |
| Ultimate Heatsink         | Cooling                          | SEC Train B Cooling                     | U-2                                      | SEC Train B Cooling   | SEA/SEC-B/SEA     |            | SEC-B-RS | SEC-B-DS   | SEC-B-PO  | RRI-B-HX |         |       |       |  |
| Hea                       |                                  | Alternative Heatsink                    | U-3                                      | Alternative Heatsink  |                   |            |          |            |           |          |         |       |       |  |
| tte I                     |                                  | RRI Train A Cooling                     | U-11                                     | RRI Train A Cooling   | SEC/RRI-A/HXA     | HX-A       | RRI-A-PO | [RRI-A-HX] |           |          |         |       |       |  |
| ima                       | U2. Component<br>Cooling         | RRI Train B Cooling                     | U-12                                     | RRI Train B Cooling<br>RRI Commons cooling                  | SEC/RRI-B/HXA     | HX-B       | RRI-B-PO | [RRI-B-HX] |           |          |         |       |       |  |
| Ē                         | coomig                           | RRI Commons<br>Cooling                  | U-13                                     | (Train A)<br>RRI Commons cooling                            | SEC/RRI-A/HXC     | нх-сом     | RRI-A-PO | [RRI-A-HX] |           |          |         |       |       |  |
|                           |                                  | Cooming                                 | U-14                                     | (Train B)   | SEC/RRI-B/HXC     |            | RRI-B-PO | [RRI-B-HX] |           |          |         |       |       |  |

Tsunami event results in damage

Seismic event results in damage



Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

|              | Required F                    | unction                              | SSCs that provide Functional Requirement |  |                             |           |                      |                |                     |         |                   |      |   |  |
|--------------|-------------------------------|--------------------------------------|--|--|-----------------------------|-----------|----------------------|----------------|---------------------|---------|-------------------|------|---|--|
| -            | Functional<br>Requirement     | Sub-Function                         | Met                                      | hods to fulfil Functi  | ional Req. (SSCs)           |           |                      |                | Sub                 | -SSC    |                   |      |   |  |
|              |                               | Control Rods                         | C-S1                                     | Control Rod  | CRDMs                       | FL-ASS    | FL-ASS CNTL-ROD CRDM |                |                     |         |                   |      |   |  |
|              |                               |                                      | C-L42                                    | REA Boration (direct or<br>normal)                                 | REA/RCV/RCP                 | REA/B-TNK | REA/B-PO             | REA            | -RCV                | RCV-PO  |                   |      |   |  |
|              |                               |                                      | C-L44                                    | Normal charging from PTR<br>tank                                   | PTR/RCV/RCP                 |           |                      | PTR-RCV        |                     | RCV-PU  | RCV-CL            |      |   |  |
|              | C1. Sub-Criticality           | Boron Injection                      | C-L34                                    | Charging using Emergency<br>Seal Injection                         | ESS/ESS-CL/RCP              | PTR-TNK   |                      | DTD 500        |                     | 500 00  |                   | RCP  |   |  |
|              |                               |                                      | C-L33                                    | Emergency Seal Injection   | ESS/ESS-SI/RCP              |           |                      | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |   |  |
|              |                               |                                      | C-L11                                    | Accumulators   | ACC/RCP                     | ACC       |                      |                | ACC-RCP             |         |                   |      |   |  |
|              |                               | RCP System                           | C-121                                    | RCP Integrity  | RCP*                        | RCP*      | RCP<br>Pumps*        | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*  | Safety<br>Valves* |      |   |  |
|              | C2. Primary System            | SG                                   | C-122                                    | SG Integrity   | SG*                         | SGs*      |                      |                |                     |         |                   |      |   |  |
|              | Integrity                     | RRA System Integrity<br>(SD)         | C-123                                    | RRA Integrity  | RCP*/RRA*/RCP*              | RCP*      | RRA-SL*              | RRA-PO*        | RRA-Hx*             | RRA-DL* | RRA-SV*           |      |   |  |
|              |                               | RRA System Isolation<br>(SD)         | C-124                                    | RRA Isolation  | RCP*                        | RCP*      | RRA-SL               | RRA-DL         |                     |         |                   |      |   |  |
|              |                               | Normal Soul Injustion                | C-L31                                    | Normal Seal Injection  | REA/RCV/RCP                 | REA/B-TNK | REA/B-PO             | REA            | -RCV                | RCV-PO  | RCV-SI            |      |   |  |
|              | C3. RCP Seal<br>injection     | Normal Seal Injection                | C-L32                                    | PTR Seal Injection   | PTR/RCV/RCP                 | PTR-TNK   |                      | PTR-RCV        |                     | KCV-FO  | KCV-3I            | RCP  |   |  |
|              |                               | Emergency Seal<br>Injection          | C-L33                                    | Emergency Seal Injection   | ESS/RCP                     | - FIR-INK |                      | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |   |  |
|              |                               |                                      | C-L42                                    | REA Boration (direct or<br>normal)                                 | REA/RCV/RCP                 | REA/B-TNK | REA/B-PO             | DEA            | -RCV                |         |                   |      |   |  |
|              |                               | RCV Normal charging                  | C-L43                                    | Normal charging from REA<br>water system                           | REA/RCV/RCP                 | REAW-TNK  | REAW-PO              | REA            | -NOV                | RCV-PO  | RCV-CL            |      |   |  |
|              |                               |                                      | C-L44                                    | Normal Charging from<br>PTR  | PTR/RCV/RCP                 |           |                      | PTR-RCV        |                     |         | NOV-CL            |      |   |  |
|              |                               | ESS Charging<br>Injection (Low Flow) | C-L34                                    | Charging using ESS<br>(6m3/hr)                                     | ESS/ESS-CL/RCP              |           |                      | PTR-ESS        |                     | ESS-PO  |                   |      |   |  |
|              |                               | ESS Seal injection<br>(Low Flow)     | C-L33                                    | Emergency Seal Injection<br>(6m3/hr)                               | ESS/ESS-SI/RCP              | PTR-TNK   |                      | PIR-E55        |                     | E33-PU  | ESS-SI            | RCP  |   |  |
|              | C4. Primary System<br>Make-up | HHSI - Direct Inj.                   | C-L45                                    | HHSI Direct Injection  | PTR/RCV/BIT/RCP             |           |                      | PTR-RCV        |                     | RCV-PO  | RCV-HSI           | KOF  |   |  |
|              |                               | LHSI - Direct Inj.                   | C-L46                                    | LHSI Direct Injection  | PTR/RIS/RCP                 |           |                      | PTR-RIS        |                     | RIS-PO  |                   |      |   |  |
| _            |                               | LHSI - Recirculation                 | C-L47                                    | LHSI Recirculation   | SMP/RIS/RCP                 |           |                      | SMP-RIS        |                     | KIS-FU  | - RIS-LSI         |      |   |  |
| Cor          | -                             | EAS Back-up to RIS                   | C-L48                                    | EAS Back-up to RIS   | SMP/EAS/EAS-<br>4PO/RIS/RCP | CNT-SMP   | SMP-EAS              | EAS-PO         | EAS-RIS             | RIS-PO* | KIO-LOI           |      |   |  |
| ř            |                               | EAS 004 Back-up to<br>RIS            | C-L49                                    | EAS Back-up to RIS   | SMP/EAS/EAS-<br>RIS/RIS/RCP | PTR-TNK   | SMP-EAS              | EAS-PO*        | EAS-4PO             | RIS-PO* |                   |      |   |  |
| Reactor Core |                               | PTR Gravity Feed<br>(SD - Head Off)  | C-L61                                    | PTR Gravity Feed   | PTR/RIS*/RCP                | PTR-TNK   |                      | PTR-RIS        |                     | RIS-PO* | RIS-LSI           | RCP  |   |  |
| _            |                               | SG Steam Dump                        | C-L50                                    | GCTa Steam Dump  | SG/WP/GCTa                  | SGs       | WP-GCT               |                | GCTa-STM            |         |                   |      |   |  |
|              |                               |                                      | C-L51                                    | GCTc Steam Dump  | SGAMP/GCTc-                 |           |                      | GCTc-STM       | CEX-TNK-            | CEX-PO  |                   |      |   |  |
|              |                               |                                      | C-L52                                    | Turbine Driven ASG Pump  | ASG/ASGt/SG                 | ASG-TNK   | ASG-T/PO             | ASG-T/SS       | ASG                 | -T/FL   | ASG-SG/FL         |      |   |  |
|              |                               | SG Feedwater                         | C-L53                                    | Motor Driven ASG Pumps   | ASG/ASGm/SG                 |           | ASG                  | MPO            | ASG                 | -WFL    |                   | SGs  |   |  |
|              |                               |                                      | <del>C-L5</del> 4                        | ARE Main Feed  | CEXAPA/SG                   | CEX-TNK-  | CEX-PO               | ABP-HX*        | APA-PO-             | AHP-HX* | ARE-SG/FL         |      |   |  |
|              | C5. Core Cooling              |                                      | C-L55                                    | SER Make-up to ASG   | SER/ASG                     | SEE       | -TNK                 | SER-PO         | SER-ASG             |         |                   |      |   |  |
|              |                               |                                      | C-L56                                    | SER gravity Make-up to<br>ASG                                      | SER/ASG (gravity)           |           |                      | SER-BV         |                     | ASG-TNK |                   |      |   |  |
|              |                               | SG Long term<br>Feedwater Supply     | C-L57                                    | JPP Make-up to ASG   | JPP/JPD/ASG                 | JPP       | -TNK                 | JPP-PO         | JPD-ASG             |         |                   |      |   |  |
|              |                               |                                      | C-L58                                    | JPS Make-up to ASG   | SEP/JPS/JPD/ASG             | SEP-TNK   | SEP-JPP/S            | JPS-PO         | JPD-ASG             |         |                   |      |   |  |
|              |                               |                                      | C-L59                                    | SEP Make-up to JPP   | SEP/JPP                     |           |                      | JPP-TNK        |                     |         |                   |      |   |  |
|              |                               | RRA Core Cooling<br>(SD)             | C-L60                                    | RRA Cooling  | RCP/RRA/RCP                 | RCP*      | RRA-SL               | RRA-PO         | RRA-Hx              | RRA-DL  | RRA-SV            | RCP* |   |  |
|              |                               | Containment Isolation                | B-1                                      | Containment Building   |                             | B-CNT     |                      |                |                     |         |                   |      |   |  |
|              |                               | Direct Core Injection                |  | *See C4. Primary Sys   | tem Make-up                 |           |                      |                |                     |         |                   |      |   |  |
|              |                               |                                      | C-L61                                    | Containment Spray - EAS<br>Direct Injection                        | PTR/EAS/CNT                 | PTR-TNK   | PTR-EAS              |                | S-PO                |         |                   |      |   |  |
|              |                               | Containment<br>Pressure Control      | C-L62                                    | Containment Spray - EAS<br>Recirculation<br>Containment Spray -JPP | SMP/EAS/CNT                 | CNT-SMP   | SMP-EAS              | EAS-PO         | EAS-Hx              | EAS-SPR | CONT              |      |   |  |
|              | C6. Containment<br>Integrity  |                                      | C-L63                                    | Emergency Back-up  | JPP/EAS/CNT                 | JPP-TNK   | JPP-PO               | JPP-JPC        | JPC-EAS             |         |                   |      |   |  |
|              |                               |                                      | C-L64                                    | Containment Venting  |                             |           | 1                    |                |                     |         |                   |      |   |  |
|              |                               | Hydrogen Reduction                   | C-L65                                    | Hydrogen PARS  | ETY (PARS)                  | PARs      |                      |                |                     |         |                   |      | 1 |  |
|              |                               | SG Creep Rupture<br>Prevention       | C-L52                                    | Turbine Driven ASG Pump  | ASG/ASGt/SG                 | ASG-TNK   | ASG-T/PO             | ASG-T/SS       |                     | -T/FL   | ASG-SG/FL         | SGs  |   |  |
|              |                               | Basemat Melt-thro                    | C-L53                                    | Motor Driven ASG Pumps   | ASG/ASGm/SG                 |           | ASG                  | MPO            | ASG                 | -WFL    |                   |      |   |  |
|              |                               | Prevention                           | C-L66                                    | Reactor Pit Flooding   |                             |           |                      |                |                     |         |                   |      |   |  |

# Table 11:Functional requirements diagram for a beyond-design-basis earthquake (0.5 g)inducing a tsunami wave up to the 0 m terrace level (no modifications)

### Table 11:

| Functional requirements diagram for a beyond-design-basis earthquake (0.5 g) |  |
|--|--|
| inducing a tsunami wave up to the 0 m terrace level (no modifications)       |  |

|                 | Required                             | Function                                   |          |  | SSCs th                    | at provide           | Functio   | nal Requ |             |          |           |        |  |
|-----------------|--------------------------------------|--|----------|--|----------------------------|----------------------|-----------|----------|-------------|----------|-----------|--------|--|
|                 | Functional<br>Requirement            | Sub-Function                               | Met      | hods to fulfil Funct                           | ional Req. (SSCs)          |                      |           | ,        | Sub         | SSC      |           |        |  |
|                 | rioquiionioni                        | Core Exit<br>Temperature                   | C-I1     | Core Exit Temperature<br>Indication            |                            | RICxxxMT             |           |          |             | [LNi]    |           |        |  |
|                 |                                      | RCP Level                                  | C-12     | Pressuriser Level                              |                            | RCPxxxMN             |           |          |             | [LNi]    |           |        |  |
|                 |                                      | Reactor Level                              | C-124    | Indication<br>RVLIS                            |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | Indication<br>RCP pressure                 | C-13     | RCP Pressure Indication                        |                            | RCPxxxMP             |           |          |             | [LNi]    |           |        |  |
|                 |                                      | RRA Pressure                               | C-15     | RRA Pressure Indication                        |                            |                      |           |          |             |          |           |        |  |
|                 |                                      |  | _        |  |                            |                      |           |          |             | [LNi]    |           |        |  |
| ere             |                                      | SG Level                                   | C-16     | SG WR Level Indication                         |                            |                      |           |          |             | [LNi]    |           |        |  |
| ŭ               |                                      | SG Pressure                                | C-17     | SG Pressure Indication                         |                            | VVPxxxMP             |           |          |             | [LNi]    |           |        |  |
| Reactor Core    | C7. Essential<br>Indication          | ASG Tank Level                             | C-18     | ASG Tank Level Indication<br>Diesel Tank Level |                            | ASG002LN             |           |          |             |          |           |        |  |
| Re              |                                      | Diesel Tank Level<br>Containment           | C-19     | Indications<br>Containment WR Pressure         |                            | LHixoxLN             |           |          |             |          |           |        |  |
|                 |                                      | Pressure                                   | C-120    | Indication                                     |                            | ETYxxxMP<br>KRT022-  |           |          |             | [LNi]    |           |        |  |
|                 |                                      | Containment<br>Radiation                   | C-21     | Containment Radiation<br>Levels                |                            | 23MA                 |           |          |             | KRT001AR | [LBA]     |        |  |
|                 |                                      | Containment Sump<br>Level                  | C-122    | Containment Sump Level                         |                            | RISxxxSL<br>EASxxxSL |           |          |             | [LCA/B]  |           |        |  |
|                 |                                      | BaseMat<br>Thermocouples                   | C-123    | Basemat Thermo-couples                         |                            | KSBxxxMT             |           |          |             |          |           |        |  |
|                 |                                      | Containment Sump<br>Temperature            | C-I51    |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | Containment<br>Hydrogen Sampling           | C-152    |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | Reactor Pit<br>Temperature                 | C-153    |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | SFP Pool                                   | S-S1     | SFP Pool Integrity                             | SFP                        | SFP-PL               | B-SFP     |          |             |          |           |        |  |
|                 | S1. SFP Integrity                    | PTR 1/2 PO                                 | S-S1     | PTR Normal SFP Cooling<br>Integrity            | SFP\PTR\SFP                | SFP-PL               | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |  |
|                 |                                      | PTR 6 PO                                   | S-S2     | PTR 3rd Train Integrity                        | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |  |
|                 |                                      | PTR 1/2 PO                                 | S-L1     | PTR Normal Cooling                             | SFP\PTR\SFP                |                      | PTR-SL    | PTR-PO   | PTR-HX      | PTF      | R-DL      |        |  |
|                 | S2. SFP Cooling                      | PTR 6 PO                                   | S-L2     | PTR 3rd Train Cooling                          | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTR      | 3-DL      | SFP-PL |  |
|                 |                                      | SFP Steam Release                          | S-L3     | Open Vent Doors                                |                            | SFP-VD               |           |          |             |          |           |        |  |
| 00              |                                      |  | S-L4     | SED Make-up                                    | SED/SFP                    | SED-TNK              | SED       | )-PO     | SED-SFP     |          |           |        |  |
| Iel             | S3. Bulk Boiling                     | . Bulk Boiling<br>SFP Emergency<br>Make-up | S-L5     | JPP Make-up                                    | JPP/JPD/SFP                | JPP-TNK              | JPP       | P-PO     |             | SFP-PL   |           |        |  |
| Spent Fuel Pool |                                      |  | S-L6     | JPS Make-up                                    | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO   | JPD-SFP     |          |           |        |  |
| Sper            |                                      | SFP Level                                  | S-11     | SFP Level Indication                           |                            | PTRxxxMN             |           |          |             | [LNi]    | [SAR-ACC] |        |  |
|                 |                                      | SFP Temperature                            | S-12     | SFP Temperature<br>Indication                  |                            | PTRxxxMT             |           |          |             | [LNi]    |           |        |  |
|                 |                                      | Fuel Rack<br>Temperature                   | S-13     |  |                            |                      |           |          |             |          | •         |        |  |
|                 | S4. Indication                       | SFP Boron<br>Concentration                 | S-14     |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | SFP Building<br>Pressure                   | S-15     |  |                            | -                    |           |          |             |          |           |        |  |
|                 |                                      | SFP Hydrogen<br>Concentration              | S-16     |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | SFP Building<br>Humidity                   | S-17     |  |                            | -                    |           |          |             |          |           |        |  |
|                 |                                      | . amony                                    | V-L01    | JPP Make-up to Seismic<br>Vault                | JPP/JPD/VLT                | JPP                  | TNK       | JPP-PO   | JPP-JPD     |          |           |        |  |
| 벌               | V1. Seismic Vault                    | Flooding of Seismic<br>Vault               | V-L02    | JPS Make-up to Seismic<br>Vault                | SEP/JPS/JPD/VLT            |                      | SEP-JPP/S | JPS-PO   | JPS-JPD     | JPD-VLT  | VLT       |        |  |
| Val             |                                      | ·aut                                       | V-L03    | SEP Gravity Feed to<br>Seismic Vault           | SEP/JPD/VLT                | SEP-TNK              |           | SEF      | -VLT        |          |           |        |  |
| Seismic Vault   |                                      | Seismic Vault<br>Temperature               | VI-1     | Colornic Vault                                 |                            |                      |           |          |             |          |           |        |  |
| Seis            | V.2 Indication                       | Seismic Vault Water                        | VI-2     |  |                            |                      |           |          |             |          |           |        |  |
|                 |                                      | Seismic Vault                              | VI-3     |  |                            |                      |           |          |             |          |           |        |  |
| Ś               | D1. Cask Integrity                   | Pressure<br>Cask Remain Leak               | D-S1     | Cask integrity                                 | CASK                       | CASK*                |           |          |             |          |           |        |  |
| Dry<br>Casks    | D2. Cask Cooling                     | Tight<br>Cask Air cooling                  | D-L1     | Cask Cooling                                   | Cask building and Air Flow | B-LLW                | CASK-AIR  |          |             |          |           |        |  |
|                 | B1. Containment                      | maintained                                 | B1       | Containment Building                           |                            | B-CNT                | Building  | Hatch    | Penetration | Airlocks |           |        |  |
|                 | B2. NAB                              |  | B2       | Nuclear Auxiliary Building                     |                            | B-NAB                |           |          |             |          |           |        |  |
|                 | B3. Electrical Buildin               | g  | B3       | Electrical Building                            |                            | B-ELE                |           |          |             |          |           |        |  |
| Buildings       | B4. Diesel buildings                 |  | B4       | Unit Diesel Building                           |                            | B-DSL                |           |          |             |          |           |        |  |
| iplir           | B5. SBO Diesel Build                 |  | B5       | SBO Diesel Building                            |                            | B-SBO                |           |          |             |          |           |        |  |
| Ē               | B6. SEC pump-house                   |  | B6       | SEC Pumphouse Building                         |                            | B-SEC                |           |          |             |          |           |        |  |
|                 | B7. Turbine Hall<br>B8. LLW Building |  | B7<br>B8 | Turbine Hall<br>Low Level Waste Building       |                            | B-TUR<br>B-LLW       |           |          |             |          |           |        |  |
|                 | B9. ECC                              |  | B9       | Emergency Control Centre                       |                            | B-ECC                |           |          |             |          |           |        |  |
| L               |                                      |  |          |  |                            |                      |           |          |             |          |           |        |  |

# Table 11:Functional requirements diagram for a beyond-design-basis earthquake (0.5 g)inducing a tsunami wave up to the 0 m terrace level (no modifications)

|                           | Required F                            | unction                             |      |   | SSCs th          | nat | provid | e Funct | onal Req   | uirement   |          |          |       |       |
|---------------------------|---------------------------------------|-------------------------------------|------|---|------------------|-----|--------|---------|------------|------------|----------|----------|-------|-------|
|                           | Functional<br>Requirement             | Sub-Function                        | Met  | thods to fulfil Functi                        | onal Req. (SSCs) |     |        |         |            | Sub        | -SSC     |          |       |       |
|                           |                                       |                                     | E-1  | 400 KV LHA Supply                             | 400KV/LHA        |     | 400KV  | GEN-TR  | UNT-TRX    | LGA-SWB    | LGB-SWB  |          |       |       |
|                           |                                       | LHA Switchboard<br>Supply           | E-2  | 132 KV LHA Supply                             | 132KV/LHA        |     | 132KV  | S       | N-TRX      | LGE/F-SWE  | LGB-SWD  | LHA-SWB  | [LCA] | [LBA] |
|                           |                                       | [LHA]                               | E-3  | LHP Diesel LHA Supply                         | LHP/LHA          | L   | HP-DSL |         | LH         | IP-LHA     |          | LINA-SWB | [LCA] | [LDA] |
|                           | E1. Essential 6.6kV                   |                                     | E-4  | LHS Diesel LHA Supply                         | LHS/LHA          | L   | HS-DSL | Li      | IS-LHC     | LHC-SWB    | LHC-LHA  |          |       |       |
|                           | Switchboard Supply                    |                                     | E-5  | 400 KV LHB Supply                             | 400KV/LHB        |     | 400KV  | GEN-TR  | UNT-TRX    | LGD-SWB    |          |          |       |       |
|                           |                                       | LHB Switchboard                     | E-6  | 132 KV LHB Supply                             | 132KV/LHB        |     | 132KV  | S       | N-TRX      | LGE/F-SWE  | LGC-SWB  |          |       |       |
|                           |                                       | Supply<br>[LHB]                     | E-7  | LHQ Diesel LHB Supply                         | LHQ/LHB          | L   | HQ-DSL |         | LH         | Q-LHB      |          | LHB-SWB  | [LCB] | [LBB] |
|                           |                                       |                                     | E-8  | LHS Diesel LHB Supply                         | LHS/LHB          | L   | HS-DSL | L       | IS-LHC     | LHC-SWB    | LHC-LHB  |          |       |       |
|                           | E2. SBO Diesel<br>Supply              | LLY SBO Diesel<br>Supply<br>[LLY]   | E-10 | LLY Switchboard Supply                        | LLS\LLX\LLY      | L   | LS-DSL | LLX-SWI | LLX-LLY    | LLY-SWB    |          |          |       |       |
|                           |                                       |                                     | E-21 | LCA Switchboard - LHA                         | LCA\LLi\LHA      |     | [LHA]  |         | LLAIE-SWI  |            |          |          |       |       |
|                           |                                       | LCA 48V Switchboard<br>Supply [LCA] | E-22 | LCA Switchboard - LLS                         | LCAILLY          |     | [LLY]  |         |            | LCA-RD     | LCA-SWB  |          |       |       |
|                           | E3. 48 V Essential                    |                                     | E-23 | LCA Switchboard - Battery                     | LCA\BAT          |     | LCA-BA | л       |            |            | 1        |          |       |       |
|                           | Switchboard Supply                    |                                     | E-24 | LCB Switchboard - LHB                         | LCB/LLI/LHB      |     | [LHB]  |         | LLB\D-SW   |            |          |          |       |       |
|                           |                                       | LCB 48V<br>Switchboard Supply       | E-25 | LCB Switchboard - LLS                         | LCB/LLY          |     | [LLY]  |         | 1          | LCB-RD     | LCB-SWB  |          |       |       |
| E                         |                                       | [LCB]                               | E-26 | LCB Switchboard - Battery                     | LCB\BAT          |     | LCB-BA | σ       |            |            | 1        |          |       |       |
| vste                      |                                       |                                     | E-31 | LBA Switchboard - LHA                         | LBA\LLi\LHA      |     | [LHA]  |         | LLC\E-SW   |            |          |          |       |       |
| t S                       |                                       | LBA 125V<br>Switchboard Supply      | E-32 | LBA Switchboard - LLS                         | LBAILLY          |     | [LLY]  |         |            | LBA-RD     | LBA-SWB  |          |       |       |
| od                        | E4. 125 V Essential                   | [LBA]                               | E-33 | LBA Switchboard - Battery                     | LBA\BAT          |     | LBA-BA | л       |            |            |          |          |       |       |
| dng                       | Switchboard Supply                    |                                     | E-34 | LBB Switchboard - LHA                         | LBB\LLi\LHB      |     | (LHB)  |         | LLB\D-SW   |            |          |          |       |       |
| a                         |                                       | LBB 125V<br>Switchboard Supply      | E-35 | LBB Switchboard - LLS                         | LBB\LLY          |     | [LLY]  |         |            | LBB-RD     | LBB-SWB  |          |       |       |
| Electrical Support System |                                       | [LBB]                               | E-36 | LBB Switchboard - Battery                     | LBB\BAT          |     | LBB-BA | л       |            |            | 1        |          |       |       |
| Ше                        |                                       |                                     | E-41 | SIP I Dirty Supply from LHA                   | LNA/LLC/LHA      |     |        | LLC-SW  | 3 LN       | IA-RD      |          |          |       |       |
| _                         |                                       | LNA 220V Essential                  | E-42 | SIP I Clean Supply from<br>LHA                | LNA/LBC/LLA/LHA  |     | [LHA]  | LLA-SWI |            |            | 1        |          |       |       |
|                           |                                       | Switchboards<br>[LNA]               | E-43 | SIP I Supply from LSS                         | LNA/LBC/LLY      |     | [LLY]  |         | LBC-RD     | LBC-SWB    | LNA-SWB  |          |       |       |
|                           |                                       |                                     | E-44 | SIP I Battery Supply                          | LNA/LBC/BAT      |     | LBC-BA | π       |            |            |          |          |       |       |
|                           |                                       |                                     | E-45 | SIP II Dirty Supply from<br>LHB               | LNB/LLD/LHB      |     |        | LLD-SW  | 3 LN       | IB-RD      |          |          |       |       |
|                           |                                       | LNB 220V Essential                  | E-46 | SIP II Clean Supply from<br>LHB               | LNB/LBD/LLB/LHB  |     | [LHB]  | LLB-SW  |            |            | 1        |          |       |       |
|                           |                                       | Switchboards<br>[LNB]               | E-47 | SIP II Supply from LSS                        | LNB/LBD/LLY      |     | [LLY]  |         | LBD-RD     | LBD-SWB    | LNB-SWB  |          |       |       |
|                           | E5. Essential                         |                                     | E-48 | SIP II Battery Supply                         | LNB/LBD/BAT      |     | LBD-BA | π       |            |            |          |          |       |       |
|                           | Instrumentation<br>Switchboard Supply |                                     | E-49 | SIP III Dirty Supply from<br>LHA              | LNC/LLC/LHA      |     |        | LLC-SW  | B LN       | IC-RD      |          |          |       |       |
|                           |                                       | LNC 220V Essential                  | E-50 | SIP III Clean Supply from<br>LHA              | LNC/LBE/LLA/LHA  |     | [LHA]  | LLA-SWI |            |            | 1        |          |       |       |
|                           |                                       | Switchboards<br>[LNC]               | E-51 | SIP III Supply from LSS                       | LNC/LBE/LLY      |     | [LLY]  |         | LBE-RD     | LBE-SWB    | LNC-SWB  |          |       |       |
|                           |                                       |                                     | E-52 | SIP III Battery Supply                        | LNC/LBE/BAT      |     | LBE-BA | σ       |            |            |          |          |       |       |
|                           |                                       |                                     | E-53 | SIP IV Dirty Supply from<br>LHB               | LND/LLD/LHB      |     |        | LLD-SW  | 3 LN       | ID-RD      |          |          |       |       |
|                           |                                       | LND 220V Essential                  | E-54 | SIP IV Clean Supply from<br>LHB               | LND/LBF/LLB/LHB  |     | [LHB]  | LLB-SW  |            |            | 1        |          |       |       |
|                           |                                       | Switchboards<br>[LND]               | E-55 | SIP IV Supply from LSS                        | LND/LBF/LLY      |     | [LLY]  |         | LBF-RD     | LBF-SWB    | LND-SWB  |          |       |       |
|                           |                                       |                                     | E-56 | SIP IV Battery Supply                         | LND/LBF/BAT      |     | LBF-BA | л       |            |            |          |          |       |       |
|                           |                                       | SEC Train A Cooling                 | U-1  | SEC Train A Cooling                           | SEA/SEC-A/SEA    |     |        | SEC-A-R | S SEC-A-DS | SEC-A-PO   | RRI-A-HX |          |       |       |
| ink                       | U1. Essential<br>Cooling              | SEC Train B Cooling                 | U-2  | SEC Train B Cooling                           | SEA/SEC-B/SEA    |     | [Sea]  | SEC-B-R | S SEC-B-DS | 6 SEC-B-PO | RRI-B-HX | [Sea]    |       |       |
| Ultimate Heatsink         |                                       | Alternative Heatsink                | U-3  | Alternative Heatsink                          |                  |     |        |         |            |            |          |          |       |       |
| Ť                         |                                       | RRI Train A Cooling                 | U-11 | RRI Train A Cooling                           | SEC/RRI-A/HXA    |     | HX-A   | RRI-A-P | [RRI-A-HX  | ]          |          |          |       |       |
| nate                      | U2. Component                         | RRI Train B Cooling                 | U-12 | RRI Train B Cooling                           | SEC/RRI-B/HXA    |     | нх-в   | RRI-B-P | [RRI-B-HX  | 3          |          |          |       |       |
| Itin                      | Cooling                               | RRI Commons                         | U-13 | RRI Commons cooling                           | SEC/RRI-A/HXC    | T   |        | RRI-A-P | (RRI-A-HX  | ]          |          |          |       |       |
| 5                         |                                       | Cooling                             | U-14 | (Train A)<br>RRI Commons cooling<br>(Train B) | SEC/RRI-B/HXC    | 1   | нх-сом | RRI-B-P |            | -          |          |          |       |       |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |



Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

 Table 12:

 Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake

 inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented

|         | Required I                   | Function                             | SSCs that provide Functional Requirement |   |                             |                                   |          |                |                |                     |          |                   |      |           |     |  |
|---------|------------------------------|--------------------------------------|--|---|-----------------------------|-----------------------------------|----------|----------------|----------------|---------------------|----------|-------------------|------|-----------|-----|--|
| -       | Functional<br>Requirement    | Sub-Function                         | Met                                      | hods to fulfil Functi                       | ional Req. (SSCs)           |                                   |          |                |                | Sub                 | -SSC     |                   |      |           |     |  |
|         |                              | Control Rods                         | C-S1                                     | Control Rod                                 | CRDMs                       |                                   | FL-ASS   | CNTL-ROD       | CRDM           |                     |          |                   |      |           |     |  |
|         |                              |                                      | C-L42                                    | REA Boration (direct or<br>normal)          | REA/RCV/RCP                 | R                                 | EA/B-TNK | REA/B-PO       | REA            | -RCV                |          |                   |      |           |     |  |
|         |                              |                                      | C-L44                                    | Normal charging from PTR tank               | PTR/RCV/RCP                 |                                   |          |                | PTR-RCV        |                     | RCV-PO   | RCV-CL            |      |           |     |  |
|         | C1. Sub-Criticality          | Boron Injection                      | C-L34                                    | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | F                                 | TR-TNK   |                |                |                     |          |                   | RCP  |           |     |  |
|         |                              |                                      | C-L33                                    | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |                                   |          |                | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |           |     |  |
|         |                              |                                      | C-L11                                    | Accumulators                                | ACC/RCP                     |                                   | ACC      |                |                | ACC-RCP             |          |                   |      |           |     |  |
| Ī       |                              | RCP System                           | C-121                                    | RCP Integrity                               | RCP*                        |                                   | RCP*     | RCP<br>Pumps*  | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |      |           |     |  |
|         | C2. Primary System           | SG                                   | C-122                                    | SG Integrity                                | SG*                         |                                   | SGs*     |                |                |                     |          |                   |      |           |     |  |
|         | Integrity                    | RRA System Integrity<br>(SD)         | C-123                                    | RRA Integrity                               | RCP*/RRA*/RCP*              |                                   | RCP*     | RRA-SL*        | RRA-PO*        | RRA-Hx*             | RRA-DL*  | RRA-SV*           |      |           |     |  |
|         |                              | RRA System Isolation<br>(SD)         | C-124                                    | RRA Isolation                               | RCP*                        |                                   | RCP*     | RRA-SL         | RRA-DL         |                     |          | <u> </u>          |      |           |     |  |
| Ē       |                              | (00)                                 | C-L31                                    | Normal Seal Injection                       | REA/RCV/RCP                 | R                                 | EA/B-TNK | REA/B-PO       | REA            | -RCV                |          |                   |      |           |     |  |
|         | C3. RCP Seal                 | Normal Seal Injection                | C-L32                                    | PTR Seal Injection                          | PTR/RCV/RCP                 | t                                 |          |                | PTR-RCV        |                     | RCV-PO   | RCV-SI            | RCP  |           |     |  |
|         | injection                    | Emergency Seal<br>Injection          | C-L33                                    | Emergency Seal Injection                    | ESS/RCP                     | F                                 | TR-TNK   |                | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |           |     |  |
|         |                              | Shutdown Seal                        | C-125                                    | Emergency Shutdown Seal                     | RCP                         |                                   |          |                | SD             | Seal                |          |                   |      |           |     |  |
|         |                              |                                      | C-L42                                    | REA Boration (direct or<br>normal)          | REA/RCV/RCP                 | R                                 | EA/B-TNK | REA/B-PO       |                |                     |          |                   |      |           |     |  |
|         |                              | RCV Normal charging                  | C-L43                                    | Normal charging from REA<br>water system    | REA/RCV/RCP                 | RE                                | AW-TNK   | REAW-PO        |                | -RCV                | RCV-PO   |                   |      |           |     |  |
|         |                              |                                      | C-L44                                    | Normal Charging from<br>PTR                 | PTR/RCV/RCP                 | t                                 |          |                | PTR-RCV        |                     |          | RCV-CL            |      |           |     |  |
|         |                              | ESS Charging<br>Injection (Low Flow) | C-L34                                    | Charging using ESS<br>(6m3/hr)              | ESS/ESS-CL/RCP              |                                   |          |                |                |                     |          |                   |      |           |     |  |
|         |                              | ESS Seal injection<br>(Low Flow)     | C-L33                                    | Emergency Seal Injection<br>(6m3/hr)        | ESS/ESS-SI/RCP              | F                                 | TR-TNK   |                | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |           |     |  |
|         | C4. Primary System           | HHSI - Direct Inj.                   | C-L45                                    | HHSI Direct Injection                       | PTR/RCV/BIT/RCP             |                                   |          |                | PTR-RCV        |                     | RCV-PO   | RCV-HSI           | RCP  |           |     |  |
|         | Make-up                      | LHSI - Direct Inj.                   | C-L46                                    | LHSI Direct Injection                       | PTR/RIS/RCP                 |                                   |          |                | PTR-RIS        |                     |          |                   |      |           |     |  |
|         |                              | LHSI - Recirculation                 | C-L47                                    | LHSI Recirculation                          | SMP/RIS/RCP                 |                                   |          |                | SMP-RIS        |                     | RIS-PO   |                   |      |           |     |  |
| D       |                              | EAS Back-up to RIS                   | C-L48                                    | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP | -<br>c                            | NT-SMP   | SMP-EAS        | EAS-PO         | EAS-RIS             |          | RIS-LSI           |      |           |     |  |
| 3       |                              | EAS 004 Back-up to<br>RIS            | C-L49                                    | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP |                                   |          | SMP-EAS        | EAS-PO*        | EAS-4PO             | RIS-PO*  |                   |      |           |     |  |
|         |                              | PTR Gravity Feed<br>(SD - Head Off)  | C-L61                                    | PTR Gravity Feed                            | PTR/RIS*/RCP                | F                                 | TR-TNK   |                | PTR-RIS        |                     | RIS-PO*  | RIS-LSI           | RCP  |           |     |  |
| ACC 160 |                              | (OD - Tidad Oil)                     | C-L50                                    | GCTa Steam Dump                             | SG/VVP/GCTa                 |                                   |          |                |                | GCTa-STM            |          |                   |      |           |     |  |
|         |                              | SG Steam Dump                        | C-L51                                    | GCTc Steam Dump                             | SGAVP/GCTc-                 |                                   | SGs      | WP-GCT         | GCTc-STM       | CEX-TNK-            | CEX-PO-  |                   |      |           |     |  |
|         |                              |                                      | C-L52                                    | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 |                                   |          | ASG-T/PO ASG-T |                | ASG-T/FL            |          |                   |      |           |     |  |
|         |                              | SG Feedwater                         | C-L53                                    | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | 4                                 | SG-TNK   | ASG            |                |                     | WFL      | ASG-SG/FL         | SGs  |           |     |  |
|         |                              |                                      | C-L54                                    | ARE Main Feed                               | CEX/APA/SG-                 | ¢                                 | EX-TNK   | CEX-PO-        | ABP-HX*        | APA-PO              | AHP-HX*- | ARE-SG/FL         |      |           |     |  |
|         |                              |                                      | C-L55                                    | SER Make-up to ASG                          | SER/ASG                     | Г                                 |          |                | SER-PO         |                     |          |                   |      |           |     |  |
|         | C5. Core Cooling             |                                      | C-L56                                    | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)           | 1                                 | SER      | -TNK           | SER-BV         | SER-ASG             |          |                   |      |           |     |  |
|         |                              | SG Long term                         | C-L57                                    | JPP Make-up to ASG                          | JPP/JPD/ASG                 | f                                 | JPP      | TNK            | JPP-PO         | JPD-ASG             | ASG-TNK  |                   |      |           |     |  |
|         |                              | Feedwater Supply                     | C-L58                                    | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             |                                   |          |                | JPS-PO         | JPD-ASG             |          |                   |      |           |     |  |
|         |                              |                                      | C-L59                                    | SEP Make-up to JPP                          | SEP/JPP                     | S                                 | SEP-TNK  | SEP-JPP/S      | JPP-TNK        |                     |          | •                 |      |           |     |  |
|         |                              |                                      | C-L67                                    | 4th SG Injection                            | SEP/ASGx/SG                 | s                                 | EP-TNK   | ASG-4PO        |                |                     |          |                   |      |           |     |  |
|         |                              | RRA Core Cooling<br>(SD)             | C-L60                                    | RRA Cooling                                 | RCP/RRA/RCP                 |                                   | RCP*     | RRA-SL         | RRA-PO         | RRA-Hx              | RRA-DL   | RRA-SV            | RCP* |           |     |  |
| ľ       |                              | Containment Isolation                | B-1                                      | Containment Building                        |                             |                                   | B-CNT    |                |                |                     |          |                   |      |           |     |  |
|         |                              | Direct Core Injection                |  | *See C4. Primary Sys                        | tem Make-up                 |                                   |          |                |                |                     |          |                   |      |           |     |  |
|         |                              |                                      | C-L61                                    | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                 | F                                 | TR-TNK   | PTR-EAS        | EAS            | S-PO                |          |                   |      |           |     |  |
|         |                              |                                      | C-L62                                    | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                 | c                                 | NT-SMP   | SMP-EAS        | EAS-PO         | EAS-Hx              |          |                   |      |           |     |  |
|         |                              | Containment<br>Pressure Control      | C-L63                                    | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                 | J                                 | PP-TNK   | JPP-PO         | JPP-JPC        | JPC-EAS             | EAS-SPR  | CONT              |      |           |     |  |
|         | C6. Containment<br>Integrity |                                      | C-L68                                    | EAS Emergency Back-up                       | SEP/EASx/CNT                |                                   | EP-TNK   | SEP-EAS        | PE             | E-PO                |          |                   |      |           |     |  |
|         | integrity                    |                                      | C-L64                                    | Containment Venting                         |                             |                                   |          |                |                |                     |          |                   |      |           |     |  |
|         |                              | Hydrogen Reduction                   | C-L65                                    | Hydrogen PARS                               | ETY (PARS)                  |                                   | PARs     |                |                |                     |          |                   |      |           |     |  |
| - 1     |                              | SG Creep Rupture                     | C-L52                                    | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 |                                   |          | ASG-T/PO       | ASG-T/SS       | ASG                 | -T/FL    |                   |      |           |     |  |
| ļ       |                              |                                      |  | SG Creen Runture                            |                             | · · · · · · · · · · · · · · · · · |          |                | SG-TNK         |                     |          |                   |      | ASG-SG/FL | SGs |  |
|         |                              | Prevention                           | C-L53                                    | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | Ĺ                                 | SG-TNK   | ASG            | -MPO           | ASG                 | WFL      | A30-30/FL         | 000  |           |     |  |

### Table 12:

| Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake                |
|---|
| inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented |

|                 | Required                                   | Function                                    |          |   | 880c 44                    | at provide           | Eurotia   | nal Pager | iromont     |          |           |        |   |
|-----------------|--|---|----------|---|----------------------------|----------------------|-----------|-----------|-------------|----------|-----------|--------|---|
|                 | Functional                                 |   |          |   |                            | at provide           | FUNCTIO   | nai Requ  |             |          |           |        |   |
|                 | Requirement                                | Sub-Function                                | Met      | thods to fulfil Funct                         | ional Req. (SSCs)          |                      |           |           | Sub         | -SSC     |           |        |   |
|                 |  | Core Exit<br>Temperature                    | C-I1     | Core Exit Temperature<br>Indication           |                            | RICxxxMT             |           |           |             | [LNi]    |           |        |   |
|                 |  | RCP Level                                   | C-12     | Pressuriser Level<br>Indication               |                            | RCPxxxMN             |           |           |             | [LNi]    |           |        |   |
|                 |  | Reactor Level<br>Indication                 | C-124    | RVLIS   |                            |                      |           |           |             |          |           |        |   |
|                 |  | RCP pressure                                | C-13     | RCP Pressure Indication                       |                            | RCPxxxMP             |           |           |             | [LNi]    |           |        |   |
|                 |  | RRA Pressure                                | C-15     | RRA Pressure Indication                       |                            | RRAxxxMP             |           |           |             | [LNi]    |           |        |   |
|                 |  | SG Level                                    | C-16     | SG WR Level Indication                        |                            | ARExxxMN             |           |           |             | [LNi]    |           |        |   |
| Core            |  | SG Pressure                                 | C-17     | SG Pressure Indication                        |                            | VVPxxxMP             |           |           |             | [LNi]    |           |        |   |
| oro             | C7. Essential                              | ASG Tank Level                              | C-18     | ASG Tank Level Indication                     |                            | ASG002LN             |           |           |             |          |           |        |   |
| Reactor Core    | Indication                                 | Diesel Tank Level                           | C-19     | Diesel Tank Level<br>Indications              |                            | LHixoxLN             |           |           |             |          |           |        |   |
| E C             |  | Containment<br>Pressure                     | C-120    | Containment WR Pressure<br>Indication         |                            | ETYxxxMP             |           |           |             | [LNi]    |           |        |   |
|                 |  | Containment<br>Radiation                    | C-21     | Containment Radiation<br>Levels               |                            | KRT022-<br>23MA      |           |           |             | KRT001AR | [LBA]     |        |   |
|                 |  | Containment Sump                            | C-122    | Containment Sump Level                        |                            | RISxxxSL<br>EASxxxSL |           |           |             | [LCA/B]  |           |        |   |
|                 |  | BaseMat                                     | C-123    | Basemat Thermo-couples                        |                            | KSBxxxMT             |           |           |             |          |           |        |   |
|                 |  | Thermocouples<br>Containment Sump           | C-151    |   |                            |                      |           |           |             |          |           |        |   |
|                 |  | Temperature<br>Containment                  | C-152    |   |                            |                      |           |           |             |          |           |        |   |
|                 |  | Hydrogen Sampling<br>Reactor Pit            | C-153    |   |                            |                      |           |           |             |          |           |        |   |
|                 |  | Temperature<br>SFP Pool                     | S-S1     | SFP Pool Integrity                            | SFP                        | SFP-PL               | B-SFP     |           |             |          |           |        |   |
|                 | S1. SFP Integrity                          | PTR 1/2 PO                                  | S-S1     | PTR Normal SFP Cooling                        | SFP\PTR\SFP                |                      | PTR-SL    | PTR-PO*   | PTR-HX*     | PTR-DL   | PTR-SPHN  | _      | 1 |
|                 |  | PTR 6 PO                                    | S-S2     | Integrity<br>PTR 3rd Train Integrity          | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO*  | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |   |
|                 |  | PTR 1/2 PO                                  | S-L1     | PTR Normal Cooling                            | SFP\PTR\SFP                |                      | PTR-SL    | PTR-PO    | PTR-HX      |          | R-DL      |        |   |
|                 | S2. SFP Cooling                            | PTR 6 PO                                    | S-L2     | PTR 3rd Train Cooling                         | SFP\PTR3\SFP               | SFP-PL               | PTR3-SL   | PTR3-PO   | PTR3-HX     | PTR      | 3-DL      | SFP-PL |   |
|                 |  | SFP Steam Release                           | S-L3     | Open Vent Doors                               |                            | SFP-VD               |           |           |             | <u> </u> |           |        |   |
| _               | S3. Bulk Boiling                           |   | S-L4     | SED Make-up                                   | SED/SFP                    | SED-TNK              | SED       | -PO       | SED-SFP     |          | 1         |        |   |
| Poo             |  |   | S-L5     | JPP Make-up                                   | JPP/JPD/SFP                | JPP-TNK              |           | -PO       |             |          |           |        |   |
| leu.            |  | SFP Emergency<br>Make-up                    | S-L6     | JPS Make-up                                   | SEP/JPS/SFP                | SEP-TNK              | SEP-JPP/S | JPS-PO    | JPD-SFP     | SFP-PL   |           |        |   |
| Spent Fuel Pool |  |   | S-L7     | SEP Make-up                                   | SEP/SFPx                   | SEP-TNK              | SEP/SFPx  | PEE       | -P0         |          |           |        |   |
| Spe             |  | SFP Level                                   | S-I1     | SFP Level Indication                          |                            | PTRxxxMN             |           |           |             | [LNi]    | [SAR-ACC] |        |   |
|                 |  | SFP Temperature                             | S-12     | SFP Temperature                               |                            | PTRxxxMT             |           |           |             | [LNi]    |           |        |   |
|                 |  | Fuel Rack                                   | S-13     | Indication                                    |                            |                      |           |           |             | <u> </u> | I         |        |   |
|                 | S4. Indication                             | Temperature<br>SFP Boron                    | S-14     |   |                            | -                    |           |           |             |          |           |        |   |
|                 |  | Concentration<br>SFP Building               | S-15     |   |                            | -                    |           |           |             |          |           |        |   |
|                 |  | Pressure<br>SFP Hydrogen                    | S-16     |   |                            | -                    |           |           |             |          |           |        |   |
|                 |  | Concentration<br>SFP Building               | S-17     |   |                            | -                    |           |           |             |          |           |        |   |
|                 |  | Humidity                                    | V-L01    | JPP Make-up to Seismic                        | JPP/JPD/VLT                | JPP                  | -TNK      | JPP-PO    | JPP-JPD     |          |           |        |   |
| Ŧ               | V1. Seismic Vault                          | Flooding of Seismic                         | V-L02    | Vault<br>JPS Make-up to Seismic               | SEP/JPS/JPD/VLT            |                      | SEP-JPP/S | JPS-PO    | JPS-JPD     | JPD-VLT  | VLT       |        |   |
| Vau             |  | Vault                                       | V-L03    | Vault<br>SEP Gravity Feed to                  | SEP/JPD/VLT                | SEP-TNK              |           |           | -VLT        |          |           |        |   |
| Seismic Vault   |  | Seismic Vault                               | VI-1     | Seismic Vault                                 |                            |                      |           |           |             |          |           |        |   |
| Seis            | V.2 Indication                             | Temperature<br>Seismic Vault Water<br>Level | VI-2     |   |                            |                      |           |           |             |          |           |        |   |
|                 |  | Seismic Vault<br>Pressure                   | VI-3     |   |                            |                      |           |           |             |          |           |        |   |
| ×s              | D1. Cask Integrity                         | Cask Remain Leak<br>Tight                   | D-S1     | Cask integrity                                | CASK                       | CASK*                |           |           |             |          |           |        |   |
| Dry<br>Casks    | D2. Cask Cooling                           | Cask Air cooling<br>maintained              | D-L1     | Cask Cooling                                  | Cask building and Air Flow | B-LLW                | CASK-AIR  |           |             |          |           |        |   |
|                 | B1. Containment                            |   | B1       | Containment Building                          | ·                          | B-CNT                | Building  | Hatch     | Penetration | Airlocks |           |        |   |
|                 | B2. NAB                                    |   | B2       | Nuclear Auxiliary Building                    |                            | B-NAB                |           |           |             |          |           |        |   |
| s               | B3. Electrical Buildin                     | 9   | В3       | Electrical Building                           |                            | B-ELE                |           |           |             |          |           |        |   |
| Buildings       | B4. Diesel buildings                       |   | B4       | Unit Diesel Building                          |                            | B-DSL                |           |           |             |          |           |        |   |
| uild            | B5. SBO Diesel Build<br>B6. SEC pump-house |   | B5<br>B6 | SBO Diesel Building<br>SEC Pumphouse Building |                            | B-SBO<br>B-SEC       |           |           |             |          |           |        |   |
| μ<br>Δ          | B7. Turbine Hall                           |   | во<br>В7 | Turbine Hall                                  |                            | B-SEC<br>B-TUR       |           |           |             |          |           |        |   |
|                 | B8. LLW Building                           |   | B8       | Low Level Waste Building                      |                            | B-LLW                |           |           |             |          |           |        |   |
|                 | B9. ECC                                    |   | В9       | Emergency Control Centre                      |                            | B-ECC                |           |           |             |          |           |        |   |
|                 |  |   |          |   |                            |                      |           |           |             |          |           |        |   |

### Table 12:

Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake inducing a tsunami wave up to the 0 m terrace level with proposed modifications implemented

|                           | Required F  | unction  | SSCs that provide Functional Requirement  |   |   |  |  |  |  |  |  |  |  |  |
|---------------------------|---|--|---|---|---|--|--|--|--|--|--|--|--|--|
|                           | Functional<br>Requirement                                 | Sub-Function   | Methods to fulfil Fund  | tional Req. (SSCs)  | Sub-SSC   |  |  |  |  |  |  |  |  |  |
|                           |   | LHA Switchboard<br>Supply<br>[LHA]                                 | E-1         400 KV LHA Supply           E-2         132 KV LHA Supply           E-3         LHP Diesel LHA Supply           E-4         LHS Diesel LHA Supply           E-60         MBL Diesel LHA Supply  | 400KV/LHA<br>132KV/LHA<br>LHP/LHA<br>LHS/LHA<br>MBL-DSL/LHA               | 400KV         GEN-TRX         UNT-TRX         LGA-SWB         LGB-SWB           132KV         STN-TRX         LGE/F-SWB         LGB-SWB         LGB-SWB           LHP-DSL         LHP-LHA         LGE/F-SWB         LHA-SWB         [LCA]         [LBA]           LHS-DSL         LHS-LHC         LHC-SWB         LHC-LHA         LHA-SWB         [LCA]         [LBA]   |  |  |  |  |  |  |  |  |  |
|                           | E1. Essential 6.6kV<br>Switchboard Supply                 | LHB Switchboard<br>Supply<br>[LHB]                                 | E-60         MBL Diesel LHA Supply           E-5         400 KV LHB Supply           E-6         132 KV LHB Supply           E-7         LHQ Diesel LHB Supply           E-8         LHS Diesel LHB Supply           E-8         LHS Diesel LHB Supply           E-61         MBL Diesel LHB Supply | MBL-DSULIN<br>400KV/LHB<br>132KV/LHB<br>LHQ/LHB<br>LHS/LHB<br>MBL-DSL/LHB | MBL-DSL         MBL-DSL-CON         LICE-SWB         LGC-SWB  |  |  |  |  |  |  |  |  |  |
|                           | E2. SBO Diesel<br>Supply                                  | LLY SBO Diesel<br>Supply<br>[LLY]                                  | E-10 LLY Switchboard Supply   | LLS\LLX\LLY   | LLS-DSL LLX-SWB LLX-LLY LLY-SWB   |  |  |  |  |  |  |  |  |  |
|                           | E3. 48 V Essential  | LCA 48V Switchboard<br>Supply [LCA]                                | E-21 LCA Switchboard - LHA<br>E-22 LCA Switchboard - LLS<br>E-23 LCA Switchboard - Batter   | LCAILLIILHA<br>LCAILLY<br>y LCAIBAT                                       | [LH4]     LLAE-SWB       [LLY]     LCA-RD       LCA-BAT   |  |  |  |  |  |  |  |  |  |
| stem                      | Switchboard Supply  | LCB 48V<br>Switchboard Supply<br>[LCB]                             | E-24 LCB Switchboard - LHB<br>E-25 LCB Switchboard - LLS<br>E-26 LCB Switchboard - Batter   | LCB\LLI\LHB<br>LCB\LLY<br>y LCB\BAT                                       | [LHB]     LLBID-SWB       [LLY]     LCB-RD       LCB-BAT     LCB-SWB  |  |  |  |  |  |  |  |  |  |
| upport Sy                 |   | LBA 125V<br>Switchboard Supply<br>[LBA]                            | E-31 LBA Switchboard - LHA<br>E-32 LBA Switchboard - LLS<br>E-33 LBA Switchboard - Batter   | LBAILLIILHA<br>LBAILLY  | [LHA]     LLC:E-SWB       [LLY]     LBA-RD       LBA-BAT     LBA-SWB  |  |  |  |  |  |  |  |  |  |
| Electrical Support System | [I<br>E4. 125 V Essential<br>Switchboard Supply<br>L<br>S | LBB 125V<br>Switchboard Supply<br>[LBB]                            | E-34 LBB Switchboard - LHA<br>E-35 LBB Switchboard - LLS<br>E-36 LBB Switchboard - Batter   | LBB\LLI\LHB<br>LBB\LLY  | [LHB]     LLB:D-SWB       [LLY]     LBB-RD       LBB-BAT  |  |  |  |  |  |  |  |  |  |
|                           |   | LNA 220V Essential<br>Switchboards<br>[LNA]                        | E-41         SIP I Dirty Supply from LH           E-42         SIP I Clean Supply from LHA           E-43         SIP I Supply from LSS           E-44         SIP I Supply from LSS  | A LNAILC/LHA<br>LNAILBC/LLA/LHA<br>LNAILBC/LLY<br>LNAILBC/BAT             | LLC_SWB         LNA-RD           LLA-SWB         LBC-RD           [LLY]         LBC-SWB   |  |  |  |  |  |  |  |  |  |
|                           |   | LNB 220V Essential<br>Switchboards<br>[LNB]                        | E-46 SIP II Dirty Supply<br>E-46 SIP II Dirty Supply from<br>LHB<br>E-47 SIP II Clean Supply from LSS   | LNB/LB/LB/LB/LB/LBB   | LLD-SWB         LNB-RD           LLB-SWB         LBD-RD           LLUY         LBD-RD   |  |  |  |  |  |  |  |  |  |
|                           | E5. Essential<br>Instrumentation<br>Switchboard Supply    | LNC 220V Essential<br>Switchboards<br>[LNC]                        | E-48         SIP II Battery Supply           E-49         SIP III Dirty Supply from<br>LHA           E-50         SIP III Clean Supply from<br>LHA           E-51         SIP III Supply from LSS   | LNB/LBD/BAT<br>LNC/LLC/LHA<br>LNC/LBE/LLA/LHA<br>LNC/LBE/LLY              | LBD-BAT         LIC-SWB         LINC-RD           [LHA]         LLA-SWB         LBE-RD         LNC-SWB           [LLY]         LBE-RD         LBE-SWB         LNC-SWB   |  |  |  |  |  |  |  |  |  |
|                           |   | LND 220V Essential   | E-52 SIP III Battery Supply<br>E-53 SIP IV Dirty Supply from<br>LHB SIP IV Clean Supply from  | LNC/LBE/BAT<br>LND/LLD/LHB<br>LND/LBF/LLB/LHB                             | LBE-BAT<br>LLB_SWB LND-RD   |  |  |  |  |  |  |  |  |  |
|                           |   | Switchboards<br>[LND]  | E-55 SIP IV Supply from LSS<br>E-56 SIP IV Battery Supply   | LND/LBF/LLY<br>LND/LBF/BAT  | [LLY]     LBF-RD     LBF-SWB     LND-SWB       LBF-BAT     Image: Comparison of the state of the st |  |  |  |  |  |  |  |  |  |
| Ultimate Heatsink         | U1. Essential<br>Cooling                                  | SEC Train A Cooling<br>SEC Train B Cooling<br>Alternative Heatsink | U-1         SEC Train A Cooling           U-2         SEC Train B Cooling           U-3         Alternative Heatsink  | SEA/SEC-A/SEA<br>SEA/SEC-B/SEA  | Sec-ARS         SEC-ADS         SEC-APO         RRI-AHX           SEC-B-RS         SEC-B-DS         SEC-B-PO         RRI-B-HX   |  |  |  |  |  |  |  |  |  |
| imate H                   | U2. Component<br>Cooling                                  | RRI Train A Cooling<br>RRI Train B Cooling<br>RRI Commons          | U-11 RRI Train A Cooling<br>U-12 RRI Train B Cooling<br>U-13 RRI Commons cooling<br>(Train A)   | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA<br>SEC/RRI-A/HXC                           | HX-A         RRI-A-PO         [RRI-A-HX]           HX-B         RRI-B-PO         [RRI-B-HX]           HX-COM         RRI-A-PO         [RRI-A-HX]  |  |  |  |  |  |  |  |  |  |





Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

Table 13:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|              | Required I                      | Function                                   |                   |   | SSCs th                     | at p | orovid | e Fun     | ctio            | nal Requ       | rement              |          |                   |      |   |
|--------------|---------------------------------|--|-------------------|---|-----------------------------|------|--------|-----------|-----------------|----------------|---------------------|----------|-------------------|------|---|
|              | Functional<br>Requirement       | Sub-Function                               | Met               | hods to fulfil Funct                        | ional Req. (SSCs)           |      |        |           |                 |                | Sub                 | -SSC     |                   |      |   |
|              |                                 | Control Rods                               | C-S1              | Control Rod                                 | CRDMs                       | F    | L-ASS  | CNTL-     | ROD             | CRDM           |                     |          |                   |      |   |
|              |                                 |  | C-L42             | REA Boration (direct or<br>normal)          | REA/RCV/RCP                 | RE   | AB-TN  | REAR      | 8-PO            | REA            | RCV                 |          |                   |      |   |
|              |                                 |  | C-L44             | Normal charging from PTR tank               | PTR/RCV/RCP                 |      |        |           | _               | PTR-RCV        |                     | RCV-PO   | RCV-CL            |      |   |
|              | C1. Sub-Criticality             | Boron Injection                            | C-L34             | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | Р    | TR-TNK |           |                 |                |                     |          |                   | RCP  |   |
|              |                                 |  | C-L33             | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |      |        |           |                 | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |   |
|              |                                 |  | C-L11             | Accumulators                                | ACC/RCP                     |      | ACC    |           |                 |                | ACC-RCP             |          |                   |      |   |
|              |                                 | RCP System                                 | C-121             | RCP Integrity                               | RCP*                        |      | RCP*   | RC<br>Pum |                 | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*   | Safety<br>Valves* |      |   |
|              | C2 Brimany System               | SG   | C-122             | SG Integrity                                | SG*                         |      | SGs*   | - uni     | <b>p</b> 3      | 103301         | 1163301361          | 1        | Valves            |      |   |
|              | C2. Primary System<br>Integrity | RRA System Integrity<br>(SD)               | C-123             | RRA Integrity                               | RCP*/RRA*/RCP*              |      | RCP*   | RRA-      | SL*             | RRA-PO*        | RRA-Hx*             | RRA-DL*  | RRA-SV*           |      |   |
|              |                                 | RRA System Isolation                       | C-124             | RRA Isolation                               | RCP*                        |      | RCP*   | RRA       | -SL             | RRA-DL         |                     |          | <u> </u>          |      |   |
|              |                                 | (SD)                                       | C-L31             | Normal Seal Injection                       | REA/RCV/RCP                 | RE   |        | REA/B     | 3-PO            | REA            | RCV                 |          |                   | _    |   |
|              | C3. RCP Seal                    | Normal Seal Injection                      | C-L32             | PTR Seal Injection                          | PTR/RCV/RCP                 |      | -      |           |                 | PTR-RCV        |                     | RCV-PO   | RCV-SI            | RCP  |   |
|              | injection                       | Emergency Seal                             | C-L32             | Emergency Seal Injection                    | ESS/RCP                     | P    | TR-TNK |           | _               | PTR-ESS        |                     | ESS-PO   | ESS-SI            |      |   |
|              |                                 | Injection                                  | C-L33             | REA Boration (direct or                     | REA/RCV/RCP                 | pr   | A/B-TN | REA/B     | L-PO            |                |                     | 20040    | 200-01            |      |   |
|              |                                 | RCV Normal charging                        | C-L42             | normal)<br>Normal charging from REA         | REA/RCV/RCP                 |      | AW-TN  |           | _               | REA            | RCV                 | RCV-PO   |                   |      |   |
|              |                                 |  | C-L43<br>C-L44    | water system<br>Normal Charging from        | PTR/RCV/RCP                 | rKE  |        | REAV      | v-F-U           | PTR-RCV        |                     | NOV-PO   | RCV-CL            |      |   |
|              |                                 | ESS Charging                               |                   | PTR<br>Charging using ESS                   |                             |      |        |           |                 | PIR-RUV        |                     |          |                   |      |   |
|              |                                 | Injection (Low Flow)<br>ESS Seal injection | C-L34             | (6m3/hr)<br>Emergency Seal Injection        | ESS/ESS-CL/RCP              |      |        |           |                 | PTR-ESS        |                     | ESS-PO   |                   |      |   |
|              | C4. Primary System              | (Low Flow)                                 | C-L33             | (6m3/hr)                                    | ESS/ESS-SI/RCP              | - P  | TR-TNK |           |                 |                |                     |          | ESS-SI            | RCP  |   |
|              | Make-up                         | HHSI - Direct Inj.                         | C-L45             | HHSI Direct Injection                       | PTR/RCV/BIT/RCP             |      |        |           |                 | PTR-RCV        |                     | RCV-PO   | RCV-HSI           |      |   |
|              | -                               | LHSI - Direct Inj.                         | C-L46             | LHSI Direct Injection                       | PTR/RIS/RCP                 |      |        |           |                 | PTR-RIS        |                     | RIS-PO   |                   |      |   |
| e            |                                 | LHSI - Recirculation                       | C-L47             | LHSI Recirculation                          | SMP/RIS/RCP                 |      |        |           |                 | SMP-RIS        |                     |          | RIS-LSI           |      |   |
| Reactor Core |                                 | EAS Back-up to RIS                         | C-L48             | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP | С    | NT-SMP | SMP-      | EAS             | EAS-PO         | EAS-RIS             | RIS-PO*  |                   |      |   |
| ctor         |                                 | EAS 004 Back-up to<br>RIS                  | C-L49             | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP |      |        | SMP-I     | EAS             | EAS-PO*        | EAS-4PO             | RIS-PO*  |                   |      |   |
| Rea          |                                 | PTR Gravity Feed<br>(SD - Head Off)        | C-L61             | PTR Gravity Feed                            | PTR/RIS*/RCP                | Р    | TR-TNK |           |                 | PTR-RIS        |                     | RIS-PO*  | RIS-LSI           | RCP  |   |
|              |                                 | SG Steam Dump                              | C-L50             | GCTa Steam Dump                             | SG/VVP/GCTa                 |      | SGs    | WP-0      | эст             |                | GCTa-STM            |          |                   |      |   |
|              |                                 |  | C-L51             | GCTc Steam Dump                             | SGAMP/GCTc-                 |      |        |           |                 | GCTc-STM       | CEX-TNK             | CEX-PO-  |                   |      |   |
|              |                                 |  | C-L52             | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 | A    | SG-TNK | ASG-1     | r/PO            | ASG-T/SS       | ASG                 | -T/FL    | ASG-SG/FL         |      |   |
|              |                                 | SG Feedwater                               | C-L53             | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 |      |        |           | ASG-            | WPO            | ASG                 | -WFL     |                   | SGs  |   |
|              |                                 |  | <del>C-L5</del> 4 | ARE Main Feed                               | CEX/APA/SG                  | c    | EX-TNK | CEX-      | <del>PO</del> - | ABP-HX*        | APA-PO              | AHP-HX*- | ARE-SG/FL         |      |   |
|              | C5. Core Cooling                |  | C-L55             | SER Make-up to ASG                          | SER/ASG                     |      | er:    | R-TNK     |                 | SER-PO         | SER-ASG             |          |                   |      |   |
|              |                                 |  | C-L56             | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)           |      | SE     | x-119/X   |                 | SER-BV         | SER-ASG             | ASG-TNK  |                   |      |   |
|              |                                 | SG Long term<br>Feedwater Supply           | C-L57             | JPP Make-up to ASG                          | JPP/JPD/ASG                 |      | JPI    | P-TNK     |                 | JPP-PO         | JPD-ASG             | ASG-TIVK |                   |      |   |
|              |                                 |  | C-L58             | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             |      | CD T+  | 000       | DD/C            | JPS-PO         | JPD-ASG             |          |                   |      |   |
|              |                                 |  | C-L59             | SEP Make-up to JPP                          | SEP/JPP                     | s    | EP-TNK | SEP-J     | PP/S            | JPP-TNK        |                     |          |                   |      |   |
|              |                                 | RRA Core Cooling<br>(SD)                   | C-L60             | RRA Cooling                                 | RCP/RRA/RCP                 |      | RCP*   | RRA       | -SL             | RRA-PO         | RRA-Hx              | RRA-DL   | RRA-SV            | RCP* |   |
|              |                                 | Containment Isolation                      | B-1               | Containment Building                        |                             |      | B-CNT  |           |                 |                |                     |          |                   |      |   |
|              |                                 | Direct Core Injection                      |                   | *See C4. Primary Sys                        | stem Make-up                |      |        |           |                 |                |                     |          |                   |      |   |
|              |                                 |  | C-L61             | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                 | Р    | TR-TNK | PTR-      | EAS             | EAS            | -PO                 |          |                   |      |   |
|              |                                 | Containment                                | C-L62             | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                 | с    | NT-SMP | SMP-      | EAS             | EAS-PO         | EAS-Hx              | EAS-SPR  | CONT              |      |   |
|              | C6. Containment                 | Pressure Control                           | C-L63             | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                 | JI   | PP-TNK | JPP-      | PO              | JPP-JPC        | JPC-EAS             |          |                   |      |   |
|              | Integrity                       |  | C-L64             | Containment Venting                         |                             |      |        |           |                 |                |                     |          |                   |      |   |
|              |                                 | Hydrogen Reduction                         | C-L65             | Hydrogen PARS                               | ETY (PARS)                  |      | PARs   | 1         |                 |                |                     |          |                   |      |   |
|              |                                 |  | C-L52             | Turbine Driven ASG Pump                     | ASG/ASGI/SG                 |      |        | ASG-T     | [/PO            | ASG-T/SS       | ASG                 | -T/FL    |                   |      |   |
|              |                                 | SG Creep Rupture<br>Prevention             | C-L52             | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | A    | SG-TNK |           | ASG-            |                | ASG                 |          | ASG-SG/FL         | SGs  |   |
|              |                                 | Basemat Melt-thro                          |                   |   |                             |      |        |           |                 |                | A30                 |          |                   |      | ] |
|              |                                 | Prevention                                 | C-L66             | Reactor Pit Flooding                        |                             |      |        |           |                 |                |                     |          |                   |      |   |

Table 13:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                 | Required I                                      | Function                         |          |   | SSCs th                    | at provide       | Functio   | nal Requ | irement     |          |           |        |   |
|-----------------|---|----------------------------------|----------|---|----------------------------|------------------|-----------|----------|-------------|----------|-----------|--------|---|
|                 | Functional<br>Requirement                       | Sub-Function                     | Met      | thods to fulfil Funct                       | ional Req. (SSCs)          |                  |           |          | Sub         | -SSC     |           |        |   |
|                 |   | Core Exit<br>Temperature         | C-I1     | Core Exit Temperature<br>Indication         |                            | RICxxxMT         |           |          |             | [LNi]    |           |        |   |
|                 |   | RCP Level                        | C-12     | Pressuriser Level                           |                            | RCPxxxMN         |           |          |             | [LNi]    |           |        |   |
|                 |   | Reactor Level                    | C-124    | RVLIS                                       |                            |                  |           |          |             |          |           |        |   |
|                 |   | Indication                       | C-13     | RCP Pressure Indication                     |                            | DCDunttD         |           |          |             | (1 A) 2  |           |        |   |
|                 |   | RCP pressure                     |          |   |                            | RCPxxxMP         |           |          |             | [LNi]    |           |        |   |
|                 |   | RRA Pressure                     | C-15     | RRA Pressure Indication                     |                            | RRAxxMP          |           |          |             | [LNi]    |           |        |   |
| e               |   | SG Level                         | C-16     | SG WR Level Indication                      |                            | ARExxXMN         |           |          |             | [LNi]    |           |        |   |
| Co              |   | SG Pressure                      | C-17     | SG Pressure Indication                      |                            | VVPxxxMP         |           |          |             | [LNi]    |           |        |   |
| Reactor Core    | C7. Essential                                   | ASG Tank Level                   | C-18     | ASG Tank Level Indication                   |                            | ASG002LN         |           |          |             |          |           |        |   |
| eac             | Indication                                      | Diesel Tank Level                | C-19     | Diesel Tank Level<br>Indications            |                            | LHixxxLN         |           |          |             |          |           |        |   |
| E C             |   | Containment                      | C-120    | Containment WR Pressure<br>Indication       |                            | ETYxxxMP         |           |          |             | [LNi]    |           |        |   |
|                 |   | Pressure<br>Containment          | C-21     | Containment Radiation                       |                            | KRT022-          |           |          |             | KRT001AR | [LBA]     |        |   |
|                 |   | Radiation<br>Containment Sump    |          | Levels                                      |                            | 23MA<br>RISxxxSL |           |          |             |          | [2011]    |        |   |
|                 |   | Level<br>BaseMat                 | C-122    | Containment Sump Level                      |                            | EASxxxSL         |           |          |             | [LCA/B]  |           |        |   |
|                 |   | Thermocouples                    | C-123    | Basemat Thermo-couples                      |                            | KSBxxxMT         |           |          |             |          |           |        |   |
|                 |   | Containment Sump<br>Temperature  | C-I51    |   |                            |                  |           |          |             |          |           |        |   |
|                 |   | Containment<br>Hydrogen Sampling | C-152    |   |                            |                  |           |          |             |          |           |        |   |
|                 |   | Reactor Pit<br>Temperature       | C-153    |   |                            |                  |           |          |             |          |           |        |   |
|                 |   | SFP Pool                         | S-S1     | SFP Pool Integrity                          | SFP                        | SFP-PL           | B-SFP     |          |             |          |           |        |   |
|                 | S1. SFP Integrity                               | PTR 1/2 PO                       | S-S1     | PTR Normal SFP Cooling                      | SFP\PTR\SFP                |                  | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  |        | 1 |
|                 |   | PTR 6 PO                         | S-S2     | Integrity<br>PTR 3rd Train Integrity        | SFP\PTR3\SFP               | SFP-PL           | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |   |
|                 |   |                                  |          |   |                            |                  |           |          |             |          |           |        |   |
|                 | S2. SFP Cooling                                 | PTR 1/2 PO                       | S-L1     | PTR Normal Cooling                          | SFP\PTR\SFP                | SFP-PL           | PTR-SL    | PTR-PO   | PTR-HX      |          | R-DL      | SFP-PL |   |
|                 |   | PTR 6 PO                         | S-L2     | PTR 3rd Train Cooling                       | SFP\PTR3\SFP               |                  | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTF      | R3-DL     |        |   |
| _               |   | SFP Steam Release                | S-L3     | Open Vent Doors                             |                            | SFP-VD           |           |          |             | 1        |           |        |   |
| 000             | S3. Bulk Boiling                                |                                  | S-L4     | SED Make-up                                 | SED/SFP                    | SED-TNK          | SED       | D-PO     | SED-SFP     |          |           |        |   |
| ller            | 33. Buik Bolling                                | SFP Emergency<br>Make-up         | S-L5     | JPP Make-up                                 | JPP/JPD/SFP                | JPP-TNK          | JPF       | P-PO     |             | SFP-PL   |           |        |   |
| E F             |   |                                  | S-L6     | JPS Make-up                                 | SEP/JPS/SFP                | SEP-TNK          | SEP-JPP/S | JPS-PO   | JPD-SFP     |          |           |        |   |
| Spent Fuel Pool |   | SFP Level                        | S-I1     | SFP Level Indication                        |                            | PTRxxxMN         |           |          |             | [LNi]    | [SAR-ACC] |        |   |
| 0)              |   | SFP Temperature                  | S-12     | SFP Temperature<br>Indication               |                            | PTRxxxMT         |           |          |             | [LNi]    |           |        |   |
|                 |   | Fuel Rack                        | S-13     | Indication                                  |                            |                  |           |          |             |          | <u> </u>  |        |   |
|                 | S4. Indication                                  | Temperature<br>SFP Boron         | S-14     |   |                            | -                |           |          |             |          |           |        |   |
|                 | 34. inuication                                  | Concentration<br>SFP Building    |          |   |                            | -                |           |          |             |          |           |        |   |
|                 |   | Pressure<br>SFP Hydrogen         | S-15     |   |                            | _                |           |          |             |          |           |        |   |
|                 |   | Concentration                    | S-16     |   |                            | _                |           |          |             |          |           |        |   |
|                 |   | SFP Building<br>Humidity         | S-17     |   |                            |                  |           |          |             |          |           |        |   |
|                 |   |                                  | V-L01    | JPP Make-up to Seismic<br>Vault             | JPP/JPD/VLT                | JPP              | TNK       | JPP-PO   | JPP-JPD     | JPD-VLT  |           |        |   |
| Ħ               | V1. Seismic Vault                               | Flooding of Seismic<br>Vault     | V-L02    | JPS Make-up to Seismic<br>Vault             | SEP/JPS/JPD/VLT            |                  | SEP-JPP/S | JPS-PO   | JPS-JPD     | 57 D-VL1 | VLT       |        |   |
| : Va            |   |                                  | V-L03    | SEP Gravity Feed to<br>Seismic Vault        | SEP/JPD/VLT                | SEP-TNK          |           | SEP      | -VLT        |          |           |        |   |
| Seismic Vault   |   | Seismic Vault<br>Temperature     | VI-1     |   |                            |                  |           |          |             |          |           |        |   |
| Seis            | V.2 Indication                                  | Seismic Vault Water              | VI-2     |   |                            |                  |           |          |             |          |           |        |   |
|                 |   | Level<br>Seismic Vault           | VI-3     |   |                            |                  |           |          |             |          |           |        |   |
| s               | D4 Cask internet                                | Pressure<br>Cask Remain Leak     |          | Contrintent                                 | CARK                       | 04000            |           |          |             |          |           |        |   |
| Dry<br>Casks    | D1. Cask Integrity                              | Tight<br>Cask Air cooling        | D-S1     | Cask integrity                              | CASK                       | CASK*            |           | 1        |             |          |           |        |   |
| U U             | D2. Cask Cooling                                | maintained                       | D-L1     | Cask Cooling                                | Cask building and Air Flow | B-LLW            | CASK-AIR  |          |             |          |           |        |   |
|                 | B1. Containment                                 |                                  | B1       | Containment Building                        |                            | B-CNT            | Building  | Hatch    | Penetration | Airlocks | J         |        |   |
|                 | B2. NAB<br>B3. Electrical Building              | 9                                | B2<br>B3 | Nuclear Auxiliary Building                  |                            | B-NAB<br>B-ELE   |           |          |             |          |           |        |   |
| st              | B3. Electrical Building<br>B4. Diesel buildings | 9                                | В3<br>В4 | Electrical Building                         |                            | B-ELE<br>B-DSL   |           |          |             |          |           |        |   |
| Buildings       | B4. Diesel buildings<br>B5. SBO Diesel Buildi   | ing                              | В4<br>В5 | Unit Diesel Building<br>SBO Diesel Building |                            | B-SBO            |           |          |             |          |           |        |   |
| uilc            | B6. SEC pump-house                              |                                  | B6       | SEC Pumphouse Building                      |                            | B-SEC            |           |          |             |          |           |        |   |
|                 | B7. Turbine Hall                                |                                  | B0<br>B7 | Turbine Hall                                |                            | B-SEC            |           |          |             |          |           |        |   |
|                 | B8. LLW Building                                |                                  | B8       | Low Level Waste Building                    |                            | B-LLW            |           |          |             |          |           |        |   |
|                 | B9. ECC   |                                  | B9       | Emergency Control Centre                    |                            | B-ECC            |           |          |             |          |           |        |   |
| L               |   |                                  |          |   |                            |                  |           |          |             |          |           |        |   |

Table 13:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                           | Required F   | unction  |                      |   | SSCs th                                       | at  | provide                   | e Functi      | onal Requ                 | irement                         |                      | _       |      |   |       |
|---------------------------|--|--|----------------------|---|---|-----|---------------------------|---------------|---------------------------|---------------------------------|----------------------|---------|------|---|-------|
|                           | Functional<br>Requirement                              | Sub-Function   | Met                  | hods to fulfil Functi   | onal Req. (SSCs)                              |     |                           |               |                           | Sub                             | -SSC                 |         |      |   |       |
|                           |  | LHA Switchboard<br>Supply<br>[LHA]                                 | E-1<br>E-2<br>E-3    | 400 KV LHA Supply<br>132 KV LHA Supply<br>LHP Diesel LHA Supply                               | 400KV/LHA<br>132KV/LHA<br>LHP/LHA             |     | 400KV<br>132KV<br>HP-DSL  | GEN-TRX<br>ST | N-TRX                     | LGA-SWB<br>LGE/F-SWB<br>2-LHA   | LGB-SWB              | LHA-SWB | [LCA | J | [LBA] |
|                           | E1. Essential 6.6kV<br>Switchboard Supply              | LHB Switchboard<br>Supply  | E-4<br>E-5<br>E-6    | LHS Diesel LHA Supply<br>400 KV LHB Supply<br>132 KV LHB Supply                               | LHS/LHA<br>400KV/LHB<br>132KV/LHB             |     | HS-DSL<br>400KV<br>132KV  | GEN-TRX       | S-LHC<br>UNT-TRX<br>N-TRX | LHC-SWB<br>LGD-SWB<br>LGE/F-SWB | LHC-LHA              | LHB-SWB | [LCB | 7 | [LBB] |
|                           | E2. SBO Diesel   | [LHB]<br>LLY SBO Diesel  | E-7<br>E-8           | LHQ Diesel LHB Supply   | LHQ/LHB<br>LHS/LHB                            | L   | HQ-DSL<br>HS-DSL          |               | S-LHC                     | LHC-SWB                         | LHC-LHB              |         | 1202 |   | [LUU] |
|                           | Supply   | LCA 48V Switchboard<br>Supply [LCA]                                | E-10<br>E-21<br>E-22 | LLY Switchboard Supply<br>LCA Switchboard - LHA<br>LCA Switchboard - LLS                      | LCAILLILHA                                    |     | LS-DSL<br>[LHA]<br>[LLY]  | LLX-SWB       | LLX-LLY                   | LLY-SWB                         | LCA-SWB              |         |      |   |       |
|                           | E3. 48 V Essential<br>Switchboard Supply               | LCB 48V<br>Switchboard Supply                                      | E-23<br>E-24<br>E-25 | LCA Switchboard - Battery<br>LCB Switchboard - LHB<br>LCB Switchboard - LLS                   | LCA/BAT<br>LCB/LL/LHB<br>LCB/LLY              |     | LCA-BAT<br>[LHB]<br>[LLY] |               | LLB\D-SWE                 | LCB-RD                          | LCB-SWB              |         |      |   |       |
| rt System                 |  | [LCB]<br>LBA 125V<br>Switchboard Supply                            | E-26<br>E-31<br>E-32 | LCB Switchboard - Battery<br>LBA Switchboard - LHA<br>LBA Switchboard - LLS                   | LCB\BAT<br>LBAILLILHA<br>LBAILLY              |     | LCB-BAT                   |               | LLC\E-SWE                 | LBA-RD                          | LBA-SWB              |         |      |   |       |
| Electrical Support System | E4. 125 V Essential<br>Switchboard Supply              | [LBA]<br>LBB 125V<br>Switchboard Supply<br>[LBB]                   | E-33<br>E-34<br>E-35 | LBA Switchboard - Battery<br>LBB Switchboard - LHA<br>LBB Switchboard - LLS                   | LBA\BAT<br>LBB\LLI\LHB<br>LBB\LLY             |     | LBA-BAT<br>[LHB]<br>[LLY] |               | LLB\D-SWE                 | LBB-RD                          | LBB-SWB              |         |      |   |       |
| Electri                   | L  | LNA 220V Essential   | E-36<br>E-41<br>E-42 | LBB Switchboard - Battery<br>SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA    | LBB\BAT<br>LNA/LLC/LHA<br>LNA/LBC/LLA/LHA     |     | LBB-BA                    | LLC-SWB       |                           | 4-RD                            |                      |         |      |   |       |
|                           |  | Switchboards<br>[LNA]  | E-43<br>E-44         | SIP I Supply from LSS<br>SIP I Battery Supply<br>SIP II Dirty Supply from                     | LNA/LBC/LLY                                   |     | [LLY]<br>LBC-BA           |               | LBC-RD                    | LBC-SWB                         | LNA-SWB              |         |      |   |       |
|                           |  | LNB 220V Essential<br>Switchboards<br>[LNB]                        | E-45<br>E-46<br>E-47 | LHB<br>SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS                              | LNB/LLD/LHB<br>LNB/LBD/LLB/LHB<br>LNB/LBD/LLY |     | (LHB)<br>(LLY)            | LLD-SWB       | LBD-RD                    | LBD-SWB                         | LNB-SWB              |         |      |   |       |
|                           | E5. Essential<br>Instrumentation<br>Switchboard Supply | LNC 220V Essential<br>Switchboards                                 | E-48<br>E-49<br>E-50 | SIP II Battery Supply<br>SIP III Dirty Supply from<br>LHA<br>SIP III Clean Supply from<br>LHA | LNB/LBD/BAT<br>LNC/LLC/LHA<br>LNC/LBE/LLA/LHA |     | LBD-BAT                   | LLC-SWB       | LNG                       | C-RD                            | LNC-SWB              |         |      |   |       |
|                           |  | [LNC]  | E-51<br>E-52<br>E-53 | SIP III Supply from LSS<br>SIP III Battery Supply<br>SIP IV Dirty Supply from<br>LHB          | LNC/LBE/LLY<br>LNC/LBE/BAT<br>LND/LLD/LHB     |     | (LLY)<br>LBE-BA           | LLD-SWB       |                           | LBE-SWB                         | LNC-SWB              |         |      |   |       |
|                           | S  | LND 220V Essential<br>Switchboards<br>[LND]                        | E-54<br>E-55<br>E-56 | SIP IV Clean Supply from<br>LHB<br>SIP IV Supply from LSS<br>SIP IV Battery Supply            | LND/LBF/LLB/LHB<br>LND/LBF/LLY<br>LND/LBF/BAT |     | (LHB)<br>(LLY)<br>LBF-BAT | LLB-SWB       | - LBF-RD                  | LBF-SWB                         | LND-SWB              |         |      |   |       |
| atsink                    | U1. Essential<br>Cooling                               | SEC Train A Cooling<br>SEC Train B Cooling<br>Alternative Heatsink | U-1<br>U-2<br>U-3    | SEC Train A Cooling<br>SEC Train B Cooling  | SEA/SEC-A/SEA                                 |     | [Sea]                     | SEC-A-RS      | -                         | SEC-A-PO<br>SEC-B-PO            | RRI-A-HX<br>RRI-B-HX | [Sea]   |      |   |       |
| Ultimate Heatsink         | U2. Component<br>Cooling                               | RRI Train A Cooling<br>RRI Train B Cooling                         | U-11<br>U-12         | Alternative Heatsink RRI Train A Cooling RRI Train B Cooling RRI Commons cooling              | SEC/RRI-AHXA<br>SEC/RRI-B/HXA                 |     | HX-A<br>HX-B              | RRI-A-PO      | [RRI-B-HX]                |                                 |                      |         |      |   |       |
| UIt                       | , young  | RRI Commons<br>Cooling   | U-13<br>U-14         | (Train A)<br>RRI Commons cooling<br>(Train B)   | SEC/RRI-A/HXC<br>SEC/RRI-B/HXC                | - + | ю-сом                     | RRI-A-PO      |                           |                                 |                      |         |      |   |       |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |

|  |  |  |  | Tsunami event results in damage |
|--|--|--|--|---------------------------------|
|  |  |  |  | Seismic event results in damage |

Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

Table 14:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|     | Required I                   | Function  | SSCs that provide Functional Requirement   |   |   |                       |  |  |  |                           |                   |                   |      |          |
|-----|------------------------------|---|--|---|---|-----------------------|--|--|--|---------------------------|-------------------|-------------------|------|----------|
|     | Functional<br>Requirement    | Sub-Function  | Met  | hods to fulfil Funct  | ional Req. (SSCs)   |                       |  |  |  | Sub                       | -SSC              |                   |      |          |
|     |                              | Control Rods  | C-S1   | Control Rod   | CRDMs   |                       | FL-ASS   | CNTL-ROE   | CRDM   |                           |                   |                   |      |          |
|     |                              |   | C-L42  | REA Boration (direct or   | REA/RCV/RCP   | R                     | A/B-TNK  | REA/B-PC   | REA  | -RCV                      |                   |                   |      |          |
|     |                              |   | C-L44  | normal)<br>Normal charging from PTR   | PTR/RCV/RCP   | t                     |  |  | PTR-RCV                                      |                           | RCV-PO            | RCV-CL            |      |          |
|     | C1. Sub-Criticality          | Boron Injection   |  | tank<br>Charging using Emergency  |   |                       | TR-TNK   |  |  |                           |                   |                   | RCP  |          |
|     |                              | Boron injection   | C-L34  | Seal Injection  | ESS/ESS-CL/RCP  | - '                   | TIK-TINK   |  | PTR-ESS                                      |                           | ESS-PO            |                   | RCP  |          |
|     |                              |   | C-L33  | Emergency Seal Injection  | ESS/ESS-SI/RCP  |                       |  |  | _  |                           |                   | ESS-SI            |      |          |
|     |                              |   | C-L11  | Accumulators  | ACC/RCP   |                       | ACC  |  |  | ACC-RCP                   |                   |                   |      |          |
|     |                              | RCP System  | C-121  | RCP Integrity   | RCP*  |                       | RCP*   | RCP<br>Pumps*  | RCP<br>Vessel*                               | RCP<br>Pressuriser*       | PORVs*            | Safety<br>Valves* |      |          |
|     | C2. Primary System           | SG  | C-122  | SG Integrity  | SG*   |                       | SGs*   |  |  |                           | -                 |                   |      |          |
|     | Integrity                    | RRA System Integrity<br>(SD)  | C-123  | RRA Integrity   | RCP*/RRA*/RCP*  |                       | RCP*   | RRA-SL*  | RRA-PO*                                      | RRA-Hx*                   | RRA-DL*           | RRA-SV*           |      |          |
|     |                              | RRA System Isolation<br>(SD)  | C-124  | RRA Isolation   | RCP*  |                       | RCP*   | RRA-SL   | RRA-DL                                       |                           |                   |                   |      |          |
|     |                              |   | C-L31  | Normal Seal Injection   | REA/RCV/RCP   | R                     | EA/B-TNK   | REA/B-PC   | RE/  | 4-RCV                     | 001/00            | DOMO              |      |          |
|     | C3. RCP Seal                 | Normal Seal Injection   | C-L32  | PTR Seal Injection  | PTR/RCV/RCP   |                       |  |  | PTR-RCV                                      |                           | RCV-PO            | RCV-SI            |      |          |
|     | injection                    | Emergency Seal<br>Injection   | C-L33  | Emergency Seal Injection  | ESS/RCP   |                       | TR-TNK   |  | PTR-ESS                                      |                           | ESS-PO            | ESS-SI            | RCP  |          |
|     |                              | Shutdown Seal   | C-125  | Emergency Shutdown Seal   | RCP   |                       |  |  | SD   | -Seal                     |                   |                   |      |          |
|     |                              |   | C-L42  | REA Boration (direct or normal)   | REA/RCV/RCP   | R                     | AB-TNK   | REA/B-PC   |  |                           |                   |                   |      |          |
|     |                              | RCV Normal charging   | C-L43  | Normal charging from REA  | REA/RCV/RCP   | RE                    | AW-TNK   | REAW-PC  |  | A-RCV                     | RCV-PO            |                   |      |          |
|     |                              | 00  | C-L44  | water system<br>Normal Charging from  | PTR/RCV/RCP   |                       |  |  | PTR-RCV                                      |                           |                   | RCV-CL            |      |          |
|     |                              | ESS Charging  | C-L34  | PTR<br>Charging using ESS   | ESS/ESS-CL/RCP  |                       |  |  |  |                           |                   |                   |      |          |
|     |                              | Injection (Low Flow)<br>ESS Seal injection  | C-L34  | (6m3/hr)<br>Emergency Seal Injection  | ESS/ESS-CL/RCP  |                       | TR-TNK   |  | PTR-ESS                                      |                           | ESS-PO            | ESS-SI            |      |          |
|     | C4. Primary System           | (Low Flow)  |  | (6m3/hr)  |   |                       |  |  |  |                           |                   |                   | RCP  |          |
|     | Make-up                      | HHSI - Direct Inj.  | C-L45  | HHSI Direct Injection   | PTR/RCV/BIT/RCP   | -                     |  |  | PTR-RCV                                      |                           | RCV-PO            | RCV-HSI           |      |          |
|     |                              | LHSI - Direct Inj.  | C-L46  | LHSI Direct Injection   | PTR/RIS/RCP   |                       |  |  | PTR-RIS                                      |                           | RIS-PO            |                   |      |          |
|     |                              | LHSI - Recirculation  | C-L47  | LHSI Recirculation  | SMP/RIS/RCP   | _                     |  |  | SMP-RIS                                      | 1                         |                   | RIS-LSI           |      |          |
| 5   |                              | EAS Back-up to RIS  | C-L48  | EAS Back-up to RIS  | SMP/EAS/EAS-<br>4PO/RIS/RCP   | C                     | NT-SMP   | SMP-EAS  | EAS-PO                                       | EAS-RIS                   | RIS-PO*           |                   |      |          |
|     |                              | EAS 004 Back-up to<br>RIS   | C-L49  | EAS Back-up to RIS  | SMP/EAS/EAS-<br>RIS/RIS/RCP   |                       |  | SMP-EAS  | EAS-PO*                                      | EAS-4PO                   | RIS-PO*           |                   |      |          |
| מרו |                              | PTR Gravity Feed<br>(SD - Head Off)   | C-L61  | PTR Gravity Feed  | PTR/RIS*/RCP  | F                     | TR-TNK   |  | PTR-RIS                                      |                           | RIS-PO*           | RIS-LSI           | RCP  |          |
| 2   |                              | SC Street During  | C-L50  | GCTa Steam Dump   | SG/VVP/GCTa   |                       | 6 <b>6</b> -   |  |  | GCTa-STM                  |                   |                   |      |          |
|     |                              | SG Steam Dump   | C-L51  | GCTc Steam Dump   | SGAVP/GCTc-   |                       | SGs  | WP-GCT   | GCTc-STN                                     | CEX-TNK                   | CEX-PO-           |                   |      |          |
|     |                              |   | C-L52  | Turbine Driven ASG Pump   | ASG/ASGt/SG   |                       |  | ASG-T/PC   | ASG-T/SS                                     | ASG                       | -T/FL             |                   |      |          |
|     |                              | SG Feedwater  | C-L53  | Motor Driven ASG Pumps  | ASG/ASGm/SG   | A                     | SG-TNK   | ASC  | -WPO   | ASG                       | WFL               | ASG-SG/FL         | SGs  |          |
|     |                              |   | C-L54  | ARE Main Feed   | CEX/APA/SG  | ¢                     | EX-TNK   | CEX-PO-  | ABP-HX*                                      | APA-PO-                   | AHP-HX*-          | ARE-SG/FL         |      |          |
|     |                              |   | C-L55  | SER Make-up to ASG  | SER/ASG   | T                     |  |  | SER-PO                                       |                           |                   |                   |      |          |
|     | C5. Core Cooling             |   | C-L56  | SER gravity Make-up to  | SER/ASG (gravity)   | 1                     | SER  | TNK  | SER-BV                                       | SER-ASG                   |                   |                   |      |          |
|     |                              |   | C-L57  | ASG<br>JPP Make-up to ASG   | JPP/JPD/ASG   | t                     | .IPP.  | TNK  | JPP-PO                                       | JPD-ASG                   | ASG-TNK           |                   |      |          |
|     |                              | SG Long term  |  | JPS Make-up to ASG  |   | ſ                     |  |  | JPS-PO                                       | JPD-ASG                   |                   |                   |      |          |
|     |                              | Feedwater Supply  | C-1.58   |   |   |                       |  |  |  |                           |                   | 1                 |      |          |
|     |                              | reedwater Supply  | C-L58  |   | SEP/JPS/JPD/ASG   | s                     | EP-TNK   | SEP-JPP/S  |  |                           |                   |                   |      |          |
|     |                              | Peedwater Supply  | C-L59  | SEP Make-up to JPP  | SEP/JPP   |                       |  |  | JPP-TNK                                      |                           |                   |                   |      |          |
|     |                              | RRA Core Cooling  | C-L59<br>C-L67   | SEP Make-up to JPP<br>4th SG Injection  | SEP/JPP<br>SEP/ASGx/SG  |                       | EP-TNK   | ASG-4PO  | JPP-TNK                                      |                           |                   | DD4 OV            | DODE | <b>_</b> |
| -   |                              | RRA Core Cooling<br>(SD)  | C-L59<br>C-L67<br>C-L60  | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling   | SEP/JPP   | s                     | EP-TNK   |  |  | RRA-Hx                    | RRA-DL            | RRA-SV            | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation   | C-L59<br>C-L67   | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP   | s                     | EP-TNK   | ASG-4PO  | JPP-TNK                                      | RRA-Hx                    | RRA-DL            | RRA-SV            | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)  | C-L59<br>C-L67<br>C-L60<br>B-1   | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>*See C4. Primary Sys   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up  | s                     | B-CNT  | ASG-4PO<br>RRA-SL  | JPP-TNK<br>RRA-PO                            |                           | RRA-DL            | RRA-SV            | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation   | C-L59<br>C-L67<br>C-L60  | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>*See C4. Primary Sys<br>Ortainment Spray - EAS<br>Direct Injection   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP   | s                     | EP-TNK   | ASG-4PO<br>RRA-SL<br>PTR-EAS                                 | JPP-TNK<br>RRA-PO<br>EA                      | RRA-Hx<br>S-PO            | RRA-DL            | RRA-SV            | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection  | C-L59<br>C-L67<br>C-L60<br>B-1   | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>*See C4. Primary Sys<br>Containment Spray - EAS<br>Direct Injection<br>Containment Spray - EAS<br>Recirculation  | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up  | S                     | B-CNT  | ASG-4PO<br>RRA-SL  | JPP-TNK<br>RRA-PO                            |                           | RRA-DL<br>EAS-SPR | RRA-SV<br>CONT    | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation   | C-L59<br>C-L67<br>C-L60<br>B-1<br>C-L61  | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>*See C4. Primary Sys<br>Containment Spray - EAS<br>Direct Injection<br>Containment Spray - EAS   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up<br>PTR/EAS/CNT   | S<br>F<br>C           | EP-TNK<br>RCP*<br>B-CNT  | ASG-4PO<br>RRA-SL<br>PTR-EAS                                 | JPP-TNK<br>RRA-PO<br>EA                      | S-PO                      |                   |                   | RCP* |          |
|     | C6. Containment<br>Integrity | RRA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection  | C-L59<br>C-L67<br>C-L60<br>B-1<br>C-L61<br>C-L61                                     | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>"See C4. Primary Sys<br>Containment Spray - EAS<br>Direct Injection<br>Containment Spray - FAS<br>Recirculation<br>Containment Spray - JPP   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up<br>PTR/EAS/CNT<br>SMP/EAS/CNT  | S<br>S<br>F<br>C<br>C | EP-TNK<br>RCP*<br>B-CNT<br>PTR-TNK<br>INT-SMP                      | ASG-4PO<br>RRA-SL<br>PTR-EAS<br>SMP-EAS                      | PP-TNK<br>RRA-PO<br>EAS-PO<br>JPP-JPC        | S-PO<br>EAS-Hx            |                   |                   | RCP* |          |
| -   |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection  | C-L69<br>C-L67<br>B-1<br>C-L61<br>C-L61<br>C-L62<br>C-L63                            | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>"See C4. Primary Sys<br>Containment Byray - EAS<br>Direct Injection<br>Containment Spray - EAS<br>Recirculation<br>Containment Spray - JPP<br>Emergency Back-up  | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>term Make-up<br>PTR/EAS/CNT<br>SMP/EAS/CNT<br>JPP/EAS/CNT                              | S<br>S<br>F<br>C<br>C | EP-TNK<br>RCP*<br>B-CNT<br>B-CNT<br>TR-TNK<br>CNT-SMP              | ASG-4PO<br>RRA-SL<br>PTR-EAS<br>SMP-EAS<br>JPP-PO            | PP-TNK<br>RRA-PO<br>EAS-PO<br>JPP-JPC        | S-PO<br>EAS-Hx<br>JPC-EAS |                   |                   | RCP* |          |
|     |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection  | C-L69<br>C-L67<br>B-1<br>C-L60<br>C-L61<br>C-L61<br>C-L63<br>C-L63                   | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>*See C4. Primary Sys<br>Ornatiament Spray - EAS<br>Direct Injection<br>Containment Spray - EAS<br>Recirculation<br>Containment Spray - JPP<br>Emergency Back-up<br>EAS Emergency Backup  | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>term Make-up<br>PTR/EAS/CNT<br>SMP/EAS/CNT<br>JPP/EAS/CNT                              | S<br>S<br>F<br>C<br>C | EP-TNK<br>RCP*<br>B-CNT<br>B-CNT<br>TR-TNK<br>CNT-SMP              | ASG-4PO<br>RRA-SL<br>PTR-EAS<br>SMP-EAS<br>JPP-PO            | PP-TNK<br>RRA-PO<br>EAS-PO<br>JPP-JPC        | S-PO<br>EAS-Hx<br>JPC-EAS |                   |                   | RCP* |          |
|     |                              | RRA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection<br>Containment<br>Pressure Control<br>Hydrogen Reduction | C-L59<br>C-L67<br>B-1<br>C-L61<br>C-L61<br>C-L62<br>C-L63<br>C-L68                   | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>'See C4. Primary Sys<br>Direct Injection<br>Containment Spray - EAS<br>Recirculation<br>Containment Spray - EAS<br>Containment Spray - JPP<br>Emergency Back-up<br>EAS Emergency Backup<br>Containment Venting                   | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up<br>PTR/EAS/CNT<br>SMP/EAS/CNT<br>SP/EAS/CNT<br>SEP/EAS//CNT                |                       | EP-TNK<br>RCP*<br>B-CNT<br>TR-TNK<br>XTR-TNK<br>SEP-TNK<br>SEP-TNK | ASG-4PO<br>RRA-SL<br>PTR-EAS<br>SMP-EAS<br>JPP-PO            | JPP-TNK<br>RRA-PO<br>EAS-PO<br>JPP-JPC<br>PE | S-PO<br>EAS-Hx<br>JPC-EAS | EAS-SPR           | CONT              |      | ]        |
|     |                              | RPA Core Cooling<br>(SD)<br>Containment Isolation<br>Direct Core Injection<br>Containment<br>Pressure Control                       | C-L59<br>C-L67<br>C-L60<br>B-1<br>C-L61<br>C-L62<br>C-L63<br>C-L68<br>C-L64<br>C-L65 | SEP Make-up to JPP<br>4th SG Injection<br>RRA Cooling<br>Containment Building<br>'See C4. Primary Sys<br>Containment Spray - EAS<br>Direct Injection<br>Containment Spray - EAS<br>Recirculation<br>Containment Spray - JPP<br>Emergency Back-up<br>EAS Emergency Back-up<br>Containment Venting<br>Hydrogen PARS | SEP/JPP<br>SEP/ASGx/SG<br>RCP/RRA/RCP<br>tem Make-up<br>PTR/EAS/CNT<br>SMP/EAS/CNT<br>SEP/EAS/CNT<br>SEP/EAS/CNT<br>SEP/EAS/CNT |                       | EP-TNK<br>RCP*<br>B-CNT<br>PTR-TNK<br>NT-SMP<br>PP-TNK<br>SEP-TNK  | ASG-4PO<br>RRA-SL<br>PTR-EAS<br>SMP-EAS<br>JPP-PO<br>SEP-EAS | JPP-TNK<br>RRA-PO<br>EAS-PO<br>JPP-JPC<br>PE | EAS-Hx<br>JPC-EAS<br>E-PO | EAS-SPR           |                   | RCP* | ]        |

Table 14:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                 |                                      |                                    |                |  | <b>-</b>                       |                      | <u> </u>  |                   |             |          |           |        |  |
|-----------------|--------------------------------------|------------------------------------|----------------|--|--------------------------------|----------------------|-----------|-------------------|-------------|----------|-----------|--------|--|
|                 | Required                             | runction                           |                |  | SSCs the                       | at provide           | e ⊢unctio | nal Requi         | rement      |          |           |        |  |
|                 | Functional<br>Requirement            | Sub-Function                       | Met            | thods to fulfil Funct                    | ional Req. (SSCs)              |                      |           |                   | Sub         | -SSC     |           |        |  |
|                 |                                      | Core Exit<br>Temperature           | C-I1           | Core Exit Temperature<br>Indication      |                                | RICxxxMT             |           |                   |             | [LNi]    |           |        |  |
|                 |                                      | RCP Level                          | C-12           | Pressuriser Level<br>Indication          |                                | RCPxxxMN             |           |                   |             | [LNi]    |           |        |  |
|                 |                                      | Reactor Level<br>Indication        | C-124          | RVLIS                                    |                                |                      |           |                   |             |          |           |        |  |
|                 |                                      | RCP pressure                       | C-13           | RCP Pressure Indication                  |                                | RCPxxxMP             |           |                   |             | [LNi]    |           |        |  |
|                 |                                      | RRA Pressure                       | C-15           | RRA Pressure Indication                  |                                | RRAxxxMP             |           |                   |             | [LNi]    |           |        |  |
|                 |                                      | SG Level                           | C-16           | SG WR Level Indication                   |                                | ARExxXMN             |           |                   |             | [LNi]    |           |        |  |
| ore             |                                      | SG Pressure                        | C-17           | SG Pressure Indication                   |                                | VVPxxxMP             |           |                   |             | [LNi]    |           |        |  |
| Reactor Core    |                                      | ASG Tank Level                     | C-18           | ASG Tank Level Indication                |                                | ASG002LN             |           |                   |             |          |           |        |  |
| eact            | C7. Essential<br>Indication          | Diesel Tank Level                  | C-19           | Diesel Tank Level<br>Indications         |                                | LHixxxLN             |           |                   |             |          |           |        |  |
| Ř               |                                      | Containment<br>Pressure            | C-120          | Containment WR Pressure<br>Indication    |                                | ETYxxxMP             |           |                   |             | [LNi]    |           |        |  |
|                 |                                      | Containment                        | C-21           | Containment Radiation                    |                                | KRT022-              |           |                   |             | KRT001AR | [LBA]     |        |  |
|                 |                                      | Radiation<br>Containment Sump      | C-122          | Levels<br>Containment Sump Level         |                                | 23MA<br>RISxxxSL     |           |                   |             | [LCA/B]  |           |        |  |
|                 |                                      | Level<br>BaseMat                   | C-123          | Basemat Thermo-couples                   |                                | EASxxxSL<br>KSBxxxMT |           |                   |             |          |           |        |  |
|                 |                                      | Thermocouples<br>Containment Sump  | C-I51          |  |                                |                      |           |                   |             |          |           |        |  |
|                 |                                      | Temperature<br>Containment         | C-152          |  |                                |                      |           |                   |             |          |           |        |  |
|                 |                                      | Hydrogen Sampling<br>Reactor Pit   | C-153          |  |                                |                      |           |                   |             |          |           |        |  |
|                 |                                      | Temperature<br>SFP Pool            | S-S1           | SFP Pool Integrity                       | SFP                            | SFP-PL               | B-SFP     |                   |             |          |           |        |  |
|                 | S1. SFP Integrity                    | PTR 1/2 PO                         | S-S1           | PTR Normal SFP Cooling                   | SFP\PTR\SFP                    | OTTAL                | PTR-SL    | PTR-PO*           | PTR-HX*     | PTR-DL   | PTR-SPHN  |        |  |
|                 | on on magney                         | PTR 6 PO                           | S-S2           | Integrity<br>PTR 3rd Train Integrity     | SFP\PTR3\SFP                   | SFP-PL               | PTR3-SL   | PTR3-PO*          | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |  |
|                 |                                      | PTR 1/2 PO                         |                |  |                                |                      | PTR-SL    |                   | PTR-HX      |          | R-DL      |        |  |
|                 | S2. SFP Cooling                      | PTR 6 PO                           | S-L1<br>S-L2   | PTR Normal Cooling PTR 3rd Train Cooling | SFP\PTR\SFP<br>SFP\PTR3\SFP    | SFP-PL               | PTR3-SL   | PTR-PO<br>PTR3-PO | PTR3-HX     |          | :3-DL     | SFP-PL |  |
|                 |                                      | SFP Steam Release                  | S-L2           | -  | SFFIF INSIGFF                  | SFP-VD               | F TRO-OL  | FIRJFO            | F IKJ-IK    |          | 0-DE      |        |  |
|                 | S3. Bulk Boiling                     | SFF Stealin Release                | S-L3           | Open Vent Doors<br>SED Make-up           | SED/SFP                        | SED-TNK              | SEL       | )-PO              | SED-SFP     |          | 1         |        |  |
| Spent Fuel Pool |                                      |                                    | S-L5           | JPP Make-up                              | JPP/JPD/SFP                    | JPP-TNK              |           | -PO               | 020-011     |          |           |        |  |
| nel             | co. Dam Doming                       | SFP Emergency<br>Make-up           | S-L6           | JPS Make-up                              | SEP/JPS/SFP                    | SEP-TNK              | SEP-JPP/S | JPS-PO            | JPD-SFP     | SFP-PL   |           |        |  |
| ц               |                                      |                                    | S-L7           | SEP Make-up                              | SEP/SFPx                       | SEP-TNK              | SEP/SFPx  | PEE               | -PO         |          |           |        |  |
| Spe             |                                      | SFP Level                          | S-I1           | SFP Level Indication                     | SEPORT                         | PTRxxxMN             | OEI/OIT X |                   |             | [LNi]    | [SAR-ACC] |        |  |
|                 |                                      | SFP Temperature                    | S-12           | SFP Temperature                          |                                | PTRxxxMT             |           |                   |             | [LNi]    | [out noo] |        |  |
|                 |                                      | Fuel Rack                          | S-13           | Indication                               |                                | T TRUCKINT           |           |                   |             | [LIN]    |           |        |  |
|                 | S4. Indication                       | Temperature<br>SFP Boron           | S-14           |  |                                | -                    |           |                   |             |          |           |        |  |
|                 | ou. malcadon                         | Concentration<br>SFP Building      | S-14           |  |                                | -                    |           |                   |             |          |           |        |  |
|                 |                                      | Pressure<br>SFP Hydrogen           |                |  |                                | -                    |           |                   |             |          |           |        |  |
|                 |                                      | Concentration<br>SFP Building      | S-16           |  |                                | -                    |           |                   |             |          |           |        |  |
|                 |                                      | Humidity                           | S-17           | JPP Make-up to Seismic                   |                                |                      | -TNK      | JPP-PO            | JPP-JPD     |          |           |        |  |
|                 | V1. Seismic Vault                    | Flooding of Seismic                | V-L01<br>V-L02 | Vault<br>JPS Make-up to Seismic          | JPP/JPD/VLT<br>SEP/JPS/JPD/VLT | JPP                  | SEP-JPP/S | JPP-PO            | JPP-JPD     | JPD-VLT  | VLT       |        |  |
| Seismic Vault   | VI. Seisniic Vaul                    | Vault                              | V-L02          | Vault<br>SEP Gravity Feed to             | SEP/JPS/JPD/VLT                | SEP-TNK              | SEP-JPP/S | JPS-PO<br>SEP     |             |          | VC1       |        |  |
| nic             |                                      | Seismic Vault                      | V-L03          | Seismic Vault                            | GEFIJEDIVET                    |                      |           | 3EP               |             |          |           |        |  |
| eisr            | V.2 Indication                       | Temperature<br>Seismic Vault Water | VI-1<br>VI-2   |  |                                | -                    |           |                   |             |          |           |        |  |
| 0               |                                      | Level<br>Seismic Vault             | VI-2<br>VI-3   |  |                                |                      |           |                   |             |          |           |        |  |
| , v             | D1. Cask Integrity                   | Pressure<br>Cask Remain Leak       | D-S1           | Cask integrity                           | CASK                           | CASK*                |           |                   |             |          |           |        |  |
| Dry<br>Casks    | D2. Cask Cooling                     | Tight<br>Cask Air cooling          | D-51           | Cask Cooling                             | Cask building and Air Flow     | B-LLW                | CASK-AIR  |                   |             |          |           |        |  |
|                 | B1. Containment                      | maintained                         | B1             | Containment Building                     | 2 Jon ballong and Air 1 10W    | B-CNT                | Building  | Hatch             | Penetration | Airlocks |           |        |  |
|                 | B2. NAB                              |                                    | B2             | Nuclear Auxiliary Building               |                                | B-NAB                |           |                   |             |          | 1         |        |  |
|                 | B3. Electrical Buildin               | g                                  | B3             | Electrical Building                      |                                | B-ELE                |           |                   |             |          |           |        |  |
| sgn             | B4. Diesel buildings                 |                                    | B4             | Unit Diesel Building                     |                                | B-DSL                |           |                   |             |          |           |        |  |
| Buildings       | B5. SBO Diesel Build                 |                                    | B5             | SBO Diesel Building                      |                                | B-SBO                |           |                   |             |          |           |        |  |
| В               | B6. SEC pump-house                   |                                    | B6             | SEC Pumphouse Building                   |                                | B-SEC                |           |                   |             |          |           |        |  |
|                 | B7. Turbine Hall<br>B8. LLW Building |                                    | В7<br>В8       | Turbine Hall<br>Low Level Waste Building |                                | B-TUR<br>B-LLW       |           |                   |             |          |           |        |  |
|                 | B9. ECC                              |                                    | B9             | Emergency Control Centre                 |                                | B-ECC                |           |                   |             |          |           |        |  |
| L               | B9. ECC                              |                                    |                | I  |                                |                      |           |                   |             |          |           |        |  |

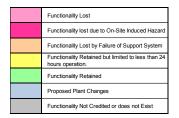
### Table 14:

Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                   | Required I   | Function                                    |                      |  | SSCs th                                       | at provide                  | e Functio            | nal Requ                 | irement                      |                      |         |       |       |
|-------------------|--|---|----------------------|--|---|-----------------------------|----------------------|--------------------------|------------------------------|----------------------|---------|-------|-------|
|                   | Functional<br>Requirement                              | Sub-Function                                | Met                  | thods to fulfil Functi   | ional Req. (SSCs)                             |                             |                      |                          | Sub                          | -SSC                 |         |       |       |
|                   |  |   | E-1<br>E-2           | 400 KV LHA Supply<br>132 KV LHA Supply   | 400KV/LHA<br>132KV/LHA                        | 400KV<br>132KV              | GEN-TRX              | UNT-TRX                  | LGA-SWB                      | LGB-SWB              |         |       |       |
|                   |  | LHA Switchboard<br>Supply<br>[LHA]          | E-3<br>E-4           | LHP Diesel LHA Supply<br>LHS Diesel LHA Supply   | LHP/LHA<br>LHS/LHA                            | LHP-DSL<br>LHS-DSL          | LHS                  | LHP-                     | LHA                          | LHC-LHA              | LHA-SWB | [LCA] | [LBA] |
|                   | E1. Essential 6.6kV<br>Switchboard Supply              |   | E-60<br>E-5          | MBL Diesel LHA Supply<br>400 KV LHB Supply   | MBL-DSL/LHA<br>400KV/LHB                      | MBL-DSL<br>400KV            | GEN-TRX              | MBL-DS                   | SL-CON                       | LGC-SWB              |         |       |       |
|                   |  | LHB Switchboard<br>Supply<br>[LHB]          | E-6<br>E-7<br>E-8    | 132 KV LHB Supply<br>LHQ Diesel LHB Supply<br>LHS Diesel LHB Supply                    | 132KV/LHB<br>LHQ/LHB<br>LHS/LHB               | 132KV<br>LHQ-DSL<br>LHS-DSL | STN                  | -TRX<br>LHQ              | LGE/F-SWB<br>-LHB<br>LHC-SWB | LHC-LHB              | LHB-SWB | [LCB] | [LBB] |
|                   |  |   | E-61                 | MBL Diesel LHB Supply  | MBL-DSL/LHB                                   | MBL-DSL                     |                      | MBL-DS                   |                              | Eno Eno              |         |       |       |
|                   | E2. SBO Diesel<br>Supply                               | LLY SBO Diesel<br>Supply<br>[LLY]           | E-10                 | LLY Switchboard Supply   | LLS\LLX\LLY                                   | LLS-DSL                     | LLX-SWB              | LLX-LLY                  | LLY-SWB                      |                      | 1       |       |       |
|                   |  | LCA 48V Switchboard<br>Supply [LCA]         | E-21<br>E-22         | LCA Switchboard - LHA<br>LCA Switchboard - LLS   | LCAILLIILHA                                   | [LHA]                       |                      | LLA\E-SWB                | LCA-RD                       | LCA-SWB              |         |       |       |
| _                 | E3. 48 V Essential<br>Switchboard Supply               | LCB 48V                                     | E-23<br>E-24         | LCA Switchboard - Battery<br>LCB Switchboard - LHB                                     | LCA/BAT<br>LCB/LL/ILHB                        | LCA-BAT                     |                      | LLB\D-SWB                | LCB-RD                       |                      |         |       |       |
| System            |  | Switchboard Supply<br>[LCB]                 | E-25<br>E-26         | LCB Switchboard - LLS<br>LCB Switchboard - Battery                                     | LCB\LLY<br>LCB\BAT                            | [LLY]                       | r                    |                          |                              | LCB-SWB              |         |       |       |
| Support System    | E4 425 V Encential                                     | LBA 125V<br>Switchboard Supply<br>[LBA]     | E-31<br>E-32<br>E-33 | LBA Switchboard - LHA<br>LBA Switchboard - LLS<br>LBA Switchboard - Battery            | LBAILLIILHA<br>LBAILLY<br>LBAIBAT             | [LHA]<br>[LLY]              |                      | LLC\E-SWB                | LBA-RD                       | LBA-SWB              |         |       |       |
| Electrical S      | E4. 125 V Essential<br>Switchboard Supply              | LBB 125V<br>Switchboard Supply<br>[LBB]     | E-34<br>E-35<br>E-36 | LBB Switchboard - LHA<br>LBB Switchboard - LLS<br>LBB Switchboard - Battery            | LBB\LLi\LHB<br>LBB\LLY<br>LBB\BAT             | (LHB)<br>(LLY)<br>LBB-BA    |                      | LLB\D-SWB                | LBB-RD                       | LBB-SWB              |         |       |       |
| ш                 |  | LNA 220V Essential<br>Switchboards<br>[LNA] | E-41<br>E-42         | SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA                          | LNA/LLC/LHA<br>LNA/LBC/LLA/LHA                | [LHA]                       | LLC-SWB              | LNA<br>LBC-RD            | -RD<br>LBC-SWB               | LNA-SWB              |         |       |       |
|                   |  |   | E-43<br>E-44<br>E-45 | SIP I Supply from LSS<br>SIP I Battery Supply<br>SIP II Dirty Supply from<br>LHB       | LNA/LBC/LLY<br>LNA/LBC/BAT<br>LNB/LLD/LHB     | LBC-BA                      | r<br>LLD-SWB         | LNB                      |                              |                      |         |       |       |
|                   |  | LNB 220V Essential<br>Switchboards<br>[LNB] | E-46<br>E-47         | SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS                              | LNB/LBD/LLB/LHB                               | (LHB)                       | LLB-SWB              | LBD-RD                   | LBD-SWB                      | LNB-SWB              |         |       |       |
|                   | E5. Essential<br>Instrumentation<br>Switchboard Supply |   | E-48<br>E-49         | SIP II Battery Supply<br>SIP III Dirty Supply from<br>LHA<br>SIP III Clean Supply from | LNB/LBD/BAT                                   | LBD-BA                      | LLC-SWB              | LNC                      | -RD                          |                      |         |       |       |
|                   |  | LNC 220V Essential<br>Switchboards<br>[LNC] | E-50<br>E-51<br>E-52 | LHA<br>SIP III Supply from LSS<br>SIP III Battery Supply                               | LNC/LBE/LLA/LHA<br>LNC/LBE/LLY<br>LNC/LBE/BAT | [LLY]                       | LLA-SWB              | LBE-RD                   | LBE-SWB                      | LNC-SWB              |         |       |       |
|                   |  | LND 220V Essential<br>Switchboards          | E-53<br>E-54         | SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from<br>LHB                     | LND/LLD/LHB<br>LND/LBF/LLB/LHB                | [LHB]                       | LLD-SWB<br>LLB-SWB   | LND                      | -RD                          | LND-SWB              |         |       |       |
|                   |  | [LND]                                       | E-55<br>E-56         | SIP IV Supply from LSS<br>SIP IV Battery Supply  | LND/LBF/LLY<br>LND/LBF/BAT                    | [LLY]                       |                      |                          | LBF-SWB                      |                      |         |       |       |
| ink               | U1. Essential<br>Cooling                               | SEC Train A Cooling<br>SEC Train B Cooling  | U-1<br>U-2           | SEC Train A Cooling<br>SEC Train B Cooling   | SEA/SEC-A/SEA<br>SEA/SEC-B/SEA                | [Sea]                       | SEC-A-RS<br>SEC-B-RS | SEC-A-DS<br>SEC-B-DS     | SEC-A-PO<br>SEC-B-PO         | RRI-A-HX<br>RRI-B-HX | [Sea]   |       |       |
| leats             |  | Alternative Heatsink                        | U-3                  | Alternative Heatsink   |   |                             |                      |                          |                              |                      |         |       |       |
| Ultimate Heatsink | 112 Comment  | RRI Train A Cooling                         | U-11<br>U-12         | RRI Train A Cooling  | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA                | HX-A<br>HX-B                | RRI-A-PO<br>RRI-B-PO | [RRI-A-HX]<br>[RRI-B-HX] |                              |                      |         |       |       |
| Ultim             | U2. Component<br>Cooling                               | RRI Commons<br>Cooling                      | U-13<br>U-14         | RRI Commons cooling<br>(Train A)<br>RRI Commons cooling<br>(Train B)                   | SEC/RRI-A/HXC<br>SEC/RRI-B/HXC                | нх-сом                      | RRI-A-PO<br>RRI-B-PO | [RRI-A-HX]<br>[RRI-B-HX] |                              |                      |         |       |       |

Tsunami event results in damage

Seismic event results in damage



Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

|              |                               |                                      | g a tsunami wave up to the 0 m terrace level (no modifications) |   |                             |      |         |               |                |                     |         |                   |      |  |
|--------------|-------------------------------|--------------------------------------|---|---|-----------------------------|------|---------|---------------|----------------|---------------------|---------|-------------------|------|--|
|              | Required I                    | Function                             |   |   | SSCs th                     | at p | orovid  | e Functio     | nal Requ       | irement             |         |                   |      |  |
| Γ            | Functional<br>Requirement     | Sub-Function                         | Met   | hods to fulfil Funct                        | ional Req. (SSCs)           |      |         |               |                | Sub-                | -SSC    |                   |      |  |
|              |                               | Control Rods                         | C-S1  | Control Rod                                 | CRDMs                       | F    | L-ASS   | CNTL-ROD      | CRDM           |                     |         |                   |      |  |
|              |                               |                                      | C-L42   | REA Boration (direct or normal)             | REA/RCV/RCP                 | RE   | AB-TNK  | REA/B-PO      | REA            | RCV                 | RCV-PO  |                   |      |  |
|              |                               |                                      | C-L44   | Normal charging from PTR<br>tank            | PTR/RCV/RCP                 |      |         |               | PTR-RCV        |                     | RCV-PU  | RCV-CL            |      |  |
|              | C1. Sub-Criticality           | Boron Injection                      | C-L34   | Charging using Emergency<br>Seal Injection  | ESS/ESS-CL/RCP              | P    | TR-TNK  |               | DTD 500        |                     | 500 00  |                   | RCP  |  |
|              |                               |                                      | C-L33   | Emergency Seal Injection                    | ESS/ESS-SI/RCP              |      |         |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |  |
|              |                               |                                      | C-L11   | Accumulators                                | ACC/RCP                     |      | ACC     |               |                | ACC-RCP             |         |                   |      |  |
|              |                               | RCP System                           | C-121   | RCP Integrity                               | RCP*                        |      | RCP*    | RCP<br>Pumps* | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*  | Safety<br>Valves* |      |  |
|              | C2. Primary System            | SG                                   | C-122   | SG Integrity                                | SG*                         |      | SGs*    |               |                |                     |         |                   |      |  |
|              | Integrity                     | RRA System Integrity<br>(SD)         | C-123   | RRA Integrity                               | RCP*/RRA*/RCP*              |      | RCP*    | RRA-SL*       | RRA-PO*        | RRA-Hx*             | RRA-DL* | RRA-SV*           |      |  |
|              |                               | RRA System Isolation<br>(SD)         | C-124   | RRA Isolation                               | RCP*                        |      | RCP*    | RRA-SL        | RRA-DL         |                     |         |                   |      |  |
|              |                               | Normal Scal biot                     | C-L31   | Normal Seal Injection                       | REA/RCV/RCP                 | RE   | AB-TNK  | REA/B-PO      | REA            | -RCV                | RCV-PO  | RCV-SI            |      |  |
|              | C3. RCP Seal<br>injection     | Normal Seal Injection                | C-L32   | PTR Seal Injection                          | PTR/RCV/RCP                 |      |         |               | PTR-RCV        |                     | RGV-PU  | NGV-51            | RCP  |  |
|              |                               | Emergency Seal<br>Injection          | C-L33   | Emergency Seal Injection                    | ESS/RCP                     | Γ    | TR-TNK  |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |  |
|              |                               |                                      | C-L42   | REA Boration (direct or normal)             | REA/RCV/RCP                 | RE   | AB-TNK  | REA/B-PO      |                | RCV                 |         |                   |      |  |
|              |                               | RCV Normal charging                  | C-L43   | Normal charging from REA water system       | REA/RCV/RCP                 | RE   | AW-TNK  | REAW-PO       | REA            | RCV                 | RCV-PO  | POVO              |      |  |
|              |                               |                                      | C-L44   | Normal Charging from<br>PTR                 | PTR/RCV/RCP                 |      |         |               | PTR-RCV        |                     |         | RCV-CL            |      |  |
|              |                               | ESS Charging<br>Injection (Low Flow) | C-L34   | Charging using ESS<br>(6m3/hr)              | ESS/ESS-CL/RCP              |      |         |               | DTD 500        |                     | 500 00  |                   |      |  |
|              |                               | ESS Seal injection<br>(Low Flow)     | C-L33   | Emergency Seal Injection<br>(6m3/hr)        | ESS/ESS-SI/RCP              | P    | TR-TNK  |               | PTR-ESS        |                     | ESS-PO  | ESS-SI            |      |  |
|              | C4. Primary System<br>Make-up | HHSI - Direct Inj.                   | C-L45   | HHSI Direct Injection                       | PTR/RCV/BIT/RCP             |      |         |               | PTR-RCV        |                     | RCV-PO  | RCV-HSI           | RCP  |  |
|              |                               | LHSI - Direct Inj.                   | C-L46   | LHSI Direct Injection                       | PTR/RIS/RCP                 |      |         |               | PTR-RIS        |                     |         |                   |      |  |
|              |                               | LHSI - Recirculation                 | C-L47   | LHSI Recirculation                          | SMP/RIS/RCP                 |      |         |               | SMP-RIS        |                     | RIS-PO  | 510 1 01          |      |  |
| Core         |                               | EAS Back-up to RIS                   | C-L48   | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>4PO/RIS/RCP | С    | NT-SMP  | SMP-EAS       | EAS-PO         | EAS-RIS             | RIS-PO* | RIS-LSI           |      |  |
| tor          |                               | EAS 004 Back-up to<br>RIS            | C-L49   | EAS Back-up to RIS                          | SMP/EAS/EAS-<br>RIS/RIS/RCP |      |         | SMP-EAS       | EAS-PO*        | EAS-4PO             | RIS-PO* |                   |      |  |
| Reactor Core |                               | PTR Gravity Feed<br>(SD - Head Off)  | C-L61   | PTR Gravity Feed                            | PTR/RIS*/RCP                | P    | TR-TNK  |               | PTR-RIS        |                     | RIS-PO* | RIS-LSI           | RCP  |  |
| -            |                               | SG Steam Dump                        | C-L50   | GCTa Steam Dump                             | SG/VVP/GCTa                 |      | SGs     | WP-GCT        |                | GCTa-STM            |         |                   |      |  |
|              |                               | oo olaan Dahip                       | C-L51   | GCTc Steam Dump                             | SGAMP/GCT6-                 |      | 003     | WI-001        | GCTc-STM       | CEX-TNK-            | CEX-PO- |                   |      |  |
|              |                               |                                      | C-L52   | Turbine Driven ASG Pump                     | ASG/ASGt/SG                 |      | SG-TNK  | ASG-T/PO      | ASG-T/SS       | ASG                 | -T/FL   | ASG-SG/FL         |      |  |
|              |                               | SG Feedwater                         | C-L53   | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 |      | 50 1111 | ASG-          | WPO            | ASG-                | -WFL    | 100 001 2         | SGs  |  |
|              |                               |                                      | C-L54   | ARE Main Feed                               | CEX/APA/SG                  | G    | ex-tnk  | CEX-PO-       | ABP-HX*        | APA-PO-             | AHP-HX* | ARE-SG/FL         |      |  |
|              | C5. Core Cooling              |                                      | C-L55   | SER Make-up to ASG                          | SER/ASG                     |      | SED     | -TNK          | SER-PO         | SER-ASG             |         |                   |      |  |
|              |                               |                                      | C-L56   | SER gravity Make-up to<br>ASG               | SER/ASG (gravity)           |      | JER     |               | SER-BV         | OLN-MOG             | ASG-TNK |                   |      |  |
|              |                               | SG Long term<br>Feedwater Supply     | C-L57   | JPP Make-up to ASG                          | JPP/JPD/ASG                 |      | JPP     | -TNK          | JPP-PO         | JPD-ASG             | 7.00° M |                   |      |  |
|              |                               |                                      | C-L58   | JPS Make-up to ASG                          | SEP/JPS/JPD/ASG             |      | EP-TNK  | SEP-JPP/S     | JPS-PO         | JPD-ASG             |         |                   |      |  |
|              |                               |                                      | C-L59   | SEP Make-up to JPP                          | SEP/JPP                     |      |         | 52. 51173     | JPP-TNK        |                     |         |                   |      |  |
|              |                               | RRA Core Cooling<br>(SD)             | C-L60   | RRA Cooling                                 | RCP/RRA/RCP                 |      | RCP*    | RRA-SL        | RRA-PO         | RRA-Hx              | RRA-DL  | RRA-SV            | RCP* |  |
|              |                               | Containment Isolation                | B-1   | Containment Building                        |                             | E    | B-CNT   |               |                |                     |         |                   |      |  |
|              |                               | Direct Core Injection                |   | *See C4. Primary Sys                        | stem Make-up                |      |         |               |                |                     |         |                   |      |  |
|              |                               |                                      | C-L61   | Containment Spray - EAS<br>Direct Injection | PTR/EAS/CNT                 | P    | TR-TNK  | PTR-EAS       | EAS            | S-PO                |         |                   |      |  |
|              |                               | Containment                          | C-L62   | Containment Spray - EAS<br>Recirculation    | SMP/EAS/CNT                 | С    | NT-SMP  | SMP-EAS       | EAS-PO         | EAS-Hx              | EAS-SPR | CONT              |      |  |
|              | C6. Containment               | Pressure Control                     | C-L63   | Containment Spray -JPP<br>Emergency Back-up | JPP/EAS/CNT                 | JF   | PP-TNK  | JPP-PO        | JPP-JPC        | JPC-EAS             |         |                   |      |  |
|              | Integrity                     |                                      | C-L64   | Containment Venting                         |                             |      |         |               |                |                     |         |                   |      |  |
|              |                               | Hydrogen Reduction                   | C-L65   | Hydrogen PARS                               | ETY (PARS)                  |      | PARs    |               |                |                     |         |                   |      |  |
|              |                               | SG Creep Rupture                     | C-L52   | Turbine Driven ASG Pump                     | ASG/ASGI/SG                 | A.   | SG-TNK  | ASG-T/PO      | ASG-T/SS       | ASG                 | -T/FL   | ASG-SG/FL         | SGs  |  |
|              |                               | Prevention                           | C-L53   | Motor Driven ASG Pumps                      | ASG/ASGm/SG                 | Ĺ    |         | ASG-          | WPO            | ASG-                | -WFL    |                   |      |  |
|              |                               | Basemat Melt-thro<br>Prevention      | C-L66   | Reactor Pit Flooding                        |                             |      |         |               |                |                     |         |                   |      |  |

# Table 15: Functional requirements diagram for a beyond-design-basis (0.6 g) earthquake inducing a tsunami wave up to the 0 m terrace level (no modifications)

Table 14:Functional requirements diagram for a beyond-design-basis (0.5 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                 | Required                                   | Function                          |          |   | SSCs th                    | at provide       | • Functio | nal Requ | irement     |          |           |        |  |
|-----------------|--|-----------------------------------|----------|---|----------------------------|------------------|-----------|----------|-------------|----------|-----------|--------|--|
|                 | Functional<br>Requirement                  | Sub-Function                      | Met      | thods to fulfil Funct                         | ional Req. (SSCs)          |                  |           |          | Sub         | -SSC     |           |        |  |
|                 |  | Core Exit<br>Temperature          | C-I1     | Core Exit Temperature<br>Indication           |                            | RICxxxMT         |           |          |             | [LNi]    |           |        |  |
|                 |  | RCP Level                         | C-12     | Pressuriser Level<br>Indication               |                            | RCPxxxMN         |           |          |             | [LNi]    |           |        |  |
|                 |  | Reactor Level                     | C-124    | RVLIS   |                            |                  |           |          |             |          |           |        |  |
|                 |  | RCP pressure                      | C-13     | RCP Pressure Indication                       |                            | RCPxxxMP         |           |          |             | [LNi]    |           |        |  |
|                 |  | RRA Pressure                      | C-15     | RRA Pressure Indication                       |                            | RRAxxxMP         |           |          |             | [LNi]    |           |        |  |
|                 |  | SG Level                          | C-16     | SG WR Level Indication                        |                            | ARExxxMN         |           |          |             | [LN]     |           |        |  |
| ore             |  | SG Pressure                       | C-17     | SG Pressure Indication                        |                            | VVPxxxMP         |           |          |             | [LNi]    |           |        |  |
| Reactor Core    |  | ASG Tank Level                    | C-18     | ASG Tank Level Indication                     |                            | ASG002LN         |           |          |             | [2,1]    |           |        |  |
| acto            | C7. Essential<br>Indication                | Diesel Tank Level                 | C-19     | Diesel Tank Level                             |                            | LHixoxLN         |           |          |             |          |           |        |  |
| Re              |  | Containment                       | C-120    | Indications<br>Containment WR Pressure        |                            | ETYxxxMP         |           |          |             | II NII   |           |        |  |
|                 |  | Pressure<br>Containment           |          | Indication<br>Containment Radiation           |                            | KRT022-          |           |          |             | [LN]     | (1 DA)    |        |  |
|                 |  | Radiation<br>Containment Sump     | C-21     | Levels  |                            | 23MA<br>RISxxxSL |           |          |             | KRT001AR | [LBA]     |        |  |
|                 |  | Level<br>BaseMat                  | C-122    | Containment Sump Level                        |                            | EASxxxSL         |           |          |             | [LCA/B]  |           |        |  |
|                 |  | Thermocouples<br>Containment Sump | C-123    | Basemat Thermo-couples                        |                            | KSBxxxMT         |           |          |             |          | -         |        |  |
|                 |  | Temperature<br>Containment        | C-I51    |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | Hydrogen Sampling<br>Reactor Pit  | C-152    |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | Temperature                       | C-153    |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | SFP Pool                          | S-S1     | SFP Pool Integrity                            | SFP                        | SFP-PL           | B-SFP     |          |             | 1        |           |        |  |
|                 | S1. SFP Integrity                          | PTR 1/2 PO                        | S-S1     | PTR Normal SFP Cooling<br>Integrity           | SFP\PTR\SFP                | SFP-PL           | PTR-SL    | PTR-PO*  | PTR-HX*     | PTR-DL   | PTR-SPHN  | SFP-PL |  |
|                 |  | PTR 6 PO                          | S-S2     | PTR 3rd Train Integrity                       | SFP\PTR3\SFP               |                  | PTR3-SL   | PTR3-PO* | PTR3-HX*    | PTR3-DL  | PTR3-SPHN |        |  |
|                 | S2. SFP Cooling                            | PTR 1/2 PO                        | S-L1     | PTR Normal Cooling                            | SFP\PTR\SFP                | SFP-PL           | PTR-SL    | PTR-PO   | PTR-HX      | PT       | R-DL      | SFP-PL |  |
|                 |  | PTR 6 PO                          | S-L2     | PTR 3rd Train Cooling                         | SFP\PTR3\SFP               |                  | PTR3-SL   | PTR3-PO  | PTR3-HX     | PTF      | R3-DL     |        |  |
| _               |  | SFP Steam Release                 | S-L3     | Open Vent Doors                               |                            | SFP-VD           |           |          |             |          | -         |        |  |
| Poo             | S3. Bulk Boiling                           |                                   | S-L4     | SED Make-up                                   | SED/SFP                    | SED-TNK          | SED       | D-PO     | SED-SFP     |          |           |        |  |
| nel             | oor Dain Doning                            | SFP Emergency<br>Make-up          | S-L5     | JPP Make-up                                   | JPP/JPD/SFP                | JPP-TNK          | JPF       | -PO      | JPD-SFP     | SFP-PL   |           |        |  |
| Spent Fuel Pool |  |                                   | S-L6     | JPS Make-up                                   | SEP/JPS/SFP                | SEP-TNK          | SEP-JPP/S | JPS-PO   | 0.001       |          |           |        |  |
| Spe             |  | SFP Level                         | S-I1     | SFP Level Indication                          |                            | PTRxxxMN         |           |          |             | [LNi]    | [SAR-ACC] |        |  |
|                 |  | SFP Temperature                   | S-12     | SFP Temperature<br>Indication                 |                            | PTRxxxMT         |           |          |             | [LNi]    |           |        |  |
|                 |  | Fuel Rack<br>Temperature          | S-I3     |   |                            |                  |           |          |             |          |           |        |  |
|                 | S4. Indication                             | SFP Boron<br>Concentration        | S-14     |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | SFP Building<br>Pressure          | S-15     |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | SFP Hydrogen<br>Concentration     | S-16     |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | SFP Building<br>Humidity          | S-17     |   |                            |                  |           |          |             |          |           |        |  |
|                 |  |                                   | V-L01    | JPP Make-up to Seismic<br>Vault               | JPP/JPD/VLT                | JPP              | TNK       | JPP-PO   | JPP-JPD     | (00.14-5 |           |        |  |
| nt              | V1. Seismic Vault                          | Flooding of Seismic<br>Vault      | V-L02    | JPS Make-up to Seismic<br>Vault               | SEP/JPS/JPD/VLT            | 0.00             | SEP-JPP/S | JPS-PO   | JPS-JPD     | JPD-VLT  | VLT       |        |  |
| s Va            |  |                                   | V-L03    | SEP Gravity Feed to<br>Seismic Vault          | SEP/JPD/VLT                | SEP-TNK          |           | SEP      | -VLT        |          |           |        |  |
| Seismic Vault   |  | Seismic Vault<br>Temperature      | VI-1     |   |                            |                  |           |          |             |          |           |        |  |
| Sei             | V.2 Indication                             | Seismic Vault Water<br>Level      | VI-2     |   |                            |                  |           |          |             |          |           |        |  |
|                 |  | Seismic Vault<br>Pressure         | VI-3     |   |                            |                  |           |          |             |          |           |        |  |
| ks<br>ks        | D1. Cask Integrity                         | Cask Remain Leak<br>Tight         | D-S1     | Cask integrity                                | CASK                       | CASK*            |           |          |             |          |           |        |  |
| Dry<br>Casks    | D2. Cask Cooling                           | Cask Air cooling<br>maintained    | D-L1     | Cask Cooling                                  | Cask building and Air Flow | B-LLW            | CASK-AIR  |          |             |          |           |        |  |
|                 | B1. Containment                            |                                   | B1       | Containment Building                          | ·                          | B-CNT            | Building  | Hatch    | Penetration | Airlocks |           |        |  |
|                 | B2. NAB                                    |                                   | B2       | Nuclear Auxiliary Building                    |                            | B-NAB            |           |          |             |          |           |        |  |
| s               | B3. Electrical Buildin                     | g                                 | B3       | Electrical Building                           |                            | B-ELE            |           |          |             |          |           |        |  |
| Buildings       | B4. Diesel buildings                       |                                   | B4       | Unit Diesel Building                          |                            | B-DSL            |           |          |             |          |           |        |  |
| suild           | B5. SBO Diesel Build<br>B6. SEC pump-house |                                   | B5<br>B6 | SBO Diesel Building<br>SEC Pumphouse Building |                            | B-SBO<br>B-SEC   |           |          |             |          |           |        |  |
| -               | B7. Turbine Hall                           |                                   | B7       | Turbine Hall                                  |                            | B-TUR            |           |          |             |          |           |        |  |
|                 | B8. LLW Building                           |                                   | B8       | Low Level Waste Building                      |                            | B-LLW            |           |          |             |          |           |        |  |
|                 | B9. ECC                                    |                                   | В9       | Emergency Control Centre                      |                            | B-ECC            |           |          |             |          |           |        |  |
|                 |  |                                   |          |   |                            |                  |           |          |             |          |           |        |  |

### Table 14:

Functional requirements diagram for a beyond-design-basis (0.5 g) earthquake inducing a tsunami wave up to 3.8 m above the terrace level with proposed modifications implemented

|                           | Required F                                | unction                                     | SSCs that provide Functional Requirement |  |                   |                |           |               |          |          |         |       |        |  |
|---------------------------|---|---|--|--|-------------------|----------------|-----------|---------------|----------|----------|---------|-------|--------|--|
|                           | Functional<br>Requirement                 | Sub-Function                                | Me                                       | thods to fulfil Functi                             | ional Req. (SSCs) |                |           |               | Sub      | -SSC     |         |       |        |  |
|                           |   | LHA Switchboard                             | E-1<br>E-2                               | 400 KV LHA Supply                                  | 400KV/LHA         | 400KV<br>132KV | GEN-TRX   | UNT-TRX       | LGA-SWB  | LGB-SWB  |         |       |        |  |
|                           |   | Supply<br>[LHA]                             | E-3                                      | LHP Diesel LHA Supply                              | LHP/LHA           | LHP-DSL        |           |               | -LHA     |          | LHA-SWB | [LCA] | [LBA]  |  |
|                           | E1. Essential 6.6kV                       |   | E-4                                      | LHS Diesel LHA Supply                              | LHS/LHA           | LHS-DSL        | LHS       | LHC           | LHC-SWB  | LHC-LHA  |         |       |        |  |
|                           | Switchboard Supply                        |   | E-5                                      | 400 KV LHB Supply                                  | 400KV/LHB         | 400KV          | GEN-TRX   | UNT-TRX       | LGD-SWB  | LGC-SWB  |         |       |        |  |
|                           |   | LHB Switchboard<br>Supply                   | E-6                                      | 132 KV LHB Supply                                  | 132KV/LHB         | 132KV          | STN       | TRX LGE/F-SWB | 200-0110 | LHB-SWB  | [LCB]   | (LBB) |        |  |
|                           |   | [LHB]                                       | E-7                                      | LHQ Diesel LHB Supply                              | LHQ/LHB           | LHQ-DSL        |           | LHQ-LHB       |          |          | LINDOWD | [202] | [20.0] |  |
|                           |   |   | E-8                                      | LHS Diesel LHB Supply                              | LHS/LHB           | LHS-DSL        | LHS       | LHC           | LHC-SWB  | LHC-LHB  |         |       |        |  |
|                           | E2. SBO Diesel<br>Supply                  | LLY SBO Diesel<br>Supply<br>[LLY]           | E-10                                     | LLY Switchboard Supply                             | LLS\LLX\LLY       | LLS-DSL        | LLX-SWB   | LLX-LLY       | LLY-SWB  |          |         |       |        |  |
|                           |   |   | E-21                                     | LCA Switchboard - LHA                              | LCA\LLi\LHA       | [LHA]          |           | LLA\E-SWB     | LCA-RD   |          |         |       |        |  |
|                           |   | LCA 48V Switchboard<br>Supply [LCA]         | E-22                                     | LCA Switchboard - LLS                              | LCAILLY           | [LLY]          |           |               | LCA-RD   | LCA-SWB  |         |       |        |  |
|                           | E3. 48 V Essential                        |   | E-23                                     | LCA Switchboard - Battery                          | LCA\BAT           | LCA-BAT        | r         |               |          |          |         |       |        |  |
|                           | Switchboard Supply                        | LCB 48V                                     | E-24                                     | LCB Switchboard - LHB                              | LCB/LLI/LHB       | [LHB]          |           | LLB\D-SWB     | LCB-RD   |          |         |       |        |  |
|                           |   | Switchboard Supply<br>[LCB]                 | E-25                                     | LCB Switchboard - LLS                              | LCB\LLY           | [LLY]          |           |               | LOD-ND   | LCB-SWB  |         |       |        |  |
| em                        |   | [200]                                       | E-26                                     | LCB Switchboard - Battery                          | LCB\BAT           | LCB-BA         | r         |               |          |          |         |       |        |  |
| yst                       | E4. 125 V Essential<br>Switchboard Supply | LBA 125V<br>Switchboard Supply<br>[LBA]     | E-31                                     | LBA Switchboard - LHA                              | LBA\LLi\LHA       | [LHA]          |           | LLC\E-SWB     | LBA-RD   |          |         |       |        |  |
| r S                       |   |   | E-32                                     | LBA Switchboard - LLS                              | LBA\LLY           | [LLY]          |           |               | LUARID   | LBA-SWB  |         |       |        |  |
| odc                       |   |   | E-33                                     | LBA Switchboard - Battery                          | LBA\BAT           | LBA-BA         | r         |               |          |          |         |       |        |  |
| Electrical Support System |   | LBB 125V<br>Switchboard Supply<br>[LBB]     | E-34                                     | LBB Switchboard - LHA                              | LBB\LLi\LHB       | [LHB]          | LLB\D-SWB | LBB-RD        |          |          |         |       |        |  |
| cal                       |   |   | E-35                                     | LBB Switchboard - LLS                              | LBB\LLY           | [LLY]          |           |               |          | LBB-SWB  |         |       |        |  |
| ctri                      |   |   | E-36                                     | LBB Switchboard - Battery                          | LBB\BAT           | LBB-BA         | r         |               |          |          |         |       |        |  |
| Ele                       |   | LNA 220V Essential<br>Switchboards<br>[LNA] | E-41                                     | SIP I Dirty Supply from LHA                        | LNA/LLC/LHA       | [LHA]          | LLC-SWB   | LNA           | RD       | LNA-SWB  |         |       |        |  |
|                           |   |   | E-42                                     | SIP I Clean Supply from<br>LHA                     | LNA/LBC/LLA/LHA   |                | LLA-SWB   | LBC-RD        |          |          |         |       |        |  |
|                           |   |   | E-43                                     | SIP I Supply from LSS                              | LNA/LBC/LLY       | [LLY]          |           |               | LBC-SWB  |          |         |       |        |  |
|                           |   |   | E-44                                     | SIP I Battery Supply                               | LNA/LBC/BAT       | LBC-BA         | r         |               |          |          |         |       |        |  |
|                           |   | LNB 220V Essential<br>Switchboards<br>[LNB] | E-45                                     | SIP II Dirty Supply from<br>LHB                    | LNB/LLD/LHB       | [LHB]          | LLD-SWB   | LNB           | I-RD     |          |         |       |        |  |
|                           |   |   | E-46                                     | SIP II Clean Supply from<br>LHB                    | LNB/LBD/LLB/LHB   |                | LLB-SWB   | LBD-RD        |          | LNB-SWB  |         |       |        |  |
|                           |   |   | E-47                                     | SIP II Supply from LSS                             | LNB/LBD/LLY       | [LLY]          |           |               | LBD-SWB  |          |         |       |        |  |
|                           | E5. Essential<br>Instrumentation          |   | E-48                                     | SIP II Battery Supply<br>SIP III Dirty Supply from | LNB/LBD/BAT       | LBD-BA         | r         |               |          |          |         |       |        |  |
|                           | Switchboard Supply                        |   | E-49                                     | LHA<br>SIP III Clean Supply from                   | LNC/LLC/LHA       | [LHA]          | LLC-SWB   | LNC           | -RD      |          |         |       |        |  |
|                           |   | LNC 220V Essential<br>Switchboards          | E-50                                     | LHA  | LNC/LBE/LLA/LHA   |                | LLA-SWB   | LBE-RD        |          | LNC-SWB  |         |       |        |  |
|                           |   | [LNC]                                       | E-51                                     | SIP III Supply from LSS                            | LNC/LBE/LLY       | [LLY]          |           |               | LBE-SWB  |          |         |       |        |  |
|                           |   |   | E-52                                     | SIP III Battery Supply<br>SIP IV Dirty Supply from | LNC/LBE/BAT       | LBE-BA         |           |               |          |          |         |       |        |  |
|                           |   |   | E-53                                     | LHB<br>SIP IV Clean Supply from                    | LND/LLD/LHB       | [LHB]          | LLD-SWB   | LND           | I-RD     |          |         |       |        |  |
|                           |   | LND 220V Essential<br>Switchboards          | E-54                                     | LHB  | LND/LBF/LLB/LHB   |                | LLB-SWB   | LBF-RD        |          | LND-SWB  |         |       |        |  |
|                           |   | [LND]                                       | E-55                                     | SIP IV Supply from LSS                             | LND/LBF/LLY       | [LLY]          |           |               | LBF-SWB  |          |         |       |        |  |
|                           |   |   | E-56                                     | SIP IV Battery Supply                              | LND/LBF/BAT       | LBF-BA         |           |               |          |          | _       |       |        |  |
| ¥                         | U1. Essential                             | SEC Train A Cooling                         | U-1                                      | SEC Train A Cooling                                | SEA/SEC-A/SEA     | [Sea]          | SEC-A-RS  |               |          |          | [Sea]   |       |        |  |
| Ultimate Heatsink         | Cooling                                   | SEC Train B Cooling                         | U-2                                      | SEC Train B Cooling                                | SEA/SEC-B/SEA     |                | SEC-B-RS  | SEC-B-DS      | SEC-B-PO | RRI-B-HX |         |       |        |  |
| Неа                       |   | Alternative Heatsink                        | U-3                                      | Alternative Heatsink                               |                   |                |           |               |          |          |         |       |        |  |
| ate                       |   | RRI Train A Cooling                         | U-11                                     | RRI Train A Cooling                                | SEC/RRI-A/HXA     | HX-A           | RRI-A-PO  | [RRI-A-HX]    |          |          |         |       |        |  |
| ime                       | U2. Component<br>Cooling                  | RRI Train B Cooling                         | U-12                                     | RRI Train B Cooling<br>RRI Commons cooling         | SEC/RRI-B/HXA     | HX-B           | RRI-B-PO  | [RRI-B-HX]    |          |          |         |       |        |  |
| Ē                         |   | RRI Commons<br>Cooling                      | U-13                                     | (Train A)<br>RRI Commons cooling                   | SEC/RRI-A/HXC     | нх-сом         | RRI-A-PO  | [RRI-A-HX]    |          |          |         |       |        |  |
|                           |   |   | U-14                                     | (Train B)  | SEC/RRI-B/HXC     |                | RRI-B-PO  | [RRI-B-HX]    |          |          |         |       |        |  |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |



Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency

Table 16:Functional requirements diagram for a beyond-design-basis (0.6 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|              | Required Function                      |  |       | SSCs that provide Functional Requirement     |                               |             |         |         |                   |                |                     |               |                   |        |      |  |  |
|--------------|--|--|-------|--|-------------------------------|-------------|---------|---------|-------------------|----------------|---------------------|---------------|-------------------|--------|------|--|--|
|              | Functional<br>Requirement Sub-Function |  |       | Methods to fulfil Functional Req. (SSCs)     |                               |             |         | Sub-SSC |                   |                |                     |               |                   |        |      |  |  |
|              |  | Control Rods                               | C-S1  | Control Rod                                  | CRDMs                         | 1           | -L-ASS  | (       | CNTL-ROD          | CRDM           |                     |               |                   |        |      |  |  |
|              |  |  | C-L42 | REA Boration (direct or<br>normal)           | REA/RCV/RCP                   | R           | EA/B-TN | к       | REA/B-PO          | REA            | -RCV                |               |                   |        |      |  |  |
|              |  |  |       | C-L44  | Normal charging from PTR tank | PTR/RCV/RCP |         |         |                   |                | PTR-RCV             |               | RCV-PO            | RCV-CL |      |  |  |
|              | C1. Sub-Criticality                    | Boron Injection                            | C-L34 | Charging using Emergency<br>Seal Injection   | ESS/ESS-CL/RCP                | P           | PTR-TNK | <       |                   |                |                     |               |                   | R      | CP   |  |  |
|              |  |  | C-L33 | Emergency Seal Injection                     | ESS/ESS-SI/RCP                |             |         |         |                   | PTR-ESS        |                     | ESS-PO        | ESS-SI            |        |      |  |  |
|              |  |  | C-L11 | Accumulators                                 | ACC/RCP                       |             | ACC     | 1       |                   |                | ACC-RCP             |               |                   |        |      |  |  |
|              |  | RCP System                                 | C-121 | RCP Integrity                                | RCP*                          |             | RCP*    |         | RCP<br>Pumps*     | RCP<br>Vessel* | RCP<br>Pressuriser* | PORVs*        | Safety<br>Valves* |        |      |  |  |
|              | C2. Primary System                     | SG   | C-122 | SG Integrity                                 | SG*                           |             | SGs*    | I       |                   |                |                     |               |                   |        |      |  |  |
|              | Integrity                              | RRA System Integrity<br>(SD)               | C-123 | RRA Integrity                                | RCP*/RRA*/RCP*                |             | RCP*    | T       | RRA-SL*           | RRA-PO*        | RRA-Hx*             | RRA-DL*       | RRA-SV*           |        |      |  |  |
|              |  | (SD)<br>(SD)                               | C-124 | RRA Isolation                                | RCP*                          |             | RCP*    | T       | RRA-SL            | RRA-DL         |                     | <u> </u>      |                   |        |      |  |  |
| ľ            |  | (65)                                       | C-L31 | Normal Seal Injection                        | REA/RCV/RCP                   | R           | EA/B-TN | к       | REA/B-PO          | REA            | -RCV                |               |                   |        |      |  |  |
|              | C3. RCP Seal                           | Normal Seal Injection                      | C-L32 | PTR Seal Injection                           | PTR/RCV/RCP                   |             |         | T       |                   | PTR-RCV        |                     | RCV-PO        | RCV-SI            | R      | CP   |  |  |
|              | injection                              | Emergency Seal                             | C-L33 | Emergency Seal Injection                     | ESS/RCP                       | P           | TR-TNK  |         |                   | PTR-ESS        |                     | ESS-PO        | ESS-SI            |        |      |  |  |
|              |  | Injection                                  | C-L42 | REA Boration (direct or                      | REA/RCV/RCP                   | R           | EA/B-TN | к       | REA/B-PO          |                |                     |               |                   |        |      |  |  |
|              |  | RCV Normal charging                        |       | normal)<br>Normal charging from REA          | REA/RCV/RCP                   | -           | AW-TN   | +       | REAW-PO           | REA            | RCV                 | RCV-PO        |                   |        |      |  |  |
|              | C4. Primary System<br>Make-up          |  | C-L44 | water system<br>Normal Charging from         | PTR/RCV/RCP                   |             |         | t       | PTR-RCV           |                |                     |               | RCV-CL            |        |      |  |  |
|              |  | ESS Charging                               | C-L34 | PTR<br>Charging using ESS                    | ESS/ESS-CL/RCP                |             |         |         |                   |                |                     |               |                   |        |      |  |  |
|              |  | Injection (Low Flow)<br>ESS Seal injection | C-L33 | (6m3/hr)<br>Emergency Seal Injection         | ESS/ESS-SI/RCP                | -           | PTR-TNK |         |                   | PTR-ESS        |                     | ESS-PO        | ESS-SI            |        |      |  |  |
|              |  | (Low Flow)<br>HHSI - Direct Inj.           | C-L45 | (6m3/hr)<br>HHSI Direct Injection            | PTR/RCV/BIT/RCP               | 1           |         |         |                   | PTR-RCV        |                     | RCV-PO        | RCV-HSI           | RCP    | CP . |  |  |
|              |  | LHSI - Direct Inj.                         | C-L46 | LHSI Direct Injection                        | PTR/RIS/RCP                   |             |         |         |                   | PTR-RIS        |                     |               |                   |        |      |  |  |
|              |  | LHSI - Recirculation                       | C-L40 | LHSI Recirculation                           | SMP/RIS/RCP                   | -           |         |         |                   | SMP-RIS        |                     | RIS-PO        |                   |        |      |  |  |
| e            |  |  |       |  | SMP/EAS/EAS-                  |             | CNT-SMP |         | 0.5.5.0           |                | 540 B/0             | <b>DID DO</b> | RIS-LSI           |        |      |  |  |
| Reactor Core |  | EAS Back-up to RIS<br>EAS 004 Back-up to   | C-L48 | EAS Back-up to RIS                           | 4PO/RIS/RCP<br>SMP/EAS/EAS-   | -           | NI-SMP  |         | SMP-EAS           | EAS-PO         | EAS-RIS             | RIS-PO*       |                   |        |      |  |  |
| acto         |  | RIS<br>PTR Gravity Feed                    | C-L49 | EAS Back-up to RIS                           | RIS/RIS/RCP                   |             |         |         | SMP-EAS           | EAS-PO*        | EAS-4PO             | RIS-PO*       |                   | _      |      |  |  |
| Ř            |  | (SD - Head Off)                            | C-L61 | PTR Gravity Feed                             | PTR/RIS*/RCP                  | P           | TR-TNK  |         |                   | PTR-RIS        |                     | RIS-PO*       | RIS-LSI           | R      | CP   |  |  |
|              |  | SG Steam Dump                              | C-L50 | GCTa Steam Dump                              | SG/VVP/GCTa                   |             | SGs     |         | WP-GCT            |                | GCTa-STM            |               |                   |        |      |  |  |
|              |  | SG Feedwater                               | C-L51 | GCTc Steam Dump                              | SGAAP/GCTc-                   |             |         |         | GCTc-STM          |                | CEX-TNK             | CEX-PO-       |                   |        |      |  |  |
|              |  |  | C-L52 | Turbine Driven ASG Pump                      | ASG/ASGt/SG                   | ASG-TNK     |         | <       | ASG-T/PO ASG-T/SS |                |                     | -T/FL         | ASG-SG/FL         |        |      |  |  |
|              |  |  | C-L53 | Motor Driven ASG Pumps                       | ASG/ASGm/SG                   |             |         | 4       |                   |                |                     | WFL           |                   | S      | Gs   |  |  |
|              |  |  | C-L54 | ARE Main Feed                                | CEX/APA/SG                    | ¢           | EX-TNK  | ¢       | CEX-PO            | ABP-HX*        | APA-PO              | AHP-HX*       | ARE-SG/FL         |        |      |  |  |
|              | C5. Core Cooling                       |  | C-L55 | SER Make-up to ASG<br>SER gravity Make-up to | SER/ASG                       | _           | SE      | R-1     | 'NK               | SER-PO         | SER-ASG             |               |                   |        |      |  |  |
|              |  |  | C-L56 | ASG  | SER/ASG (gravity)             |             |         |         |                   | SER-BV         |                     | ASG-TNK       |                   |        |      |  |  |
|              |  | SG Long term<br>Feedwater Supply           | C-L57 | JPP Make-up to ASG                           | JPP/JPD/ASG                   |             | JP      | P-T     | NK                | JPP-PO         | JPD-ASG             |               |                   |        |      |  |  |
|              |  |  | C-L58 | JPS Make-up to ASG                           | SEP/JPS/JPD/ASG               | s           | EP-TNK  |         | SEP-JPP/S         | JPS-PO         | JPD-ASG             |               |                   |        |      |  |  |
|              |  | BBA Core Contine                           | C-L59 | SEP Make-up to JPP                           | SEP/JPP                       | -           |         | 4       |                   | JPP-TNK        |                     |               |                   |        |      |  |  |
|              |  | RRA Core Cooling<br>(SD)                   | C-L60 | RRA Cooling                                  | RCP/RRA/RCP                   |             | RCP*    | 4       | RRA-SL            | RRA-PO         | RRA-Hx              | RRA-DL        | RRA-SV            | RC     | P*   |  |  |
|              |  | Containment Isolation                      | B-1   | Containment Building                         |                               |             | B-CNT   |         |                   |                |                     |               |                   |        |      |  |  |
|              |  | Direct Core Injection                      |       | *See C4. Primary Sys                         | tem Make-up                   |             | _       | -       |                   |                |                     |               |                   |        |      |  |  |
|              |  |  | C-L61 | Containment Spray - EAS<br>Direct Injection  | PTR/EAS/CNT                   | P           | TR-TNK  | ¢       | PTR-EAS           | EAS            | -PO                 |               |                   |        |      |  |  |
|              |  | Containment                                | C-L62 | Containment Spray - EAS<br>Recirculation     | SMP/EAS/CNT                   | c           | NT-SMF  |         | SMP-EAS           | EAS-PO         | EAS-Hx              | EAS-SPR       | CONT              |        |      |  |  |
|              | C6. Containment                        | Pressure Control                           | C-L63 | Containment Spray -JPP<br>Emergency Back-up  | JPP/EAS/CNT                   | J           | PP-TNK  |         | JPP-PO            | JPP-JPC        | JPC-EAS             |               |                   |        |      |  |  |
|              | Integrity                              |  | C-L64 | Containment Venting                          |                               |             |         |         |                   |                |                     |               |                   |        |      |  |  |
|              |  | Hydrogen Reduction                         | C-L65 | Hydrogen PARS                                | ETY (PARS)                    |             | PARs    |         |                   |                |                     |               |                   |        |      |  |  |
|              |  | SG Creep Rupture                           | C-L52 | Turbine Driven ASG Pump                      | ASG/ASGt/SG                   |             | SC TAP  |         | ASG-T/PO          | ASG-T/SS       | ASG                 | -T/FL         | ASG-SG/FL         | s      | 2.   |  |  |
|              |  | Prevention                                 | C-L53 | Motor Driven ASG Pumps                       | ASG/ASGm/SG                   |             | SG-TNK  |         | ASG-I             | WPO            | ASG                 | WFL           | ASG-SG/FL         | S      | 55   |  |  |
|              |  | Basemat Melt-thro                          |       |  |                               | -           | -       |         |                   |                |                     |               |                   | -      |      |  |  |

Table 16:Functional requirements diagram for a beyond-design-basis (0.6 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                 | Required I                | Function                          |       |                                       | SSCs th                    | at provide       | e Functio | nal Requ     | irement     |          |           |        |  |  |
|-----------------|---------------------------|-----------------------------------|-------|---------------------------------------|----------------------------|------------------|-----------|--------------|-------------|----------|-----------|--------|--|--|
|                 | Functional<br>Requirement | Sub-Function                      | Met   | hods to fulfil Funct                  | ional Req. (SSCs)          | Sub-SSC          |           |              |             |          |           |        |  |  |
|                 |                           | Core Exit<br>Temperature          | C-I1  | Core Exit Temperature<br>Indication   |                            | RICxxxMT         |           |              |             | [LNi]    |           |        |  |  |
|                 |                           | RCP Level                         | C-12  | Pressuriser Level                     |                            | RCPxxxMN         |           |              |             | [LNi]    |           |        |  |  |
|                 |                           | Reactor Level                     | C-124 | RVLIS                                 |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | Indication<br>RCP pressure        | C-I3  | RCP Pressure Indication               |                            | RCPxxxMP         |           |              |             | [LNi]    |           |        |  |  |
|                 |                           |                                   | _     |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | RRA Pressure                      | C-15  | RRA Pressure Indication               |                            | RRAxxxMP         |           |              |             | [LNi]    |           |        |  |  |
| e               |                           | SG Level                          | C-16  | SG WR Level Indication                |                            | ARExxXMN         |           |              |             | [LNi]    |           |        |  |  |
| Reactor Core    |                           | SG Pressure                       | C-17  | SG Pressure Indication                |                            | VVPxxxMP         |           |              |             | [LNi]    |           |        |  |  |
| tor             | C7. Essential             | ASG Tank Level                    | C-18  | ASG Tank Level Indication             |                            | ASG002LN         |           |              |             |          |           |        |  |  |
| teac            | Indication                | Diesel Tank Level                 | C-19  | Diesel Tank Level<br>Indications      |                            | LHixxxLN         |           |              |             |          |           |        |  |  |
| œ               |                           | Containment<br>Pressure           | C-120 | Containment WR Pressure<br>Indication |                            | ETYxxxMP         |           |              | -           | [LNi]    |           |        |  |  |
|                 |                           | Containment                       | C-21  | Containment Radiation                 |                            | KRT022-          |           |              |             | KRT001AR | [LBA]     |        |  |  |
|                 |                           | Radiation<br>Containment Sump     | C-122 | Levels<br>Containment Sump Level      |                            | 23MA<br>RISxxxSL |           |              |             | [LCA/B]  | . ,       |        |  |  |
|                 |                           | Level<br>BaseMat                  | _     |                                       |                            | EASxxxSL         |           |              |             | [LOA/B]  |           |        |  |  |
|                 |                           | Thermocouples<br>Containment Sump | C-123 | Basemat Thermo-couples                | <br>                       | KSBxxxMT         |           |              |             |          |           |        |  |  |
|                 |                           | Temperature                       | C-151 |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | Containment<br>Hydrogen Sampling  | C-152 |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | Reactor Pit<br>Temperature        | C-153 |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | SFP Pool                          | S-S1  | SFP Pool Integrity                    | SFP                        | SFP-PL           | B-SFP     |              |             |          |           |        |  |  |
|                 | S1. SFP Integrity         | PTR 1/2 PO                        | S-S1  | PTR Normal SFP Cooling<br>Integrity   | SFP\PTR\SFP                |                  | PTR-SL    | PTR-PO*      | PTR-HX*     | PTR-DL   | PTR-SPHN  |        |  |  |
|                 |                           | PTR 6 PO                          | S-S2  | PTR 3rd Train Integrity               | SFP\PTR3\SFP               | SFP-PL           | PTR3-SL   | PTR3-PO*     | PTR3-HX*    | PTR3-DL  | PTR3-SPHN | SFP-PL |  |  |
|                 |                           | PTR 1/2 PO                        | S-L1  | PTR Normal Cooling                    | SFP\PTR\SFP                |                  | PTR-SL    | PTR-PO       | PTR-HX      | PTF      | R-DL      |        |  |  |
|                 | S2. SFP Cooling           |                                   |       | -                                     |                            | SFP-PL           |           |              |             |          | R3-DL     | SFP-PL |  |  |
|                 |                           | PTR 6 PO                          | S-L2  | PTR 3rd Train Cooling                 | SFP\PTR3\SFP               |                  | PTR3-SL   | PTR3-PO      | PTR3-HX     | PIR      | (3-DL     |        |  |  |
| -               |                           | SFP Steam Release                 | S-L3  | Open Vent Doors                       |                            | SFP-VD           |           |              | 1           | -        | 1         |        |  |  |
| Poe             | S3. Bulk Boiling          | SFP Emergency<br>Make-up          | S-L4  | SED Make-up                           | SED/SFP                    | SED-TNK          | SED       | P-PO JPD-SFP |             | SFP-PL   |           |        |  |  |
| iuel            |                           |                                   | S-L5  | JPP Make-up                           | JPP/JPD/SFP                | JPP-TNK          | JPF       |              |             |          |           |        |  |  |
| Spent Fuel Pool |                           |                                   | S-L6  | -L6 JPS Make-up SEP/JPS/SFP           |                            | SEP-TNK          | SEP-JPP/S | JPS-PO       |             |          |           |        |  |  |
| Spe             |                           | SFP Level                         | S-I1  | SFP Level Indication                  |                            | PTRxxxMN         |           |              |             | [LNi]    | [SAR-ACC] |        |  |  |
|                 |                           | SFP Temperature                   | S-12  | SFP Temperature<br>Indication         |                            | PTRxxxMT         |           |              |             | [LNī]    |           |        |  |  |
|                 |                           | Fuel Rack<br>Temperature          | S-13  |                                       |                            |                  | -         |              |             | -        |           |        |  |  |
|                 | S4. Indication            | SFP Boron<br>Concentration        | S-14  |                                       |                            | -                |           |              |             |          |           |        |  |  |
|                 |                           | SFP Building                      | S-15  |                                       |                            | -                |           |              |             |          |           |        |  |  |
|                 |                           | Pressure<br>SFP Hydrogen          | S-16  |                                       |                            | -                |           |              |             |          |           |        |  |  |
|                 |                           | Concentration<br>SFP Building     |       |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | Humidity                          | S-17  | JPP Make-up to Seismic                |                            |                  |           |              |             |          |           |        |  |  |
| <u>.</u> .      |                           | Flooding of Seismic               | V-L01 | Vault<br>JPS Make-up to Seismic       | JPP/JPD/VLT                | JPP              | TNK       | JPP-PO       | JPP-JPD     | JPD-VLT  |           |        |  |  |
| ault            | V1. Seismic Vault         | Vault                             | V-L02 | Vault                                 | SEP/JPS/JPD/VLT            | SEP-TNK          | SEP-JPP/S | JPS-PO       | JPS-JPD     |          | VLT       |        |  |  |
| Seismic Vault   |                           |                                   | V-L03 | SEP Gravity Feed to<br>Seismic Vault  | SEP/JPD/VLT                |                  |           | SEP          | -VLT        |          |           |        |  |  |
| ism             |                           | Seismic Vault<br>Temperature      | VI-1  |                                       |                            |                  |           |              |             |          |           |        |  |  |
| Se              | V.2 Indication            | Seismic Vault Water<br>Level      | VI-2  |                                       |                            |                  |           |              |             |          |           |        |  |  |
|                 |                           | Seismic Vault<br>Pressure         | VI-3  |                                       |                            |                  |           |              |             |          |           |        |  |  |
| ks<br>ks        | D1. Cask Integrity        | Cask Remain Leak<br>Tight         | D-S1  | Cask integrity                        | CASK                       | CASK*            |           |              |             |          |           |        |  |  |
| Dry<br>Casks    | D2. Cask Cooling          | Cask Air cooling<br>maintained    | D-L1  | Cask Cooling                          | Cask building and Air Flow | B-LLW            | CASK-AIR  |              |             |          |           |        |  |  |
|                 | B1. Containment           |                                   | B1    | Containment Building                  |                            | B-CNT            | Building  | Hatch        | Penetration | Airlocks |           |        |  |  |
|                 | B2. NAB                   |                                   | B2    | Nuclear Auxiliary Building            |                            | B-NAB            |           |              |             |          |           |        |  |  |
|                 | B3. Electrical Building   | 9                                 | B3    | Electrical Building                   |                            | B-ELE            |           |              |             |          |           |        |  |  |
| Buildings       | B4. Diesel buildings      |                                   | B4    | Unit Diesel Building                  |                            | B-DSL            |           |              |             |          |           |        |  |  |
| ildi            | B5. SBO Diesel Build      | ing                               | B5    | SBO Diesel Building                   |                            | B-SBO            |           |              |             |          |           |        |  |  |
| Bu              | B6. SEC pump-house        |                                   | B6    | SEC Pumphouse Building                |                            | B-SEC            |           |              |             |          |           |        |  |  |
|                 | B7. Turbine Hall          |                                   | B7    | Turbine Hall                          |                            | B-TUR            |           |              |             |          |           |        |  |  |
|                 | B8. LLW Building          |                                   | B8    | Low Level Waste Building              |                            | B-LLW            |           |              |             |          |           |        |  |  |
|                 | B9. ECC                   |                                   | B9    | Emergency Control Centre              |                            | B-ECC            |           |              |             |          |           |        |  |  |

Table 16:Functional requirements diagram for a beyond-design-basis (0.6 g) earthquakeinducing a tsunami wave up to 3.8 m above the terrace level (no modifications)

|                           | Required Function                                      |  |  | SSCs that provide Functional Requirement   |   |    |  |                      |                          |                      |                    |             |    |       |       |       |       |
|---------------------------|--|--|--|--|---|----|--|----------------------|--------------------------|----------------------|--------------------|-------------|----|-------|-------|-------|-------|
|                           | Functional<br>Requirement                              | Sub-Function   | Methods to fulfil Functional Req. (SSCs) |  |   |    | Sub-SSC                                |                      |                          |                      |                    |             |    |       |       |       |       |
|                           |  | LHA Switchboard<br>Supply  | E-1<br>E-2                               | 400 KV LHA Supply<br>132 KV LHA Supply   | 400KV/LHA<br>132KV/LHA                        | 1  | 100KV<br>32KV                          | GEN-TRX UNT-T        |                          |                      |                    | X LGE/F-SWE |    | VB    | VВ    | [LCA] | [LBA] |
|                           | E1. Essential 6.6kV<br>Switchboard Supply              | [LHA]  | E-3<br>E-4                               | LHP Diesel LHA Supply  | LHP/LHA<br>LHS/LHA                            | LH | IP-DSL                                 |                      | -LHC                     | LHC-SWB              | LHC-LH             | iA          |    |       |       |       |       |
|                           | Switchboard Supply                                     | LHB Switchboard<br>Supply<br>[LHB]                                 | E-5<br>E-6<br>E-7                        | 400 KV LHB Supply<br>132 KV LHB Supply<br>LHQ Diesel LHB Supply                              | 400KV/LHB<br>132KV/LHB<br>LHQ/LHB             | 1  | 00KV<br>32KV<br>Q-DSL                  | GEN-TRX              | UNT-TRX<br>-TRX<br>LHC   | LGD-SWB<br>LGE/F-SWB | LGC-SV             | UB LHB-SV   | νв | [LCB] | [LBB] |       |       |
|                           |  | LLY SBO Diesel   | E-8                                      | LHS Diesel LHB Supply  | LHS/LHB                                       | LH | IS-DSL                                 | LHS                  | -LHC                     | LHC-SWB              | LHC-LH             | ŀВ          |    |       |       |       |       |
|                           | E2. SBO Diesel<br>Supply                               | Supply<br>[LLY]  | E-10                                     | LLY Switchboard Supply   | LLS\LLX\LLY                                   |    | .S-DSL                                 | LLX-SWB              | LLX-LLY                  | LLY-SWB              |                    |             |    |       |       |       |       |
|                           | E3. 48 V Essential                                     | LCA 48V Switchboard<br>Supply [LCA]                                | E-21<br>E-22<br>E-23                     | LCA Switchboard - LHA<br>LCA Switchboard - LLS<br>LCA Switchboard - Battery                  | LCAILLIILHA<br>LCAILLY<br>LCAIBAT             |    | [LHA]<br>[LLY]<br>LCA-BAT              |                      | LLA\E-SWB                | LCA-RD               | LCA-SV             | VB          |    |       |       |       |       |
| E                         | Switchboard Supply                                     | LCB 48V<br>Switchboard Supply<br>[LCB]                             | E-24<br>E-25<br>E-26                     | LCB Switchboard - LHB<br>LCB Switchboard - LLS<br>LCB Switchboard - Battery                  | LCB\LLI\LHB<br>LCB\LLY<br>LCB\BAT             |    | ILHB]<br>[LLY]<br>LCB-BA               |                      | LLB\D-SWB                | LCB-RD               | LCB-SV             | VB          |    |       |       |       |       |
| Electrical Support System | E4. 125 V Essential<br>Switchboard Supply              | LBA 125V<br>Switchboard Supply<br>[LBA]                            | E-31<br>E-32<br>E-33                     | LBA Switchboard - LHA<br>LBA Switchboard - LLS   | lbailliilha<br>Lbailly                        |    | <mark>(LHA)</mark><br>(LLY]<br>LBA-BAT |                      | LLC\E-SWB                | LBA-RD               | LBA-SV             | VВ          |    |       |       |       |       |
| ical Supp                 |  | LBB 125V<br>Switchboard Supply<br>[LBB]                            | E-33<br>E-34<br>E-35                     | LBA Switchboard - Battery<br>LBB Switchboard - LHA<br>LBB Switchboard - LLS                  | LBAIBAT<br>LBBILLIILHB<br>LBBILLY             |    | <mark>(LHB)</mark><br>(LLY]            |                      | LLB\D-SWB                | LBB-RD               | LBB-RD LBB-SWE     |             |    |       |       |       |       |
| Electr                    |  | LNA 220V Essential<br>Switchboards<br>[LNA]                        | E-36<br>E-41<br>E-42                     | LBB Switchboard - Battery<br>SIP I Dirty Supply from LHA<br>SIP I Clean Supply from<br>LHA   | LBB\BAT<br>LNA/LLC/LHA<br>LNA/LBC/LLA/LHA     |    | LBB-BAT                                | LLC-SWB              |                          | RD                   |                    |             |    |       |       |       |       |
|                           |  |  | E-43<br>E-44                             | SIP I Supply from LSS<br>SIP I Battery Supply  | LNA/LBC/LLY<br>LNA/LBC/BAT                    |    | [LLY]<br>LBC-BA                        |                      | LBC-RD                   | LBC-SWB              | LNA-SWB            | VВ          |    |       |       |       |       |
|                           |  | LNB 220V Essential<br>Switchboards<br>[LNB]                        | E-45<br>E-46<br>E-47                     | SIP II Dirty Supply from<br>LHB<br>SIP II Clean Supply from<br>LHB<br>SIP II Supply from LSS | LNB/LLD/LHB<br>LNB/LBD/LLB/LHB<br>LNB/LBD/LLY |    | (LHB)<br>(LLY)                         | LLD-SWB              | LNE                      | LBD-SWB              | LNB-SV             | VB          |    |       |       |       |       |
|                           | E5. Essential<br>Instrumentation<br>Switchboard Supply | [2:02]   | E-48<br>E-49                             | SIP II Battery Supply<br>SIP II Dirty Supply from  | LNB/LBD/BAT                                   |    | LBD-BAT                                | LLC-SWB              | LNC                      | C-RD                 |                    | _           |    |       |       |       |       |
|                           |  | LNC 220V Essential<br>Switchboards<br>[LNC]                        | E-50<br>E-51                             | SIP III Clean Supply from<br>LHA<br>SIP III Supply from LSS                                  | LNC/LBE/LLA/LHA                               |    |  | LLA-SWB              | LBE-RD                   | LBE-SWB              | LNC-SV             | VB          |    |       |       |       |       |
|                           |  | LND 220V Essential<br>Switchboards                                 | E-52<br>E-53<br>E-54                     | SIP III Battery Supply<br>SIP IV Dirty Supply from<br>LHB<br>SIP IV Clean Supply from<br>LHB | LNC/LBE/BAT<br>LND/LLD/LHB<br>LND/LBF/LLB/LHB |    | LBE-BAT                                | LLD-SWB              | LNE<br>LBF-RD            | D-RD                 | LND-SV             |             |    |       |       |       |       |
|                           |  | [LND]  | E-55<br>E-56                             | SIP IV Supply from LSS<br>SIP IV Battery Supply  | LND/LBF/LLY<br>LND/LBF/BAT                    |    | [LLY]<br>LBF-BAT                       |                      | LDF-RD                   | LBF-SWB              | LIND-SV            |             |    |       |       |       |       |
| ttsink                    | U1. Essential<br>Cooling                               | SEC Train A Cooling<br>SEC Train B Cooling                         | U-1<br>U-2                               | SEC Train A Cooling<br>SEC Train B Cooling   | SEA/SEC-A/SEA<br>SEA/SEC-B/SEA                |    | [Sea]                                  | SEC-A-RS<br>SEC-B-RS | SEC-A-DS                 | SEC-A-PO<br>SEC-B-PO | RRI-A-H<br>RRI-B-H | [Sea]       |    |       |       |       |       |
| Ultimate Heatsink         | U2. Component  | Alternative Heatsink<br>RRI Train A Cooling<br>RRI Train B Cooling | U-3<br>U-11<br>U-12                      | Alternative Heatsink RRI Train A Cooling RRI Train B Cooling                                 | SEC/RRI-A/HXA<br>SEC/RRI-B/HXA                | -  | HX-A<br>HX-B                           | RRI-A-PO<br>RRI-B-PO | [RRI-A-HX]<br>[RRI-B-HX] |                      |                    |             |    |       |       |       |       |
| Ultin                     | U2. Component<br>Cooling                               | RRI Commons<br>Cooling   | U-13<br>U-14                             | RRI Commons cooling<br>(Train A)<br>RRI Commons cooling<br>(Train B)                         | SEC/RRI-A/HXC<br>SEC/RRI-B/HXC                | н  | к-сом                                  | RRI-A-PO<br>RRI-B-PO | [RRI-A-HX]<br>[RRI-B-HX] |                      |                    |             |    |       |       |       |       |

| Functionality Lost   |
|--|
| Functionality lost due to On-Site Induced Hazard                       |
| Functionality Lost by Failure of Support System                        |
| Functionality Retained but limited to less than 24<br>hours operation. |
| Functionality Retained   |
| Proposed Plant Changes   |
| Functionality Not Credited or does not Exist                           |

|  |  | Tsunami event results in damage |
|--|--|---------------------------------|
|  |  | Seismic event results in damage |

Note \* indicates integrity not active function

Note [XXX] indicates as system support dependency