| Eskom | KOEBERG CHEMISTRY SPECIFICATIONS | Allocation Centre 38A | REFERENCE NUMBER KBA0022CHEMSPEC00 | REV 1 |
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# KOEBERG CHEMISTRY SPECIFICATIONS

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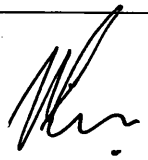
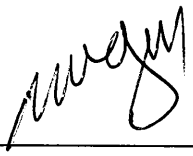
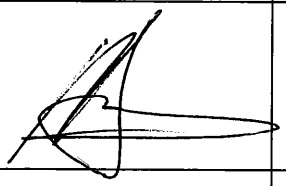
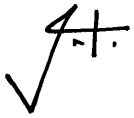
|---|---|---|---|
| Nuclear Restricted | CSR | | |
| **COMPILED** | **REVIEWED** | **AUTHORISED** | **ACCEPTED** |
|  |  |  |  |
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| CHIEF SCIENTIST NUCLEAR SUPPORT | SENIOR ADVISOR NUCLEAR ENGINEERING | GENERAL MANAGER NUCLEAR ENGINEERING | POWER STATION MANAGER KOEBERG |
| DATE: 2017.03.29 | DATE: 2017.03.29 | DATE: 2017-03-31 | DATE: 2017-04-10 |

| FUNCTIONAL CONTROL AREA | ALARA REVIEW DATE | SUPERSEDES |
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| NUCLEAR ENGINEERING | N/A | KBA0022CHEMSPEC00 Rev 0 |

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| 35 | X | | X | | | | | | |
| 36 | X | | X | | | | | | |
| 37 | X | | X | | | | | | |
| 38 | X | | X | | | | | | |
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Note: the lower-case “x” indicates editorial changes only

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# 1.0 PURPOSE

This document defines the regulatory chemistry and radiochemistry specifications and surveillance requirements of plant systems at Koeberg Nuclear Power Station to provide assurance that nuclear safety is not compromised by adverse chemical conditions.

# 2.0 SCOPE

This document stipulates the mandatory Chemistry Control Parameters and Radiochemistry specifications, their limiting values, surveillance frequencies, as well as the actions to take when a parameter is exceeded.

# 3.0 REFERENCES

## 3.1 NORMATIVE

| | |
|---|---|
| ISO 9001 | Quality Management Systems |
| OTS | Operating Technical Specifications |
| SAR | Koeberg Safety Analysis Report |
| SRSM | Safety Related Surveillance Manual |

## 3.2 INFORMATIVE

KBA0022CHEMJUSTIF1 Technical Bases for Koeberg Chemistry Specifications

# 4.0 DEFINITIONS AND ABBREVIATIONS

## 4.1 DEFINITIONS

4.1.1 Action to take

A mandatory action that must be taken by Operating or Chemistry when a parameter limit value has been exceeded.

4.1.2 Action levels

Action levels prescribe threshold values of a parameter beyond which the system's reliability may be at risk.

Action Level 1 (AL1) – Represents the value beyond which plant or research data or engineering judgement indicates that long-term system component reliability may be threatened, thereby warranting actions to return the parameter from the AL1 condition to the target condition which may include power reduction in certain circumstances.

Action Level 2 (AL2) – Represents the value beyond which plant or research data or engineering judgement indicates significant damage could be done to the system in the short-term, thereby warranting prompt correction of the abnormal condition which includes power reduction and unit shutdown.

Action Level 3 (AL3) – Represents the value beyond which plant or research data or engineering judgement would indicate that it is inadvisable to continue to operate the plant.

Not all parameters have action levels. Action levels are included for the most critical chemical control parameters related to reactor coolant system and steam generator degradation.

### 4.1.3 Ammonia Regime

The feedwater is conditioned with ammonia solution for pH control (ETA dosing is out-of-service).

### 4.1.4 Analysis Frequency

This is the analysis frequency for a parameter that must be adhered to. Not adhering to the minimum analysis frequency constitutes surveillance non-compliance.

### 4.1.5 Analysis Frequencies

Analysis frequencies are defined in accordance with the table below. A 25% tolerance is applicable to all surveillances.

| SYMBOL | DEFINITION |
|---|---|
| S | Every shift = Once every 12 hours |
| D | Once every 24 hours |
| 48 hours | Once every 48 hours |
| 3 × W | Normally Monday, Wednesday, Friday * (Once every 72 hours) |
| W | Once every 7 days |
| 2 × M | Once every 16 days |
| M | Once every 31 days |
| P | Prior to any action |

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*NOTE: For missed analyses, refer to OTS missed surveillances rule*

* *If a surveillance falls on a public holiday, the surveillance may be performed on the preceding or subsequent day.*

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### 4.1.6 CHE Events

Deviations from the chemistry parameter requirements associated with each operating domain are called ‘CHE Events’. These are listed in Appendix 1.

4.1.7 Dose Equivalent I-131

The dose equivalent Iodine-131 (I-131) relates to the internal contamination of the thyroid gland. The dose equivalent I-131 is estimated from the combined activities of the different isotopes of iodine according to the formula:

$$A(equivalent) = A(I\text{-}131) + \frac{A(I\text{-}132)}{30} + \frac{A(I\text{-}133)}{4} + \frac{A(I\text{-}134)}{50} + \frac{A(I\text{-}135)}{10},$$

where the weighting coefficients are derived from the maximum permissible water-dissolved isotopic concentration for workers.

4.1.8 Equilibrium Activity

Equilibrium activities measured are normalised for letdown flow and make-up (not applicable for noble gas activity). Activity values shall be measured while the reactor is operating at stable power. The reactor is considered to be stable after operation at a specific power level for a period of 48 hours.

4.1.9 Ethanolamine Regime

The feedwater is conditioned with ETA (and ammonia) for pH control (ammonia dosing may be in-service or out-of-service).

4.1.10 I-134 Activity ($A_1$)

The I-134 activity ($A_1$) represents the theoretical change in I-134 activity coming from contamination. $A_1$ is calculated by RFE.

4.1.11 Limit Value (Specification Limit)

The minimum or maximum allowable value for a parameter.

4.1.12 Operating Domains

RCD - Reactor Completely Defueled

RSD - Refuelling Shutdown

MCSD - Maintenance Cold Shutdown

SD/RRA – Shutdown on RRA

SD/SG – Shutdown on Steam Generators

RP - Reactor at Power

4.1.13 Peak I-131 Equivalent Activity

Peak I-131 equivalent activity is the instantaneous activity measured during a transient (not normalised for letdown flow or make-up).

4.1.14 Total Noble Gas

Total Noble Gas activity used for limit values in Operating Technical Specifications is calculated according to the formula:

$$A(Total\ Noble\ Gas) = A(Kr\text{-}85m) + A(Kr\text{-}87) + A(Kr-88) + A(Xe-133m) + A(Xe-133) + A(Xe-135) + A(Xe-138)$$

 

## 4.2 ABBREVIATIONS

| ABBREVIATION | DESCRIPTION |
|---|---|
| AL | Action Level |
| EOC | End of Cycle |
| ETA | Ethanolamine |
| OTS | Operating Technical Specifications |
| RFE | Reactor Fuel Engineering |
| SG | Steam Generator |
| TSP | Trisodium Phosphate |
| U/S | Upstream |
| VCT | Volume Control Tank |

# 5.0 SPECIFICATION

## 5.1 RULES

5.1.1 The sampling and analyses required by this document shall be performed according to approved Chemistry working procedures.

5.1.2 Analysis frequencies, as defined in Paragraph 4.1.5 apply to successive sampling times.

5.1.3 A sample must be taken within the time scale equal to the normal surveillance interval. The analysis must be completed before the end of the tolerance period.

5.1.4 If an analysis cannot be performed before the end of the tolerance period for any reason, the parameter must be considered to be out-of-specification unless it can be adjudged otherwise based on an assessment of the conditions.

5.1.5 The limit values provided in this document are exact. All figures after the decimal that are not supplied must be taken as zero.

5.1.6 When an on-line analyser is out of service, the sampling and analysis frequency for that parameter will be as defined for the relevant system.

5.1.7 The prompt to analyse any system due to a volume / level change must come from Operating.

5.1.8 Surveillance requirements are specified in Paragraph 5.2.

5.1.9 Actions required for Chemistry and Radiochemistry Events (CHE Events) are described in Appendix 1.

## 5.2 SPECIFICATION SUB-DIVISIONS

5.2.1 The specifications have been subdivided into sections as follows:

- Section 1.0 Primary Circuit
- Section 2.0 Primary Circuit Auxiliary Systems
- Section 3.0 Secondary Steam/Water Circuit
- Section 4.0 Radiochemistry

 

The following table references chemistry requirements for the various systems.

## REFERENCE TABLE



 

| Section: 1.1 | Reactor Coolant System | | | | RCP |
|---|---|---|---|---|---|
| Domain: RP | REACTOR AT POWER | | | | 1° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **As required for reactivity control OTS minimum** | **W** | Refer to OTS. | In case of unavailability of the boron meter, refer to OTS. |
| **Pressuriser Boron** | mg B/kg | **ΔB < 50** [1] | **W** | Refer to OTS. | Analyse when the RCP loop boron concentration changes by more than 100 mg B/kg in any 6-hour period. |
| **Lithium** | mg Li/kg | **AL1: > 3,68 / Outside of Control Band** [2] | **3 × W** | Return to control band as soon as possible. | In response to a power transient, lithium must be in the control band 24h after Xe-equilibrium. |
| CC-061 **Chloride**<br>**Fluoride** | μg Cl/kg<br>μg F/kg | **AL1: > 50**<br>**AL2: > 150**<br>**AL3: > 1500** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: RP – RCP 3.<br>AL3 - Initiate CHE Event: RP – RCP 4. | The ALs refers to chloride and fluoride separately and not to the accumulative concentration. |
| **Sulphate** | μg $SO_4$/kg | **AL1: > 50**<br>**AL2: >150**<br>**AL3: > 1500** | **W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: RP – RCP 3.<br>AL3 - Initiate CHE Event: RP – RCP 4. | |
| CC-061 **Dissolved Oxygen** | μg $O_2$/kg | **AL1: > 5**<br>**AL2: > 100**<br>**AL3: > 1000** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: RP – RCP 3.<br>AL3 - Initiate CHE Event: RP – RCP 4. | |
| **Dissolved Hydrogen** | ml $H_2$/kg @ STP | **AL1: < 20; > 50**<br>**AL2: < 15**<br>**AL3: < 5** | **3 × W** | AL1 – Return to within AL1 as soon as possible.<br>AL2 - Initiate CHE Event: RP – RCP 1.<br>AL3 - Initiate CHE Event: RP – RCP 2. | AL1 is not applicable during degassing for a unit shutdown. |

[1] If pressuriser boron concentration is less than that of the primary loop.

[2] The Control Band values are calculated on a daily basis by Chemistry.

| Section: 1.2 | Reactor Coolant System | | | | RCP/RRA |
|---|---|---|---|---|---|
| Domain: SD/SG | NORMAL SHUTDOWN – SG | | | | 1° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVELS** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **As required for reactivity control**<br>**OTS** minimum<br>**2700** maximum | **W** | Refer to OTS. | In case of unavailability of the boron meter, refer to OTS. |
| CC-061<br>**Chloride**<br>**Fluoride** | µg Cl/kg<br>µg F/kg | **AL1: > 50**<br>**AL2: > 150**<br>**AL3: > 1500** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: SD/SG – RCP 1.<br>AL3 - Initiate CHE Event: SD/SG – RCP 2. | The ALs refer to chloride and fluoride separately and not to the accumulative concentration. |
| **Sulphate** | µg $SO_4$/kg | **AL1: > 50**<br>**AL2: > 150**<br>**AL3: > 1500** | **W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: SD/SG – RCP 1.<br>AL3 - Initiate CHE Event: SD/SG – RCP 2. | |
| CC-061<br>**Dissolved Oxygen** | µg $O_2$/kg | **AL1: > 5**<br>**AL2: > 100**<br>**AL3: > 1000** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: SD/SG – RCP 1.<br>AL3 - Initiate CHE Event: SD/SG – RCP 2. | |

| Section: 1.3 | Reactor Coolant System / Residual Heat Removal System | | | | RCP/RRA |
|---|---|---|---|---|---|
| Domain: SD/RRA | NORMAL SHUTDOWN – RRA | | | | 1° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **As required for reactivity control**<br>**OTS** minimum<br>**2700** maximum | **W**<br>**48 hours** [1] | Refer to OTS. | In case of unavailability of the boron meter, refer to OTS. |
| **Chloride**<br>**Fluoride** | µg Cl/kg<br>µg F/kg | **AL1: > 50**<br>**AL2: > 150**<br>**AL3: > 1500** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: SD/RRA – RCP 1 [2] or SD/RRA – RCP 3.[3]<br>AL3 - Initiate CHE Event: SD/RRA – RCP 2 [2] or SD/RRA – RCP 4.[3] | The ALs refer to chloride or fluoride separately and not to the accumulative concentration. |
| **Dissolved Oxygen** | µg $O_2$kg | **AL1: > 5**<br>**AL2: > 100**<br>**AL3: > 1000** | **3 × W** | AL1 - Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: SD/RRA – RCP 3.<br>AL3 - Initiate CHE Event SD/RRA RCP 4. | This specification is applicable when the temperature is > 120 °C.<br>Normal monitoring is continuous, via on-line analyser.<br>This limit value is only applicable if the integrity of the RCP circuit is to be maintained (i.e. no oxygenation). |

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[1] To verify boron meter operability by comparison with manual analysis. More frequent analysis may be requested by Operating.

[2] For reactor coolant temperature ≤ 120°C.

[3] For reactor coolant temperature > 120°C.

| Section: 1.4 | Reactor Coolant System / Residual Heat Removal System | | | | RCP/RRA |
|---|---|---|---|---|---|
| Domain: MCSD to RSD | MAINTENANCE COLD SHUTDOWN TO REFUELLING SHUTDOWN | | | | 1° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **As required for reactivity control**<br>**OTS** minimum<br>**2700** maximum | **48 hours** [1] | Refer to OTS. | In case of unavailability of the boron meter, refer to OTS. |
| CC-061<br>**Chloride**<br>**Fluoride** | µg Cl/kg<br>µg F/kg | **AL1: > 50**<br>**AL2: > 150** | **3 × W** | AL1- Return to below AL1 as soon as possible.<br>AL2 - Initiate CHE Event: MCSD – RCP 1 or<br>CHE Event: RSD – RCP 1. | The ALs refer to chloride or fluoride separately and not to the accumulative concentration. |

[1] To verify boron meter operability by comparison with a manual analysis. More frequent analysis may be requested by Operating.

| Section: 2.1 | Containment Spray System | | | | EAS |
|---|---|---|---|---|---|
| All Domains | 003/004/005/006 BA (TSP BASKETS) | | | | 1° Aux |
| PARAMETER | UNITS | LIMIT VALUE / ACTION LEVEL | ANALYSIS FREQUENCY | ACTION TO TAKE | COMMENTS |
| **TSP Dissolution Time** | Hours | **< 4** | During every refuelling outage | Replace the TSP. | . |
| **pH @ 25°C** | | **> 7,02** | During every refuelling outage | Replace the TSP. | |
| **Level check** [1] | | **Low level as indicated locally** | During every refuelling outage | Top up with TSP. | |

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[1] SRSM Requirement

| Section: 2.2 | Reactor and Spent Fuel System | | | | PTR |
|---|---|---|---|---|---|
| **Tank Filled** | **PTR 001 BA (WHILE TANK CONTENTS ARE NOT IN THE REACTOR CAVITY)** | | | | **1° Aux** |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **2500** minimum<br>**2700** maximum | **M** | Refer to OTS. | |
| **Chloride**<br><br>**Fluoride** | μg Cl/kg<br><br>μg F/kg | **150** maximum | **M** | Return to below the Limit Value as soon as possible. | The limit value refers to chloride or fluoride separately and not to the accumulative concentration. |

| Section: 2.3 | Reactor and Spent Fuel System | | | | PTR |
|---|---|---|---|---|---|
| All Domains | SPENT FUEL POOL | | | | 1°Aux |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **2440** minimum<br>**2700** maximum | **W** [1] [2] [3] | Refer to OTS. | |
| **Chloride**<br><br>**Fluoride** | μg Cl/kg<br><br>μg F/kg | **150** maximum | **2 × M** | Return to below the Limit Value as soon as possible. | The limit value refers to chloride or fluoride separately and not to the accumulative concentration. |

[1] More frequent analysis may be requested by Operating.

[2] Analyse after make-up.

[3] Analyse on request during fuel movement.

| Section: 2.4 | Reactor and Spent Fuel System | | | | PTR |
|---|---|---|---|---|---|
| **Filled** | **REACTOR CAVITY** | | | | **1° Aux** |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **2440** minimum<br>**2700** maximum | **W** [1] | Refer to OTS. | |
| **Chloride**<br><br>**Fluoride** | μg Cl/kg<br><br>μg F/kg | **150** maximum | **W** | Return to below the Limit Value as soon as possible. | The limit value refers to chloride or fluoride separately and not to the accumulative concentration. |

[1] Analyse on request during fuel movement.
[2] Sampling is not required when there is no fuel present in the Reactor Cavity.

| Section: 2.5 | Reactor Make-up System | | | | REA |
|---|---|---|---|---|---|
| Domain: RSD to RP | BORON TANKS – 1/2 REA 004 BA AND 9 REA 003 BA | | | | 1° Aux |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **7300** minimum<br>**7700** maximum | **M** | Refer to OTS. | |
| **Chloride**<br>**Fluoride** | μg Cl/kg<br>μg F/kg | **150** maximum | **M** | Return to below the Limit Value as soon as possible. | The limit value refers to chloride or fluoride separately and not to the accumulative concentration. |

| WATER TANKS – 9 REA 001 AND 002 BA | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Chloride**<br>**Fluoride** | μg Cl/kg<br>μg F/kg | **150** maximum | **M** | Return to below the Limit Value as soon as possible. | The limit value refers to chloride or fluoride separately and not to the accumulative concentration. |

| Section: 2.6 | Reactor Safety Injection System | | | | RIS |
|---|---|---|---|---|---|
| Domain: SD/SG to RP | BORON INJECTION TANK - 004 / 021 BA | | | | 1° Aux |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **2000** minimum<br>**5600** maximum | **M** | Refer to OTS. | |

| ACCUMULATORS - 001, 002 AND 003 BA | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Boron** | mg B/kg | **2500** minimum<br>**2700** maximum | **M** | Refer to OTS. | |

| Section: 3.1 | Steam Generator Feedwater | | | | AHP |
|---|---|---|---|---|---|
| **Domain: RP** | **REACTOR POWER > 25%** | | | | **2°** |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Dissolved Oxygen** | µg $O_2$/kg | **AL1: > 5** [4]<br>**AL2: > 100** [4] | **S** [1]<br>**W** [2] | AL1 - Initiate CHE Event: RP – AHP 2. | |
| **Hydrazine** | µg $N_2H_4$/kg<br>Ratio | **AL1: < 20** [3]<br>**AL2: $N_2H_4$:$O_2$ < 2** | **S** [1]<br>**W** [2] | AL1 - Return to > AL1 as soon as possible.<br>AL2 - Initiate CHE Event: RP – AHP 3. | |

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| REACTOR POWER ≤ 25 % | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Dissolved Oxygen** | µg $O_2$/kg | **AL1: > 50** [4]<br>**AL2: > 100** [4] | **S** [1]<br>**W** [2] | Initiate CHE Event: RP – AHP 1 | |
| **Hydrazine** | µg $N_2H_4$/kg<br>Ratio | **AL1: < 20** [3]<br>**AL2: $N_2H_4$:$O_2$ < 2** | **S** [1]<br>**W** [2] | AL1 - Return to > AL1 as soon as possible.<br>AL2 – Initiate CHE Event: RP – AHP 3. | CHE Event: RP – AHP 3 is not applicable during startup of a unit |

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[1] Perform manual analysis if on-line analyser is out-of-service.

[2] Verify on-line reading with manual analysis.

[3] 20 µg $N_2H_4$/kg (minimum) or 8 × the FW dissolved oxygen concentration; whichever number is the larger.

[4] The limit value may be exceeded during a startup of a unit. The limits only come into effect 10h after ARE starts feeding the SGs. During start up, feed water may be changed from ASG to ARE if the dissolved $O_2$ is > 50 µg $O_2$/kg provided that it is < 300 µg $O_2$/kg.

| Section: 3.2 | Steam Generator Blowdown | | | | APG |
|---|---|---|---|---|---|
| Domain: RP | REACTOR CRITICAL AND POWER OPERATION | | | | 2° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **pH @ 25°C** | | **8,0** minimum<br>**10,5** maximum | **S** [1]<br>**W** [2] | Initiate CHE Event: RP – APG 4. | |
| **Cation Conductivity @ 25°C** | µS/cm | **AL1: > 1**<br>**AL2: > 4**<br>**AL3: > 7** | **S** [1]<br>**W** [2] | AL1 - Initiate CHE Event: RP – APG 1.<br>AL2 - Initiate CHE Event: RP – APG 2.<br>AL3 - Initiate CHE Event: RP – APG 3. | Apply the actions related to the highest AL entered. |
| CC-061 **Sodium** | µg Na/kg | **AL1: > 5**<br>**AL2: > 50**<br>**AL3: > 150** | **S** [1]<br>**W** [2] | AL1 - Initiate CHE Event: RP – APG 1.<br>AL2 - Initiate CHE Event: RP – APG 2.<br>AL3 - Initiate CHE Event: RP – APG 3. | |

APG Action Levels (ALs) are indicated in the diagram below and are defined in Appendix 1: CHEMISTRY AND RADIOCHEMISTRY EVENTS

[1] Perform manual analysis if on-line analyser out of service.

[2] Verify the on-line reading with manual analysis.

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| Section: 3.3 | Steam Generator Blowdown | APG |
|---|---|---|
| Domain: RP | | 2° |

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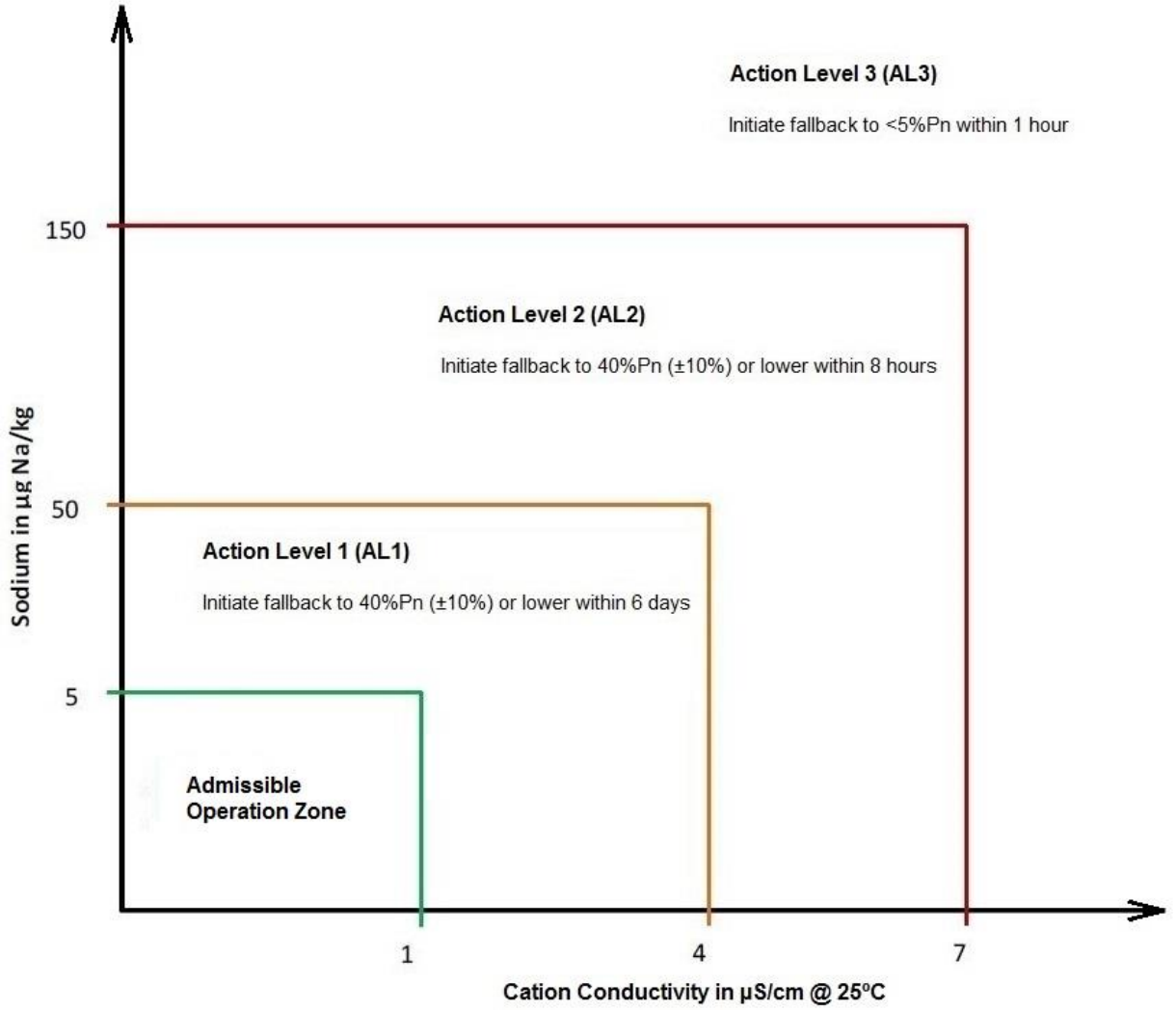
## APG CATION CONDUCTIVITY AND SODIUM ACTION LEVELS



| Section: 3.4 | Steam Generator Blowdown | | | | APG |
|---|---|---|---|---|---|
| Domain: SD/RRA to SD/SG | REACTOR NOT CRITICAL | | | | 2° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **pH @ 25°C** | | **8,0** minimum [1]<br>**10,5** maximum [1] | **S**<br>**W** [2] | | Normal monitoring is continuous, via on-line analyser (when analysers are in service). |
| **Cation Conductivity @ 25°C** | µS/cm | | **S**<br>**W** [2] | | |
| **Sodium** | µg Na/kg | | **S**<br>**W** [2] | | |

[1] Only applicable from / until state SD/RRA Primary Pressure ≥ 2,3 MPa to SD / SG.

[2] Verify the on-line reading with manual analysis, only applicable from state SD/RRA Primary Pressure ≥ 2,3 MPa to SD / SG.

| Section: 3.5 | Auxiliary Feedwater | | | | ASG |
|---|---|---|---|---|---|
| Domain: SD/SG to RP | | | | | 2° |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Dissolved Oxygen** | µg $O_2$/kg | **100** maximum | **S** [1]<br>**W** [2] | Initiate CHE Event: RP – ASG 1.<br>Initiate CHE Event: SD/SG – ASG 1. | |

[1] Unit on ASG feed to steam generators

[2] Unit on ARE feed to steam generators

| Section: 4.1 | Steam Generator Blowdown | | | | APG |
|---|---|---|---|---|---|
| Domain: SD/RRA to RP | | | | | RADIOCHEMISTRY |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Gross Gamma** | Bq/m$^3$ | | **S**<br>**W** [1] | | Shiftly monitoring of KRT reading. |
| CC-061 **Iodine-131 Equivalent** | Bq/m$^3$ | **7,40×10$^7$**<br>maximum | **M** | Initiate CHE Event: RP – APG 5 or 6.<br>Initiate CHE Event: SD/SG – APG 1 or 2.<br>Initiate CHE Event: SD/RRA – APG 1 or 2. | |
| **Primary to Secondary Leak Rate** | l/h | **30,0**<br>maximum | **W** | Refer to OTS. | Leak rate applies per steam generator. |

[1] Weekly gamma spectrum to verify accuracy of KRT reading (performed through the comparison of the trends for the instruments and the total measured activity in APG).

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| Section: 4.2 | Reactor Coolant System | | | | RCP/RRA |
|---|---|---|---|---|---|
| SD/SG to RP | | | | | RADIOCHEMISTRY |
| **PARAMETER** | **UNITS** | **LIMIT VALUE / ACTION LEVEL** | **ANALYSIS FREQUENCY** | **ACTION TO TAKE** | **COMMENTS** |
| **Gamma Spectrum** | $Bq/m^3$ | | **D** | | |
| **Equilibrium** [1] **Total Noble Gas Activity** | $Bq/m^3$ | **$1{,}50 \times 10^{11}$** maximum | | Initiate CHE Event: RP – RCP 5, 6 or 7. | |
| **Equilibrium** [1] **Dose Equivalent I-131 Activity** | $Bq/m^3$ | **$1{,}85 \times 10^{10}$** maximum | | Initiate CHE Event: RP – RCP 6 or 7. | |
| **Equilibrium I-134 Activity** [1] | $Bq/m^3$ | **$A_1 + 1{,}0 \times 10^{10}$** maximum | | Initiate CHE Event: RP – RCP 6. | |
| **Peak I-131 Equivalent Activity** [1] | $Bq/m^3$ | **$1{,}50 \times 10^{11}$** maximum | | Initiate CHE Event: RP – RCP 8. | |

***NOTE:*** *For alpha, beta and gamma analyses, RCV U/S is an acceptable alternative sample to RCP/RRA.*

[1] Refer to definitions.

# APPENDIX 1

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

## 1. REACTOR AT POWER (RP)

### 1.1 AHP – HIGH PRESSURE FEED-WATER HEATER SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RP - AHP 1**<br>Feed-water oxygen > 50 μg $O_2$/kg,<br>-AND-<br>Pn ≤ 25%. | • Initiate fallback to Pn < 2% within 3 days.<br>• If $O_2$ content is >100 μg $O_2$/kg,<br>— initiate fallback to Pn < 2% within 8 hours with the steam generators supplied by ASG.<br>***NOTE:*** *The limit value may be exceeded during a startup of unit. The limits only come into effect 10h after ARE starts feeding the SGs. During start up, feed water may be changed from ASG to ARE if the dissolved $O_2$ is > 50 μg $O_2$/kg provided that it is < 300 μg $O_2$/kg.* |
| **RP - AHP 2**<br>Feed-water oxygen > 5 μg $O_2$/kg,<br>-AND-<br>Pn > 25%. | • Initiate fallback to Pn < 2% within 3 days.<br>• If $O_2$ content >100 μg $O_2$/kg:<br>— initiate fallback to Pn < 2% within 8 hours with the steam generators supplied by ASG.<br>***NOTE:*** *Once Pn < 25%, this event may be cleared and AHP 1 event declared. The elapsed time does not revert to zero at the time of AHP 1 declaration.* |
| **RP - AHP 3**<br>Feed-water hydrazine: Feed-water oxygen ratio < 2<br>-AND-<br>Pn > 2%. | • Initiate fallback to Pn < 2% within 8 hours with the steam generators supplied by ASG.<br>***NOTE:*** *This event is not applicable during start up whilst the power is < 25%* |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

### 1.2 APG – STEAM GENERATOR BLOWDOWN SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RP - APG 1**<br>Cation conductivity at 25°C<br>> 1 µS/cm and ≤ 4 µS/cm<br>-OR-<br>Sodium concentration<br>> 5 µg Na/kg and ≤ 50 µg Na/kg | • Initiate power reduction to 40% (±10%) or lower within 6 days.<br>• Power reduction may be terminated when either parameter is below AL1 (1 µS/cm or 5 µg Na/kg).<br>• After evaluation of the need for further steam generator clean-up actions (consult Chemistry) power increase may commence.<br>• If AL1 conditions persist for more than 8 hours after reaching the reduced power, then initiate power reduction to < 5% within 1 hour. |
| **RP - APG 2**<br>Cation conductivity at 25°C<br>> 4 µS/cm and ≤ 7 µS/cm<br>-OR-<br>Sodium concentration<br>> 50 Na/kg and ≤ 150 µg Na/kg | • Initiate power reduction to 40% (±10%) or lower within 8 hours.<br>• After evaluation of the need for further steam generator clean-up actions (consult Chemistry) power increase may commence once either parameter is below the AL1 condition.<br>• If AL conditions persist for more than 100 hours after entering the AL2 condition, then initiate fallback to SD / SG within 1 hour. |
| **RP - APG 3**<br>Cation conductivity at 25°C > 7 µS/cm<br>-OR-<br>Sodium concentration > 150 µg Na/kg | • Initiate power reduction to < 5% within 1 hour.<br>• Before power may be increased, technical assessment of the conditions must be performed and a steam generator clean-up plan must be completed. The restorative action would include a hide-out return campaign (consult Chemistry).<br>• After reaching < 5% power, then if AL conditions persist initiate fallback to SD / SG initiate fallback to SD / SG within 7 hours. |
| **RP - APG 4**<br>pH < 8,0 at 25°C,<br>-OR-<br>pH > 10,5 at 25°C. | • Initiate fallback to SD / SG within 3 days if normal values are not re-established. |
| **RP - APG 5**<br>SG secondary side specific activity (dose equivalent I-131) is within the range $7,4x10^7$ to $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Take a daily gamma spectrometry reading.<br>• If the activity level is due to primary-to-secondary leakage and/or due to an abnormal increase of activity in the primary coolant, refer to OTS and RCP (5 to 8) Chemistry events. |

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| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| CC-061<br>**RP - APG 6**<br>SG secondary side specific activity (dose equivalent I-131) is greater than $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Initiate fallback to MCSD within 1 hour.<br>• Take a daily gamma spectrometry reading.<br>• If the activity level is due to primary-to-secondary leakage and/or due to an abnormal increase of activity in the primary coolant, refer to OTS and RCP (5 to 8) Chemistry events. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

1.3 ASG – AUXILIARY FEED-WATER SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RP - ASG 1**<br>Auxiliary feed-water oxygen content > 100 μg $O_2$/kg. | • If the steam generators are supplied by ASG and $O_2$ content ≤ 1 000 μg $O_2$/kg, initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• If the steam generators are supplied by ASG and $O_2$ content > 1 000 μg $O_2$/kg, initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• If the steam generators are supplied by ARE restore the water quality and eliminate the $O_2$ ingress. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

1.4 RCP – REACTOR COOLANT SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RP – RCP 1**<br>Hydrogen content < 15 ml $H_2$/kg @ STP | • Initiate fallback to SD / SG within 24 hours<br>***NOTE:*** *Not applicable during degassing for a unit shutdown* |
| **RP – RCP 2**<br>Hydrogen content < 5 ml $H_2$/kg @ STP | • Initiate fallback to SD / SG within 8 hours |
| **RP - RCP 3**<br>Chloride content in the range:<br>150 µg Cl/kg to 1 500 µg Cl/kg,<br>-OR-<br>Fluoride content in the range:<br>150 µg F/kg to 1 500 µg F/kg,<br>-OR-<br>Sulphate content in the range:<br>150 µg $SO_4$/kg to 1 500 µg $SO_4$/kg,<br>-OR-<br>Oxygen content in the range:<br>100 µg $O_2$/kg to 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• If two or more parameters are affected, initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. If conditions are not restored to < AL1 within 24 hours, initiate fallback to SD / RRA T < 90°C within 1 hour. |
| **RP - RCP 4**<br>Chloride content > 1 500 µg Cl/kg,<br>-OR-<br>Fluoride content > 1 500 µg F/kg,<br>-OR-<br>Sulphate content > 1 500 µg $SO_4$/kg,<br>-OR-<br>Oxygen content > 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and < AL 1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL 1 within 24 hours. |
| **RP - RCP 5**<br>Equilibrium total noble gas activity<br>1,5 x $10^{11}$ Bq/$m^3$ (4,0 Ci/t) < A < 5,0 x $10^{11}$ Bq/$m^3$ (13,5 Ci/t) | • Initiate a power reduction at a rate determined by RFE within 10 days of operation at stable power.<br>***NOTE:*** *Power increase may start after RFE assessment.* |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RP - RCP 6**<br>Equilibrium I-131 equivalent activity<br>$1,85 \times 10^{10}$ Bq/m$^3$ (0,5 Ci/t) < A < $3,7 \times 10^{10}$ Bq/m$^3$ (1 Ci/t),<br>-OR-<br>Equilibrium total noble gas activity<br>$5,0 \times 10^{11}$ Bq/m$^3$ (13,5 Ci/t) < A < $1,0 \times 10^{12}$ Bq/m$^3$ (27 Ci/t),<br>-OR-<br>Equilibrium I-134 activity<br>A > $A_{1.}$+ $1,0 \times 10^{10}$ Bq/m$^3$ (0,27 Ci/t). | • Initiate fallback to SD / SG within 2 days. |
| **RP - RCP 7**<br>Equilibrium I-131 equivalent activity<br>A > $3,7 \times 10^{10}$ Bq/m$^3$ (1 Ci/t),<br>-OR-<br>Equilibrium total noble gas activity<br>A > $1,0 \times 10^{12}$ Bq/m$^3$ (27 Ci/t). | • Initiate fallback to SD / SG within 8 hours. |
| **RP - RCP 8**<br>Peak I-131 equivalent activity<br>A > $1,5 \times 10^{11}$ Bq/m$^3$ (4 Ci/t). | • Initiate fallback to SD / SG within 1 hour. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

## 2. NORMAL SHUTDOWN – SG (SD / SG)

### 2.1 APG – STEAM GENERATOR BLOWDOWN SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / SG - APG 1**<br>SG secondary side specific activity (dose equivalent I-131) is within the range $7,4x10^7$ to $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Take a daily gamma spectrometry reading.<br>• Verify primary-to-secondary leakage. |
| **SD / SG - APG 2**<br>SG secondary side specific activity (dose equivalent I-131) is greater than $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Initiate fallback to MCSD within 1 hour.<br>• Take a daily gamma spectrometry reading.<br>• Verify primary-to-secondary leakage. |

### 2.2 ASG – AUXILIARY FEEDWATER SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / SG - ASG 1**<br>Auxiliary feed-water oxygen content > 100 μg $O_2$/kg. | • If the steam generators are supplied by ASG and $O_2$ content ≤ 1 000 μg $O_2$/kg, initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• If the steam generators are supplied by ASG and $O_2$ content > 1 000 μg $O_2$/kg, initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• If the steam generators are supplied by ARE restore the water quality and eliminate the $O_2$ ingress. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

2.3 RCP – REACTOR COOLANT SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / SG - RCP 1**<br>Chloride in the range<br>150 µg Cl/kg to 1 500 µg Cl/kg,<br>-OR-<br>Fluoride in the range<br>150 µg F/kg to 1 500 µg F/kg,<br>-OR-<br>Sulphate in the range<br>150 µg $SO_4$/kg to 1 500 µg $SO_4$/kg,<br>-OR-<br>Oxygen content in the range<br>100 µg $O_2$/kg to 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• If two or more parameters are affected, initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. If conditions are not restored to < AL1 within 24 hours, initiate fallback to SD / RRA T < 90°C within 1 hour. |
| **SD / SG - RCP 2**<br>Chloride content > 1 500 µg Cl/kg,<br>-OR-<br>Fluoride content > 1 500 µg F/kg,<br>-OR-<br>Sulphate content > 1 500 µg $SO_4$/kg,<br>-OR-<br>Oxygen content > 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and normal concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored within 24 hours. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

## 3. NORMAL SHUTDOWN – RRA (SD / RRA)

3.1 APG – STEAM GENERATOR BLOWDOWN SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / RRA - APG 1**<br>SG secondary side specific activity (dose equivalent I-131) is within the range $7,4x10^7$ to $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Take a daily gamma spectrometry reading.<br>• Verify primary-to-secondary leakage. |
| **SD / RRA - APG 2**<br>SG secondary side specific activity (dose equivalent I-131) is greater than $7,4x10^8$ Bq/$m^3$ as measured during stable operation. | • Initiate fallback to MCSD within 1 hour.<br>• Take a daily gamma spectrometry reading.<br>• Verify primary-to-secondary leakage. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

3.2 RCP – REACTOR COOLANT SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / RRA - RCP 1**<br>Reactor coolant temperature ≤ 120°C and chloride content in the range<br>150 µg Cl/kg to 1 500 µg Cl/kg ,<br>-OR-<br>Reactor coolant temperature < 120°C and fluoride content in the range<br>150 µg F/kg to 1 500 µg F/kg. | • Initiate fallback to SD / RRA T < 90°C within 3 days.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. |
| **SD / RRA - RCP 2**<br>Reactor coolant temperature ≤ 120°C and chloride content > 1 500 µg Cl/kg,<br>-OR-<br>Reactor coolant temperature < 120°C and fluoride content > 1 500 µg F/kg. | • Initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. |
| **SD / RRA - RCP 3**<br>Reactor coolant temperature > 120°C and chloride content in the range<br>150 µg Cl/kg to 1 500 µg Cl/kg,<br>-OR-<br>Reactor coolant temperature > 120°C and fluoride content in the range<br>150 µg F/kg to 1 500 µg F/kg,<br>-OR-<br>Reactor coolant temperature > 120°C and oxygen content in the range<br>100 µg O/kg to 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 24 hours.<br>• If two or more parameters are affected, initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored within 24 hours. If conditions are not restored to < AL1 within 24 hours, initiate fallback to SD / RRA T < 90°C within 1 hour. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **SD / RRA - RCP 4**<br>Reactor coolant temperature > 120°C and chloride content > 1 500 µg Cl/kg,<br>-OR-<br>Reactor coolant temperature > 120°C and fluoride content > 1 500 µg F/kg,<br>-OR-<br>Reactor coolant temperature > 120°C and oxygen content > 1 000 µg $O_2$/kg. | • Initiate fallback to SD / RRA T < 90°C within 8 hours.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

# 4. MAINTENANCE COLD SHUTDOWN (MCSD)

4.1 RCP – REACTOR COOLANT SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **MCSD - RCP 1**<br>Chloride content > 150 µg Cl/kg,<br>-OR-<br>Fluoride content > 150 µg F/kg. | • Restore conditions<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored within to < AL1 within 24 hours. |

## APPENDIX 1 (Continued)

## CHEMISTRY AND RADIOCHEMISTRY EVENTS

## 5. REFUELLING SHUTDOWN (RSD)

### 5.1 RCP – REACTOR COOLANT SYSTEM

| CHE EVENT | ACTIONS REQUIRED |
|---|---|
| **RSD - RCP 1**<br>Chloride content > 150 µg Cl/kg,<br>-OR-<br>Fluoride content > 150 µg F/kg. | • Restore conditions.<br>• Do not restart unless:<br>— the cause is established and < AL1 concentration levels are restored;<br>-OR-<br>— it is expected that concentration levels can be restored to < AL1 within 24 hours. |

## JUSTIFICATION FOR REVISION

| Description of / Justification for Change: | | |
|---|---|---|
| **EXISTING PAGE / PARA** | **NEW REV PAGE / PARA** | |
| | | Rev 0 [JULY 2013 - Full Review] |
| | | This document was compiled to create a specification for Chemistry OTS parameters. This allows the Chemistry Section to be removed from the OTS. The requirement for this Chemistry Nuclear document arose during the compilation of the OTS Revision 7, implemented in 2011. Previously, OTS Revision 6 (OPS 7030) contained the Chemistry and Radiochemistry OTS parameters and surveillances. OTS Revision 7 was not designed to include the Chemistry and Radiochemistry parameters and surveillances, since Revision 7 was based on the Electricité de France documentation structure where the Chemistry and Radiochemistry OTS parameters and surveillances are contained in a separate specification. |
| July 2016 | | Chemistry Specifications Change CC-055 – Safety Evaluation E2016-0007. |
| | Rev 0a 28 / App 1 Section 1.2 | The 'Actions Required' for a sodium and/or cation excursion is amended to be in accordance with the EPRI guidelines and/or EDF requirements. This change makes provision for plant responses that are commensurate with the severity of the chemistry excursions. It also clarifies the option of specifying the appropriate clean-up action for a specific type of chemistry excursion based on the severity and/or duration, in accordance with industry best practice. In future, different responses could be taken based on the nature of the severity and/or duration of the occurrence. |
| | | Rev 1 [May 2017 - Full Review] - Safety Evaluation 2015-0026 |
| General | | The technical bases for this document has been compiled and the following changes / additions have arisen as a result of this process: Action levels have been included for the most critical control parameters.<br>RCP lithium control has been added.<br>RCP hydrogen control has been added.<br>RCP/RRA sulphate has been included from RP to SD/SG.<br>PTR chloride and fluoride have been included.<br>REA chloride and fluoride have been included.<br>AHP hydrazine control has been added.<br>There have also been minor editorial changes, clarification and corrections from revision 0 that have insignificant material effect on the intent of the document. |

**Description of / Justification for Change:**

| EXISTING PAGE / PARA | NEW REV PAGE / PARA | |
|---|---|---|
| | 4 / 3.2 | Changed informative reference to be the Technical Bases for Koeberg Chemistry Specifications. |
| | 5 / 4.1.3<br>6 / 4.1.9 | Added definitions for ammonia regime and ethanolamine regime. |
| | 5 / 4.1.4 | Added definition for Analysis Frequency. |
| | 5 / 4.1.5 | 72-hourly monitoring has been changed to 3xW as 72-hour interval is not practical. |
| | 5 / 4.1.5 | Added reference to OTS missed surveillances rule which is applied to missed chemistry analyses. |
| 5 / 4.1.4 | 5 / 4.1.8 | Added a comment that normalisation of charging and letdown is not applicable for noble gasses as they are not affected by the letdown flow. |
| | 7 / 5.1.4 | Rule added for when analysis cannot be performed before the end of the tolerance period. |
| | 8 / - | Changed applicable domains for monitoring of APG from “RSD to SD/SG” to “SD/RRA to SD/SG” |
| | 9 / 1.1 | New action limits and events created for dissolved Hydrogen. The following limits have been re-numbered. There was an instruction to initiate a fall back in the table. This is inconsistent with the remainder of the document. The table now only refers to the CHE event and this event contains the fall back requirements |
| | 24 / - | Note added. Different analysis for ASG vs ARE feed. |
| | 26 / - | Comment related to gamma spectrum removed. Erroneously included in Rev 0. |
| | 27 / App 1 RP-AHP 1 | Event description expanded to indicate that it is only applicable during steady conditions and not during power fluctuations. |
| | 27 / App 1 RP-AHP 3 | CHE Event RP-AHP 3 has been added. |
| | 31 / RP – RCP1<br>RP - RCP2 | New action events created for dissolved Hydrogen. The following events have been re-numbered. |
| | 36 / App 1 SD/RRA-RCP 1 and 2 | SD/RRA-RCP 1 and 2 chloride limit has been changed to 1500 µg Cl/kg. Historical anomaly corrected and aligned to EDF and EPRI limiting values. |

**Description of / Justification for Change:**

| EXISTING PAGE / PARA | NEW REV PAGE / PARA | |
|---|---|---|
| | CC-061 | Rev. 1: December 2017, Safety Evaluation E2017-0024 r0 |
| General editorial | | Replaced decimal points with decimal commas throughout the document. |
| General editorial | | Added a colon after alarm level in the tables of Section 1.1 to Section 3.2. |
| 5, 4.1.5 | 5, 4.1.5 | Added “Normally …” and a Note below the table:<br>* If a surveillance falls on a public holiday, the surveillance may be performed on the preceding or subsequent day. |
| 21, Section 3.3<br>22, Section 3.3 | 21, Section 3.3 | Replaced the two Action Level diagrams with a single, updated diagram. |
| 23 to 41 | 22 to 40 | Pages repaginated. |
| 28 and 29, 1.2 | 27 and 28, 1.2 | Replaced ‘RP – APG 1 to 4’ with updated ‘RP – APG 1 to 3’. Renumbered ‘RP – APG 5 to 7’ to ‘RP – APG 4 to 6’. |
| 41, Justification of Change | 40 and 41, Justification of Change | Added to the ‘Justification for Change’ for this revision 1. |