Comment DS 525: Chemistry Programme for Water Cooled NPPs

COMMENTS BY REVIEVER Reviewer: Mr. OUKIL Khaled Page…of…. Country/Organisation : COMENA / ALGERIA Date : 22thSeptember 2022				RESOLUTION			
Comment No	Para/line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
1	**Point 2.4**	I suggest adding the following point: f) Plans the management of chemical or radiochemical waste				**X**	The point 2.5. (d): Reducing the amount of chemical and radioactive waste and planned discharges to the environment already addresses this intent.
2	**Point 2.17**	I suggest adding this sentence: Chemistry department should be represented in development of the emergency preparedness and response plans.			2.22. … outage planning, emergency preparedness and response planning, reducing dose rates		
3	**Point 4.4 d**	I suggest taking into account: vii: The impact of irradiation on the fluid (decomposition of the fluid such as heavy water).				**X**	No need to go to this level of detail in the document. The intent is already included in (i), (k) and (o).

4	**Point 5.13**	Isn't necessary to define parameters value and procedures for extended shutdown conditions?		**X**			

COMMENTS BY REVIEVER Reviewer: Joerg Fandrich Page…of…. Country/Organisation : Germany / Framatome Date: 2022-09-29				RESOLUTION			
Comment No	Para/line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
1	1.2.	Either: "… a nuclear power plant …" or "… nuclear power plants …."		X			
2	1.2.	"…as well as to minimize…."				X	Text has been already reviewed by IAEA editors for English
3	2.4.a)	Propose to use "reactivity control" instead of "criticality control"		X			
4	3.3.	… demonstrating …" instead of "… demonstrate…"				X	Text has been already reviewed by IAEA editors for English
5	4.4. i)	"…control and diagnostic parameters…."		X			

6	4.4.r	"….ALARA…" – should be assigned in one of the previous paragraphs to stand for "as low as reasonable achievable"				X	Text has been already reviewed by IAEA editors for language and according to them the term is not used often enough to have an acronym.
7	5.12	This paragraph should be split into 2 separate paragraphs because of the tools for fuel assessment and burnup do not correlate necessarily with the content of the first sentence in this paragraph.			X Second sentence start now: Also the detection limits and …		
9	5.36	Delete "Ammonia". This is not correct in the context of this paragraph.	The contribution of Ammonia to maintain the pH(T) is negligible at operating conditions. Ammonia is used as source of Hydrogen			X	The text reads: potassium hydroxide and ammonia are used to adjust pHT, Ammonia is dosed to water to release potassium from the ion exchange resins. So even though the ammonia itself does not affect the pH(T) it is needed in pH adjustment.

			(Radiolytic decomposition) to suppress the formation of oxidizing species originated from the radiolysis of water.				
10	5.39	Propose to use “Silica compounds” or “Silicates” instead of silicon dioxide.	Which silica compound may be present in the system is strongly dependent on the pH of the medium	X			
11	5.50	To be clear, please specify either “cationic conductivity”, “acidic conductivity” or “conductivity after strong acidic cationic ion exchanger” to avoid misunderstanding regarding		X			

		"specific conductivity"					
12	5.54	Propose to change the sequence of this enumeration: put a) on bottom because of b),…. are more global aspects.				X	The primary focus of secondary side chemistry regime is to minimize the FAC, no change
13	5.56	The first sentence in this questionable. It mixes the role of a conditioning agent being a reducing agent and oxygen scavenger. An oxygen scavenger is not necessarily a reducing agent and vice versa a reducing agent is not necessarily an oxygen scavenger – this statement is correct only for Hydrazine in its double role to scavenge Oxygen and ensuring reducing conditions.				X	I agree. But in previous chapter the document states that alkalizing agents should be used to ensure sufficiently high pH. And in this one we say that reducing agent should be used to scavenge oxygen. The message is clear. No change.

14	Complete section 5 (PWR and PHWR)	At least one paragraph should capture the role of organic decomposition products and their impact on turbine material integrity respective steam quality. This is completely missing throughout the document		X	5.64 reads now: 5.64. Impurity concentrations (inorganic and organic) in the demineralized make-up water….		
15	Section 7	A separate paragraph should be added that way: "Sampling systems shall be designed and installed to fit to the needs of a correct Chemistry parameter monitoring"	Improper designed sampling lines are a frequent error source especially when monitoring Oxygen, corrosion products			X	These aspects are already addressed in 7.40 and 7.41

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: ENISS		Page 1 of 8		ENISS			
Country/Organization: ENISS		Date: 30 September 2022					
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
General comment							
1	§2.1	The integrated management system should define clear functions and responsibilities at the plant in accordance with the requirements established for all chemistry activities, such as management of resources, chemistry and radiochemistry control and measurements, dose management, chemistry and radiochemistry surveillance, chemistry and radiochemistry data management, quality control, reviews of results and staff training and qualification as described in IAEA Safety Guide publication on The Management System for Nuclear Installations, IAEA Safety Standard Series No. GS-G-3.5, IAEA, Vienna (2016) [4]. ~~Detailed~~ Job descriptions of chemistry staff should be available in plant documentation.	"Detailed" is too subjective. Jobs should be described.	X			

2	§2.10	Plant management should periodically reinforce its expectations on the chemistry programme. Plant management should set clear targets for continuous improvement of operational safety performance in the chemistry area. Targets and management expectations should be described in plant or fleet documentation.	Continuous improvement is integrated in plants chemistry performance. However, each plant may not have individual targets and management expectations is not described in plant documentation for all the plants. Fleet indicators are used, positioning each plant among the fleet.	X			
3	§2.9	The operating organization should provide adequate facilities, sampling and equipment (including laboratory and on-line instruments) for chemistry measurements. The operating organization should ensure that the chemistry equipment and related systems are ready to return to service after maintenance and modifications according to predefined acceptance criteria ~~and specifications~~.	Specifications are not used to check that equipment is ready to return to service.	X			
4	§2.15	Water chemistry and radiochemistry reports should be shared with other relevant departments in the operating organization. The contents of these reports, how frequently and to which organization they are sent, should match the needs of the operating organization ~~be clearly defined in plant documentation~~. However, these reports should leave place to report also non-routine events. A method for delivering analytical results to other departments (e.g. the operations department) should be well established and communicated. When	Reports are edited depending on the needs of the other departments. Their content is modified to match those needs.	X			

		actions are required, the responsibilities should be clearly assigned.					
5	§3.3	The chemistry management should ensure that chemistry personnel are qualified~~, and that sufficient number of staff is always available at the plant or can quickly come to the plant when needed~~. For each position the required qualification should be described. The qualification programme should ensure that sufficient supervision is done by the chemistry management and that chemistry staff demonstrate commitment to high safety performance [1, 4].	Number of staff available and their ability to come quickly to the plant is not relevant in the "Training and Qualification" section.		Agree, moved the sentence to 4.4.		
6	§3.6	~~Ongoing training for routine tasks should be carried out regularly for all chemistry staff and it should have clearly written goals. Refresher trainings should also be considered at plants in which there is a large chemistry staff that does not perform certain tasks on a regular basis (e.g. yearly safety training, use of post-accident sampling system if not used for regular sampling etc.).~~ Ongoing or refresher training should be carried out regularly, especially at plants in which there is a large chemistry staff that does not perform certain tasks on a regular basis (e.g. access to and use of post-accident sampling system if not used for regular sampling etc.).	What is the difference between on-going and refresher training ? Their objective being to maintain skills, their goal is not always clearly written. Depending on the topics, the frequency may not be yearly. It is proposed to included §3.15 in this §3.6 : "access and use of post-accident sampling"			X	Ongoing training is the one which all staff members do as part of their more or less regular activities. Refresher training is as described now in the text. Yearly is an example hence e.g. 3.20 (old 3.15) should be there it

							is now because as a separate paragraph it emphasizes the importance of this activity.
7	§3.15	~~Chemistry staff should regularly train different routes to reach the post-accident sampling arrangement, if normal ways will not be accessible during accident conditions.~~	Proposition to withdraw §3.15 and to add the access to PASS in §3.6.			X	See comment above
8	§4.4.c	The chemistry programme should be regularly reviewed to take into account the operating experience, including good practices, from other utilities and Member States (e.g. appropriate feedback on operating events, research results, and revised standards), conclusions documented and improvements incorporated into the chemistry programme, when considered beneficial. Chemistry managers and supervisors should regularly review available internal and external operating experience information. Operating experience information and results of these reviews should be made available to ~~the whole~~ chemistry staff;	It is important that operating experience be available to the chemists in charge of improving the chemistry programme. Hence, the comprehensive operating experience and its review may not be available to ALL the plants chemists.		X : information. Relevant operating experience information….		All plant chemists should be aware about relevant OE in their area.
9	§4.4.u	~~The chemistry programme should define~~ Clear cleanliness requirements and storage conditions should be defined for SSCs during construction and commissioning phases to ensure safe and reliable operation of SSCs throughout the plant lifetime	Cleanliness requirements and storage conditions exist but they may be defined in other documents than the chemistry programme.	X			

10	§5.12	Radiochemistry should be systematically monitored, trended, evaluated and in case of deviation they should be correlated with chemical and operational data, like pHT (pH at operating temperature) and thermal power [8]. Tools should be available to enable detection ~~and estimation of the type and amount~~ of the fuel leakage as well as to provide information about ~~the burn-up of the fuel rod~~ its severity.	It is important to monitor and trend radiochemical parameters. However, if they are as expected, there is no need to have them correlated with chemical and operational data. It is important to have tools to assess fuel integrity and to be able to detect fuel failures. However, estimating the number of defects and the burnup can be difficult.	X			
11	§5.37	The concentration of hydrogen should be kept within specified limits during power operation to minimize the concentration of oxygen and other oxidizing species in primary coolant. In addition, if make-up water is deaerated, the oxygen concentration of make-up water should be monitored and degassed or chemically scavenged to be within specifications.	For example, boron make-up water is deaerated in many plants worldwide.			X	Reason is correct but the change is not clear. The changed the rest of the sentence does not make sense ?
12	5.58	The levels of deleterious impurities (e.g. sodium, chloride, sulphate, lead and copper ions) in the steam generator water should be ~~measured and~~ kept as low as possible. These impurities concentrate in the steam generators during the steady-state operation and therefore blow-down limits for these species should be established either for each impurity or through a representative indicator	Copper alloy is being removed and replaced by stainless steel and/or titanium in several plants. Moreover, maintenance programmes prevent from using lead as much as possible (like mentioned in §5.59). Hence, it is very unlikely that copper and lead be present in the secondary water during operation.			X	Note e.g. is in brackets. I agree with the statement in general but I keep word “measured” Also instead of using These

		(e.g. cation conductivity), if they are likely to be present.					impurities I changed the text to read The impurities…. Blow down water always contains impurities and therefore I do not add suggested workd.
13	5.60.b 5.60.d	The potential impact of chemistry parameters on the integrity of the steam generator should be regularly evaluated and related results should be trended. The main tools for such an evaluation should be: […] b) the measurement of 'hideout return' to get an estimation of impurity levels in crevices and in flow-restricted areas ~~with restricted flow areas~~ (sludge piles, deposits, etc.). […] d) evaluation of the amount of hard deposits in the steam generators able to cause clogging ;	Editorial comment on alinea b. Major comment on alinea d : the major issue is the estimation of clogging on tube to tube support plate interstices.	X			
14	6.5	The dissolution of elemental cobalt to the reactor water coolant should be controlled through engineering modifications and an optimized chemistry regime. The use of materials containing cobalt (59Co) that comes in contact with primary	It is not always possible to pre-passivated equipment after decontamination. However, surfaces have to be properly rinsed to avoid subsequent corrosion with residual chemicals used during		X :…heavily decontaminated components should be properly pre-		a)Rinsing does not decrease unnecessary dissolution of cobalt ions into

		coolant should be avoided to the extent possible to reduce dose rates due to 60Co. To avoid unnecessary dissolution of inactive cobalt ions into the primary coolant, all large replacement or heavily decontaminated components should be properly rinsed and/or pre-passivated before their surfaces are exposed to the operating environment. Purification of the water should ensure the removal of corrosion products.	decontamination, and purification should ensure removal of the corrosion products.		passivated, if technically possible, before their surfaces…		the primary coolant. b) rinsing fits nicely to 6.17 as does the comment on purification.
15	6.17	Extensive chemical decontamination processes should be avoided in order to avoid high corrosion dissolution rates. After chemical decontamination of larger primary circuit components or the full system, the proper rinsing and/or re-passivation of system surfaces should be carried out to avoid extensive corrosion product deposits on the fuel surfaces with increased risk of fuel cladding failure and potential power shifts. Purification of the water should ensure the removal of corrosion products.	See comment # 14 above.	X			
16	6.20.a	In order to minimize liquid and gaseous waste and/or activity, the plant should: a) Monitor and quickly identify leakages in the primary systems and take ~~immediate~~ corrective actions in a timely manner;	Actions have to be taken given the severity of the leak.	X			
17	7.17	Measurement of fission product activity should be carried out to confirm the fuel integrity, identify	See comment # 10	X			

		fuel cladding leaks and get an estimation of ~~number of leaking fuel elements~~ the severity of the leaks					
18	7.26	Methods that rely on radiochemical separation and properly calibrated instruments should also be applied to monitor releases of tritium and 14C ~~speciation (inorganic and organic)~~ as particularly low energy beta emitters, especially in gaseous form.	Specific technical procedures are needed to perform 14C speciation which can be difficult to apply in plants. Moreover, the need to monitor such a speciation should be discussed.	X			
19	7.29	Redundancy of laboratory facilities on site or in other location or organization for most important analyses should be provided to ensure analytical services at all times including design basis accidents and beyond design basis accident conditions.	Redundancy may be achieved with central laboratories or laboratories from another plant.	X			
20	7.30	Adequately redundant instrumentation and equipment for performing analyses of given types and frequencies should be made available for the most important chemistry and radiochemistry parameters. If some of these activities are outsourced, the chemistry department should ensure the necessary redundancy is also available by service providers or other organization.	See comment # 19	X			
21	8.4	In the case of deviations or anomalies in measurement results, analyses should be checked and verified by a qualified chemistry staff member and proper ~~and prompt~~ corrective actions	Proper actions have to be taken based on the severity and on the consequences of the deviation.	X			

		should be taken in a timely manner and documented.					
22	8.9	Trends should be reviewed soon after data have been recorded, in order to identify problems that may need corrective action before a parameter exceeds its specified limit. The expected values should be used to detect a parameter approaching its specified limit. These expected values should have sufficient margins to control limits, to the extent possible. Trending should also be used to evaluate transients of short duration caused by plant operational changes and slower, long term changes occurring during steady state operation.	In some cases, when control limits are low, it is not possible to have important margins between expected values and control limits.	X			
23	9.5	Chemicals and other substances should not be used in safety-related SSCs if they contain corrosion inducing components above specified limits or may increase activity on plant surfaces. If this is not possible, a risk assessment should be performed and documented.	Systems that are non safety related SCCs are not concerned by this statement.		X :...substances should not be used in in-scope SSCs....		Note :DS525 scope defines : . This programme should ensure that SSCs important to safety, those SSCs whose failure may prevent SSCs important to safety from fulfilling their intended function and those SSCs that are credited

							in the safety analyses
24	A-12	If the components are made of high alloyed steels, like austenitic stainless steels, typically no specific preservation actions are needed. If the layup period is extensively long, such systems can be drained and, if necessary, flushed with demineralized water and dry air. For systems made of low alloyed steels like carbon steels when dry preservation is not feasible, wet alkaline preservation is selected in most cases, particularly if the ~~layout~~ layup time is longer. In some systems and components both type of materials may exist, in which case wet alkaline preservation modes are preferred. Quite often system overpressure is needed to avoid air ingress. Venting and fill & drain approaches need to be considered to ensure that the selected preservation method reaches all locations, including dead legs and branches.	Replace layout with layup	X			
25	A-20	The flushing plan must also have a criterion when flushing can be completed. Typically, some of the following parameters are used for such acceptance criteria to ensure that expected cleanliness has been achieved: ~~a)~~ pH value and total level of impurity levels which are typically estimated using conductivity	There just one alinea. Hence the “a)” can be removed.	X			

		measurement results. In some Member States plants also measure relevant corrosion products like iron and/or suspended solids and especially corrosion inducing ions like fluoride, chloride and sulphate.					

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Russian Federation Page.1. of..1.. Country/Organization: RF/SECNRS Date: September 2022							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	Para. 5.42	The choice of additional chemical compounds, including depleted zinc or electrocatalysts, that can be used to further optimize the chemical control in the primary water must be justified, and their positive effect on the corrosion processes of primary materials must be proven. The predominance of benefit	Materials of the primary circuit of VVER and PWR differ significantly. The recommendation to supplement additional substances, including zinc, may create an unproven sense of benefit where there is none.			X	I agree with the comment but text remains as it is. I want to emphasize that 5.42 uses word **may** and also states that **evaluation** should be done if needed. The reason you have given in th column is such a evaluation.

		over harm should also be proven if a decision is made to add such components to the primary coolant in VVER reactors. The conclusions of such evaluations should be clearly documented.					

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: USNRC							
Country/Organization: USNRC			Date: 09/30/2022				
Comment No.	Para/ Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	3.5	Please add training on “likely emergency scenarios” because being able to be prepared for any likely emergency should be addressed during training. Initial training should include when to open the emergency procedures		X			

		and what to do in the event of an emergency.					
2	3.6	Refresher training allows for two-way communication and sharing of ideas as well as concerns. Refresher training is usually conducted on an annual basis to discuss trends, as well as to ensure any safety concerns are addressed.				X	Requirement to have it yearly cannot be put in SG since i twill not be approved by all MS. Also refresher training has slightly different goals and reasons in different MS. Hence generic statement.
3	3.14	As noted above, training on emergency procedures is a good practice. However, in this section, it is written to imply the possible release of radioactive materials. I think what is meant is: Chemistry staff should take part in training programmes or emergency exercises simulating possible release of chemicals or radioactive materials.		X			
4	4.4 r)	I think the word “species” should be “specimens” or “materials”				X	No Species is correct term
5	5.20-5.30	This section on BWRs does not include noble metal injection for				X	Not correct, 5.21 and 5.29 address these

		crack mitigation and dose rate reduction.					topics directly or indirectly.
6	5.38	Should the word “stressors” be replaced with “impurities”?				X	Stressors are typically used in corrosion science as contributors to material degradation. E.g. oxygen is not an impurity
7	5.41	Add “and atmosphere” to the end of the sentence.	X				
8	5.53-5.64	Please consider addressing MIC (microbiologic influenced corrosion) in auxiliary systems.	X				
9	5.54 c)	Please include deposit plating in the steam generator dryer.				X	Too specific to be included in Should statement
10	Annex	Please consider including structural degradation.				X	I do not understand the suggestion. The whole annex is related to that.

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
1.	1.1	~~and in IAEA Specific Safety Guide on Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities, IAEA Safety Standards Series No. SSG-47 [2]~~	SSG-47 does not contain recommendations related to the chemistry program. Therefore, it should be deleted. Further, it should also be deleted from references.	X			
2.	1.6	The objective is achieved by providing recommendations which mitigate degradation of SSCs and ensure their availability, adhere to a commitment to reduce radiation doses and limit discharges of radioactive material and chemicals to the environment to levels that are as low as reasonably achievable and to reduce the generation of ~~**liquid**~~ radioactive waste.	The word "liquid" should be deleted to make the text more clear. The chemistry program reduces the amount of liquid, gaseous as well as solid radioactive waste.	X			

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
3.	1.7	This programme should ensure that SSCs important to safety, those SSCs whose failure may prevent ~~**SSCs important to safety**~~ from fulfilling their intended function and those SSCs that are credited in the safety analyses can operate reliably throughout the original design lifetime including the construction….	For clear understanding and simplification "SSCs important to safety" should be deleted.			X	This safety guide needs to be aligned with SSG-48 and hence the wording
4.	1.9	~~The information in Annex A can be used for planning the preservation of SSCs during different phases of plant lifetime and in preparation for decommissioning.~~	The mentioned text should be deleted because this is not a part of the scope of this DS. It is already provided in section 1.10.			X	Thi si part of this DS525 and also the Annex needs to be approved by MS, but not to be followed.

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
5.	2.4 (e)	Reduce amount of ~~chemical and~~ radioactive waste and to reduce planned discharges and chemicals to the environment.	The text should be modified by deleting strike-through text and rearrange it.			X	Plants generate also chemical waste and some of those are dischared
6.	2.12	The self-assessment programme should also include participation in an **intera-laboratory** and interlaboratory comparison programme which should include both chemistry and radiochemistry measurements.	The text should be modified by adding "intera-laboratory."	X			
7.	3.5	Initial training for chemists should cover chemistry-specific areas during start-up, normal operation, shutdown and most probable transient	Missing areas should be included.	X			

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
		situations, **accident conditions, and refueling outages**.					
8.	Section 3	Inclusion of recommendations related to the **execution of initial training of chemistry staff**	Missing areas should be included.			X	This is part of the requirements in SSG-75 which is already used in text. In text we wanted to highlight the chemists because this has been

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
							week poin in MS.
9.	Section 3	Inclusion of **safety culture** content in training.	The training shall promote safety culture as per requirement 4.19 of SSR-2/2 (Rev. 1)	X			
10.	Section 3	Inclusion of **instructor qualification and competence**	Instructor qualification and competence shall be addressed as per requirement 4.23 of SSR-2/2 (Rev. 1)			X	Reference already in 3.1 and 3.2
11.	4.1	Inclusion of **development of chemistry program prior to normal operation**	Development of the chemistry program prior to the operation should be addressed as per requirement 7.13 of SSR-2/2 (Rev. 1).	X			

COMMENTS BY REVIEWER Reviewer: **Nasir Mughal, NUSSC Member** Country/Organization: **Pakistan/PNRA** Date: Sept **2022**				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Agreed	Agreed, but modified as follows	Rejected	Justification for modification
12.	4.4 (l)	Online instruments and equipment in the laboratory should be regularly inspected, ~~calibrated, maintained~~ and kept up to date.	The strikethrough text should be deleted as it is already given in section 7.11 of this DS.			X	Safety Guides can have repetition and here it is needed
13.	Reference [6]	IAEA, Maintenance, Testing, Surveillance and Inspection in Nuclear Power Plants, IAEA Safety Standards Series No. SSG-~~72~~ **74**, IAEA, Vienna (2022).	The text should be modified by deleting strike-through text and addressed as mentioned.	X			

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Canadian Nuclear Safety Commission Pages: 2 Country/Organization: Canada Date: 2022-09-29							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	2.11	Relevant information should be distributed in written form (paper or electronic), properly archived and easily retrievable.	Specify which written form is acceptable or not.	x			
2.	3.6	Ongoing training for routine tasks should be carried out regularly for all chemistry staff and it should have clearly written goals. Periodic ~~R~~refresher trainings should also be considered ~~at plants in which there is a large chemistry staff that does not perform certain tasks on a regular basis~~ for infrequent tasks (e.g., yearly safety training, use of post-accident sampling system if not used for regular sampling, etc.).	Editorial change for clarity.	X			
3.	5.48	~~Graded~~ Upper and lower limit~~s values~~ for deuterium/~~and~~ hydrogen and oxygen concentrations in cover gas systems should be adequately	LEL and HEL for explosive gases should include oxygen concentration also.	X			

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Canadian Nuclear Safety Commission Pages: 2 Country/Organization: Canada Date: 2022-09-29							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		established in order to eliminate the possibility of creating an explosive gas mixture.					
4.	5.51	During shut down for maintenance, to the extent possible, the empty part of the primary system should be filled with nitrogen gas to minimize ~~inward leakage of~~ air ingress.	Editorial change for clarity	X			
5.	5.53-5.64	SECONDARY WATER CHEMISTRY CONTROL AT PRESSURIZED WATER REACTORS (PWR, WWER AND PHWR)	Are these requirements generic for all reactor designs with H2O on the secondary side? Can aspects of this document be made to be technology neutral?			X	Yes to first question, No to second. To have a technology neutral document we would have to generalize the document to such extent that it would be useless
6.	9.6	Procedures should be in place for the procurement, storage, replacement and ordering of chemicals and other	This paragraph should contain a note saying that the use of chemicals	X			

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Canadian Nuclear Safety Commission Pages: 2 Country/Organization: Canada Date: 2022-09-29							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		substances, including hazardous chemicals. These procedures should align with or be more stringent than local regulations	should be in accordance with appropriate regulations.				

	COMMENTS BY REVIEWER				RESOLUTION			
	Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Page 1 of 2 Country/Organization: **Germany** Date: 2020-09-26							
Relevance	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
3	1	2.4	2.4. Paragraph 7.13 of SSR-2/2 (Rev. 1) [1] states:	Missing number	X			
1	2	3.14	(e) the proper disposal of chemicals	Additional aspect		X: (a) The storage, and handling and		

						proper disposal of hazardous….		
3	3	4.3	The plant documentation should describe potential ~~remedial~~ corrective actions to be applied in various operational stages.	wording	X			
2	4	5.37	When potassium hydroxide is used the total alkali mixture (i.e. potassium injected, lithium produced by neutron reaction on boron, and possibly sodium as an impurity) should be monitored using available techniques, such as …	Examples could be added as appropriate			X	It is not suitable to give examples but let MS to decide. Some MS might consider suggestions are requirements.
2	5	9.10	When a chemical is transferred from a stock container to a smaller container, the latter should be labelled with the name of the chemical, the date of transfer and pictograms to indicate the risk and application area. ~~All the chemical containers should have an expiration date~~. If a sealed stock container has been opened, the date of opening has to be documented/noted as well.	(a) (Authorised) containers for chemicals typically do not have an expiry date. (b) It is also important to note the date when a sealed stock container was opened.	X			
2	6	9.12	The replacement of harmful chemicals or other substances (from the point of view of personnel safety, environmental protection and material	In terms of content, this contradicts the		X 9.12. The number of new chemicals and substances in the		

			compatibility) by harmless ones should be encouraged. ~~The number of new chemicals and substances in the plant should be minimized.~~	statement in the first sentence, as in most cases the replacement is also accompanied by an adjustment of the method in which case new chemicals are used.		plant should be minimized. However, The replacement of harmful chemicals or other substances (from …) by harmless ones should be encouraged.		
2	7	9.17	When storing chemicals, account should be taken of the reduced shelf life of opened containers. ~~Unsealed and partly emptied containers should be stored in such a manner that the remaining product is kept in a satisfactory condition.~~	What is a satisfactory condition when it comes to chemicals? The chemicals stored either meet the certified specifications or they do not. In any case, they must be checked regularly if storage is intended for a longer period.		X :Unsealed and partly emptied containers should be stored in such a manner that the remaining product meets the certified specifications		

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Page 1 of 1 Country/Organization: Republic of Korea / Korea Institute of Nuclear Safety Date:							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.9/4 1.10/8 5.14/2	The information in Annex ~~A~~ can be used for planning the preservation of SSCs during different phases of plant lifetime and in preparation for decommissioning. Annex ~~A~~ provides guidance on preservation of SSCs in nuclear power plants during the different phases of the plant lifetime. During outages, equipment and systems should be maintained under adequate lay-up conditions (see Annex ~~A~~) and in accordance with safety requirements.	Typo	X X X			

2	1.11/6	--- construction, commissioning and operation, ~~life extension periods~~ as well as ---	Unnecessary (because it is also an operation period)	X			

TITLE DS525, Chemistry Programme for Water Cooled Nuclear Power Plants

COMMENTS BY REVIEVER Reviewer: Hanan AlJneibi Page…1 of 1…. Country/Organisation : UAE Date: 26 Sep 2022				RESOLUTION			
Comment No	Para/line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
1	6.10 2nd para.	6.10. … Injection of Zn during this period should be considered.	The 6.10 requirement may be adjusted to reflect zinc's intended application (i.e., 5.25, 5.29, 5.42, 5.43, no guidance to PHWR). These requirements are optional usage of zinc, but, 6.10 makes a very strong statement (i.e., ... if not used, the basis clearly documented).	X		X	Current best international practice is to use Zn during hot functional test. If not used, the basis should be clearly documented. The plants do not have to do so but if not they have to justify it some how.

2	Objectives	Adding Fuel Integrity as a purpose of Chemistry Control				X	Too detailed topic for objective. This is addressed multiple times later on in the document.
3	Scope	Chemistry Control programmer differs from one cooled nuclear plant to another, based on their design parameters				x	The intentions and expectations of the chemistry programme are only described in-so-far as is necessary to understand the scope of chemistry control and chemistry measurements, because each programme is plant specific
4	Managements of chemistry data	I believe there should be a guide on recorded data retrieve. Meaning, saving old data to know if there is a pattern or a similar event.				x	retrievability and trackability as well as trending is discussed in various parts of the document
5	Titles	Bold typed titles				X	IAEA editors have already approved to document to be aligned with the Agency styles
6	7.11 and 7.12	Can be merged together				X	Would be too long paragraph
7		Since the paper is about cooled water power plant, suggest adding a table with chemicals and their purpose to illustrate common chemicals used in these plants				X	This would be too detailed information.
9	9.1	The policy should be established by whom?				X	Depends on MS. Normally the policy is written by chemistry department and approved by

							plant management team because it needs to be aligned with other policies.

COMMENTS BY REVIEVER Reviewer: Page…1 of 1…. Country/Organisation: Bangladesh Date: 09 Sep 2022				RESOLUTION			
Comment No	Para/line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification /rejection
1	2.15/15	What kind of Chemistry progrmme : may be included example of Chemistry progrmme in this line				X	Chapter 4 describes the general expectations for chemistry programme. In Safety Guide examples are not given.
2	3.16	Radiation protection, radiation safety or nuclear safety related training may also be included in this list			X; added radiation protection to the text		
3	4.2/2	The related Chemistry (may be included example): Example of Chemistry program may be included as an example				X	Examples are not given in safety standards, because some MS may consider them to be the only way to address the question.

4	4.4 1(c)	Chemistry programme should be regularly reviewed by appropriate authority				X	2.27 states in enough detail the interface to the regulator. The purpose of this safety guide does not give direct guidance for regulators what they should do. I am sure that this is done through national regulations everewhere.
5	4.4	Concentration of radionuclide in the discharge effluents to the environment to the environment may be included in the list (after SN v.)				X	This safety guide does not give particular concentrations because these values would not be applicable to all plants in MSs.
6	4.4	Separate arrangement for hazardous chemical and radioactive waste required in this list	X				Already addressed in 4.4. (r,s,t)
7	5.2/1	Example of chemistry parameter may be included				X	This safety guide does not give particular parameters because these values would not be applicable to all plants in MSs
8	5.5/1	Name of control parameter may be included, as an example in this line				X	This safety guide does not give particular parameters because these values would not be applicable to all plants in MSs
9	7.32/5	radiation safety should be ensured during all chemistry and	X			X	3.10, 7.33, 7.43 addresses this topic already. Please note that these numbers may be different in your version than what is currently been used.

		radiochemistry measurements by appropriate department					
10	7.36/1	Example of relevant parameter may be included in this line				X	This safety guide does not give particular parameters because these values would not be applicable to all plants in MSs. In some should statements this can be done because they are common.
11	7.41	A list of chemistry parameter which are required to monitor for post – accident may be included				X	This safety guide does not give particular parameters because these values would not be applicable to all plants in MSs.

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: M-L Järvinen, K. Hämäläinen Page.... of....							
Country/Organization: STUK Date:27th Sept. 2022							
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1.	3.11	The theoretical part of the training should include the chemistry regime, the chemistry control and the chemistry measurements, impacts of change in chemistry on safety of the NPP (including operational events), and the appropriate rationale.	Please add: (including operational events), The addition emphasizes the importance of operational events as a training tool.	X			
2.	3.16	e) safe handling of radioactive substances.	Please add: e) safe handling of radioactive substances. A suggested addition to emphasize the need to		X :(a) The storage, and handling and proper disposal of hazardous, flammable and poisonous chemicals as well as		

			understand the media the NPP laboratory works with		radioactive substances		
3.	3.17	After the training the chemistry staff should be knowledgeable of all relevant plant requirements for nuclear, radiation and industrial safety.	Please add radiation for clarity. Radiation safety is a key part of laboratory training and should be added to the list.	X			
4.	4.4	q) Radiochemistry measurements should be carried out to detect leaks in pressure boundaries (for closed cooling water circuits in all NPP types and primary and secondary sides of PWRs and PHWRs).	Please rewrite and clarify 4.4 q). Suggestion to broaden the need for measurements. There are closed cooling circuits in PWRs too.			X	Originally text was like suggested here but our English editors changed it as it is now. To me the intent is the same.
5.	4.4	The chemistry programme should provide information of approved decontamination procedures.	Comment. Also the decontamination procedures should be addressed in the chemistry programme		X : (t)(v) The chemistry programme should include guidance documentation to select suitable decontamination		

					techniques, when necessary.		
6.	5.11	Normal operational values should also be defined for the activity concentrations of the most important radioactive nuclides present in the primary coolant including corrosion, activation and fission products.	Please add: coolant including corrosion, activation and fission products Emphasizing all the different types of radioactive products that need to be considered.			X	As it is written now is sufficient for plant chemists and nationla regulators. No more details are needed.
7.	5.25	The concentrations of iron (incl. Fe/Ni ratio), copper (in the case of components containing copper) and zinc (in the case of Zn injections) should be adequately controlled in the feedwater system to minimize fuel performance risks.	The Fe/Ni ratio is of importance as well as the concentration levels.			X	Too specific requirement to be applied in all MS.
8.	7.10	The validation data should be properly documented and recorded so that it is easily available and retraceable.	The addition is to emphasize the fact that at the availability of data might not mean easy retraceability to the original measurements.	X			

9.	7.10	Instrumentation, equipment and the methods to be applied should be validated before commissioning. The validation process should show that instruments, equipment and methods are suitable for the task. The validation data should be properly documented and recorded so that it is easily available.	The addition emphasizes that the validation process should be complete before the equipment/method is taken into use.	X			
10.	7.19	Such measurements should be carried out at different sampling points (e.g. upstream pipe and downstream pipe from the steam generators).	Please add: (e.g. upstream pipe and downstream pipe from the steam generators). Clarification			X	If put in the safety guide this detailed information some MS may assume that the measurements has to be done in these locations.
11.	7.21	Radiochemical methods such as tritium measurements should be used to evaluate barrier leak rates which cannot be monitored by other measurement techniques,	Please add: such as tritium measurements The addition is suggested to emphasize the need for tritium measurements			X	I understand the need but MS have to identify necessary parameters by them selves. Some MS would not accept this and hence it cannot be in the SG.

12.	7.22	Radiochemistry measurements should be applied in monitoring the performance of purification systems (eg. DF decontamination factor),	Clarification. The suggested addition emphasizes the need for evaluating the performance of the purification system			X	Addition does not give any added value
13.	7.28	Laboratories should be suitably secured and should have adequate space, supplies and equipment and a sufficient ventilation system to allow the handling of chemicals and radioactive substances.	Please add: and a sufficient ventilation system to allow the handling of chemicals and radioactive substances. Addition to emphasize the need for a good ventilation system to allow the use of radioactive substances in the laboratory			X	7.34 and 7.35 address this concern.
14.	7.31	…Eating, drinking and smoking (including snuff) should not be allowed in the laboratories. …	The suggested addition is made due to an increased occurrence of snuff in NPPs			X	Only relevant in Finland and Sweden. Not needed here
15.	7.31	Laboratories should have good general housekeeping, orderliness and cleanliness at working areas and at sampling points. These areas should comply with criteria for contamination levels defined in plant procedures. Eating, drinking and smoking should	The added text is needed to ensure the necessary surveillance of surface contamination within the laboratory.			X	Already addressed in 7.33

		not be allowed in the laboratories. Proper environmental conditions should be maintained in the laboratory. A regular surveillance of surface contamination should be done. Radiochemistry laboratories should be regularly controlled by radiation protection department to avoid build-up of radiation fields.					
16.	7.32	Industrial safety (including and considering but not limited to fume hoods for ventilation, appropriate storage of flammable solvents and hazardous materials as well as tools to deal with spilled chemicals, flammable and other gases, provision of safety showers for personnel, as well as personal protective equipment and first aid kits) and radiological safety (proper radiation shielding and contamination control facilities) should be ensured during all chemistry and radiochemistry related actions and measurements.	Clarification. The added text emphasizes the need for the abovementioned safety features to be taken into account in all activities, not just measurements.		X : …should be ensured during all chemistry and radiochemistry related activities.		
17.	7.39	The representativeness of air samples should also be discussed.	Comment			X	If needed will be addressed during next revision.

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	1.	1.2	This Safety Guide provides recommendations on water chemistry in water-cooled nuclear power plants.	Clarification – recommendations are applicable to traditional water-cooled reactors, please distinguish from innovative designs	X			
2	2.	1.3 Line 4	…. The main goals of the chemistry programme (both chemistry and radiochemistry) are to contribute to the reactivity management, to minimize all forms of corrosion of SSCs influenced by the chemistry regime, to preserve the integrity of the fuel and to reduce the buildup of radioactive material enabling lower occupational radiation exposure	Please introduce term "radiochemistry", used elsewhere in text, here as well.	X			
1	3.	1.11	This Safety Guide covers all types of water-cooled nuclear power plants This	Two further functions of chemistry programme,			X	This is addressed in Chapter 2

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			Safety Guide provides Member States with recommendations and guidance on the chemistry programme the plant should have in place. This programme should: 1) contribute to the reactivity management, 2) reduce the build-up of radioactive material, 3) ensure that SSCs important to safety, those SSCs whose failure may prevent SSCs important to safety from fulfilling their intended function and those SSCs that are credited in the safety analyses can operate reliably throughout the original design lifetime including the construction,	i.e. its contribution to the reactivity management and reducing the build-up of radioactive material, should be mentioned in scope as well.				where this fits better.

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			commissioning and operation, life extension periods as well as the decommissioning stage.					
3	4.	2.4	Paragraph 7.13 of SSR-2/2 (Rev. 1) [1] states:	Typo	X			
2	5.	2.10	The operating organization is required to assess performance and enable its continuous improvement in accordance with Requirement 13 of GSR Part 2 [5] and Requirement 9 of SSR-2/2 (Rev. 1) [1].	Please make clear: continuous improvement of what is required	X			
2	6.	2.19 Line 2	… The chemistry management should regularly collect operating experience from national and international utilities and organizations to ensure information exchange and …	It should be emphasized also at this place, that operating experience feedback can also be gathered from NPP operators.	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	7.	2.20	The operating organization is required to maintain a formally designated entity that ~~takes~~ has overall responsibility for the continuing integrity of the plant design, the 'design authority' (see para. 3.2(f) of SSR-2/2 (Rev. 1) [1]).	The sentence is not clear. Please put in line with para. 3.2(f) of SSR-2/2 (Rev. 1).		X: Deleted the whole sentence. Not relevant to this safety guide. Remaining part of the paragraph is.		
2	8.	2.22	Information relating to chemistry should be shared with the ~~meetings~~ reviewing activities relating to, for example, ageing management, corrosion, leakages, outage planning, reducing dose rates at the plant and reducing liquid radioactive waste.	Clarification			X	Deletion does not improve clarity, quite the opposite
2	9.	2.24	Proper interface arrangements should be established between the chemistry group and other groups (operations, maintenance, instrumentation and	We suggest to use "avoid" instead of "keep	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			control, technical support) to ensure that necessary repairs to chemistry systems and equipment are made in a timely manner and that their repair backlogs are ~~kept to a minimum~~ avoided.	to a minimum" in this sentence.				
2	10.	3.3	All chemistry activities should be performed by authorized chemistry personnel, but trainees may be assigned to carry out chemistry activities while ~~'shadowing' (~~supervised by~~)~~ authorized personnel.	Please make the formulation of this sentence clear.	X			
2	11.	3.6	… ~~Line~~ The chemistry management or a qualified trainer should approve the successful completion of the initial training.	Clarification.	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	12.	3.10	Training courses should include techniques for <u>and sensitization of personnel for</u> recognizing unusual conditions …	It may be a good idea to clarify that sensitized personnel is crucial in prematurely detecting anomalies			X	The experienced personnel is giving training to teach identifying unusual situations.
3	13.	3.12	Chemists should ~~know~~ <u>be familiar with</u> the equipment used by chemistry personnel and have the knowledge how to operate it, even if they are not the ones responsible for executing the related tasks on a daily basis.	Editorial	X			
2	14.	4.1	The chemistry programme should contribute to ensuring safe operation, long term integrity of SSCs and integrity of fuel, minimizing buildup of radioactive material, and limiting all <u>radioactive</u> discharges to the	Clarification			X	All is better because it covers all possible realeases.

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			environment to levels as low as reasonably achievable [1].					
2	15.	4.2	The integrated management system should define the accountabilities and responsibilities of the chemistry management regarding the implementation of the chemistry programme. Implementation and responsibilities of the chemistry programme should be organized and documented in such a way that takes into account the organizational structure of the company (e.g. fleet, corporate, single site, <u>multi-unit facility</u>).	Please include multi-unit facility as well, as this topic is being actively developed by IAEA currently.	X			
2	16.	4.3 Line 4	… The chemistry instructions should explicitly define graded limit values	The term “action level” is commonly used and could be introduced here			X	I am used to use action level term, but all experts

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			("action levels") for specific chemistry parameters …	for clarification. It might be advisable to change "graded limit values" into "action levels". Please verify				who helped with revision agreed that nowadays graded limit values is the correct term.
2	17.	5.1	Chemistry control should ensure that systems within the scope of the chemistry programme are operated in accordance with the appropriate chemistry regime~~s~~.	We assume "chemistry regime" is being used in current Safety Guide in singular. Please verify.	X			
2	18.	5.3	To achieve effective chemistry control, the chemistry programme should define detailed chemistry parameters to be followed in all water-cooled reactor types.	Clarification. This Safety Guide is about water-cooled reactors.	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	19.	5.4	The control parameters should be those parameters which are known to have a negative impact on material integrity, fuel rod corrosion, fuel design performance, or have a direct impact on reactivity control, radiation fields or the environment. <u>It is beneficial if control parameters are chosen which can easily be measured with high accuracy</u>.	High-quality measurements allow for a better assessment of the current status of the plant.			X	True but in safety standards the statements must have should. And the addition would be obvious.
2	20.	5.5	The control parameters should have clear graded <u>action levels</u> ~~limit values~~ and it should be ensured that these values are strictly followed.	It might be advisable to change “graded limit values” into “action levels”, as the term “action level” is more commonly used (see also our comment above).			X	See comment above

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	21.	5.11	The chemistry department should ~~regularly~~ continuously trend control and diagnostic parameters …	"Regularly" could also be once per year – but this is clearly not meant here. Thus, a clarification could make sense.	X			
3	22.	5.15	During outages, equipment and systems should be maintained under adequate ~~lay-up~~ layup conditions and in accordance with safety requirements. Further information on ~~lay-up~~ layup conditions is provided in the Annex. Preservation parameters should be monitored, documented and corrective actions should be implemented, if needed.	Different spelling throughout the text: lay-up and layup	X			
2	23.	5.16	The water chemistry regime of active and passive safety systems (e.g. boric acid tanks, containment sprinkler systems, bubble stacks, reservoirs	The examples in the brackets refer to the	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			containing gadolinium) that contain liquid neutron absorbers ~~(e.g. boric acid tanks, containment sprinkler systems, bubble stacks, reservoirs containing gadolinium)~~ should be maintained in accordance with their technical specifications.	safety systems not to the liquid neutron absorbers				
3	24.	5.18	The quality of diesel fuel should be verified before ~~unloading~~ transferring into the diesel fuel tanks	"unloading" may be misleading, "transferring" seems to be a clearer wording.	X			
1	25.	5.22	To avoid or minimize stress corrosion cracking of specific components, mitigating chemicals ~~should~~ can be injected into the coolant. ~~and~~ If appropriate, their concentration should be carefully measured. The basis for	Not all chemistry regimes for BWR require the addition mitigating chemicals.		X: added if applicable but kept should. The second sentence says that if not used the basis should be		

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			the applied chemistry regime should be clearly documented.			properly documented.		
2	26.	5.25	Steam humidity should be kept as low as possible to reduce spread of contamination and ~~erosion~~ corrosion of the steam lines.	Erosion or corrosion? Clarification.		X:degradation used		
3	27.	5.26 Line 3	… Similarly, during a plant shutdown for a refueling outage, during a release phase of the crud and corrosion products, the flow rate in the cleanup system should be as high as possible ~~during the crud and corrosion product release phase.~~	Editorial			X	IAEA editors already approved the English language
3	28.	5.27	The origin of corrosion products entering the reactor coolant should be understood to implement necessary mitigation actions to minimize their	There is no comma needed after e.g.			X	IAEA editors already approved the English language

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			impact on fuel cladding and on the amount of activated corrosion products (e.g.~~,~~ feedwater sources, reactor internal materials sources, reactor water clean-up system surfaces with carbon steel).					
2	29.	5.32	For a nuclear power plant with a graphite moderated nuclear power reactor, the chemistry regime should be applied without the use of any acids or ~~alkalizing~~ <u>alkaline</u> chemicals. …	Better alkaline than alkalizing In the text are different wordings: alkalizing chemicals, alkalizing substances, alkalizing agent, alkali solutions. Does it always mean different things?			X	This was provided by RBMK experts. I would keep it. To your question: no

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	30.	5.33	(a) The deposition of corrosion products on heat exchanger surfaces and <u>in</u> piping should be minimized;	Clarification. "In piping" or, alternative, "on piping surfaces".	X			
3	31.	5.42	No specific ~~lay-up~~ <u>layup</u> conditions are needed for drained primary systems during the outages since the materials are not supposed to be susceptible to corrosion at ambient temperature.	Different spelling throughout the text: lay-up and layup	X			
2	32.	5.51	The concentration of chloride, fluoride and sulphate ~~ions~~, and of corrosion products should be kept below specified limits. …	Sulphate (SO_4^{2-}) is already an ion like chloride (Cl^-) and fluoride (F^-). At 5.26. is also written without ion.	X			
3	33.	5.56	The secondary circuit should be operated with a high pH value, which should be obtained using volatile alkaline reagents such as ammonia	The official IUPAC name is 2-aminoethan-1-ol.	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			and/or amines (e.g. morpholine, 2-aminoethan-1-ol ~~ethanolamine~~, dimethylamine).	Ethanolamine is a simplification/colloquial				
2	34.	5.56 Line 4	… Concentration of ~~alkalizing substances~~ alkaline chemicals should be specified and verified.	Better alkaline than alkalizing. In the text are different wordings: alkalizing chemicals, alkalizing substances, alkalizing agent, alkali solutions. Does it always mean different things?	X			
2	35.	5.59	The levels of deleterious impurities (e.g. sodium ions, chloride, sulphate, lead ions, copper ions) in the steam generator water should be measured and kept as low as possible. …	Sodium and lead as a cation (Na^{+}/Pb^{2+}/$^{4+}$). Otherwise it means a elemental sodium/lead (Na/Pb).	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				Sulphate (SO_4^{2-}) is already an ion like chloride (Cl^-) and fluoride (F^-).				
2	36.	5.63	To further optimize corrosion product control in the steam generators, the use of dispersant compounds and film forming products ~~should be considered~~ in the secondary water should be assessed.	It should be made clear that the use of these substances is not necessarily the best option in all plants.	X			
2	37.	6.2	Specifications for all important radiochemistry parameters should be established and applied during different operating modes to ensure compliance of doses to the personnel with the dose limits and to maintain radiation exposures of personnel as low as reasonably achievable.	Clarification			X	IAEA editors already approved the English language

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
3	38.	6.4 Line 3	… Particular attention should be ~~placed~~ paid on preparations for shutdown.	"paid" seems to be the more suitable word here.			X	IAEA editors already approved the English language
2	39.	6.6	Chemistry control should minimize the deposition of elemental nickel into the reactor core during steady-state operation and efficiently dissolve 58Co during shutdown procedures.	Clarification what should be minimize elemental nickel and/or nickel ions.			X	What is the process of getting elemental nickel into the core? Normally Ni is dissolved into the water being an alloying element in construction materials

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	40.	6.7	Programs for the replacement of Stellite™ (typically 57% Co)~~,~~ and alloys with antimony and silver in SSCs should be considered, where practicable.	Alloys with antimony and silver or elemental antimony and silver?		X 6.7. Programmes for the replacement of Stellite™ (typically 57% Co), silver and materials containing antimony should be considered, where practicable.		Sb is most typically filling material in seals.
2	41.	6.12	The normal level of fission product activity in the primary coolant should be measured during the initial period of reactor operation following startup, in order to ~~provide~~ define a reference background level, which ~~level~~ value should be used for trend analysis.	Clarification	X			
2	42.	6.19	Within application of chemistry programme, t~~T~~reatment and interim storage of radioactive waste arising	Relation of statements from this para to		X: 6.19. In accordance with chemistry		

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			from plant operation should be strictly controlled in a manner consistent with the requirements for safe disposal of waste established in IAEA Safety Standards Series No. SSR-5, Disposal of Radioactive Waste [11]. During treatment and interim storage, the requirements defined by waste acceptance criteria should be followed. Further recommendations on waste management in the operation of nuclear power plants are provided in IAEA Safety Standards Series No. SSG-40, Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors [12].	chemistry programme should be communicated.		programme, treatment….		
2	43.	6.20	(c) Should segregate liquids <u>from different sources</u> to avoid …	The addition is intended to make the sentence	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				clearer without changing its meaning.				
2	44.	9.6	Chemicals and other substances should not be used in SSCs if they contain corrosion inducing components above the specified limits or if they might increase the activity on plant surfaces. If ~~this~~ the rejection of such chemicals and substances is not possible, a risk assessment should be performed and documented.	Clarification	X			
3	45.	9.16 Line 3	Oxidizing and reducing chemicals, flammable solvents and concentrated acid and ~~alkali~~ alkaline solutions should be stored separately.	Uniform spelling in the text: alkaline	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	46.	REFERENCES	[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Management System for Nuclear Installations, IAEA Safety Standards Series No. GS-G-3.5, IAEA, Vienna (2009) <u>(under review as DS513).</u>	GS-G-3.5 is currently under revision as DS513, this should be mentioned			X	IAEA editors already approved also references
2	47.	A-5 Line 3	… Preservation measures impact the lifetime of the plant components and are hence an important part of the ageing <u>management</u> programme or the asset management programme.	"ageing management" is the commonly used term.	X			
3	48.	A-7 Line 5	… For example, to limit chemical discharges to the environment, dry layup of the secondary system feedwater train could be preferred instead of using ~~alkalized~~ <u>alkaline</u> wet preservation.	Uniformly spelling in the text: alkaline	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
2	49.	A-9 Line 3	… If preservation cannot be implemented, the basis <u>for this decision</u> needs to be justified and documented.	Maybe this addition provides for a better understanding.	X			
2	50.	A-10 (b)	(b) The length of the planned period of time, <u>which might be available for preservation's layup</u>;	Clarification	X			
2	51.	A-12 Line 3	… For systems made of low alloyed steels, such as carbon steels, when dry preservation is not feasible, wet alkaline preservation is selected in most cases, particularly if the ~~layout~~ <u>layup</u> time is longer	"layup" should be the correct word here.	X			
1	52.	A-22 / A-23	~~. In some Member States~~, <u>Depending on the preservation strategy,</u> ~~plants also measure~~ the measurement of relevant corrosion products (e.g. iron	The cited text is placed between A-22 and A-23. Please consider creating a new paragraph with this		X: Depending on the preservation strategy plants also measurement of		

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			ions and/or suspended solids) and corrosion inducing ions (e.g. fluoride, chloride, sulphate) can be beneficial.	content or deleting the text. Please also clarify if elemental iron or iron ions are meant.		relevant corrosion products and corrosion inducing ions is recommended.		
2	53.	A-30	(a) Checking the quality of the last flushing water, including checking parameters such as pH, corrosion inducing ions (e.g. fluoride, chloride, sulphate), conductivity~~,~~ and relevant corrosion products (e.g. iron ions, suspended solids).	Instead of a comma should be an *and.* Elemental iron or iron ions? Please clarify.	X			Iron ions
3	54.	A-30	(g) If over-pressurized inert gas is used to prevent air ingress:	*And* should be written in small letters and there is no need for a comma.	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			(i) Checking and analysing the trend in the overpressure (using a manometer) once per day ~~A~~a<u>n</u>d~~,~~ after a steady state is reached, once per week;					
3	55.	A-30	(h) If vacuum is used to decrease humidity, checking and analysing the trend in the under-pressure (using a manometer) once per day ~~A~~and~~,~~ after a steady state is reached, once per week.	*And* should be written in small letters and there is no need for a comma.	X			
2	56.	A-31 Line 4	… For example, the secondary side of the steam generator is in most cases preserved using demineralized water containing a high enough concentration of ~~alkalizing agent~~ <u>alkaline chemicals</u> to reach the target	Better alkaline than alkalizing. In the text are different wordings: alkalizing chemicals, alkalizing substances, alkalizing agent, alkali solutions.	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			pH value and an appropriate reducing agent to scavenge oxygen.	Does it always mean different things?				
2	57.	A-35	For wet preservation without chemicals, the plant has to ensure that low enough (precisely defined) conductivity conditions are achieved prior to preservation. For alkaline wet preservation, amine and any <u>other</u> reducing agent is added to the demineralized water.	Is only one specific amine added or could be different amines be added? And /or any other reducing agent?			X	Different amines can be used. Other cannot be used not all amines are considered reducing in context of being able to reduce oxidants from the water.
2	58.	A-36	During the neutral wet preservation, the plant needs to implement a monitoring program for conductivity	Monitoring for iron ions or elemental iron? Please clarify.			X	ions

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
			and for the concentration of predefined anions and iron ions.					
3	59.	A-36 Line 2	… Regarding ~~alkalized~~ alkaline treatments, the pH, as well as the concentration of reducing chemicals, predefined anions and iron need to be checked regularly.	Consistent spelling in the text: alkaline	X			
1	60.	A-38 Headline	Monitoring of ~~dry~~ wet preservation	The following section deals with wet preservation.	X			
3	61.	A-38	g) Checking and analysing the trend in over-pressure (using a manometer) if the system is under inert gas, once per day and~~,~~ after a steady state is reached once per week.	There is no need for a comma. Checking throughout the text for *and with a*	X			

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Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				comma direct after words. Should be consistent.				
3	62.	A-39	d) Checking that the system is filled up to the specified level once per day ~~A~~and~~,~~ after a steady state is reached, once per week;	*And* should be written in small letters and there is no need for a comma.	X			
3	63.	A-39	e) Checking and analysing the trend in over-pressure (using a manometer) when the system is under inert gas, once per day~~,~~ and~~,~~ after a steady state is reached, once per week;	There is no need for 2 commas.	X			
1	64.	A-44	An effectiveness review of the actions taken should be documented so that reoccurrence of the same transient is ~~mitigated~~ prevented.	It should be the goal of this review to prevent reoccurrence. Mitigation	X			

	COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)** (with comments of GRS and BASE) Pages: 15 Country/Organization: **Germany** Date: 29.09.2022				RESOLUTION			
Rele-vanz	Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
				is usually the second-best option.				

COMMENTS BY REVIEWER Reviewer: United Kingdom Page.1. of..1.. Country/Organization: UK/ONR (NUSSC) Date: September 2022				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1a.	Para. 1.1	n/a	It would be useful if this revision of the guide could comment on its applicability, or otherwise, to Small Modular Reactors (SMRs)			X	Yes IAEA should have something for sodium cooled reactors etc, which are already under operation, but in different safety guide. For

			and/or Advanced Nuclear Technologies (ANTs).				SMR more difficult since no operating experience exist yet.
1.	Para. 1.2; line 1.	Implementing a chemistry programme is essential to ensure the safe operation of a nuclear power plant.	Typo in original text and some words suggested to place the focus on the importance of implementation. Suggested additional words underlined.	X			
2.	Para. 1.2; line 4	The chemistry programme is based on a detailed rationale usually provided by the manufacturer, but ultimately, ownership of the contents and proper implementation of the chemistry programme rests with the plant operator/licensee.	The text should be further adjusted to clarify the expectation that the operator/licensee for the plant has ultimate legal responsibility for operating their plant safely. Suggested new text underlined.	X			
3.	Para. 1.3; line 2	The chemistry regime is defined by the reactor type, its design, ~~and~~ construction materials used and any requirements placed on	Underlined text proposed to strengthen the understanding of the importance of the links between the chemistry programme and the plant's safety analysis, which should	X			

		the operating chemistry in the plant's safety analysis.	derive any chemistry-related parameters/limits and conditions which need to be controlled in the interests of safety.				
4.	Para. 1.3; line 3	Chemistry control should assure that the plant is operated in accordance with the chemistry regime and any relevant requirements from the plant's safety analysis.	Same reason as comment 3 above. Suggested new text underlined			X	Unnecessary repetition
5.	Para. 1.5; Line 1	This Safety Guide should be used by responsible managers of operating organizations to effectively oversee the plant chemistry programme and by regulatory bodies not only when fulfilling their external oversight responsibilities ~~and~~ but also during development of national regulatory	Typo – "and" not required. Missing word – "the".	X			Text already modified due to comments from MS

		requirements in <u>the</u> water chemistry area.					
6.	Para. 1.6	n/a	Suggestion/observation – should this para. also cover maintaining the integrity of nuclear fuel? Implementing good chemistry control through the chemistry programme should also reduce the amount of solid radioactive waste generated, as well as liquid?			X	Fuel integrity discussed in detail below. Modified as follows:…to reduce the generation of radioactive waste.
7.	Para. 2.5	The operating organization should ensure that the chemistry programme supports the reliable and continued operation of SSCs in the long term, ~~and~~ does not compromise design assumptions during the entire operating lifetime of the plant and decommissioning period, <u>and that all relevant chemistry parameters derived from the plant's</u>	Same reason as comments 3 and 4 above. Suggested new text underlined.			X	To reduce repetition I will copy paste this to Chapter 3 instead of using it here.

		safety analysis, are adequately controlled.					
8.	Para. 2.19	Proper interface arrangements should be established between the chemistry group and other groups (operations, maintenance, instrumentation and control, technical support, safety analysis) to ensure that necessary repairs to chemistry systems and equipment are made in a timely manner, ~~and~~ that their repair backlogs are kept to a minimum, and that equipment remains available to meet any relevant requirements defined by the plant's safety analysis.	Strengthen the importance of having chemistry personnel involved with safety assessment and safety analysis implementation. Suggested new text underlined.	X		X	Accepted the latter one but rejected the first one because within the brackets are addressed organisations.
9.	Para. 2.22; Line 3.	The operating organization should ensure that the chemistry department provides sufficient support and control of contractors	Missing word – "the".	X			

		working within the chemistry area.					
10.	Para. 3.5	n/a	Initial training should also cover safety analysis/assessment/analysis awareness and promote the understanding amongst chemistry staff, about what the plant's safety analysis says about chemistry and what is necessary to control in the interests of safety. Also, this section should also cover general training in radiological protection/handling radioactive samples, etc.	X			Later one address in other modified training paragraphs
11.	Para. 3.11	n/a	Similar to comment 10 above. This should include theoretical training also cover required knowledge of the plant's safety analysis.	X			
12.	Para. 3.16	n/a	We appreciate this section may be aimed at the conventional health and safety aspect of chemistry operations. However,	X			

			similar to comment 10 above, this should include relevant training in radiological protection matters				
13.	Para. 4.2	Implementation and responsibilities of the chemistry programme should be organized and documented in such a way that it takes into account the organizational structure of the company (fleet, corporate, single site, etc.) and the plant's safety analysis.	Same reason as comments 3, 4 and 7 above. Suggested new text underlined.	X			
14.	Para. 4.4; (b)	A plant specific chemistry regime should exist and be in accordance with the original plant design and safety analysis. Potential design changes should take into account the existing chemistry regime and any relevant requirements of the extant safety analysis, and if needed, the existing	Same reason as comments 3, 4, 7 and 13 above. Suggested new text underlined.	X		X	Accepted the first but not second due to repetition.

		chemistry programme should be updated to reflect the structural changes done to the SSCs					
15.	Para. 4.4; (d)	n/a	This list should also cover the importance of monitoring and "controlling"/the impact on, activation products (i.e., noble gases, tritium etc.) and also fission products. For example, use of depleted Li and/or minimising [B] and the impact this has on H-3 production.			X	The list has to be generic otherwise would be too long.
16	Para. 4.4; (e)	For plants which do not employ a direct cycle, the secondary side chemistry regime should minimize…….	As the guide is also applicable to BWRs, suggested additional wording underlined, to clarify this would obviously only apply to plants which don't have a direct cycle.			X	This chapter gives generic guidance on chemistry programme. More detailed ones are in later on.
17	Para. 4.4; (g)	The chemistry regime for auxiliary systems should be in accordance with the used materials to preserve their full integrity and availability, and any	Same reason as comments 3, 4, 7, 13 and 14 above. Suggested new text underlined.			X	Repetition, not used here because obvious.

		requirements defined by the plant's safety analysis.					
18	Para. 4.4; (j)	Results of the chemistry programme should be communicated in a timely manner…….	Missing word – "a".	X			
19	Para. 4.4; (k)	Any deviations (e.g., deficiencies, adverse trends, fast transients) from normal operational limits should be addressed in a timely manner, and in accordance with the requirements of the plant's safety analysis, and effectiveness of used methodologies should be regularly evaluated and improved, if necessary;	Same reason as comments 3, 4, 7, 13, 14 and 17 above. Suggested new text underlined.			X	Same as above
20	Para. 4.4; (l)	On-line instruments and equipment in the laboratory should be regularly inspected, calibrated, maintained, and kept up to date. The necessary redundancies for this equipment should	Same reason as comments 3, 4, 7, 13, 14, 17 and 19 above. Suggested new text underlined.			X	Same as above

		be ensured and should meet any/all relevant requirements defined by the plant's safety analysis.					
21	Para. 4.4; (o)	The proper alignment of graded limit values and measurement frequencies should be carefully evaluated and should be determined by considering any/all relevant requirements defined by the plant's safety analysis;	Same reason as comments 3, 4, 7, 13, 14, 17, 19 and 20 above. Suggested new text underlined.			X	Same as above
22	Para. 5.1; Line 1	Chemistry control should ensure that systems within the scope of chemistry programme are operated according to the appropriate chemistry regimes and in accordance with the plant's safety analysis.	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20 and 21 above. Suggested new text underlined.			X	Same as above
23	Para. 5.1; Line 2	The chemistry regime depends on the design of the plant and on construction materials used and any	Same as comment 3 above. Suggested new text underlined.			X	Same as above

		requirements placed on the operating chemistry in the plant's safety analysis.					
24	Para. 5.13	Chemistry parameters and their corresponding graded limit values, when applicable, should be clearly defined in chemistry procedures or other relevant plant documentation, including the plant's safety analysis, for:	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22 and 23 above. Suggested new text underlined.			X	Same as above
25	Para. 5.13	The quality of diesel fuel should be verified before unloading into the diesel fuel tanks. The quality of diesel fuel in the storage tanks for the emergency diesel generators should be checked in accordance with plant documentation, including the plant's safety analysis.	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23 and 24 above. Suggested new text underlined.			X	Same as above
26		n/a	An objective should be included to control/manage the			X	Addressed in 5.18

			potential for the formation of a flammable atmosphere.				
27	Para. 5.21	The basis for the applied chemistry regime should be clearly documented and adequately justified in the plant's safety analysis.	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24 and 25 above. Suggested new text underlined.			X	Same as above
28	Para. 5.22	n/a	It would be useful for the guide to suggest that for plants which perform HWC, and therefore inject hydrogen, the total amount added should be optimised based on the relevant risks (i.e., higher [H_2] have been associated with increased activated-CP deposition/higher dose rates) and H_2 can increase main steam line dose rates.			X	Safety Guide should have only should statements and no neutral paragraphs
29	Para. 5.25	n/a	This list should also cover platinum (for plants which perform NobleChem) and should it also mention controlling silica. Pt on fresh fuel surfaces has always been	X		X	Added silica because relevant to all BWRs, Pt only for those using NobleChem).

			cited as a particular risk to fuel integrity.				
30	Para. 5.31	For a nuclear power plant with a graphite moderated and water-cooled primary circuit (RBMK),	Suggest "and water-cooled primary circuit", to avoid any potential confusion with other reactor technologies such as graphite moderated, gas cooled reactors. Also suggest the title of this section is modified to reflect this comment.	X		X	Changed the text, not title
31	Para. 5.35	n/a	Potential typo. Should the title of this section read "(PWR and VVER)", as opposed to "(PWR and WWER)"?			X	WWER is correct word
32	Para 5.35 – 5.43	n/a	There is an increasingly common trend for some PWRs to use enriched boric acid (EBA) in the primary circuit, e.g., the EPR. We would suggest this section of the guide needs to say something more about it – including an expectation for its			X	Correct statement. In safety guid we have to use should statements and we can not say that MS should start using enriched boron.

			use to be considered and justified (whether used or not) in the plant's safety analysis. For plants which do use EBA, the importance of the chemistry programme in adequately controlling the isotopic enrichment of B becomes important, as well as the total [B].				5.36.5.37. The concentration of dissolved 10B in the reactor coolant system for controlling core reactivity should be regularly monitored.. covers this part
33	Para. 5.40	Any deliberate deviation from the procedures <u>should be avoided where practicable, be consistent with the requirements of the plant's safety analysis,</u> and carefully evaluated by relevant plant organizations and the basis clearly documented for future assessments.	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25 and 27 above. Suggested new text underlined.			X	Same as above
34	Para. 5.41	No specific lay-up conditions are required for drained primary systems during the outages since	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25, 27 and 33 above.			X	Same as above

		the materials are not supposed to be susceptible to corrosion at ambient temperature. <u>However, all lay-up procedures should be implemented in accordance with the plant's safety analysis and relevant risks minimized, so far as is reasonably practicable.</u>	Suggested new text underlined.				
35	Para. 5.41	The conclusions of such evaluations should be clearly documented, <u>including an adequate justification being provided in the plant's safety analysis.</u>	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25, 27, 33 and 34 above. Suggested new text underlined.			X	Same as above
36	Para. 5.43	n/a	For plants which add zinc for dose control purposes/reducing radioactivity generation and transport to as low as reaconably achievable, the text would benefit from reference to a lower "limit" to be specified for these purposes.			X	The lower limit is plant specific and would be difficult to address in IAEA safety guide.

37	Paras. 5.53 – 5.64	n/a	The majority of the description/principles in this section are also applicable to chemistry control in the secondary side of other reactor technologies such as advanced gas-cooled reactors (AGRs).. This section would need to be reviewed to ensure consistency/applicability to other such technologies. For example, para. 5.57 would remain very important but for different reasons – because of the design and operating pressure o, for example, advanced gas-cooled reactors, the concern is leakage the other way around from the secondary side to the primary side. There may be others.			X	No clear suggestion given how the text in DS525 should be modified.
38	Para. 5.54	g) be adequately justified in the plant's safety analysis	Suggest adding an additional item. Item (g).			X	Same as above. This statement is already mentioned in the chapter for chemistry programme and

			Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25, 27, 33, 34 and 35 above. Suggested new text underlined.				hence valid to all chapter after it.
39	Para. 5.61	If necessary, an effective cleaning procedure should be applied to remove deposits from steam generators to mitigate the effects of various forms of corrosion. <u>However, the need to perform/rely on cleaning should first and foremost, be avoided, by implementing effective chemistry control and/or other related measures, i.e., materials selection/compatibility, etc. If cleaning becomes necessary, an adequate safety justification should be performed, taking account of the relevant requirements of the plant's safety analysis.</u>	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23, 24, 25, 27, 33, 34, 35 and 36 above. Also, to stress the importance of trying to avoid the need for cleaning in the first place. Suggested new text underlined.	X			

40	Para. 6.1; (c)	(c) reduction of the generation and/or volume of radioactive waste, and/or the radioactivity contained in radioactive wastes.	There are a few factors to consider. The generation of waste at source may be eliminated/reduced, if this can't be done, it's volume might be reduced and/or the radioactivity of the waste may be reduced.	X			
41	Para. 6.2	n/a	We appreciate there are differences in UK vs. international approach/terminology. Please consider exchanging ALARA, for So Far as is Reasonably Practicable (SFAIRP).			X	The safety guide needs to follow the international terminology, not from one MS
42	Para. 6.5	The use of materials containing cobalt (59Co) that comes in contact with primary coolant should be avoided to the extent possible to reduce dose rates due to 60Co. For some reactor designs, this should include, where reasonably practicable, specifying low Co-containing grades of	Some high surface area SS components, which are not necessarily components with hard facings made from Stellite, may make significant contributions to the source term and therefore, low Co grades might need to be specified.	X			

		stainless steel for some SSCs.					
43	Para. 6.7	Programmes for the replacement of Stellite™ (typically 57% Co), antimony and silver should be considered, where practicable. Ideally, this should occur at the design stage. The impact of materials selection decisions for SSCs, on the generation and transport of radioactivity in the primary circuit, should also consider the relative importance of manufacturing processes/techniques, and/or surface treatments/finishes, on their longer-term in-service performance. These decisions should be considered in, and adequately justified by,	Added words to reflect the importance of making these decisions as early as possible, preferably at the design stage. Also, we couldn't see anywhere in Section 6 which talks about the importance of the relationship between manufacturing methods/controls, the ability to specific certain surface treatments/finishes to reduce the generation and transport of radioactivity and how these are linked to the operating chemistry. For some SSCs, it can be the importance of controlling manufacturing etc., which has the biggest impact on long-term performance, i.e., for SGs, the tube manufacture			X	Fully agree. Suggested text more relevant to SSR 2/1 safety guide than this one.

		the plant's safety analysis…….	technique and impact on metal release rates.				
44	Para. 6.9	Chemistry conditions to be maintained during this period should be aligned with the materials used in the system and considered by, and justified in, the plant's safety analysis.	Capturing the importance of the safety analysis considering and justifying the commissioning phase. The chemistry aspects can often be missed out and/or not adequately justified, despite the importance of commissioning chemistry control on the long-term behaviour of the plant.	X			
45	Para 6.14	The plant should define levels for fission product concentrations in the coolant beyond which the plant should not participate in load follow actions or, if the fuel failure is significant enough, should require shutdown of the unit within a reasonable period of time to remove the defective fuel element. There should be a clear link between relevant fission	Ensuring that the highest limit values for relevant radionuclides are derived from/informed by the safety analysis/safety analysis, and the clear link/" golden thread" is there.	X			

		product concentrations/limits and the plant's safety analysis/safety analysis.					
46	Para. 6.15	Comprehensive decontamination procedures (e.g., chemical, electrochemical and mechanical) should be developed and validated for different applications. When choosing the decontamination technique, potential long-term impacts to plant materials should be considered along with minimizing the re-contamination rates as well as generation of nuclear waste. The need to undertake decontamination should be reduced so far as is reasonably practicable.	Stressing the importance of designing and operating the plant to avoid the need for decontamination, to begin with.	X			
47	Para. 7.1	The scope and frequency of chemistry and	Same reason as comments 3, 4, 7, 13, 14, 17, 19, 20, 21, 22, 23,			X	Same as previously

		radiochemistry monitoring activities for plant commissioning, plant operational modes (start-up, shutdown, operation at stable power levels, outages) as well as transient conditions should be specified by the chemistry department in relevant plant documents and procedures <u>and should be informed by the plant's safety analysis.</u>	24, 25, 27, 33, 34, 35, 36 and 39 above. Suggested new text underlined.				
48	Para. 7.6; Line 1	<u>Programmes</u> used to calculate chemistry parameters should be verified and validated according to	Typo? Should these be "programs", as in computer programs? Suggest "computer" is used as the first word.	X			
49	Para. 7.11	A calibration and maintenance programme should be established and applied to all on-line and laboratory monitoring instrumentation. The responsibilities for calibration and	Ensuring the importance of maintaining any chemistry-related equipment which may be safety classified, is done in accordance with the requirements of the safety analysis, to ensure it achieves			X	Same as above

		maintenance should be clearly defined. For any safety classified instrumentation on the plant, maintenance should be performed in accordance with the requirements of the plant's safety analysis.	the level of reliability required as per its safety classification.				
50	Para. 7.18; Line 2.	These measurements together with proper sampling arrangements should also be part of the process to identify leaking fuel rods.	Missing word – "the".	X			
51	Sections 5 & 6	n/a	The part of Section 5 covering PWRs does not explicitly state the benefits (OPEX) for dose reduction that a lot of plants can see from injecting zinc. Para. 5.42 makes a suggestion to consider using Zn, but nothing more definitive. Likewise, para. 6.10, makes perhaps a stronger recommendation during Hot Functional Testing – asking for			X	I agree. No clear guidance what to change and how. More like a comment

			the basis for not injecting zinc, to be clearly documented. However, the guide does not appear to apply the same emphasis/insistence on injecting Zn at-power.				
52	Section 5	n/a	The part of Section 5 covering PWRs does not explicitly state the "requirement" to implement acid-oxidising (forced oxygenation) conditions during the shutdown. Para. 5.40 only appears to make some general statements about the importance of "shutdown and start-up procedures".			X	Agree. Not all plant in the world do forced oxidising phase. Text more like a comment
53	References	n/a	There is no mention of radiological protection standards in the references, such as GSR Part 3, or NS-G.1.13 (Radiation Protection Aspects of Design for Nuclear power Plants).			X	GSR part 3 mentioned in Annex

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer: Japan NUSSC member Country/Organization: Japan/NRA		Page of 5 Date: 30 Sep. 2022					
No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection

1. 1	3.6., 3.11., 3.12.	3.6. Initial training for ~~chemists~~ chemistry personnel should include on the job training in those areas which are related to chemistry control and measurements (e.g. in laboratories, sampling points, chemical handling, storage areas, and injection points of chemicals in operating systems). Initial training for ~~chemists~~ chemistry personnel should cover chemistry-specific areas during startup, normal operation, shutdown and most probable transients. Line management or a qualified trainer should approve the successful completion of the training. 3.11. ~~Chemists~~ Chemistry personnel at a nuclear power plant should have sufficient knowledge in their areas of responsibility to be able to communicate effectively with and to support the operating personnel. The theoretical part of their training should include the chemistry regime, the chemical control, the chemistry measurements, the potential impact of changes in chemistry on the safety of the nuclear power plant, and the appropriate rationale. 3.12. ~~Chemists~~ Chemistry personnel should know the equipment used by ~~chemistry personnel~~ them and have the knowledge how to operate it, even if they are not the ones responsible for executing the related tasks on a daily basis.	The words “chemist” should be replaced by “chemistry personnel” for word coincidence. If “chemist” is different from “chemistry personnel”, the definitions should be clarified.			X	These desrcibed tasks are too detailed and comprehensive for whole chemisty personnel. Chemist term is universal term for expert who supervise laboratory technictians.

2. 2	4.4. (d)	4.4. The chemistry programme should cover at least the following aspects: ... (d) The primary water chemistry regime should take into account its potential impact on: (i) plant specific corrosion mechanisms of ~~construction~~ materials, (ii) fuel cladding corrosion, (iii) activation and transport of corrosion products, (iv) dose rates, (v) crud induced power shifts and (vi) crud induced localized corrosion.	The word "construction materials" is typically used for materials for building walls and so on. "Construction materials" should be replaced by simply "materials".			X	The term construction material refers also pipes, tanks, pools, etc.
3. 3	4.4. (p)	4.4. The chemistry programme should cover at least the following aspects: ... (p) A process to avoid impurity ingress from chemicals and substances should be in place. Selection of new ~~construction~~ materials due to modernization or refurbishment activities should be carefully evaluated to minimize the dissolution of corrosion products and their subsequent activation in the reactor core.	The same comment on #2.			X	See comment above

4. 4	4.4. (r)	4.4. The chemistry programme should cover at least the following aspects: ... (r) Discharges of radioactive species and chemicals should be kept as low as reasonably achievable and within national regulations. Chemistry departments should carefully evaluate, thoroughly understand and properly document the potential impact of any changes in the chemistry regime on safe operation of the nuclear power plant including aspects of radioactive and chemical discharges. Radioactive discharges to the environment should be measured ~~on-line~~ before their discharge to ensure that national and plant limits are not exceeded and to evaluate potential impacts on the environment (e.g. for production of tritium and ^{14}C).	On-line measurement for tritium a 5 d ^{14}C is not a common practice in the Member States. So, on-line measures seem not suitable.		The e.g e.g. for production of tritium and 14C is deleted but on-line kept		
5. 5	After 5.27.	*The following para should be added after para.5.27.* Shutdown and startup procedures should be strictly followed to control the release of corrosion products and to effectively remove them using coolant purification system filters and demineralizers, as well as to minimize corrosion and explosion risks. Any deliberate deviation from the procedures should be carefully evaluated by operating organizations and the basis clearly documented for future assessments.	Paragraph 5.41 in PWR subsection is also important and applicable for BWR. So the same text in para. 5.41 should be added followed by para. 5.27.	X			

6. 6	5.54.	Special attention should be paid to the integrity of the various parts of the secondary and auxiliary systems that might be significantly affected by various forms of corrosion or deposited corrosion products. The secondary ~~circuit~~ and auxiliary systems and ~~its~~ their water chemistry control should be designed to minimize the ingress of corrosive impurities.	To keep a consistency with the first and the second sentences.	X			
7. 7	5.60.	The use of lead-containing equipment or materials (Bolt seizure inhibitor, etc.) in the secondary systems during operation or maintenance works should be avoided to the extent possible.	For better understanding, typical examples of lead containing material should be shown.	X	The use of lead-containing equipment or materials like certain greases,…		
8. 8	5.61.	The potential impact of chemistry parameters on the integrity of the steam generator should be regularly evaluated and related results should be analysed for trends. The main tools for such an evaluation should be the following: ... (c) Evaluation of the quality and quantity of sludge removed from steam generators during outages, which may cause denting etc.; (d) Evaluation of the amount of hard deposits in the steam generators that can cause wall thinning.	The reason of evaluation is better to be mentioned.			X	Sludge can result in many other degradation mechnisms. Also hard sludge can result in differrent corrosion phenemena depending on location and materials

9. 9	6.7.	Programmes for the replacement of Stellite™ (typically 57% Co)~~,~~ and alloys which contain antimony ~~and~~ or silver should be considered, where practicable. The chemistry department should be part of the approval process when new equipment and materials are being approved for use in plant systems.	Single substance of antimony or silver are not used, but alloys are used in NPPs.	X	Programmes for the replacement of Stellite™ (typically 57% Co), silver and materials containing antimony should be considered		I do not know Ag or Sb as alloying éléments in NPP materials. But Sb can be in seals and Ag in soldering.
10. 11	7.29.	Determination of the radioisotopes on the ~~primary~~ inner surfaces of primary circuit should be done by using in-situ gamma spectrometry at carefully selected parts of the primary circuit. Other techniques could be the use of wipe sampling, oxide layer scraping or electrochemical sampling. These data should be analysed for trends and correlated with chemical and operational data, such as pHT and thermal power.	This term "primary surface" should be clarified.	X			

11. 12	7.31.	~~Redundancy of laboratory facilities~~ Alternative system for the most important analyses should be provided in the site to ensure that analytical services can be provided at all times, including ~~design basis accidents and beyond design basis~~ accident conditions.	When considering analytical service for important analyses in the event of loss of laboratory function owing to accident conditions, alternative system could be located outside the plant itself. "Beyond design basis accidents" is the wording one generation before.	X	7.31. Redundancy of laboratory facilities on site or in other location or organization for most important analyses should be provided…		
12. 13	9.16.	Chemicals should be stored in an appropriate cabinet which is, for example, fire protected and captures spillages, and ~~in a room which is equipped with~~ a safety shower should be equipped in or near the room, in accordance with plant documentation. Waste disposal procedures should be established. Oxidizing and reducing chemicals, flammable solvents and concentrated acid and alkali solutions should be stored separately. Reasonably small amounts of approved and properly labelled chemicals can be stored in other controlled environments in the workshops or in the operational department.	A safety shower is necessary, but not always in the place where chemicals are stored. It is acceptable to place near the room.			X	The showers do not have to be next to the chemicals but should in the same room. Please note that thesentence ends saying in accordance with plant documentation. So plant can decide.