Summary of NUSSC, WASSC and RASSC Comments on DS525, Chemistry Programme for Water Cooled Nuclear Power Plants

COMMENTS BY REVIEWER				RESOLUTION			
Reviewer:							
Country/Organization:			Date: 18/10/2023				
Comment No.	Para/ Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
1	1.4	The chemistry programme comprises the following basic elements: the chemistry regime, chemistry control and chemistry measurements. The chemistry regime is defined by the reactor type and design, the construction materials used, and any requirements placed on the operating chemistry in the plant's safety analysis. The chemistry control confirms that the plant is operated in accordance with the chemistry regime requirements and defines the parameters to be measured, their measurement frequencies, ~~expected measurement values,~~ graded limit values and corrective actions to be taken if necessary. The chemistry measurements provide information about	Control parameters have expected values but most diagnostic parameters are not associated to any expected value.	X	, expected measurement values when deemed valuable,..		

		the actual chemistry conditions in the systems, which in turn serve as the basis for all further operational and safety-related decisions.					
2	1.10	This Safety Guide provides recommendations on the chemistry programmes that should be established in all types of water cooled nuclear power plants. These programmes ensure that SSCs important to safety, SSCs whose failure might prevent SSCs important to safety from fulfilling their intended function, and SSCs that are credited in the safety analyses can operate reliably throughout the plant's original design lifetime, including construction, commissioning, all operational states ~~and accident conditions~~, and decommissioning.	The chemistry programme does not deal with accident conditions. Those conditions are within the scope of the preparedness requirements.			X	Chosen chemistry regime should ensure that SSC will function also during accident conditions, e.g. to prevent sump clogging due to used incompatibility of materials and water chemistry used in containment spray water
3	2.1	The operating organization is required to develop, implement, assess and continuously improve an integrated management system, in accordance with the requirements established in IAEA Safety Standards Series No. GSR	As the beginning of sentence is at the same time the wording of Requirement 2 of SSR-2/2 (Rev. 1), formulation "as stated in" might be better.			X	IAEA language check approved current version

		Part 2, Leadership and Management for Safety [4] and ~~with~~ as stated in Requirement 2 of SSR-2/2 (Rev. 1) [1].					
4	2.2	o The following is suggested. (before) ~~measurements, dose management, chemistry and radiochemistry~~~ (after) ~~measurements, management of the buildup of radioactive material, chemistry and radiochemistry~~~	o I don't think that dose management is the main activity of the chemistry programme. Based on the SSG-13(2011) 2.1 (b), it is recommended that dose management is replaced.	X			
5	2.7	The operating organization should provide sufficient resources for the development of chemistry control methodologies. In addition, the operating organization should provide adequate facilities, ~~and~~ sampling and measuring equipment (including laboratory and on-line monitoring instruments) for chemistry measurements. The operating organization should also ensure that the chemistry equipment and related systems are ready to return to service after	In addition to adequate facilities and sampling equipment, the operating organization should also provide adequate instruments to perform the needed measurements (laboratory and on-line monitors).	X			

		maintenance and modifications, in accordance with predefined acceptance criteria. Further recommendations are provided in IAEA Safety Standards Series No. SSG-74, Maintenance, Testing, Surveillance and Inspection in Nuclear Power Plants [6].					
6	2.15	Requirement 24 and paras 5.27–5.33 of SSR-2/2 (Rev. 1) [1] establish requirements on feedback of operating experience. The managers of the chemistry programme should regularly collect operating experience from operating organizations at the national and international level to ensure that the chemistry programme is kept up to date with best industry practices. Lessons identified from operating experience relating to the chemistry programme should be appropriately taken into account in the procedures of the chemistry programme or other types of plant documentation, and should be brought to the attention	Some operating experience results are specific to some plants configurations and do not apply to all plants.	X			

		of the chemistry personnel.					
7	2.24	Qualified external contractors and consultants should be made available as necessary to meet the needs of the chemistry programme. The operating organization may delegate certain tasks of the chemistry programme to other organizations, but the operating organization is required to retain overall responsibility for these tasks, in accordance with Requirement 1 of SSR-2/2 (Rev. 1) [1] and para. 4.33 of GSR Part 2 [4]. The operating organization should ensure that the chemistry department provides sufficient support to and control of contractors working within the chemistry area.	Typo	X	The operating organization may delegate to other organizations some tasks of the chemistry programme, but the operating organization should retain overall responsibility for such delegated work.		
8	3.5	The managers of the chemistry programme should develop and implement basic chemistry training for all relevant nuclear power plant personnel, as well as initial, ongoing and refresher training for the chemistry personnel as appropriate.	All nuclear plant personnel is not trained to chemistry. For instance, personnel from the administrative departments have no need for a chemistry training.	X			

9	3.11	The theoretical training of chemistry personnel should include the chemistry regime, chemistry control, chemistry measurements, and the potential impact of changes in chemistry on the safety of the nuclear power plant (~~including~~ for the different operational states).	Clarification	X	including different operational states		
10	3.14	3.14. Chemistry personnel and other plant personnel who deal with chemicals should be trained in the following specific areas: (a) The classification, labelling and packaging of hazardous;	I agree that chemistry personnel should be trained in labelling and packaging. This should be limited to hazardous items. Labelling of radioactive substances will be done by RP personnel. It is not expedient to give chemistry personnel this whole needed RP education.			X	The text states:" chemistry personnel and other plant personnel…" other plant personnel refer for example to RP personnel.
11	4.1	In fulfilment of other requirements established in SSR-2/2 (Rev. 1) [1], the chemistry programme should also contribute to ensuring the integrity of fuel and limiting all planned discharges to the environment.	Control of unplanned discharge cannot be provided by chemistry programme	X			

12	4.3	The principle of optimization of protection and safety should be applied when setting discharge limits, and the regulatory body should evaluate whether the processes established by the operating organization to protect workers and the public are optimized. The operating organization should establish procedures to monitor the source term and the environment in order to control effluents and verify compliance with the discharge limits. Further recommendations on establishing discharge limits and on the process for the optimization of the protection of workers managing radioactive effluents and the members of the public are provided in IAEA Safety Standards Series No. GSG-9, Regulatory Control of Radioactive Discharges [10]. The source term for a release of radioactive material to the environment should be evaluated for operational states and accident conditions as	We suggest to add more information on what the source term for current tasks/in current case is.	X	6.22 The source term for a release of radi-oactive material to the environment should be evaluated for operational states and accident conditions as rec-ommended in paras 2.16–2.19 of SSG-2 (Rev. 1). ~~Further information on sources of radiation and source terms in differ-ent plants could be found in DS524.~~		Neutral statement and reference to SS under revision is not practical at this point.

		recommended in paras 2.16–2.19 of SSG-2 (Rev. 1). Further information on sources of radiation and source terms in different plants could be found in DS524.					
13	4.4.(d)	o The following is suggested. (before) (i) Plant specific corrosion mechanisms of construction materials; (after) (i) Plant specific corrosion mechanisms of materials in the primary system	o The primary water chemistry regime is the primary system in NPP. So, I think that it is clearer. It is recommended that construction materials are replaced.	X			
14	4.5	The chemistry programme should include documentation to serve as a basis for the selection, monitoring and analysis of the chemistry parameters. The instructions for the chemistry programme should be aligned with the operational limits and conditions (see also IAEA Safety Standards Series No. SSG-70, Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants [11]). These instructions should explicitly define graded limit values for specific chemistry parameters enabling	Corrective actions should be described but not necessarily in the operating procedures. Other plant documentation may describe those actions (for example Technical Specifications or Chemistry Guidelines).	x			

		efficient implementation of the chemistry programme. The plant ~~operating procedures~~ documentation should describe potential corrective actions relating to water chemistry to be applied at various operational stages.					
15	4.6.(b)	A plant specific chemistry regime should be developed in accordance with the plant design and safety analysis to contribute to safe plant operation during all operational states~~, design basis accidents and design extension conditions~~. The managers of the chemistry programme should understand any proposed design changes and the consequences of these changes for the chemistry programme, updating the programme accordingly if necessary. Any changes in the design basis documents relevant to the water chemistry programme should be approved by the managers.	The chemistry regime is not intended to deal with accident conditions. Those conditions are within the scope of the preparedness requirements.			X	Chosen chemistry regime should ensure that SSC will function also during accident conditions, e.g. sump clogging due to used materials in containment vs spray water
16	4.6.(c)	The chemistry programme should be regularly reviewed to take into account operating	Clarification	X	(c) The chemistry programme should be		Text modified during English language review at IAEA.

		experience, including good practices, from other utilities and Member States (e.g. feedback on operating events, research results, revised standards)~~,~~ The conclusions of the review should be ~~the~~ documented ~~conclusions~~ and the improvements incorporated into the chemistry programme, when considered beneficial. Managers and supervisors of the chemistry programme should regularly review available internal and external information on operating experience. The information on operating experience and the results of these reviews should be made available to relevant chemistry personnel.			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, revised standards); and the documented conclusions and the improvements incorporated into the chemistry programme, when considered beneficial.		
17	4.6.(d)	New nuclear power plants should benefit from the experience of other similar plants in the selection of materials, equipment and water chemistry programmes, for example to minimize the source term during plant operations and later on during decommissioning phase.	There are other areas concerned, not only source term minimization. For example, reducing waste.	X			

18	4.6 (d)	New nuclear power plants should benefit from the experience of other similar plants in the selection of materials and water chemistry programmes to minimize the source term during plant operations and later on during decommissioning phase (see also para. 4.3).	Please add some additional information to explain the source term.			X	The new information would be a neutral statement and cannot no be used in Safety Standard
19	4.6.(n)	The chemistry department should provide information ~~on~~ to the plant ageing management programme to ensure the safe and long term operation of the SSCs.	Clarification	X			
20	4.6.(q)	The selection of new construction materials for modernization or refurbishment activities should be carefully considered to minimize the ~~dissolution~~ generation of corrosion products and their subsequent activation in the reactor core.	The term "generation" is more appropriate, rather than the term "dissolution".	X	..generation and subsequent dissolution of corrosion…		
21	4.6.(z)	The chemistry programme should include clear expectations and instructions for SSC preservation during ~~commissioning and~~ outages (see Annex).	Commissioning is already mentioned in 4.6.(y).	X	..clear chemistry expectations and instructions for SSC preservation periods (see the Annex).		
22	5.1	The purpose of chemistry control is to ensure that systems within the scope of the chemistry	Clarification	X			

		programme are operated in accordance with the appropriate chemistry regime. The chemistry regime depends on the design of the plant and on the construction materials used. Chemistry control should be continuously improved by taking into account up-to-date knowledge, research results and operating experience.					
23	5.3	To achieve effective chemistry control in all water cooled reactor types, the managers of the chemistry programme should define detailed chemistry parameters to be followed ~~in all water cooled reactor types~~. These parameters should be developed taking into consideration their potential safety importance. All parameters should be based on adequate technical knowledge and international nuclear industry experience	Clarification			X	IAEA English language check approved current version
24	5.6	To enable the implementation of corrective actions in a timely manner, the chemistry department	Please add: If continuous monitoring is unavailable, sufficient sampling should be implemented.	X			

		should use sufficiently sensitive and accurate analytical techniques and should select appropriate monitoring frequencies of control parameters. If continuous monitoring is unavailable, sufficient sampling should be implemented.	It is very important that there are substitutive procedures in place in case of the continuous monitoring is unavailable.				
25	Chapter 5, para 5.11	"The chemistry department should continuously analyse trends in control and diagnostic parameters and react proactively if adverse trends are identified. Trending should be performed to identify deviations in both short term and long term perspectives.	Clarification	X			
26	5.12b	The nominal operational levels of the most important activation and corrosion product activities in the primary-, secondary- and auxiliary systems should be determined. Any deviations from the nominal values should be proactively investigated to minimize the harmful effects on the radiation fields and radioactive discharges.	After the latest revision 5.12 does not include corrosion and activation products surveillance. This addition is needed to emphasize the holistic surveillance of power plant radiochemistry.			X	Agree and therefore this topic is addressed in various places: 5.27-5.31, 5.42, 5,56 c, 5.64 etc. and in 7.19. Perhaps the text does not clearly indicate surveillance but actions mentioned in the document not possible without it.

27	5-13	Radiochemistry parameters should be systematically monitored, analysed for trends, evaluated and — in case of deviation —correlated with chemical and operational data and in relation to occupational exposure and environmental discharges, such as pH at operating temperature (pH_T) and thermal power in the following stages: (a) Power operation (primary and secondary coolant); (b) Transients (primary coolant); (c) Shutdown (primary coolant); (d) Outages (primary coolant); Tools should be available to enable the detection of fuel leakage and provide information about its severity.	In order to be: Comprehensive ("and in relation to occupational exposure and environmental discharges") and consistent with 5-14 for the bullets.	X	Radiochemistry parameters should be systematically monitored, analysed for trends, evaluated and — in case of deviation — correlated with chemical and operational data the following stages: (a)Power operation (primary and secondary coolant); (b)Transients (primary coolant); (c)Shutdown (primary coolant); (d)Outages (primary coolant); Radiochemistry parameters should be taken into account when occupational exposure and environmental discharges are evaluated.		To improve clarity

					Tools should be available to enable the detection of fuel leakage and provide information about its severity.		
28	5.15	During outages, ~~chemistry~~ equipment and systems should be maintained under adequate lay-up conditions and in accordance with Requirement 32 of SSR-2/2 (Rev. 1) [1]). Further information on preservation conditions is provided in the Annex. Lay-up parameters should be monitored and documented, and corrective actions should be implemented, if needed.	Clarification	X			
29	5.32&5.46	The concentration of activated corrosion products in the boiling water reactor water and the transport of those products should be minimized. During normal operation, the <u>continuous</u> injection of zinc into the feedwater should be optimized for this purpose, when applicable.	Please add the term continuous. It is known that the zinc injection does not have a history effect (the positive effect fades after one week).	X			
30	5.38	The concentration of dissolved ^{10}B in the	10B depletion is very slow in PWRs and there is no			X	Plant specific, situation is different for plants using

		pressurized water reactor coolant system for controlling core reactivity should be regularly monitored to prevent deviation from normal isotopic depletion. The concentration of boric acid should be monitored using either on-line measurements or grab sample measurements conducted frequently to support control of pH_T of the primary coolant. ~~The concentration of ^{10}B should be verified before preparation of borated solution to ensure that the necessary percentage of ^{10}B is present in the boric acid.~~	need to verify the 10B concentration each time a borated solution is prepared.				enriched boric acid and others. Furthermore the plant should verify that the product is what they ordered.
31	5.58	5.58. The secondary circuit should be operated with a high pH value, which should be obtained using volatile alkaline reagents such as ammonia and/or amines (e.g. morpholine, 2-aminoethan-1-ol, dimethylamine, hydrazine,). The pH value of the secondary side water is plant specific and should be such that an appropriate pHT value is ensured throughout the	Hydrazine, even if being carcinogen, is still commonly used in PWR secondary systems and should also be mentioned in the parentheses.	X	organization. 5.57.The secondary circuit should be operated with a high pH value, which should be obtained using volatile alkaline reagents such as ammonia and/or amines (e.g. morpholine, 2-aminoethan-1-ol, dimethylamine,		

		secondary circuit. The concentration of alkaline chemicals should be specified and verified.			hydrazine). The pH value		
32	5-61	The levels of deleterious impurities (e.g. sodium ions, chloride ions, sulphate ions, lead ions, copper ions, total suspended solids, suspended iron) in the steam generator water should be measured and kept as low as possible. As impurities accumulate in the steam generators during steady state operation, blow-down limits should be established either for each impurity or through a representative indicator (e.g. cation conductivity).	because it gives the impression that we are only going to monitor ions	X			
33	6.1.(a)	Continuous ~~increasing~~ reduction of dose rates in the plant over time;	Clarification	X			
34	6.1	6.1. The optimization of the chemistry regime should contribute to reducing radiation exposure by the following means:	I disagree with such a statement. The chemistry regime should contribute to dose rate reductions, that's ok, but not increasingly. That's not possible!	X	Continuous reduction of dose rates in the plant over time		

35	6.2	Specifications for all important radiochemistry parameters should be established and applied during different operating modes to ensure that doses to personnel are in compliance with the dose limits and that the radiation exposure of personnel is kept as low as reasonably achievable and within regulatory requirements.	Please add that doses should be within regulatory requirements.	X			
36	6.3.(a)	The application of a suitable chemistry regime to minimize ~~dissolution~~ generation of corrosion products, deposition of corrosion products in-core and their subsequent transport to surfaces of SSCs.	The term "generation" is more appropriate, rather than the term "dissolution".	X	..generation and subsequent dissolution of corrosion…		
37	6.6	Chemistry control should minimize the deposition of nickel into the reactor core during steady state operation and efficiently dissolve 58Co during shutdown procedures.	Editorial correction.	X	..periods.		
38	6.7	Programmes for the replacement of Stellite™ (typically 57% cobalt) and other cobalt-containing hard-facing alloys, as well as silver and materials containing antimony should be considered, where practicable. The chemistry department should be part of the	We suggest to add "cobalt-containing hard-facing alloys", to be more general, as Stellite™ is one trademark and there could be further manufactures.	X			

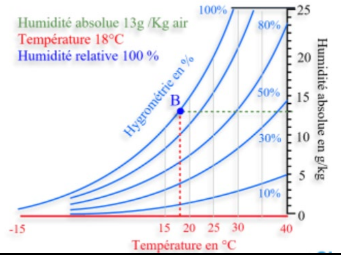
		approval process when new equipment and materials are being approved for use in plant systems.					
39	6.11	Harmful chemical species (e.g., oxygen, ~~hydrogen,~~ halogens, ~~alkali~~, corrosion products, ~~additives such as zinc~~) and chemical additives (e.g., hydrogen, alkali, zinc) should be strictly controlled to minimize fuel cladding deterioration.	For clear understanding	X			
40	6.17.	Extensive chemical decontamination processes should be avoided in order to prevent ~~high dissolution rates~~ the deterioration of the surface of primary circuits including a stable protective oxide layer of the primary circuit. After chemical decontamination of larger primary circuit components or the full system, proper rinsing and/or re-passivation of system surfaces should be performed to avoid extensive deposits of corrosion products on fuel surfaces that could have an increased risk of fuel cladding failure and potential power shifts. Water should be purified to remove corrosion products.	The subject of "dissolution rate" is unclear. In SSG-13 para. 5.23, "In primary circuits, the extensive use of chemical decontamination processes should be avoided in order to minimize deterioration of the protective oxide layer on the surfaces, …", and what should be described in this para may be like that. Explanation about "deterioration of the surface" is added.	X	..prevent too high dissolution rate of the protective oxide films on the primary circuit.		

41	7.1 Line 6	…. The scope and frequency of chemistry and radiochemistry monitoring activities during commissioning, various operating modes (e.g. startup, shutdown, operation at stable power levels) and outages, as well as in transient conditions, should be specified by the chemistry department in the relevant plant documentation and procedures. The same applies to accident conditions and decommissioning.	Please indicate that the same applies to accident conditions and decommissioning.	X			
42	7.2	The frequency with which chemistry and radiochemistry measurements are taken should be defined taking into consideration the rate of change of parameters, ~~compared to~~ the time scales for actions associated with graded limit values, the safety importance of SSCs, aggressiveness of the measured impurities and operational modes.	Clarification			X	Clear enough
43	7.3	The chosen analytical method should provide sufficient sensitivity in the expected and graded limit values concentration	Clarification, as “components” is typically reserved for SSC.	X			

		ranges. The 'matrix effect' (the effect of other ~~components~~ ingredients in the sample) should be determined and corrections made, if necessary.					
44	7.4	The chemistry and radiochemistry measurements should be used to detect trends in the chosen parameters, to discover and eliminate undesirable effects and to minimize the consequences of deviations in chemistry parameters. The measurements should be taken at all stages in the lifetime of a plant, including commissioning, startup and shutdown periods, and when systems are taken out of operation for long periods or during decommissioning.	Please add "decommissioning" as well.	X			
45	7.7	The ~~most important~~ control parameters should be measured using on-line monitoring techniques, if applicable.	On-line monitoring is constrained by the technical limitations of the on-line instrument.			X	Due to the potential technical limitations mentioned in your comment, only the most important control parameters should be measured on-line
46	7.9 Line 5	All on-line and laboratory analysis procedures should include the following:	Clarification			X	IAEA language check OKed

		(a) Description of tThe intended use of the procedure;					
47	7.13	Monitoring equipment should be calibrated at regular intervals, at a frequency decided on the basis of the manufacturers' specifications, plant experience or equipment control charts. The calibration should be checked regularly with a control standard. The concentration of the control standards should be close to the expected value. The results of the calibration checks should be ~~graphically displayed in control charts with~~ analysed against appropriate control and warning limits. Depending on the analytical method applied, calibration control measurements should be performed before and/or after each analytical run.	The important action is to analyse the results of the calibration checks to make sure they are within the control limits. This can be done by other means than a graphical display in control chart.	X			
48	7.17	The activity of fission products should be measured to confirm the fuel integrity, identify fuel cladding leaks and get an estimation of the severity of leaks. The following should be taken into consideration for	We suggest to change to "task"	X	.. consideration for the conduct of these tasks:		

		performing these tasks ~~measurements~~:					
49	7.41.(f)	~~Specification~~ Identification of the chemistry parameters to be monitored.	The chemistry parameters to be monitored should be identified, but they are not associated with specifications as in normal operation.	X			
50	9.15	Chemicals should be stored appropriately, in accordance with plant documentation, for example in a cabinet that is fire resistant and that catches spillages. The chemical storage area should have a safety shower~~, in accordance with plant documentation,~~ and waste disposal procedures. Oxidizing and reducing chemicals, flammable solvents and concentrated acid and alkaline solutions should be stored separately. Reasonably small amounts of approved and properly labelled chemicals can be stored in other controlled environments.	Clarification	X	9.15. Chemicals should be stored in an appropriate cabinet which is, for example, fire resistant and captures spillages. A safety shower should be in place in accordance with national regulatory requirements, plant design and documentation.		
51	*FIG. A–1.*	*Generic flow chart showing the potential steps in a preservation process. RH — relative humidity at T =x °C (T has to be indicated in the figure with RH); γ —*	because a relative humidity value is only valid for a given temperature			X	The temperature relation is clearly given in the text below

<table>
<tr><td></td><td></td><td>conductivity; critical parameters — the chemistry parameters needed for successful lay-up</td><td>
</td><td></td><td></td><td></td><td></td></tr>
<tr><td>52</td><td>A–2</td><td>It is common to have many plant systems and components open and exposed to air when they are inspected, maintained and repaired during outages. Depending on the actions taken by plant personnel, the internal surfaces of plant systems and components will be exposed to different types of environment<s>s</s> for various lengths of time.</td><td>“environment<s>s</s>” in plural or singular? Please check</td><td>X</td><td>According to IAEA language review environments is OK.</td><td></td><td></td></tr>
<tr><td>53</td><td>A-21</td><td>Flushing is typically done either by blow-out or by recirculating the coolant through the system. Independent of the method, it is important to have an adequate flow rate to remove any particulates or chemicals that might reside in the system. The water quality of the flushing media needs to be equal to or better than the water quality used during normal operation. If the system is an in-line system</td><td>Clarification</td><td>X</td><td>. If the system is an in-line system, then it needs to be lined up to water purification equipment which has to be optimized to remove effectively the impurities expected to exist in the flushing media.</td><td></td><td></td></tr>
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		~~(i.e. the purification system is built in)~~, the water purification equipment needs to be lined up with the flushing media and optimized for the effective removal of expected impurities.					
54	A-30	Air quality is checked ~~regularly~~ during dry lay-up. Dry and clean air, free of oil and dust, need to be used throughout the process. Humidity criteria are established and humidity is monitored to ensure that residual moisture on surfaces remains at acceptable levels.	Most of the time, air quality is checked at the beginning of sweeping. Then, regularly during dry lay-up, humidity is controlled.	X	A–27. When implementing dry layup, the air quality has to be checked. Dry and clean air, free of oil and…		
55	A-31	When a dry lay-up is complemented by the use of inert gas overpressure, measurements are taken to ensure that overpressure is maintained. If desiccants (i.e. substances able to adsorb water) are used, they need to be carefully handled to reduce the risk of introducing impurities or foreign materials into the systems and the equipment. Consideration needs be given to the material compatibility of the desiccant (or desiccant bag) with metal surfaces.	Desiccants are not used to reduce risk of introducing impurities or foreign material. That risk is higher when using dessicants. Hence, the use of dessicants is very helpful to keep a low relative humidity, but they have to be handled carefully.	X	If desiccants (i.e. substances able to adsorb water) are used they have to be carefully handled to reduce the risk of introducing…		

56	A-37	For wet lay-up, two media can be used : demineralized water, or water conditioned with chemicals ~~can be used~~ to obtain the necessary pH and reducing conditions. The method is chosen on the basis of the type of material present in the system and on the length of the preservation.	The use of demineralised water without chemicals does not allow to obtain the necessary pH and reducing conditions. This is done only with water conditioned with chemicals.	X			
57	A-38	For neutral wet lay-up (i.e. without chemicals), low enough (precisely defined) conductivity conditions need to be achieved prior to preservation. For alkaline wet lay-up, ammonia and/or an amine and ~~or another~~ possibly a reducing agent ~~is~~ are added to the demineralized water. Clear acceptance values need to be defined for selected impurities in these chemicals, and attention needs to be paid to the management of the chemicals used in the lay-up.	For alkaline wet lay-up, the following chemicals are usually added : • Ammonia and/or an amine to get the necessary pH; A reducing agent to get reducing conditions. However, recent studies tend to show that a high pH can be sufficient to preserve the equipment without any reducing agent.	X	For alkaline wet preservation, amine and/or an amine as well as reducing agent is added to the demineralized water.		
58	A-39	During neutral wet lay-up, a programme for monitoring conductivity and the concentration of predefined ~~an~~ions and iron needs to be implemented. During alkaline wet lay-	Cations and anions are likely to be monitored.	X			

		up, the pH, as well as the concentration of reducing chemicals, predefined ~~an~~ions and iron need to be checked regularly. In addition, target values and limit values for those parameters need to be defined, taking into account the analytical performance of the monitoring equipment. For representative sampling, sufficient recirculation of the lay-up medium needs to be ensured when possible.					
59	Sub-title	*Monitoring of ~~neutral~~ wet lay-up*	Under that sub-title, A-41 deals with neutral wet lay-up, but A-42 deals with alkaline wet lay-up.	X			
60	A–41 Line 6	(c) Checking that the system is fully filled (e.g. once per day at the beginning and once per week after a steady state is reached ~~once per week~~);	Typo	X	A-38 (c)		
61	*A-41*	A-41 The following steps could be taken to ensure effective wet lay-up without additives: A Checking the quality of demineralized water before filling the system, including checking the concentration of corrosion inducing ions (e.g fluoride, chloride, sulphate, cation	because it gives the impression that we are only going to monitor anions	X			

		conductivity at 25°C, sodium)					
62	A-47	A~~n~~ review of the actions taken during preservation should be conducted and documented, with a view to preventing the reoccurrence of the same transients. The collective documentation of each system preserved needs to be shared with the plant's ageing management personnel or experts once the preservation period is over.	Typo	X	A–44. An effectiveness review of the actions taken should be documented so that reoccurrence of the same transient is prevented….		