Safety of Nuclear Fuel Cycle Research and Development Facilities DS381

Master Resolution Table

COMMENTS BY REVIEWER Reviewer: **Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)** (with comments of GRS) Page 1 of 30 Country/Organization: **Germany** Date: 2015-01-05				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	General	Therefore, it is proposed to replace 'basic safety functions' by 'main safety functions' to be consistent in terminology within new IAEA Safety Standards. The superordinate Safety Requirements NS-R-5 (Rev. 1) only refer to 'safety functions'.	In this Safety Guide, the term 'basic safety function' is used. In a few recently published IAEA Safety Standards, however, the term 'main safety functions' is introduced, e.g. in the Safety Guide SSG-30 "Safety Classification of Structures, Systems and Components in Nuclear Power Plants" (2014).	Y, *main* is the preferred term			
02	02.002	1st bullet: "The radiological consequences caused by the release of radioactive materials under accident conditions can be significant. ~~While the radiotoxicity of uranium is relatively low, this is not the case for plutonium or other radionuclides.~~"	The second sentence should be deleted. In nuclear fuel cycle R&D facilities, exposures of workers to U and/or Pu may often involve a complex mixture of isotopes with different decay properties. The tables III.2A (for workers) and III.2D (for members of the public) in Schedule III of GSR Part 3 show that the radiotoxicity of U and Pu is roughly in the same order of magnitude:	Y			

			1. The committed effective doses $e(g)$ per unit intake via ingestion are in the same order of magnitude for U nuclides and Pu nuclides, respectively. 2. For a few Pu nuclides, the committed effective doses $e(g)$ per unit intake via inhalation are higher than those for the U nuclides. 3. However, the gut transfer factors f_1 (used for the calculation of inhalation dose coefficients and ingestion dose coefficients, respectively) for Pu compounds are lower than those for U compounds (tables III.2B and III.2C).				
03	02.002	2nd bullet: "Furthermore, fissile materials have the potential to achieve criticality under certain conditions. The subcriticality of a system depends on many parameters relating to the fissile material, including its mass, concentration, geometry, volume, enrichment and density. Subcriticality is also affected by the presence of other materials such as moderators, absorbers and reflectors [12]."	The presence of moderators, absorbers and reflectors play an important role with respect to criticality. This bullet provides a link to Para 1.3 of the Safety Guide SSG-27 "Criticality Safety in the Handling of Fissile Material".	Y			
04	02.004	1st sentence: "The term '~~L~~licensing documentation' (or 'safety case'), including the safety	Maintain consistency with Paras 2.9 and 2.10 (first sentence each) of the Safety		Clarified throughout.		

		analysis report ~~case~~ and the operational limits and conditions (OLCs), is defined in paragraphs 2.9–2.15 of Ref. [1].”	Requirements NS-R-5 (Rev. 1). In the context of nuclear fuel cycle facilities, the terms ‘licensing documentation’ and ‘safety case’ are used synonymously, see footnote No. 2 in NS-R-5 (Rev. 1).		Footnote added.		
05	02.007	“The safety approach (as documented in the safety analysis report) for a R&D facility should provide the same level of safety assurance whether the R&D facility comprises a laboratory in a university, or a large established nuclear R&D center. ~~This equivalence of standard is achieved by application of a graded approach.~~”	The current text could be misleading. In fact, the graded approach does not take into account the type of the operating organization (such as university, large research center, industrial R&D department, etc.). Therefore, it is proposed to delete the last sentence.		Paragraph re-written to focus on the type of activity, not the operating organization.		
06	02.008	1st sentence: “When deactivating or reactivating parts of an existing R&D facility~~’s nuclear facilities or equipment~~, the safety assessment of the facility should be reviewed and updated and should cover potential legacy waste and decommissioning needs as far as achievable.”	Streamlining of text without loss of information.	Y			
07	02.010	“R&D facilities are normally established for a variety of different R&D programmes. Before starting a new programme, the operator should verify that the new programme is either covered by the existing license ~~facility safety case~~, or otherwise is subject to a suitable modification with an appropriate authorization, as described later in this Section.”	From a regulatory point of view, it is much more important whether a new R&D programme is covered by the existing license and the conditions specified therein. If this is not the case, the operator has to apply for a license revision.	Y			

08	02.011	2nd to 4th sentence: "When there is change of use of a R&D facility (or part of), an appropriate modification programme ~~change modification process~~ should be ~~applied~~ implemented, with peer review by suitably qualified personnel. ~~Moving from laboratory scale to pilot plant usage would be an example of this situation.~~ Where the increase in scale is large, the operating organization should plan the increase in stages where possible, in order to permit feedback and validation of each stage."	2nd sentence: In the context of the Safety Requirements NS-R-5 (Rev. 1), "*a modification is a deliberate change in or an addition to the existing facility configuration, with potential safety implications, intended for continuation of the facility's operation*" (see footnote No. 3). Keeping this in mind, the usage of a circular definition should be avoided. Our proposal for revised wording is provided at the left. Note that different terms are used in other Safety Standards: • 'modification process' in NS-G-2.3 "Modifications to Nuclear Power Plants" (2001); • 'modification programme' in SSR-2/2 "Safety of Nuclear Power Plants: Commissioning and Operation" (2011); • 'modification project' in NS-R-4 "Safety of Research Reactors" (2005) and SSG-24 "Safety in the utilization and modification of research reactors" (2012). 3rd sentence: It is proposed to delete this sentence. When moving	Y			

			from laboratory scale to pilot plant usage, usually a new license for the pilot plant is required (see also our comment on Para 2.12). 4th sentence: When scaling from a laboratory scale to a pilot plant, the scaling cannot always be done in small steps.				
09	02.012	1st sentence: "According to the safety significance of the modification and in agreement with the national regulatory authority, modifications should be verified, approved or licensed by the regulatory authority before implementation."	The recommendation provided is too weak. Depending on the safety impact of the modification, an approval or license revision may be necessary, i.e. verification alone is not sufficient.		Registered or licensed inserted. Approval and authorization are very similar to licensing.		
10	02.014	"The licensing documentation should ~~provide for the on-site emergency~~ demonstrate that the arrangements for emergency preparedness and response are commensurate with the hazards associated with the facility in accordance with Ref. [7] and Ref. [27]."	Our clarification aims to emphasize that the licensing documentation of the R&D facility should demonstrate safety, including adequate provisions for emergency preparedness and response.	Y			
11	02.015	2nd sentence: "Paragraph 4.7 of Ref. [1] goes on to state that "The operating organization shall clearly specify the responsibilities and accountabilities of all staff ~~personnel~~ involved in conducting or controlling ~~the control or conduct of~~ operations that affect safety. The person with the responsibility for direct supervision ~~overall safety management~~ shall be clearly identified at all times ~~and suitably appointed~~"."	Correct citation of Para 4.7 of the Safety Requirements NS-R-5 (Rev. 1).	Y			

12	02.016	"The management processes and organizational provisions should reflect the requirements of Ref. [1] and also those of Ref. [8]. ~~The licensing of R&D facilities should be based on a complete and adequate safety case produced by suitably qualified personnel. This safety case should include OLCs and a listing of the procedures to be followed in accordance with Section 9 of Ref. [1].~~"	The last two sentences are more a guidance on licensing rather than on management of safety. However, as they are considered to be important, it is proposed to delete them here and place them as a new paragraph in the subsection "R&D facility licensing" (Paras 2.3–2.14).	Y, moved to para 2.4			
13	02.017	"These processes and provisions apply throughout the lifetime of the facility and/or experiment, from its siting to its decommissioning. Paragraph 9.29 of Ref. [1] provides additional requirements applying to the maintenance of SSCs. ~~Systems that should continue to operate to maintain the R&D facility and/or experiment in a safe state include:~~ ~~– Heat removal systems in storage areas to remove decay heat from heat producing materials, and in heat producing experimental apparatus;~~ ~~– Dynamic containment systems (i.e. ventilation) should continue to operate to prevent radioactive material leakage from the facility;~~ ~~– Safety monitoring systems;~~ ~~– Inert gas feed systems e.g.: to hot cells or glove boxes.~~"	The last sentence is more a guidance on design to maintain a safe state rather than on management of safety. However, as this sentence is considered to be important, we propose to delete it here and to place it as a new paragraph in Section 4 "Design".	Y, moved to para 4.8			
14	02.018	"R&D facility personnel should always be aware of the fact that technical installations can fail, even if the design is robust. An attitude of technical inquisitiveness and conservatism ~~(e.g. built in redundancy)~~ is an important contribution to safety culture and should	Redundancy is a design principle for improving the reliability of systems important to safety. As this paragraph is more dealing with the attitude of the personnel, no further	Y			

		be maintained by adequate training.”	explanations on how to consider conservatism in the design is necessary here.				
15	02.021	“A safety analysis should be performed in which ~~potential accidents~~ postulated initiating events are analyzed to assure that accidents ~~they~~ are adequately prevented, detected and their consequences are mitigated. ~~A graded approach should be taken to the safety requirements as outlined in Paragraph 1.14 of Ref. [1].~~”	1st sentence: Safety analyses are performed for postulated initiating events (e.g. anticipated operational occurrences, design basis accidents, or design extension conditions). 2nd sentence: Deletion is proposed since the 1st sentence addresses the rationale of a safety analysis, and this rationale cannot be graded.	Y Y			
16	02.022	“~~For the implementation of the defense in depth requirements (Section 2 of Ref. [1]), the first two levels are the most significant, as the risks are mainly eliminated by design and appropriate operating procedures (see Sections 4, 6 and 7 of Ref. [1]). However, all levels of Defense in Depth should be considered.~~”	This paragraph is not related to safety management, but explains the concept of defence in depth in more detail. As this paragraph is considered to be important, we propose to delete it here and to place it as a new paragraph in Section 4 “Design” after Para 4.1.	Y			
17	02.024	“Due consideration should be given to the minimization~~, segregation~~ and processing (i.e. pretreatment, treatment and conditioning) of radioactive wastes that will be produced during operation and decommissioning of the R&D facility, as well as any legacy material.”	According to the IAEA Safety Glossary (2007 Edition), the term ‘processing’ is more comprehensive and covers ‘pretreatment’, ‘treatment’ and ‘conditioning’. Segregation of waste is part of pretreatment operations.	Y			

			See also our related comment on Para 4.128 (e).				
18	02.026	"In a R&D facility, the use of remote handling operations, adequate shielding and confinement of contaminated atmospheres should be considered to reduce occupational exposures from radioactive materials and to ensure safe operations, especially in experiments using highly toxic or radioactive materials."	In addition to remote handling operations, proper shielding and confinement of contaminated atmospheres should be considered as well for protection against radiation exposure. Compare with Para 6.40 of the Safety Requirements NS-R-5 (Rev. 1) which states: "*Protection against radiation exposure shall be achieved by means of engineered provisions such as adequate shielding and the use of remote handling equipment.*"	Y			
19	03.003	"Requirements for the evaluation of a site for a Fuel Cycle R&D Facility are provided in Ref. [13]. Where the facility is a pilot for a Fuel Cycle Facility of another type, reference should also be made to the relevant Specific Safety Guide, e.g. Ref. [20], Ref. [23] or Ref. [24]."	For completeness. There is no reason to favor a particular reference over the others. Compare with Para 4.127.	Y			
20	04.002	"**Main ~~Basic S~~safety functions for R&D facilities**"	See our general comment No. 1.	Y			
21	04.002	"The main ~~basic~~ safety functions (see paragraphs 6.37 to 6.53 and paragraphs V.1 to V.10 in Appendix V of Ref. [1]) are those functions, the loss of which, may lead to radioactive releases or exposures having possible radiological consequences for workers, the public and/or the environment, namely:	In a few recently published IAEA Safety Standards (e.g. in the Safety Guide SSG-30), the term 'main safety functions' is used. For the sake of consistency, it is proposed to replace 'basic safety functions' by 'main safety functions'.		As requested, "Basic" changed to "main", for consistency. However the list of functions has been retained for consistency with		

		(1) Prevention of criticality; (2) Heat removal from ~~Confinement of~~ radioactive material~~, including removal of decay heat~~; (3) Confinement of radioactive material, including ~~P~~protection against external radiation exposure~~;~~.”	It is recommended to change the order of the main safety functions to be consistent with the usual order in other IAEA Safety Standards (for NPPs) and in the IAEA Safety Glossary (2007 Edition), i.e. 1. Control of reactivity; 2. Cooling of radioactive material; 3. Confinement of radioactive material. In general, heat removal is also a main safety function and not only a safety function related to the confinement of radioactive material. Our proposal aims for improving consistency with the definition of the term ‘main safety functions’ in the IAEA Safety Glossary.		NS-R-5 and other related guides. Added sentence to section on loss of cooling instead.		
22	04.006	2nd sentence: “The definition and the specific safety requirements relating to design basis accidents are established in Ref. [1] at paragraphs 6.4–6.9, V.1 of Appendix V and ~~III.10~~ III-10 of Annex III to ensure that …”	Wrong paragraph is cited. Para III.10 belongs to Appendix III. The definition of a DBA is given in Para III-10 of Annex III.		Added to footnote.		
23	04.006	Last sentence: “Ref. [18], ~~and~~ Ref. [19] and Ref. [31] provide guidance on the relevant DBEs.” Add the Safety Guide SSG-21 to the list of references: “[31] INTERNATIONAL ATOMIC	The Safety Guide SSG-21 provides guidance on the relevant DBEs in relation to volcanic hazards. For the sake of completeness, a reference to this publication should be included here.	Y			

		ENERGY AGENCY, Volcanic Hazards in Site Evaluation for Nuclear Installations, Safety Standards Series No. SSG-21, IAEA, Vienna (2012)"					
24	04.007	"In addition to the radiological hazards outlined above, particular consideration should be given to the following hazards: (a) Internal and external human induced phenomena such as ~~F~~fire, ~~or~~ chemical explosion or accidental aircraft crash; (b) Natural phenomena such as earthquakes, tsunami, flooding or tornadoes~~;~~. ~~(c) Aircraft crash.~~"	By means of the simplified structure, we propose to clarify that the facility could be endangered by natural hazards and human induces hazards. The latter ones can be internal or external to the plant. An accidental aircraft crash represents a human induced hazard. Therefore, it can be placed under bullet (a).	Y			
25	04.008	"Some of the internal events listed in paragraph 4.7 may occur as a consequence of a postulated initiating event (PIE) and a selection of PIEs is listed in Annex I of Ref. [1]."	To clarify that only internal events could be initiated by PIEs. External hazards are completely independent from PIEs.		Para 4.8 rewritten		
26	04.009	Last sentence: "Annex II ~~in Ref. [1]~~ of this Safety Guide presents examples of representative events that may challenge the associated safety functions."	Annex II in NS-R-5 (Rev. 1) deals with the availability and reliability principles to be applied in fuel cycle facilities, but presents no examples of events. Instead, it should be referred to Annex II in this document (see analogous Para 4.13 in the Draft Safety Guide DS360 "Safety of Nuclear Fuel Reprocessing Facilities").	Y			
27	04.011	1st sentence: "Paragraph 6.45 in Ref. [1] establishes requirements for all fuel-cycle facilities where criticality is considered … and ~~the subsequent~~ paragraph 6.47 states that ~~a~~	Wording; correct citation of Para 6.47 of the Safety Requirements NS-R-5 (Rev. 1).	Y			

		~~fundamental requirement of criticality management is a conservative approach~~ "Criticality evaluations and calculations shall be performed on the basis of making conservative assumptions".”					
28	04.012	“The criticality safety analysis should demonstrate that the design of equipment is such that the values of control parameters are always maintained in the subcritical range for all operational states (i.e. normal operation and anticipated operational occurrences) and during and after DBA conditions. This should be achieved by determining the effective multiplication factor K_{eff}, which depends on the mass, the distribution and the nuclear properties of the fissionable material, and all other materials with which it is associated. The calculated value of K_{eff} is then compared with the value specified ~~by the design limit~~ in national regulations.”	1st sentence: Clarification and consistency with Para 4.6 of the Safety Guide SSG-27 “Criticality Safety in the Handling of Fissile Material”. Last sentence: Limits for the effective multiplication factor K_{eff} are usually defined by the regulatory body. These regulatory limits should be met.	Y See →	…..design limit or national regulations, whichever is the lower.		
29	04.014	1st bullet: “A conservative approach, taking into account: ○ Uncertainties in physical parameters, optimum moderation conditions and potential non-homogenous distributions of moderators; ○ Anticipated operational occurrences ~~Potential operating abnormalities~~ and their combinations, if they cannot be proven to be independent; ○ Facility states~~, e.g.~~ that may result~~ing~~ from external and internal hazards.”	1st item: Editorial (missing word). 2nd item: Use of correct terminology. We assume that the term ‘potential operating abnormalities’ should mean ‘anticipated operational occurrences’. 3rd item: From a regulatory point of view, the current recommendation is too narrow.	Y Y Y			

			In addition to external hazards, the criticality safety analysis should also take into account facility states that may result from internal hazards. This is in line with Para 4.6 of the Safety Guide SSG-27.				
30	04.014	2nd bullet: "Appropriate computer codes that are verified ~~&~~ and validated (i.e. compared with benchmarks to determine the effects of code bias and code uncertainties on calculated K_{eff}) within their applicable range and using appropriate cross section libraries. Detailed guidance is provided in paragraphs 4.20–4.25 of Ref. [12]."	Verification is the process of determining whether a calculation method correctly implements the intended mathematical model. Validation is the process of determining whether the overall calculation method adequately reflects the real system being modelled, and enables the quantification of any code bias and uncertainty, by comparing the predictions of the model with observations of the real system or with experi-mental data. The Safety Guide SSG-27 provides further guidance on the verification and validation of computer codes. Therefore, we propose to include a reference to this publication.	Y			
31	04.019	2nd sentence: "There ~~are~~ is a specific requirement for the design of ~~safety systems and components~~ SSCs to ~~reduce~~ minimize	For ensuring consistency with Para 6.19 of NS-R-5 (Rev. 1), the word 'reduce' needs to be replaced by		There is a specific requirement for the design of		

		exposure during maintenance in paragraph 6.19 of Ref. [1].”	‘minimize’.		items important to safety to minimize exposure during maintenance, see paragraph 6.19 of Ref. [1]		
32	04.026	1st sentence: “In accordance with paragraphs 6.37–6.38 of Ref. [1], containment should be the primary method for protection against the escape of contamination.”	For completeness.	Y			
33	04.030	Please add new last sentence: “The dynamic containment should create a gradient of reducing absolute pressures (i.e., creating negative pressure) between the environment outside the building and the radioactive or hazardous material inside the hood, hot cell, or glove box. Backflow of gaseous or particulate contamination should be prevented. The exhaust air should be filtered (see paragraph 4.34).”	Creating a pressure gradient is not sufficient. The exhaust air needs to be filtered. Further guidance on an adequate filter system is provided in Para 4.34. We recommend to include a link to this paragraph.	Y			
34	04.035	Last sentence: “The ventilation system should be designed according to accepted standards, e.g. those of the International Organization for Standardization (ISO) and ~~the American Society of Mechanical Engineers (ASME)~~ national nuclear standards.”	We propose to formulate the last sentence more general. Why promoting ASME standards ? KTA and RRC-M, for example, would also be applicable nuclear design codes.	Y			
35	04.036	1st sentence: “The ~~lifetime of filters and~~ potential for failure of a fully loaded filter should be considered in the safety analysis.”	The lifetime of a filter is an issue rather for maintenance and OLCs than for a safety analysis.	Y. Sentence about heavy filter usage added to end of paragraph.			

36	04.043	1st sentence: "The design of any radiation shielding should ensure compliance with occupational exposure targets (see Section 6 and paragraph V.1 of Ref. [1]) based on assumptions regarding …"	Editorial.	Y			
37	04.044	"The design of shielding should consider both the inventory and the location of radioactive materials (including deposited radionuclides). In high radiation areas (such as those handling commercial spent fuel), ~~the design of~~ protection of workers should primarily rely on shielding ~~should consider both source term and location~~. In medium or low activity areas (such as a teaching laboratory), a combination of ~~source term,~~ shielding and administrative controls should be utilized for protection of workers for both whole body and extremity doses. A general design guide is to shield as close as practical to the source."	In this paragraph, it is not clearly written what should be done. The source term is important for radioactive materials releases, typically airborne. The location of radioactive materials is referring to the direct radiation and external exposure. It is proposed to rephrase this paragraph to distinguish between different types of exposure (direct vs. indirect exposure; internal vs. external exposure). Furthermore, it is important to distinguish between the radiological hazards (inventory and location) against the workers should be protected and the protective measures as such (shielding or administrative control).		Accepted with altered word-order		
38	04.045	"For the determination of radiological hazards, ~~Source terms should take into account~~ the potential for radiation from deposited radionuclides inside pipes, equipment, hoods, glove boxes and hot cells should be carefully taken into account. The interior surfaces of equipment such as glove-boxes can be	According to the IAEA Safety Glossary (2007 Edition), the 'source term' is the amount and isotopic composition of material released from a facility. In general, the source term does not take into account	Y			

		covered or coated to prevent accumulation of deposits from processed materials or their daughter products.”	the direct radiation from deposited radionuclides. An increase of the source term can only be achieved due to desorption or resuspension of previously deposited radionuclides.				
39	04.047	2nd sentence: “Further ~~Facility~~ requirements on environmental protection that are also relevant to R&D facilities of specific types are ~~also~~ defined in paragraphs I.9, II.14, III.9, IV.7 and IV.8 of Ref. [1].”	Clarification.	Y			
40	04.048	“POSTULATED INITIATING EVENTS, INTERNAL AND EXTERNAL HAZARDS”	It is proposed to add internal and external hazards to clearly distinguish between a PIE and a hazard. A hazard itself is not a PIE, but can initiate a PIE.		The sub-headings were changed to refer to hazards, not events.		
41	04.050	1st sentence: “The fire hazard analysis should identify any areas that require special consideration ~~in accordance with the graded approach~~.”	There is no need for a graded approach. The necessity for a fire hazard analysis is independent from the radiological risk potential.	Y			
42	04.067	“To fulfil the requirement established in paragraph 6.28 of Ref. [1], electric power supplies to the R&D facility ~~facilities~~ should be robust. In the event of loss of normal power and depending on the status of the R&D facility, an emergency power supply should be provided to certain structures, systems and components important to ~~R&D facility~~ safety, including the following: …”	Editorial.	Y			
43	04.073	1st sentence:	In our opinion, citation of	Y			

		"Requirement 10 of Ref. [11] requires an assessment that structures, systems and components are sufficiently robust, and includes lifting equipment that should be assessed."	GSR Part 4 is too vague. In order to be more specific, please refer to a certain requirement or paragraph, e.g. Requirement 10 or Para 4.32.				
44	04.074	"Mechanical or human failures during the handling of radioactive material may result in degradation of criticality control, confinement or shielding. Dropped loads are included as postulated initiating events in Annex I of Ref. [1] and their possible consequences should be minimized (see paragraph IV.42 of Ref. [1]). Mechanical or human failures during the handling of non-radioactive loads may result in degradation of R&D facilities safety functions. Safe travel paths should be provided and floors designed to withstand a dropped load. Hosting devices should be designed in such a way that a load drop become extremely unlikely to occur with a high level of confidence. Containers should be designed and qualified to maintain containment and protect their contents wherever appropriate."	It is proposed to add a reference to Appendix IV, Para IV.42 of the Safety Requirements NS-R-5 (Rev. 1) which states: "*In the design of a reprocessing facility, the possibility of load drops shall be considered and their impact on safety shall be assessed.*" As load drops impose a significant threat to workers, they should be practically eliminated by design of the hosting devices. The concept of practical elimination has already been introduced in the IAEA Safety Standards SSR-2/1 and NS-G-1.10 relevant for NPPs. The term 'practically eliminated' is defined as follows: "*The possibility of certain conditions occurring is considered to have been practically eliminated if it is physically impossible for the conditions to occur or if the conditions can be*	Y Y			

			considered with a high level of confidence to be extremely unlikely to arise."				
45	04.097	Please include a new sentence: "… If the risk is acceptably low, no further evaluations are necessary. Further guidance is provided in Section 5 of Ref. [32]. See also item (h) in paragraph 5.5 of Ref. [1]." Add the Safety Guide NS-G-3.1 to the list of references: "[32] INTERNATIONAL ATOMIC ENERGY AGENCY, External Human Induced Events in Site Evaluation for Nuclear Power Plants, Safety Standards Series No. NS-G-3.1, IAEA, Vienna (2002)"	Section 5 "Aircraft crashes" of the Safety Guide NS-G-3.1 provides further guidance on the screening process and detailed evaluation procedures for accidental aircraft crashes and thereby of the term 'acceptably low'. Thus, a reference to this publication should be included here.	Y			
46	04.099	Please assign a footnote to the term 'design extension conditions' with the following text of the footnote: "Postulated accident conditions that are not considered for design basis accidents, but that are considered in the design process of the R&D facility in accordance with best estimate methodology, and for which releases of radioactive material are kept within acceptable limits."	A short definition of this term should be provided here because it is not included in the IAEA Safety Glossary (2007 Edition). The proposed text is taken from the Safety Requirements SSR-2/1 "Safety of Nuclear Power Plants: Design". At present, the concept of DECs is only established in SSR-2/1, but not yet in NS-R-5 (Rev. 1). The upcoming revision (DS478) will introduce this concept for nuclear fuel cycle facilities.		Footnote added; *Postulated accident conditions that are not considered for design basis accidents, but that are considered in accordance with best estimate methodology to avoid large or early releases.*		
47	04.104	"Glove box control Paragraph 9.60 of Ref. [1] contains requirements for fire safety controls in a	Ensure consistency with Appendix II, Para II.25 of the Safety Requirements NS-R-5 (Rev. 1) which	Y			

		R&D facility. For glove boxes under inert atmosphere, the gas concentration should be monitored and controlled for safety and possibly product quality purposes. Temperatures should also be monitored. An instrumentation and control system for fulfilling the requirements for a negative pressure should be in place, in accordance with paragraph II.25 of Ref. [1].”	states: “*Gloveboxes shall be equipped with instrumentation and control systems for fulfilling the requirements for a negative pressure.*”				
48	04.104	“Control of gaseous effluents Generic requirements for control of atmospheres and pressures are given in paragraphs 6.37 to 6.39 of Ref. [1], which state~~s~~ that … ~~These may~~ This should include real time measurements such as differential pressure to confirm that the filtration systems are working effectively, and continuous monitoring of discharges. …”	In a Safety Guide, usually recommendations (or “should” statements) are provided.	Y			
49	04.111	2nd bullet: “Determination of the radiological and associated chemical consequences of design basis accidents (or the equivalent) and design extension conditions for the public and verification that they are within the acceptable limits specified for accident conditions.”	The analysis of design extension conditions is missing in this bullet. See also our comment on Para 4.99.	Y			
50	04.112	“The results of these two steps should be reviewed for identification of the possible need for engineered safety features and/or additional operational limits and conditions.”	As safety analysis is part of the iterative design process of a R&D facility, the need for engineered safety features could also be identified.	Y			
51	04.113	“At the design stage of a new R&D facility, an assessment should be made of the ~~external~~ radiation exposure to the	In case of R&D facilities with the potential for airborne contamination,	Y			

		workers in all workplaces, on the basis of conservative assumptions for factors including the following: …"	both external and internal exposures should be considered in the assessment of the radiation exposure to the workers in all workplaces. Therefore, we propose to delete the term 'external' to be more general. See also Para 4.104 (e).				
52	04.113	2nd bullet: "Calculated radiation levels should use the enveloping R&D facility source term and contributions from direct radiation (e.g. inventory and deposited radionuclides);"	The contribution from direct radiation is missing here since the source term is defined as the amount and isotopic composition of material released from the facility (see IAEA Safety Glossary, 2007 Edition).		Inserted "*wherever located (e.g. inventory and deposited radionuclides)*", to match the reviewers intent better		
53	04.122	Bullet b): "Identification of workers and members of the public (i.e. the representative person~~(s)~~ living in the vicinity of the R&D facility) who could possibly be affected by accidents, allowing for demographic variations;" Bullet i): "Quantification of the consequences for the ~~individuals~~ representative person identified in the safety assessment."	Bullet b): No plural (there is only one representative person). GSR Part 3 defines the representative person as "*an individual receiving a dose that is representative of the doses to the more highly exposed individuals in the population*". According to the ICRP Publication 101, the dose to the representative person is the equivalent of, and re-places, the mean dose in the critical group. All members of the public are considered to be adequately protected if the estimated effective dose to the representative	Y			

			person complies with the dose limit. Bullet i): Clarification.				
54	04.125	2nd sentence: "… should be developed for a range of postulated emergencies irrespective of the cause (see paragraph 9.62 of Ref. [1], [7] and [27]).”	Editorial (missing bracket).	Y			
55	04.125	Last sentence: “Such emergencies include, but are not limited to, criticality accidents and~~,~~ nuclear or radiological emergencies coincident with external hazards affecting the infrastructure in the vicinity of the R&D facility (e.g. widespread fires, earthquakes and tsunamis).”	Our clarification aims to emphasize that hazards having a serious impact on the infrastructure should be considered in emergency planning. The hazards mentioned in brackets represent rather a collection of examples than an exhaustive list. There are more external hazards that could impair the off-site emergency arrangements due to damages of the infrastructure, such as mud slides, avalanches, high water levels, etc.	Y			
56	04.128	“Requirements for managing radioactive wastes from R&D facilities are established in paragraphs 9.54 to 9.57 in Ref. [1]. ~~Detailed guidance~~ General requirements on predisposal management of radioactive waste ~~is set out in other relevant Safety Guides,~~ are established in Ref. [14] ~~and Ref. [21]~~. Specific guidance on predisposal management of radioactive waste from nuclear fuel cycle laboratories is provided in Ref. [33], while guidance	Strictly speaking, IAEA Safety Requirements like GSR Part 5 do not provide guidance. Hence, wording needs to be adjusted. Depending on the type of R&D facility (laboratory scale or pilot scale), guidance on predisposal management of radioactive waste is provided in two	Y			

		which may relevant to pilot plants can be found in Ref. [34]. Paragraphs 6.31 and ~~9.34~~ 9.54 in Ref. [1] require the generation of radioactive waste to be minimized, as far as practicable. Ref. [4], Ref. [5] and Ref. [29] all provide further information on the optimization of protection for radioactive wastes. …" Please add the Safety Guides WS-G-2.7 and WS-G-2.6 to the list of references: "[33] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste from the Use of Radioactive Material in Medicine, Industry, Agriculture, Research and Education, IAEA Safety Standards Series No. WS-G-2.7, IAEA, Vienna (2005) {DS454}" "[34] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of High Level Radioactive Waste, IAEA Safety Standards Series No. WS-G-2.6, IAEA, Vienna (2003) {DS447}"	different Safety Guides, WS-G-2.7 and WS-G-2.6 (in analogy to decommissioning, for which WS-G-2.2 and WS-G-2.4 apply; see also first sentence of Para 8.7). Please add references to both Safety Guides.				
57	04.128	"Processing: ~~Treatment:~~ Subsequent processing ~~treatment~~ outside R&D facilities can include pretreatment (i.e. segregation, chemical adjustment and decontamination), treatment (i.e. volume reduction, removal of radionuclides from the waste, and change of composition) and conditioning~~, volume reduction, encapsulation, immobilization, and decontamination~~ (i.e. immobilization and packaging) before ~~longer term~~ storage.	According to the IAEA Safety Glossary (2007 Edition), the term 'processing' is more comprehensive and covers 'pretreatment', 'treatment' and 'conditioning'. Pretreatment includes collection, segregation, chemical adjustment and decontamination. Treatment includes volume reduction,	Y			

		Techniques and procedures for treatment and conditioning are preferred that provide waste forms and/or waste packages in line with the established or anticipated ~~available~~ waste acceptance requirements for storage and future disposal~~;~~.”	removal of radionuclides from the waste, and change of composition. Conditioning includes immobilization (i.e. the conversion of the waste into a solid waste form by solidification, embedding or encapsulation), packaging (i.e. the enclosure of the waste in a suitable container) and, if necessary, provision of an overpack.				
58	05.002	Last sentence: “The extent of regulatory involvement during construction should be commensurate with the potential hazards posed by the R&D facility during its expected life cycle.”	Maintain consistency with Para 5.2 of the Safety Requirements NS-R-5 (Rev. 1).	Y			
59	05.003	“Current good practices should be used for building construction, fabrication and installation of facility equipment. Effective means should be in place to prevent the installation of counterfeit, fraudulent or suspect items, as well as non-conforming or sub-standard components, because such items or components could impair safety even years after commissioning of the R&D facility.”	The emergent issue of counterfeit, fraudulent and suspect items, as well as the increase in non-conforming and sub-standard components, necessitates the improved sharing of operating experience between designers, manufacturers, suppliers, and facility operators. The operating organization should implement effective means to prevent the installation of such equipment because it can be considered as a latent risk to nuclear and radiation safety.	Y			
60	06.007	“The license to operate the R&D facility	2nd sentence:	Y			

		is generally issued to the operating organization just before this third phase. The regulatory body should define hold points and/or witness points as license obligations, commensurate with the proposed commissioning programme. In this case, 'hot' ~~processing~~ commissioning will be performed under the responsibility, safety procedures and organization of the operator ~~operating organization~~. The 'hot' commissioning may be considered part of operational stage of the R&D facility."	The definition of dedicated hold points and/or witness points will facilitate inspection of the facility by the regulatory body during commissioning. 3rd sentence: Maintain consistency with the terminology used in bullet (3) prior to Para 6.6 and in the last sentence of Para 6.7. Avoid circular wording ("organization of the operating organization").				
61	07.051	"On the basis of effluent monitoring data, regular estimates of exposure to the public (representative person~~(s)~~) living in the vicinity of the facility should be made."	See our related comment on Para 4.122.	Y			
62	07.061	"The requirements related to the management of radioactive waste and effluent during operation are defined in paragraphs 9.54 to 9.57 of Ref. [1]. General requirements on predisposal management of radioactive waste are ~~provided~~ established in Ref. [14] ~~and guidance in Ref. [21]~~. Specific guidance on predisposal management of radioactive waste from nuclear fuel cycle laboratories is provided in Ref. [33], while guidance which may relevant to pilot plants can be found in Ref. [34]."	Wrong reference is cited in the second sentence. The Safety Guide GSG-3 [21] is not subordinated to GSR Part 5 [14] but to GSR Part 4 [11]. Depending on the type of R&D facility (laboratory scale or pilot scale), guidance on predisposal management of radioactive waste is provided in two different Safety Guides, WS-G-2.7 [33] and WS-G-2.6 [34]. Please add references to both Safety Guides (see also our comment on Para 4.128).	Y			

63	07.063	"One easy way to reduce and/or minimize the generation of solid radioactive wastes is to minimize packaging before transfer to contamination areas. Processes like incineration, metal melting, and compaction can also be used to reduce the volume of wastes [34]. Such processes should be selected on the basis of the characteristics of the waste concerned after its segregation. According to the national regulations and as far as reasonably practicable, …"	To facilitate further treatment, solid wastes should be segregated according to the facility specific waste management programme and the available waste management options. Segregation is based on consideration of the following waste properties: (a) Combustible or non-combustible, if incineration is a viable option; (b) Metallic or non-metallic, if melting is a viable option; (c) Compressible or non-compressible, if compaction is a viable option. Further recommendations on treatment of solid radioactive waste are given in the Draft Safety Guide DS447 "Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities" (revision of WS-G-2.6; latest version dated September 2014), see Paras 6.27, 6.33–6.39.	Y			
64	07.066	"The operating organization should characterize radioactive waste as it is produced. Relevant records and reports should be created and managed according to the proper ~~safety~~ management system, Ref. ~~[21]~~ [35]."	Wrong reference is cited in this paragraph. Further guidance on relevant records and reports concerning the characterization of	Y			

		Add the Safety Guide GS-G-3.3 to the list of references: "[35] INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for the Processing, Handling and Storage of Radioactive Waste, IAEA Safety Standards Series No. GS-G-3.3, IAEA, Vienna (2008) {DS477}"	radioactive waste is provided in the Safety Guide GS-G-3.3, but not in GSG-3. With respect to this proposal, see also the IAEA resolution table of SSC members comments (June 2014) on draft version 1.0, comment No. JP.W03 provided by Japan. This comment was accepted but incorrectly implemented in the latest version of DS381.				
65	07.068	"~~Before release of equipment for recycling or clearance for disposal, it should be decontaminated to the level required by the regulatory authority. Levels for clearances required for disposal of low-levels of waste typical of many R&D facilities are defined in Schedule 1 of Ref. [2].~~ Management options such as clearance (the removal of radioactive materials within authorized practices from any further regulatory control, including for recycling or reuse), the control of discharges, and authorized disposal, in compliance with the conditions and criteria established by the regulatory body, should be used as far as practicable, with preference given to clearance for recycling or reuse. The criteria for clearance are specified in Schedule I of Ref. [2]. The limitations and controls for clearance and the control of discharges should be set by the regulatory body."	In the context of radioactive waste management, the phrase "clearance for disposal" is a contradiction in terms. According to the definitions in the IAEA Safety Glossary (2007 Edition), • the term 'clearance' means the removal of radioactive material or radioactive objects within authorized practices from any further regulatory control by the regulatory body; • the term 'disposal' means the emplacement of waste in an appropriate facility without the intention of retrieval. Consequently, the whole paragraph needs to be rephrased. Our proposal for		The order of the terms *clearance* and *release* has been corrected so there is no need to rewrite the paragraph.		

			new text is based on Para 6.2 of the Draft Safety Guide DS447 "Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities" (revision of WS-G-2.6; latest version dated September 2014).				
66	08.002	6th bullet: "Comprehensive record preparation for all significant activities and events at all stages of the facility's life, archived in a secure and readily retrievable form, indexed in a documented, logical and consistent manner;"	Clarification. The current wording is too weak.	Y			
67	08.004	"Where ~~there may be~~ fissile material is present, the ~~criticality~~ requirements on criticality safety in paragraphs V.19 and V.20 of Ref. [1] should be applied ~~apply~~."	Clarification.		Where fissile material could be present, the requirements on criticality safety in paragraphs V.19 and V.20 of Ref. [1] should be applied.		
68	08.006	1st sentence: "In the event of decommissioning being significantly delayed after a R&D facility has permanently shut down, safety measures should be implemented to maintain the R&D facility in safe and stable state, including …" Last sentence: "Effort should be made to remove as much radioactive or hazardous material from the facility as is possible, before it is permanently shut down."	Clarification. The term 'permanent shutdown', as used in GSR Part 6 and in the Draft Safety Guide DS452 "Decommissioning of Nuclear Installations" (revision and combination of WS-G-2.1 and WS-G-2.4; latest version dated 3 December 2014), means that the facility has ceased its operation and operation will not be recommenced.	Y			

69	08.009	"The level of decontamination required to recycle equipment or release buildings or facilities from regulatory control should be in accordance with the criteria set by the regulatory authority, in accordance with Ref. [22] and Schedule 1 of Ref. [2]."	Amendment to be in line with the wording in GSR Part 6 and GSR Part 3.	Y			
70	Ref. [02]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards – Safety Standards Series No. GSR Part 3 ~~(Interim Edition)~~, IAEA, Vienna ~~(2011)~~ (2014)."	The final version of GSR Part 3 has been published in July 2014. Therefore, an update is required.	Y			
71	Ref. [06]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Nuclear Fuel Cycle Facilities, Safety Standards Series No. WS-G-2.4, IAEA, Vienna (2001) {DS452}"	WS-G-2.4 is currently under revision by DS452. Add revision notice for completeness.	Y			
72	Ref. [08]	"INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for Facilities and Activities, Safety Standards Series No. GS-R-3, IAEA, Vienna (2006) {DS456}"	GS-R-3 is currently under revision by DS456. Add revision notice for completeness.	Y			
73	Ref. [09]	"INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for Nuclear Installations, IAEA Safety Standards Series ~~Guides~~ No. GS-G-3.5, IAEA, Vienna (2009)"	Uniform citation of publications issued in the IAEA Safety Standards Series.	Y			
74	Ref. [14]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, General Safety Requirements Part 5, Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009) ~~{DS447}~~"	Wrong assignment. DS447 is the revision of the Safety Guide WS-G-2.6.	Y			
75	Ref. [22]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities Using Radioactive Material	1. GSR Part 6 was published in July 2014. Therefore, an update is	Y			

		~~Safety Requirements~~, Safety Standards Series No. ~~WS-R-5~~ GSR Part 6, IAEA, Vienna (2014) ~~(2006) {DS450: Decommissioning of Facilities GSR Part 6 (2014) }~~"	required. 2. Uniform citation of publications issued in the IAEA Safety Standards Series.				
76	Ref. [25]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Medical, Industrial and Research Facilities, Safety ~~Guide~~ Standards Series No. WS-G-2.2, IAEA, Vienna (1999)"	Uniform citation of publications issued in the IAEA Safety Standards Series.	Y			
77	Ref. [26]	"INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for the Decommissioning of Facilities using Radioactive Material, Safety ~~Guide~~ Standards Series No. WS-G-5.2, IAEA, Vienna (2009)"	Uniform citation of publications issued in the IAEA Safety Standards Series.	Y			
78	General	Please check spelling in the whole document: • 'glove box' vs. 'glovebox' and 'glove-box', • 'life cycle' vs. 'lifecycle', • 'subcritical' vs. 'sub-critical'.	Harmonization of spelling throughout the Safety Guide is recommended.	Y			

COMMENTS BY REVIEWER Country/Organization: FRANCE Date: Pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	General	Consider using waste only under the singular form			Most *wastes* converted *waste* according to context		
02	02.001 -	Consider adding fire hazard into the list of main hazards		Y			
03	02.002 -	Consider deleting the last sentence of the first bullet "while the radiotoxicity of uranium …"	Not specific to R&D facilities	Y			

COMMENTS BY REVIEWER Country/Organization: FRANCE Date: Pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
04	02.002 -	Second bullet : consider replacing "enrichment" by "isotopic composition"	Enrichment is related to uranium ; isotopic composition includes also plutonium	Y			
05	02.002	Consider deleting the 4th bullet	Covered by 2.1	Y			
06	02.002	Consider reviewing the structure of 2.2	Are all the bullet – at the same level or not ?	Y			
07	02.012	"modification should be **authorized** by the regulatory…" The reassessment of the facility **safety** and the formal		Y			
08	02.014	commensurated		Y			
09	04.007	In addition to the radiological hazards outlined above, particular consideration should be given to the following hazards: (a) Fire, explosion or chemical reaction; (b) Human and organizational factors	HOF is an important issue in R&D facilities due to the local and manual actions Natural phenomena and aircraft crash are not specific to R&D facilities		Human errors and organizational failings added. Phrase *chemical explosion* retained - some chemical reactions desired.		
10	04.009	… by he safety analysis are intended to **prevent any abnormal situation, to detect this situation** or to mitigate its consequences…"	Defense in depth principle	Y			
11	04.025 and 04.045	consider using the wording : decay products	Decay products cover daughter and grandchild nuclides	Y			
12	04.050	a) Areas where **radioactive** material are processed and stored	Not only fissile material have to be taken into account	Y			
13	04.050	b) Those facilities processing **radioactive** material…		Y			
14	04.054	… Measures should be in place **to detect i**t and to	Defense in depth principle	Y			

COMMENTS BY REVIEWER Country/Organization: FRANCE Date: Pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
		minimize…	Detection in the title				
15	04.055	Consider including a bullet between 6 and 7: Fire detection systems in the rooms, cells, glove boxes and ventilation ducts…	Defense in depth principle Detection in the title	Y			
16	04.057	Consider replacing "metallic fines" by metallic dust or particles		Y			
17	04.077	Consider deleting "such as uranium hydride from the radiolysis of water" and adding uranium hydride as an example in 4.57	Uranium hydrides are produced by a reaction between water and metallic uranium; it is not directly related to radiolysis of water.	Y			
18	07.003	Consider adding a para dealing with the relations between personnel in charge of the R1D facility operation and personnel in charge of experiments (R&D personnel could belong to other entities than the operating entity).	These relations have to be very clear and the responsibility/tasks of both well defined (e.g. radioactive material management, waste management, experiment monitoring…). Specific documents have to be written and interfaces defined for the everyday life and not only through a safety committee.	Y			
19	07.005	Consider adding a para to advise that the domain defined through the OLC is large enough to avoid frequent modifications of the safety case or of the authorization.	R&D implies flexibility in the materials, processes used. This has to be allowed by the safety demonstration.	Y			

COMMENTS BY REVIEWER Country/Organization: INDIA/NPCIL Date: 17.11.2014 Pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	General	A case study of an existing Nuclear Fuel Cycle R&D facility, satisfying the different requirements of the guide can be given as an Annexure.	Facilitates better comprehension of the requirements.				We would be happy to develop on this idea, with input from Member States.
02	02.002	Add at the end"and neutron absorbers provided" 2nd para	the sub criticality of a system depends on many parameters including neutron absorbers provided	Y	Sentence restructured to add reference to neutron absorbers		
03	02.002	The following be added: • Uranium with enrichments > 5%. • Th-U233 fuel cycle with presence of hard gamma emitters like U232. To last para	In the new material examples of these be added as fuel cycle work presently is happening on these.	Y			
04	02.017	"Systems that provide Chemical Safety of the fuel cycle under high temperature conditions " be added.	Chemical Stability of the fuel cycle under high temperature, the coolant characteristics and conditions is important.	Y, inserted in para 4.8			
05	04.027	'A colour code be provided' be added:	A colour code be provided for different categories of radioactive waste and contaminated containers similar to other process/utility pipelines to identify easily. Page 16,	Y			
06	04.02	Where there is a potential for overheating, the	Additional text is proposed	Y			

COMMENTS BY REVIEWER Country/Organization: INDIA/NPCIL Date: 17.11.2014 Pages				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
	8	possibility of chemical reaction at high temperature also to be considered and provisions to retard this are to be provided.	from chemical stability point of view. Page 16,				
07	04.045	Include in the para suitably the intent of 'The potential points with accumulation of radionuclide deposits be provided with shielding'.	To avoid exposure. Page 19	Y			
07	04.132	Coverage for 'Design of fresh fuel storage' also be included in other design considerations as a separate sub-title.	The fresh fuel isotopic content may vary with time of storage and may affect radioactive exposure.	Y, new section on fuel added			
09	07.002	The diversity of inventories of fissionable, radioactive, toxic, reactive or bioactive materials in different physical forms such as powders,solids, liquids and Gases.	Radioactive materials in gaseous form also be included. Page 46	Y, now in para 1.2			
10	01.012	'and elsewhere, where' to be written as 'and elsewhere were'.	Editorial on line 4 of para 1.12		"Where" replaced by "if", which is equivalent in this context		

COMMENTS BY REVIEWER Reviewer: Page of Country/Organization: Japan/ Nuclear Regulation Authority (NRA)				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	02.024	Line 1 - Due consideration should be given to the minimization~~, segregation and conditioning~~ of radioactive wastes	The segregation and conditioning are parts of the considerable matter for minimization.	Y			
02	04.010	Line 2 - In addition, Class 2 R&D facilities corresponding to a…	Clarification of "Class 2 R&D facilities" is ~~needed.~~ ~~There are no descriptions~~ required in this guide.	Y, should read "case" not "class"			
03	04.011	Bullet 4 - 4. Moisture content in powder material: The analysis will consider the range of moisture content for powder material used in a R&D facility. ~~4.~~5. Concentration and density in analytical laboratory and in liquid effluent units: … ….. ~~9.~~ 10. Fissile content: …	Moisture content of powder material is an important parameter for criticality prevention.	Y, new bullet (f)			
04	04.043	Line 5 - A combination of source removal, reduction, shielding, distance and administrative controls.	Clarification. For radiation protection, time, shied and distance are essential elements.	Y			
05	04.046	Line 2 - barriers for the ~~containment~~ confinement of radioactive materials,	To be consistent with 4.2(2), 4.4 and 4.67(a) and others.	Y			
06	04.055	Bullet 12 - The following sentences should be moved to the Section 7 (OPERATION) with the amendment.	Consideration should be ~~given to~~ made for fire prevention by characteristics of R&D facilities.			N	Not clear what this comment means, but consideration is

		Dynamic containment systems should continue operation (including filtration) during a fire to remove smoke, heat, and particulates and to compensate for potential overpressure if appropriate. This operation is maintained so long as temperatures at filters do not exceed the threshold at which containment would be lost, as determined by the safety analysis.		Y			always "given" not "made" in English
07	04.104	Bullet (e2)- Installation of detectors for alpha surface contamination (beta/gamma, alpha) close to working areas and self-monitoring at the exits of rooms.	Adding detectors for beta and gamma surface contamination. Beta and gamma emitting radionuclides also related to internal exposure.	Y			
08	04.128	Line 2 - Paragraphs 6.31 9.54 to 6.34 9.57 in Ref. [1].	Para. 9.54 to 9.57 in NS-R-5 (Rev.1) (Ref. [1]) are requirements for management of radioactive waste in operation.	Y			
09	04.128	Lines 2-3; General Requirements and dDetailed guidance on predisposal management of radioactive waste is set out in other relevant Safety Standards Guides, Ref. [14], and Ref. [21], Ref. [X] and Ref. [Y]. Add followings to REFERENCES. [X] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities, IAEA Safety Standards Series No. DS447 (revision of WS-G-2.5 and WS-G-2.6), IAEA, Vienna [Y] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste from the Use of Radioactive Materials in Medicine, Industry, Agriculture, Research and Education, IAEA Safety Standards Series No. DS454 (revision	GSR Part5 (Ref. [14]) is not Safety Guide. DS447 and DS454 if applicable are relevant. See comment No.35.	Y			

		of WS-G-2.7), IAEA, Vienna					
10	04.128	Lines 4-5; Paragraphs 6.31 and 9.34 in Ref. [1] require the generation of radioactive waste to be minimized, as far as practicable.	Description about 'minimization of radioactive waste' is already made in in para.2.24.			N	This sentence emphasizes the requirement and "*in volume and activity"* has been added.
11	04.128	Line 5 - Ref. [4], Ref. [5], Ref. [X] and Ref. [Y29] all provide further	See the comment No.9.		Paragraph re-ordered to avoid repetition of these references		
12	04.128	Line 9 - Requirement 8 Paragraphs 6.31 and 9.54 in Ref. [141] define general requirements for radioactive waste generation and control.	Requirement 8 of GSR Part 5 is better.	Y Ref. [14] used instead			
13	04.129	Header above - Management of Gaseous and Liquid Discharge Releases	To be consistent with GSR Part 5.	Y			
14	04.129	Line 1 - should be controlled by air purification system filtration, which normally	To be consistent with para. 4.35 in this guide.	Y			
15	04.131	Line 2- Chemicals to levels authorized required by regulatory authorities.	Consistency with GSR Part 5.	Y			
16	04.136	Lines 2-3; Surfaces in areas where severe contamination (e.g. glove boxes and hot cells) may exist should be made nonporous and easy to clean.	The R&D facility design should be considered contamination levels.		Added "particularly in rooms containing hot-cells and gloveboxes, as well as within containment"		
17	06.002	Line 2 - into 3 main stages, which is	To be consistent with NS-R-5 para 8.9.	Y			
18	06.004	(2) Uranium or 'warm' commissioning	This para should be included in the hot			N	NS-R-5 requires a

		(2) Active or 'hot' commissioning 6.4. Natural or depleted uranium should be used in this phase, as necessary; to avoid criticality risks,	commissioning. To be consistent with NS-R-5 para 8.9.				minimum of two stages. *Warm* and *Hot* commissioning may be combined.
19	07.020	Line 3 - For confinement containment, continue to operate.	Better wording	Y			
20	07.022	Lines 1 and 4 - The R&D facility management should organize pre-job "tool-box and risk assessments" briefings at the start of each day and before undertaking new operations or experiments, to identify potential safety issues and define the best options for safety, as well as to review and assess procedures. See paragraph 2.37 in Ref. [9]. All R&D facility personnel should participate as far as possible in such meetings.	Adding risk assessments. Risk assessments are the essential part of the R&D facility management. The operating organization shall provide the necessary staffing for operations to be conducted safely.	Y			
21	07.043	- Radiation Air monitors are installed for airborne contamination	Wording of Bullet 10	Y			
22	07.049	Line 14 - Inside the hot cell or maintenance glove box to choose personal protective equipment and to determine if working time restrictions are required before entry.	Personal protective equipment should be chosen before entering into hot cells or maintenance glove boxes.	Y			
23	07.061 -	Heading above MANAGEMENT OF RADIOACTIVE WASTE AND EFFLUENT MANAGEMENT	To be consistent with '4. DESIGN' and DS360.	Y			
24	07.061	Line 4 - Provided in Ref [14] and guidance in Ref. [W21] , Ref. [X] and Ref. [Y]. Add followings to REFERENCE. [W] INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for the Processing, Handling and Storage of Radioactive Waste, IAEA Safety Standards Series No. GS-G-3.3, IAEA	GS-G-3.3, DS447 and DS454 are relevant. (See also the comment 9.)	Y			

		Vienna (2008)					
25	07.064	Line 3 - Compliance with the waste acceptance criteria requirements for the selected or anticipated disposal option.	Consistency with requirement 12 of GSR Part 5.	Y			
26	07.066	Line 3 - management system, Ref. [W21] and [X].	GS-G-3.3 and DS447 are relevant. (See also the comment 9 and 24.)				
27	07.068	Before clearance release of equipment for recycling or clearance for disposal, it should be decontaminated to the level required by the regulatory authority. Levels for clearances required for disposal of low-levels of waste typical of many R&D facilities are defined in Schedule 1 of Ref. [2].	Clarification The aim of clearance is to minimize radioactive waste.		7.66. Before clearance of equipment for recycling or release for disposal, it should be decontaminated to the level required by the regulatory authority. Levels for clearance applicable to many R&D facilities are defined in Schedule 1 of Ref. [2].		
28	08.003	Line 3 - Either the decommissioning work should fall inside the existing safety case decommissioning plan or…	To be consistent with GSR Part6 and DS452. There is no description on “safety case decommissioning plan” in these relevant Safety Standards.	Y			
29	08.007	Line 1 - Specific guidance on the decommissioning process for nuclear fuel cycle R&D facilities laboratories…	Clarification	Y			

30	ANNEX II (p64 and 66)	<table><tr><td>Process Area</td><td>…</td><td>Safety Function</td></tr><tr><td>Initial scientific objectives</td><td>…</td><td>1,2~~,~~ and 3</td></tr><tr><td>…</td><td>…</td><td>…</td></tr><tr><td>Transfers of nuclear and non-nuclear materials</td><td>…</td><td>2~~,~~ and 3</td></tr></table>	Editorial	Y			
31	Ref. [02]	[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards - Safety Standards Series No. GSR Part 3 (Interim Edition), IAEA, Vienna (20141)	Editorial	Y			
32	Ref. [06]	[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Nuclear Fuel Cycle Facilities, Safety Standards Series No. WS-G-2.4, IAEA, Vienna (2001) {DS452 to replace}	DS452 is under SPESS Step 8.	Y			
33	Ref. [14]	[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, General Safety Requirements Part 5, Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009) {DS447}	Editorial.	Y			
34	Ref. [22]	[22] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities Using Radioactive Materials, Safety Standards Series No. GSR Part 6 WS-R-5, IAEA, Vienna (201406) {DS450: Decommissioning of Facilities GSR Part 6 (2014) }	GSR Part 6 has been published.	Y			
35	Ref. [29]	Reference [29] should be changed to DS447 and DS454 if applicable.	Reference [29 (WS-G-2.5)] is a relevant Safety Guide, however DS448 is entitled as “Predisposal Management of	Y			

			Radioactive Waste from Nuclear Reactors". Relevant references are DS447 "Predisposal Management of Radioactive Waste from Nuclear Fuel Cycle Facilities" and DS454"Predisposal Management of Radioactive Waste from the Use of Radioactive Materials in Medicine, Industry, Agriculture, Research and Education". *DS447 was approved for submission to CSS. Closing date of MS comments on DS454 was 5 December 2014.				

COMMENTS BY REVIEWER Reviewer: Page 1 of 14 Country/Organization: Russian Federation, Moscow/ Scientific and Engineering Center for Nuclear and Radiation Safety Date: 19.11.2014				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	General		These comments don't address the consistency of the Guide structure to the structure adopted for IAEA guides and don't take into account that NS-R-5 is now under revision.		Noted. We consider it more important to finish this SSG, which was requested some time ago.		
02	General		The Guide involves a lot of very useful, adequate and valuable specific information but it should be re-structured and reduced to make the Guide more logical, clear and to avoid multiple repetitions (see		Other repetitions have been taken out, in addition to those noted.		

			specific comments).				
03	01.001	Term ‘Nuclear Fuel Cycle Research and Development Facilities (R&D facilities)” should be clarified.	Clarification remark.	Y			
04	02.002	“Exotic” nuclear materials should be clarified.	Clarification remark.		Reference to the subsequent list added		
05	02.015	This subsection should be retitled from MANAGEMENT OF SAFETY to MANAGEMENT SYSTEM	Should be renamed in compliance with Section 4 THE MANAGEMENT SYSTEM AND VERIFICATION OF SAFETY [1].	Y			
06	02.017	Should be deleted or moved to appropriate section.	The information of this para is out or the scope of the section.	Y, moved to para 4.8			
07	02.018	Delete - R&D facility personnel should always be aware of the fact that technical installations can fail, even if the design is robust.	Obvious statement that has no specificity for R&D facilities.	Y			
08	03.001	At the earliest stage of planning a R&D facility, a list of these criteria should be prepared and considered in accordance with their safety significance and agreed with regulatory bodies.	“Agreed” is more definite term.	Y			
09	04.002	(2) Confinement of radioactive material, including removal of decay heat;	Loss of cooling or removal of decay heat could lead not only to loss of confinement but also to criticality events.	Y			
10A	04.022		The whole para is a quotation [1]	Y			
10B	04.056		The whole para is a quotation [1]	Y, deleted			
11	04.026	The dynamic containment system should he used to create airflow towards areas	To create an airflow from less contaminated towards more	Y			

		that are more contaminated.	contaminated areas is not the only function of dynamic containment system				
12	04.027	Dynamic containment cannot be provided for systems such as closed items and waste containers or in some maintenance operations in open areas.	Unclear statement	Y			
13	04.057	Additionally consideration should be given to the following…. To separate in a new para	The para contents two different statements	Y			
14	04.059	Internal flooding – flooding in R&D facilities (examples of events that could lead to flooding)	examples of events that could lead to flooding in R&D facilities should be given	Y			
15	04.067	Para 4.67 and following; Loss of support	Typical support systems related to R&D facilities should be listed	Y			
16	04.086	Tornado, flooding should be separated into specific sections	Tornado and flooding are not parts of extreme weather conditions	Y			
17	04.128	Bullet b removal	In rad-waste management this term is not used	Y	Replaced by “Handling”, which is used		
18	04.132	Heading above this group of paras - Other Design Considerations	Indefinite titles of sections should be avoided			N	This heading used in SSR 2/1 and kept for consistency.
19	07.001	Characteristics of an R&D facility – all this section should be moved to the beginning of the guide because it contains general safety specific information for R&D facilities		Y			
20	07.062	This para should be moved to design part	This recommendation should be implemented in designing		Paragraph split and relevant portion moved to design		
21	07.065	This para should be moved to design part	This recommendation should be implemented in designing		Added to 4.129 (was 4.128) in		

					design, retained for operations		

COMMENTS BY REVIEWER Reviewer: US Nuclear Regulatory Commission Page of Country/Organization: United States of America Date: January 23, 2015				RESOLUTION			
Comment No.	Para/Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
01	04.007	insert "(a) chemical or toxic releases"	Consistency with hazards identified in 6.54 of Ref [1].	Y			
02	04.118	Para and header - Non-radioactive materials "This Safety Guide deals only with those hazards that can give rise to radiological hazards"	There is a conflict in the logic. 4.118 says the guide is only concerned about hazards that can give rise to radiological hazards and then goes on to give guidance for assessing releases of hazardous chemicals. Suggest the latter discussion be deleted.			N	This paragraph concerns radioactive materials that are also chemically or biologically hazardous and to which some standard must be applied.
03	04.122	delete "and other consequences" from header above	4.118 says the guide is only concerned about radiological hazards. Deleting "and other consequences" would be consistent with this focus		Title now "Assessment of possible accident consequences"		