

COMMENTS BY REVIEWER					RESOLUTION			
Country/ Organisation	Comment No.	Para/ Line No.	Proposed new text	Reason	Accepted	Accepted, but modified as follows	Rejected	Reason for modification/rejection
The Netherlands / ANVS	1	2, fourth alinea	Those changes have had an impact on safety provision incorporated in the plant design as well as on the <b>(different states of)</b> plant operation to cope with severe accidents which are modelled in Level 2 PSA.	Improve clarity		X Those changes have had an impact on safety provision incorporated, in the plant design as well as on the plant operation <b>for all plant states</b> , to cope with severe accidents which are modelled in Level 2 PSA.		
Germany / BMU & GRS	1	3, first bullet	Modelling of additional safety features considered for design extension conditions with core melting— <u>or fuel damage</u> ;	State-of-the-art PSA do not only consider core damage (melt) but also fuel damage (e.g. in the spent fuel pool (SFP)). Guidance needs to be provided in accordance with DS523 (the revision of Safety Guide SSG-3).		X Modelling of additional safety features considered for design extension conditions, <b>including the implementation of non-permanent equipment</b> ;		
Germany / BMU & GRS	2	3, second bullet	<ul style="list-style-type: none"> <li>Multi-unit <u>and multi-source</u> considerations (“<u>site-level PSA</u>”);</li> </ul>	A state-of-the art PSA takes all bigger nuclear sources (multiple collocated reactor units (could also be a research reactor present at the same site) and multiple radioactive sources (e.g. spent fuel pool (SFP), nuclear storage and waste treatment facilities) into account. Guidance needs to be provided in accordance with DS523 (the revision of Safety Guide SSG-3).		X Partially accepted The scope of the safety guide will not change. The importance of considering all sources of radioactive release at the site level other than NPPs and spent fuel pools will be mentioned while considering that the PSA methodology could be not applied, as for NPPs, due to lack of sufficient experience and practice available.		

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						<ul style="list-style-type: none"> <li>Multi-unit and multi-source considerations;</li> </ul>		
Germany / BMU & GRS	3	3, fourth bullet	<ul style="list-style-type: none"> <li>More detailed information on current practices considering <u>risk aggregation from</u> <ul style="list-style-type: none"> <li><u>all nuclear facilities at the site (reactor units as well as other radioactive sources)</u></li> <li><u>all plant operational states (power operation as well as low power and shutdown states (including the post-commercial operation safe shutdown))</u></li> <li><u>as well as internal and external hazards (including combined hazards)</u></li> </ul> </li> </ul> <p>in the scope of the Level 2 PSA;</p>	According to the state-of-the art PSA needs to aggregate the different risks. Precision in this direction was given. Guidance needs to be provided in accordance with DS523 (the revision of Safety Guide SSG-3).		<p>X Partially accepted</p> <p>More detailed information on current practices considering low power and shutdown states as well as internal and external hazards, <b>and their combinations</b>, in the scope of the Level 2 PSA.</p> <p>The considerations regarding other reactor units and their spent fuel pools are mentioned in the second bullet “Multiunit considerations”.</p> <p>However, other radioactive sources are out of the scope of this Safety Guide, despite the importance of considering all sources of radioactive release at the site level.</p> <p>This scope is in accordance to the scope considered for the review of the SSG-3, presented in the DS523, and the title of this Safety Guide (SSG-4).</p> <p>Other type of facilities such as dry storages and research</p>		

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						reactors on the site are out of the scope of this Guide. Power operation is already covered in the SSG-4 on the contrary of specifics related to low power and shutdown states.		
Japan / NRA	1	3, fifth bullet	<p>Modify 5th bullet as follows and move this bullet before first bullet.</p> <ul style="list-style-type: none"> <li>• More detailed information on the latest update on <u>additional safety features including non-permanent equipment and</u> strategies for dealing with core melt and related phenomena, as well as additional safety features to deal with damage of fuel stored in the spent fuel pool, and the results of experiments conducted in support of the strategies and improvements of code simulation capabilities;</li> </ul>	Non-permanent equipment have large impacts as measures against severe accidents and they are important in Level 2 PRA.		<p>X</p> <p>Incorporated in the first bullet</p> <p>Modelling of additional safety features considered for design extension conditions, <b>including the implementation of non-permanent equipment;</b></p>		
France	1	3	<p>Deletion of “<i>including the implementation of non permanent equipment</i>” in “Modelling of additional safety features considered for design extension conditions, <del>including the implementation of non permanent equipment;</del>”</p>	Additional text related to non permanent equipment means that use of the guidance document fosters the use of this kind of equipment in DEC. It is not the role of a PSA2 guidance to mention such a statement. Moreover, additional text is not useful considering that if it is relevant to model this kind of	X	<p>Proposed solution:</p> <ul style="list-style-type: none"> <li>• Modelling of additional safety features considered for design extension conditions;</li> <li>• Modelling the implementation of non-</li> </ul>		

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				equipment, it is included in the original sentence.”		permanent equipment;		

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Germany / BMU & GRS	4	3, fifth bullet	<p>More detailed information on the latest update on strategies for dealing with <u>the different risks (e.g., core melt and fuel damage and their related phenomena, as well as additional safety features to deal with damage of fuel stored in the spent fuel pool, hazards, etc.)</u>, and the results of experiments conducted in support of the strategies and improvements of code simulation capabilities;</p> <p>Second proposal:  <i>"More detailed information on the latest update on strategies for dealing with core melt <b>damage</b> and with damage of fuel stored in the spent fuel pool and their related phenomena, and the results of experiments conducted in support of those strategies and improvements of code simulation capabilities; <b>as the interface between Level 1 and Level 2 PSA is based on both CDF and FDF;</b>"</i></p>	For consistency with the bullets before, the statement needs to be more comprehensive and precise.		<p>X</p> <p>More detailed information on the latest update on strategies for dealing <b>with the progression of core damage and with damage of fuel stored in the spent fuel pool and their</b> related phenomena, and the results of experiments conducted in support of <b>those</b> strategies and improvements of code simulation capabilities; <b>as the interface between Level 1 and Level 2 PSA is based on both CDF and FDF;</b></p>		

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Finland / STUK	1	3/an addition to the bulleted list	Development and use of dynamic and parametric models	Paragraph 3 deals with recent developments in Member States in specific areas related to Level 2 PSA. Hence the additional bullet.	X			
Germany / BMU & GRS	5	4	The objective of this Safety Guide is to provide recommendations for meeting the requirements of GSR Part 4 (Rev. 1), SSR-2/1 (Rev. 1) and SSR-2/2 (Rev. 1) regarding Level 2 PSA for NPPs. <u>In addition, the requirements need to be consistent to DS523.</u>	A sentence was added, since guidance must be in accordance with DS523 (the revision of Safety Guide SSG-3).		X The objective of this Safety Guide is to provide recommendations for meeting the requirements of GSR Part 4 (Rev. 1), SSR-2/1 (Rev. 1) and SSR-2/2 (Rev. 1) regarding Level 2 PSA for NPPs. <b>In addition, it will complement the recommendations in the Safety Guide on Level 1 PSA.</b>		
Japan / NRA	2	4	(a) Comparison of results of the Level 2 PSA with <del>probabilistic safety goals</del> <u>probabilistic safety criteria and/or goals</u> to assess the overall level of safety of the plant;	In SSG-4, the term “probabilistic safety criteria and/or goals” are used rather than “safety goal”.		X In accordance with the terms used in the Safety Guide on Level 1 PSA. (a) Comparison of results of the Level 2 PSA with <b>probabilistic safety goals or criteria</b> to assess the overall level of safety of the plant;		

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ENISS	1	4.	<p>The guide would support:</p> <p>(a) <i>Comparison of results of the Level 2 PSA with <u>various probabilistic goals and acceptance criteria, when they have been defined</u>, to assess the overall level of safety of the plant <u>or some specific safety design and operational aspects</u>;</i></p> <p>(e) <i>Use of the source terms and frequencies <u>as input data for off-site consequence assessment</u> (Level 3 PSA)”</i></p> <p>(f) ...</p> <p>(g) <i>Use of a range of other PSA applications in combination with <u>the use</u> of Level 1 PSA results <u>and insights</u>”</i></p>	Clarifications proposed.		<p>X</p> <p>In accordance with the terms used in the Safety Guide on Level 1 PSA.</p> <p>(a) Comparison of results of the Level 2 PSA with <b>probabilistic safety goals or criteria, if these have been set</b>, to assess the overall level of safety of the plant;</p> <p>(e) Use of the source terms and frequencies <b>as input data</b> to assess off-site consequences (Level 3 PSA)”</p> <p>(g) Use of a range of other PSA applications in combination with the Level 1 PSA results <b>and insights</b>.</p>		
Japan / NRA	3	4	<p>Add as follows.</p> <p><u>(h) More detailed guidance on combination of hazards.</u></p>	Based on the lessons learned from the Fukushima Daiichi NPP accident, it is important to show concrete procedures for external PSA caused by multiple hazards, such as seismic-induced tsunami, and aftershocks after the tsunami.		<p>X</p> <p>(h) More detailed <del>guidance</del> <b>considerations to address</b> the combination of hazards</p>		

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ENISS	2	5.	<p>This Safety Guide addresses the necessary technical features of Level 2 PSA and applications for both existing and new NPPs. The revision of the Safety Guide expands the content to integrate updated considerations for Level 2 PSA on areas mentioned in Section 3 of this DPP.</p> <p><del>The recommendations of this Safety Guide will be technology neutral to the extent possible. The Safety Guide will be applicable large PWR, PHWR, BWR as well as for SMRs and can be applied to other reactor technologies with judgement</del></p> <p>The consideration of hazards arising from malicious acts is out of the scope of this Safety Guide.</p>	<p>It is surprising to include explicitly SMRs and new technologies in the current revision (it is not the case for any related reference: SSG-3, GSR Part 4, SSR/2-1, etc.). We suggest to keep the same scope for these references, including DPP523.</p>		<p>X</p> <p>The scope has been updated to be in accordance to the scope approved in the DS523 for review of the Safety Guide for Level 1 PSA SSG-3.</p> <p>This Safety Guide addresses the necessary technical features of Level 2 PSA and applications for both existing and new NPPs. The revision of the Safety Guide expands the content to integrate updated considerations for Level 2 PSA on areas mentioned in Section 3 of this DPP.</p> <p><del>The recommendations of this Safety Guide will be technology neutral to the extent possible.</del></p>		
Belgium / FANC & Bel V	1	5.	<p>“The Safety Guide will be applicable to large PWR, PHWR, BWR as well as for <u>SMRs based on the same technologies</u> and can be applied to other reactor technologies with judgement”</p> <p><b>+ remark:</b> SMR were not mentioned in the dpp of DS523 (PSA-level 1 04/2019). Both guides should consider the same scope of reactors</p>	<p>“SMR” is a large concept and includes also other technologies (fast reactor, Na, ...).</p> <p>It should be clarified that only SMR based on LW/PHWR/BWR are directly concerned</p> <p>(if this is indeed the case)</p>		<p><del>The Safety Guide will be applicable large PWR, PHWR, BWR as well as for SMRs and can be applied to other reactor technologies with judgement</del></p> <p>The consideration of hazards arising from malicious acts is out of the scope of this Safety Guide.</p>		



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Belgium / FANC & Bel V	2.	5.	Suggestion: to discuss the applicability of PSA to large Research Reactors	This question (applicability of PSA, as well for level 1 as for level 2) is more and more relevant. SMR & large research reactors can have similar powers.			X	The scope of this Safety Guide is for Nuclear Power Plants as stated in the title. For Research Reactors there is a TECDOC currently under the publication process which considers the specifics of research reactors based on the recommendations presented in the Safety Guides for developing and use Level 1 and Level 2 PSA (SSG-3 and SSG-4).
Belgium / FANC & Bel V	3.	5.	“spent fuel pool”: DS523 on PSA level 1 (04/2019) specified that only SFP for the reactor were considered and not separate spent fuel pools on the site.	BE made a comment to extend the scope.  The scope should be clearly defined for both guides – and be identical.			X	The scope will consider the issues presented in section 3 of this DPP. There, considerations regarding the spent fuel pools of NPPs will be covered (5th bullet of section 3). This is in accordance to the scope approved in the DS523 for review of the level 1 Safety Guide SSG-3.
Germany / BMU & GRS	6	6, bullet 16)	16) <del>DS494-SSG-64</del> – Protection against Internal Hazards in the Design of Nuclear Power Plants (revision and combination of NS-G-1.7 and NS-G-1.11)	Correction, since SSG-64 is already in publication.			X	The DS494 “– Protection against Internal Hazards in the Design of Nuclear Power Plants” was endorsed by the CSS on December 20th, 2019. Its publication is on going and planned to be officially issued by the end of the year. Therefore, DS494 is considered for the approval of the DPP DS528.

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Germany / BMU & GRS	7	7	1. INTRODUCTION 2. GENERAL CONSIDERATIONS RELATING TO THE PERFORMANCE AND USE OF LEVEL 2 PSA 3. PROJECT MANAGEMENT AND ORGANIZATION FOR PSA 4. FAMILIARIZATION WITH THE PLANT DESIGN, <u>risk aggregation aspects</u> AND SEVERE ACCIDENT MANAGEMENT 5. INTERFACE WITH LEVEL 1 PSA 6. CONSIDERATIONS FOR INTERNAL AND EXTERNAL HAZARDS IN LEVEL 2 PSA 7. ACCIDENT PROGRESSION AND CONTAINMENT PERFORMANCE ANALYSIS 8. SOURCE TERM FOR SEVERE ACCIDENTS 9. DOCUMENTATION OF THE ANALYSIS: PRESENTATION AND INTERPRETATION OF RESULTS 10. USE AND APPLICATION OF LEVEL 2 PSA 1 .....	The structure should adequately reflect the risk aggregation aspects (including site-level PSA aspects) and therefore be revised accordingly.			X	The issues considered in section 3 of the DPP DS528 for the review of the SSG-4 are inserted as different sections and subsections in the outline.

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The Netherlands / ANVS	2	7	<i>We suggest to consider an annex dealing with the application of this guide to research reactors, with application of the graded approach.</i>	This guidance can be applied to level-2 PSA for (large) research reactors, in a graded way. Guidance on how to proceed would be helpful.			X	The scope of this Safety Guide is for Nuclear Power Plants as stated in the title. For Research Reactors there is a TECDOC currently under the publication process which considers the specifics of research reactors based on the recommendations presented in the Safety Guides for developing and use Level 1 and Level 2 PSA (SSG-3 and SSG-4).
Russian Federation / SEC NRS	1	7. Overview	Add the separate chapter to the table of contents: “Terms and Definitions”.	Define the main terms specific for level 2 PSA, for example: plant damage states, source terms for severe accidents, release categories, large release, large early release etc.		X The need for a specific section for the “Terms and Definitions” will considered with regard to the update of the IAEA safety glossary.		
Russian Federation / SEC NRS	2	7. Overview	Highlight the separate chapter in the table of contents: “Level 2 PSA for low power and shutdown modes”.	By analogy with the IAEA SSG-3 Standard “Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants”			X	The corresponding considerations related to low power and shutdown states are intended to be incorporated in the updated subsections of section 5 “Interface with Level 1 PSA”. Therefore, there is not need for a separate section.
Russian Federation / SEC NRS	3	7. Overview	Highlight the separate chapter or develop the new appendix: “Multi-unit level 2 PSA”.	When developing a Level 2 PSA, it makes sense to consider all sources of radioactivity, including those located on several units of one nuclear power plant.			X	The corresponding considerations related to multi-unit aspects for Level 2 PSA will be incorporated in the updated subsections of section 4 “Familiarization with the plant design and severe accident management”. Therefore, there is no need for a separate section.

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Russian Federation / SEC NRS	4	7. Overview	Highlight the separate chapter or develop the new appendix: “Level 2 PSA for radioactivity sources other than core fuel”.	When developing a Level 2 PSA, it is necessary to take into account all locations of sources of radioactivity (including storage sites for spent and fresh fuel, as well as radioactive waste)			X	Despite the importance of considering all sources of radioactive release at the site level, the scope of this Safety Guide (SSG-4) will consider potential nuclear sources from spent fuel pools directly associated to the NPPs. This scope is in accordance to the scope considered for the review of the SSG-3, presented in the DS523, and the title of this Safety Guide (SSG-4). Other type of facilities or fuel storages (including dry storages) are out of the scope of this Guide.
Russian Federation / SEC NRS	5	7. Overview	Highlight the separate chapter “Model integration and quantification”	By analogy with the IAEA SSG-3 Standard “Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants”. Note that in Level 2 PSA model integration much more complicated than in Level 1 PSA and require special attention.			X	It is intended to address considerations regarding the model integration and quantification in sections 7 “Accident progression and containment performance analysis” and 8 “Source terms for severe accidents” and their subsections in relation to accident progression event trees or containment event trees and source term analysis. Therefore, there is no need to consider a separate section for Model integration and quantification.

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Russian Federation / SEC NRS	6	7. Overview	Highlight the separate chapter or develop the new appendix: “Probabilistic safety goals and criteria”.	The overall results of Level 2 PSA should be compared with the probabilistic safety criteria (if these have been specified).		X The probabilistic safety goals of safety criteria are already addressed in subsections of section 2 “General considerations relating to the performance and use of Level 2 PSA”. Therefore, there is no need to consider a new separate section. However, given the differences in definition of values for the probabilistic safety goals or safety criteria in MS, an appendix could be considered depending on the information collected.		

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Russian Federation / SEC NRS	7	7. Overview	Develop the new appendix: “Analysis of passive systems (core capture, passive cooling of containment, hydrogen recombiners, etc.) in assessing the effectiveness of the containment.	It is proposed in this appendix to give recommendations on approaches to analyzing reliability of passive systems in level 2 PSA.		X The analysis of the performance of passive safety systems related to the containment is considered in sections 4 “Familiarization with the plant design and severe accident management”, 6 “Considerations for internal and external hazards in Level 2 PSA” and 7 “Accident progression and containment performance analysis”. The development of an appendix could be developed depending on the information collected.		
South Africa / National Nuclear Regulator	1		It is acknowledged that SSG-4 does state that “ <i>The analysts should be aware of the technical limitations and weaknesses of the selected codes(s).</i> ” However given the limitations/weaknesses of computer codes, it is suggested that the revised SSG-4 document include additional guidance on how code users’ address benefits and limitations of codes as well as code resource competencies.	When performing analyses with the use of a computer code, code users should be adequately competent to allow for the limitations of analysis codes. This could possibly be through the analysts use of multiple codes run concurrently, without the reliance of only one code for decision making.		X The text in the different sections as well as in the Annex II of the revised version of the Safety Guide will consider further the specifics related to computer codes.		

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South Africa / National Nuclear Regulator	2		It is suggested that the revised SSG-4 document include Verification and Validation of codes, to ensure coupling of phenomena.	It is possible that validation of a code was performed by running experiments that are designed to study a particular phenomenon.		X The text in the different sections as well as in the Annex II of the revised version of the Safety Guide will consider further the specifics related to computer codes.		
South Africa / National Nuclear Regulator	3		It is suggested that the revised SSG-4 document include the relationship between deterministic analysis and probabilistic analyses for level 2.	Deterministic analyses may be used to verify that acceptance criteria are met and probabilistic safety analyses may be used to determine the probability of damage for each barrier. Improvements in the overall approach to safety analysis have allowed for a better integration of deterministic and probabilistic approaches.		X The text in the different sections as well as in the Annexes of the revised version of the Safety Guide will consider further the specifics related to the relationship among probabilistic and deterministic analyses performed for Level 2 PSA.		
South Africa / National Nuclear Regulator	4		It is suggested that the revised SSG-4 document include a recommended timeframe to update the PSA Level 2 models.		X			

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India	1	General	Appendix/Annexure  <b>Suggestion:</b>  It is suggested that the revised document may include a detailed Annexure on ‘Quantification Process for Containment Event Trees’.	Section 5.25 to 5.31 of present SSG-4 gives guidance and reference for estimation of nodal probabilities for Containment Event Trees. It would be useful if this guidance is further updated and detailed as part of the revision.  Considering the importance of this topic and its sensitivity on the overall PSA results, it would be desirable that an Annexure on this topic giving typical examples.		X It is intended to review the whole Safety Guide including the quantification process for containment event trees. There, updated considerations and guidance will be provided and the need for an appendix could be considered depending on the information collected.		
WNA / CORDEL	1	1.7 (3)	<b>Accident progression event tree analysis</b> <del>Containment event tree analysis</del> <sup>2</sup> is where the accident progression is modelled to identify the accident sequences that lead to challenges to the containment and releases of radioactive material to the environment.  2 The term ‘ <b>containment event tree</b> <del>accident progression event tree</del> ’ is also used by some practitioners for this part of the Level 2 PSA <b>if the analysis is focused only on the large (early) release frequency.</b>	State-of-the-art Level 2 PSA (for example as required by YVL A07 or ENSI A05) does not focus only on the status of the containment but includes all releases into the environment, for example due to filtered releases. The term Containment Event Tree shall be reserved for ASME-style L(E)RF analysis.			X	Both terms “Accident progression event tree analysis” and “Containment event tree analysis” are used in Level 2 PSA to model “containment systems” behaviour and for assessing radioactive releases to the environment. However, the appropriateness of the term used for state-of-the-art Level 2 PSA by the MS will be considered during the review process.



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WNA / CORDEL	2	3.1	Design features that can influence the progression of a severe accident and Level 2 PSA include: <del>fan coolers</del> , containment sprays, <b>core melt stabilization systems, hydrogen mitigation systems</b> , and/or filtered containment venting systems and suppression pools.	In most plants fan coolers are not designed for severe accident conditions. Hydrogen mitigation systems and core melt stabilization systems (by design or refitted) are now state-of-the-art.	X	As stated in section 3 of the DPP DS528, one of the objectives of this review is to incorporate more detailed information on the latest update on strategies for dealing with core melt and with damage of fuel stored in the spent fuel pool and their related phenomena. Therefore, the proposals for the modifications will be considered during the review process		
WNA / CORDEL	3	5.36	References [10, 35] provides information on an evaluation of uncertainties in relation to severe accidents and Level 2 PSA.  <b>[35] Hoefler, Axel &amp; Dirksen, Gerben &amp; Eyink, J. &amp; Pauli, E.-M. (2010). Uncertainty Treatment for Level-2 Probabilistic Safety Analysis. Nuclear Science and Engineering. 166. 202-217. 10.13182/NSE10-09.</b>	Added reference provides state of the art method for using Monte Carlo sampling in the calculation of Level 2 PSA branch probabilities.	X	The proposals for the modifications will be considered during the review process		

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WNA / CORDEL	4	6.16	Source term analysis that uses an integral code should be supplemented by <del>a code with more detailed models if the source term analysis for a particular release category is particularly sensitive to</del> <b>a fast running source-term code to be able to evaluate both code uncertainties and binning uncertainties for each release category. The supplemental code analysis shall in particular be sensitive to any</b> unique features of the plant design or to <del>a</del> specific transport mechanisms for radioactive material.	Integral codes provide only point value results for a specific accident progression AND with the use of a specific source term model (for example for release from the core). In Level 2 PSA both the binning uncertainty (grouping multiple sequences into one release categories) and the model uncertainties shall be taken into account (in particular for sequences unsuited for integral codes such as DCH)	X	The proposals for the modifications will be considered during the review process		