

**Westinghouse UK**  
**AP1000® GENERIC DESIGN ASSESSMENT**  
**Resolution Plan for GI-AP1000-CE-03**  
**Materials - AP1000 Material Standards and Material Specifications**

MAIN ASSESSMENT AREA	RELATED ASSESSMENT AREA(S)	RESOLUTION PLAN REVISION	GDA ISSUE REVISION
Civil Engineering	-	3	0

<b>GDA ISSUE:</b>	Justification that materials adopted on the <b>AP1000®</b> design are compatible for what would normally be expected for European construction. Clear statement on procedures for accepting suppliers proposals for material substitution of European materials for the US materials specified in the <b>AP1000</b> design.
<b>ACTION: GI-AP1000-CE-03.A1</b>	<p><b>STEEL PLATE MATERIALS</b></p> <p>The specific material properties listed below must be added into the material specifications to be used in the construction.</p> <ul style="list-style-type: none"> <li>• Steel plate US standards ASTM A572, A588 cover certain steel grades and thicknesses. Identify which standards will be used and explain their applicability and suitability in situations where steel plate is to be used outside of the range covered by proposed standards.</li> <li>• It is usual practice in Europe to specify maximum values of yield and tensile strengths and the ratio of yield to tensile. This is to ensure appropriate ductile behaviour. As ASTM 572 does not specify maximum strengths, define the maximum strengths to be specified as additional clauses to US steel standards A572, Duplex 2101 etc. This may be done on a structure by structure basis depending on the ductile performance required.</li> <li>• Justify the environment is appropriate for the performance of ASTM A588 in all locations where it is to be used.</li> <li>• Specify the Charpy V notch impact tests for all steels.</li> </ul> <p>With agreement from the Regulator this action may be completed by alternative means.</p>
<b>ACTION: GI-AP1000-CE-03.A2</b>	<p><b>CONCRETE MATERIALS</b></p> <p>The <b>AP1000</b> specification for safety related mixing and delivering concrete is stated in document number APP-CC01-Z0-026.</p> <p>Westinghouse shall provide ongoing support to ONR, and provide any supplementary evidence as appropriate, to</p>

	justify that the concrete materials specification does not compromise the structural design intent. With agreement from the Regulator this action may be completed by alternative means.
<b>RELEVANT REFERENCE DOCUMENTATION RELATED TO GDA ISSUE</b>	
<b>Technical Queries</b>	TQ-AP1000-946
<b>Regulatory Observations</b>	None
<b>Other Documentation</b>	APP-CC01-Z0-026 UKP-GW-GL-045 DCP_JNE_00493

<b>Scope of work:</b>
The key activities which will need to be completed to close this GDA Issue are: <ul style="list-style-type: none"> <li>• Address items 1-4 in Action 1.</li> <li>• Support the ongoing assessment of the concrete materials design specification.</li> </ul>

<b>Description of work:</b>
<p><u>Action 1</u></p> <p>The Design Methodology for Structural Modules identifies ASTM A36, A572 and A588 as acceptable carbon steel material types which could be used for modules plates. The location where the specific materials are implemented is described in response to Action Item 1.2 in DCP_JNE_00493. Duplex 2101 or equivalent stainless steel plates are used on the surface of the modules in contact with water in the refuelling canal, the in-containment refuelling water storage tank, the spent fuel pool, the fuel transfer canal, the cask loading pit, and the cask washdown pit. Typical plate thicknesses used are 0.5" (1.27 cm). In limited locations the plate thickness can be 1.5" (3.81 cm). Where the plate thickness is 1.5" (3.81 cm), ASTM A588 is specified, which is allowable by the specified standard. For Grade 60 plate, ASTM A572 only covers up to 1.25" (3.18 cm); therefore, it is not used where 1.5" (3.81 cm) is required. As a result, neither ASTM A572 nor A588 are used outside the range covered by the proposed standards.</p> <p>Westinghouse will perform a further review to determine if there are instances where materials are used outside of their applicability as specified by the identified design standards. If instances are identified, Westinghouse will justify the materials are appropriate to perform their required function.</p> <p>For ASTM A572, grade 60 plate is used to increase design margins and to closely match the duplex stainless steel strength. The ASTM A572 specification does not specify a maximum strength. Per the requirements in Section CQ1.4 of AISC N690-1994, which is the governing UK Class 1 structural steel code for the <b>AP1000</b> design, the maximum yield stress for use under the ASTM standard specifications is 100kips per square inch. To address this action, Westinghouse will investigate the appropriateness of defined maximum yield stress for both ASTM A572 and Duplex 2101 per AISC N690 and define an appropriate maximum yield stress that will be incorporated into a UK specific material</p>

specification as necessary. The incorporation of the determined maximum stress value will be incorporated into the **AP1000** design via the Westinghouse Configuration management system, and the appropriate **AP1000** material specification will be updated to include the additional requirement.

Westinghouse will further investigate whether it is appropriate to define maximum yield stress for the structural steel used in other power block structures (i.e. nuclear island, turbine building, radwaste building, annex building, and diesel generator building). The evaluation will be based on a structure by structure review. If it is determined that it would be appropriate to specify a maximum yield stress for the structural steel used in any of these structures, then change will be processed via the Westinghouse Configuration Management system, and the appropriate **AP1000** material specification will be updated to include the additional requirement. The results of the evaluation will be documented and submitted to ONR.

ASTM A588 is used in a limited number of locations as described in response to Action Item 1.2 in DCP\_JNE\_00493. As defined in Section 6.1.2.1 of the European DCD, carbon steel structural modules are coated with a self priming high solids epoxy (SPHSE). The protective coatings are maintained to provide enhanced corrosion protection. The outer surface of the ASTM A588 steel used in the structural modules is coated with SPSHSE. To support this item, Westinghouse will supply additional information regarding the coating as requested. The additional information will demonstrate that corrosion resistant properties of ASTM A588 are not a required design requirement.

The current **AP1000** requirements do not require Charpy V notch impact tests for the ASTM A572 steel used in the structural modules. Westinghouse understands that this testing is typically required per European and UK structural steelwork. Westinghouse intends to review the portions of BS N 1993-1-10 and define appropriate Charpy V notch impact test requirements as appropriate. If the review determines requiring Charpy V notch impact testing is appropriate, this change will be formally processed according to the Westinghouse Configuration Management system and the appropriate **AP1000** material specification will be updated to include the additional requirement.

Westinghouse will further investigate whether it is appropriate to define Charpy V notch impact tests for the structural steel used in other power block structures. The evaluation will be based on a structure by structure review. If it is determined that it would be appropriate to specify Charpy V notch impact tests for the structural steel used in any of these structures, then change will be processed via the Westinghouse Configuration Management system, and the appropriate **AP1000** material specification will be updated to include the additional requirement. The results of the evaluation will be documented and submitted to ONR.

The resolution of this action is related to the resolution of actions in CE-01, CE-02, and CE-04 that address methodology, behaviour, failure modes, and design detailing with regard to specific materials and material requirements. Consistent application will be reflected in the summary documents described in CE-01 action 1.

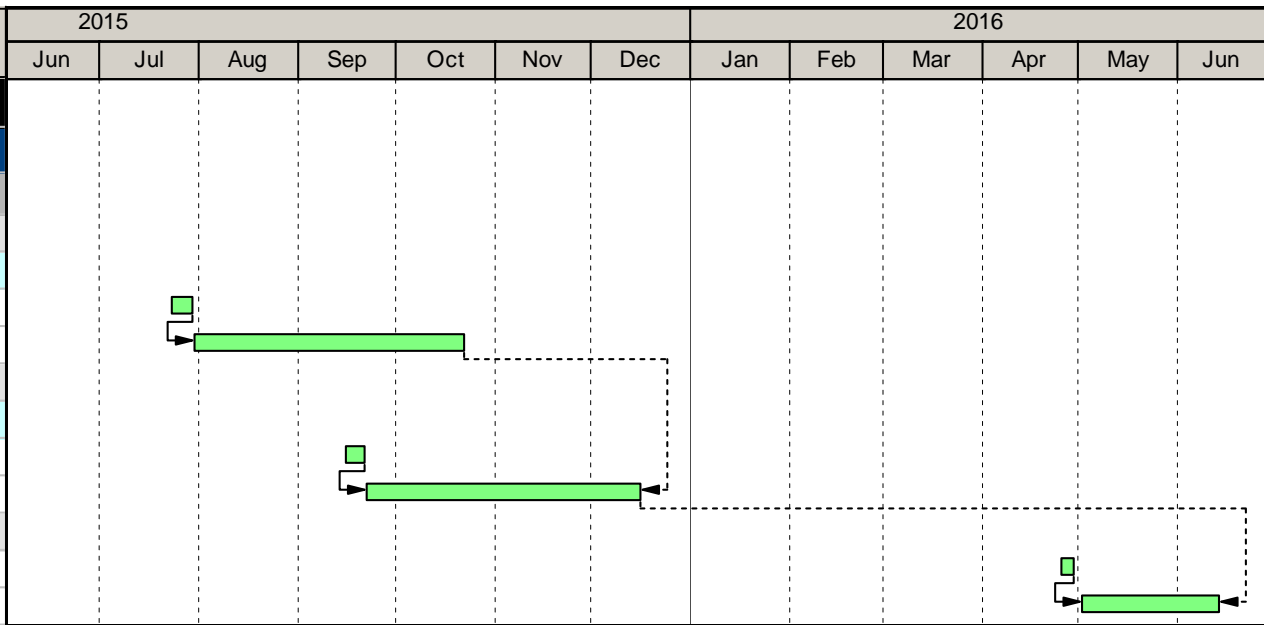
#### Action 2

Westinghouse will submit the **AP1000** safety related concrete specification and provide a concrete justification report to justify the claims within the specification.

**Schedule/ programme milestones:**

Please see the following page for the detailed schedule.

#	Activity Name	2015						2016						
		Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1	<b>UK Generic Design Assessment (GDA) Resolution Plans (51)</b>													
2	<b>CIVIL ENGINEERING</b>													
3	<b>CE.03 AP1000® Material Standards &amp; Material Specification-Resolution Plan</b>													
4	<b>CE.03 Action 1: Structural Steel</b>													
5	<b>CE.03 Prepare Steel Material Standard Document</b>													
6	Steel Material Standards-Submit for ONR Review													
7	Steel Material Standard Document-ONR Review of Submittal													
8	<b>CE.03 Action 2: Concrete Specification</b>													
9	<b>CE.03 Prepare Concrete Specification</b>													
10	Concrete Justification-Submit to ONR													
11	Concrete Justification-ONR Review of Submittal													
12	<b>CE.03 "ACTIONS" Letters Review &amp; Revisions</b>													
13	CE.03 "ACTIONS" Letters Justification-Submit to ONR													
14	CE.03 "ACTIONS" Letters Justification-ONR Assess/Validate Submittal													



**Methodology:**

Westinghouse will review its standard design specifications for structural steel in light of European standards and as appropriate develop requirements for max yield stress and Charpy V notch tests.

**Justification of adequacy:**

The response to Action 1.1, 1.2, and 1.4 will demonstrate that material requirements are specified based on UK and European expectations and the requirements of the materials to support the required safety functions of the structures they are located in. Any changes that are determined to be appropriate for the structural steel material specifications will be processed according to the Westinghouse Configuration Management System and incorporated into the appropriate material design specifications.

The response to Action 1.3 will demonstrate that ASTM A588 was not specified for its corrosion resistant properties. Corrosion resistance protection is provided by the SPHSE coating.

The **AP1000** safety related concrete specification specifies the appropriate design requirements for the concrete mixes for UK Class 1 structures to support the structures safety functions. If any UK specific deviations are required for this specification, they will be suitably justified.

**Impact assessment:**

Regarding the Impact Assessment, the Safety Submission Documents (Pre-Construction Safety Report (primarily chapter 16), Environment Report and its supporting documents, Design Reference Point, Plant Life Cycle Safety Report, Master Submission List and Roadmap) will be updated as appropriate.