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Responses to Recommendations from the 10th t-TAC Meeting

Topic/TAC Recommendation	Target Project Response to Recommendation
<p>Is the newly formulated moderator and reflector mechanical configuration viable? Does it incorporate adequate flexibility to allow for future innovations in this area?</p>	
<p>Concentric pipes for LH2 and water are not recommended because of blocking and destroying water pipes in case of loss of insulation vacuum.</p>	<p>Concentric pipes for LH2 and water are a proven solution deployed at SNS. Water must be provided within the moderator plugs to serve as the media for the thermal moderators as well as the LH2 pre-moderators and to cool moderator structures including the vacuum jacket itself, which undergoes significant nuclear heating in regions near the target. This approach is strongly preferred in this particular application because of the simplified remote handling cutting process associated with the concentric arrangement. Damage of the cryotransfer lines could occur if we experience simultaneous failure of the water flow system, vacuum line integrity, and the controls associated with immediately draining both fluid systems under a vacuum failure event. Therefore damage to the transfer lines requires the simultaneous failure of three systems, which is considered to be a highly unlikely event. For these reasons we choose to maintain the concentric pipe approach.</p>
<p>The method of cutting needs to be developed further to ensure this can be achieved with limited dose to personnel.</p>	<p>This recommendation concerns the cutting of hydrogen pipes during an exchange of a moderator reflector assembly. The presentation shown at TAC-10 displayed an option for cutting the pipes during the lifting operation of one plug. The option of cutting the pipes already during the monolith-handling phase was based on minimization of the size of the moderator and reflector exchange cask. There are at least two other options on how to cope with this situation, either the pipes will not be cut until the assembly is in the active cells and thus the handling cask will accommodate the full height of the pipes or the pipes could be cut inside the monolith prior to the start of the lifting operation (similar to the SNS cutting of the proton beam window pipes prior to their lifting operation). The method finally chosen will be based on ALARA and thus protect people from radiation hazards. Neither the cask design nor the moderator reflector plug design is mature enough to choose between the proposed solutions.</p>
<p>Is the approach that we are using to arrive at a neutronically optimized moderator/reflector reasonable?</p>	
<p>Stick to the planned date of fixing the reference moderator arrangement in Nov/Dec 2014</p>	<p>Decision made in Dec 2014; evolution continued and final configuration was approved at 05-Mar-15 ESS-CCB meeting (ESS-0026843)</p>
<p>Continue with moderator development ideas</p>	<p>Now that the moderator and reflector for the first set of plugs is established, the neutronics team will be freed up to some extent to support detailed engineering design efforts. They also plan to work in the near term with the J-PARC team on a proof-of-principle test for the physics of low-dimensional moderators. However, we agree with this recommendation and the neutronics team will continue to work on moderator development ideas, although at a reduced level.</p>
<p>Were recommendations from the 9th TAC meeting adequately addressed?</p>	
<p>Presentation of preliminary safety assessment should be made at TAC11</p>	<p>We will discuss our approach to safety classification of our systems and the status and plans for the Target Safety Systems (TSS) at the TAC11 meeting.</p>

Topic/TAC Recommendation	Target Project Response to Recommendation
Comments on progress towards completion of Preliminary Design in all areas highlighted at the meeting are most welcome	
Continue with the efforts to complete in-kind agreements with experienced partners.	A plan for establishing partnerships based on schedule need dates and readiness to seek a partner has been established. Experience is one of the key factors used in selecting partners. Progress towards establishing partnerships will be presented at the 11th TAC meeting.
Ensure that the assessment of experience and capability is strongly built into the selection of in-kind partner	Experience and capability of a potential partner is a key factor considered in selecting partners. Experience and readiness to execute the work scope are explicitly listed as criteria in the IKC Partner Response form.
The material specification of Be is important for disposal.	As a typical high-purity beryllium, we have assessed the activation characteristics of the beryllium S200F supplied by Brush Wellman (now Materion) to the Lujan Center in 2009. Furthermore, we have confirmed that this purity of beryllium is readily available and we intend to use such material. Our assessments show that the activation is dominated by the production of tritium (75% right after shutdown, 99.7% after 1 year of cool down), which comes from reactions on Be itself. If one assumes that H3 will be released, then Be7, which also comes from Be itself, dominates for the first 2 years of cool down. After that, Co60 and Fe55, which come from the Fe impurity in S200F, will become the main contributor, but at a relatively low level from a disposal viewpoint, i.e. activation of less than 10^6 Bq/cm ³ . Therefore, we conclude that as long as we purchase high-purity beryllium of the sort mentioned above, disposal will not be negatively impacted by the level of impurities. Nevertheless, we agree that beryllium itself poses a disposal issue (see the response below regarding this topic).
Confirm maximum temperature under accident conditions	Confirmation of the maximum temperature in activated beryllium under accident conditions will be determined during the detailed hazards analysis planned over the next 1 1/2 years. Although the conclusion that this is not a personnel or public safety concern remains to be confirmed through our detailed hazards analysis process, for investment protection reasons, we plan to work to reduce the impact/probability of such an event during our detailed design work. Nevertheless, if the beryllium were to exceed temperature excursion limits/durations during an accident condition, such as a loss of coolant accident, and undergoes swelling beyond the allowance provided in the design, we will be prepared to replace the plugs.
Disposal path for Be has to be pursued further in collaboration with authorities	We agree. Discussions with the Swedish nuclear waste company, SKB, are ongoing.
Present the (He) purification technologies intended to TAC11.	This topic will be presented and discussed at TAC-11
Temperature measurements in storage area should be considered	A preliminary assessment of the decay heat in the process cells has been done. The total decay heat is about 4.8 kW including waste produced during 16 years of operation. The main contributors being the target (in total 3 pieces) and the stainless steel reflectors of the moderators (in total 16 pieces). 97% of the total contribution from the targets is coming from the newly introduced target, which means that an additional target every 5 years will not increase the total decay heat by any significant amount. The 4.8 kW is close to being a plateau value. More work must be conducted to determine whether some form of ventilation of the storage pits is required or not. If ventilation is required, temperature measurements will be incorporated as part of this system. However, even if ventilation is not required, temperatures will be monitored in the storage areas by introducing measurement equipment through the storage pit lids for validation of the storage pit atmospheres at least for the first few spent targets.
Seek advice from others who work with non-traditional remote handling techniques.	We have visited other facilities, and have plans to visit more, to better understand the limitations, issues and lessons learned with our proposed RH approach. Members of the ESS Remote Handling team recently visited Areva La Hague to observe their implementation of similar non-traditional remote handling approaches. Their installation is non-traditional in the sense that they use motorized, through-wall, master slave manipulators with force feedback as well as industrial robots re-designed with force feedback; all operated using joysticks with the same graphical user interface. Our team was able to engage in discussions with operators as well as facility management concerning operation of their hot cell facility and evaluation of pros and cons with this setup. We also hope to visit Culham in the UK where they are about to install hot cells without glass shielding windows, thus using cameras for the operations. In terms of software for virtual reality (VR) remote handling testing and operation via a central control board, the remote handling team has been in contact with a Dutch company specialized in this field.
Building of a second target wheel should be considered for backup as experience from all other facilities show that it is advisable to always keep a spare target in stock. (similar for all key components)	A list of Target Station critical spares is maintained (ESS-0008954), and forms the basis for the spares purchase plan that is built into the operations plan. Spares will be purchased as funds become available based on priorities set by impact of failure of a component, lead time needed to purchase a replacement, probability of failure, and expected lifetime. Based on the strong case for having Target Station critical spares available as soon as possible, the current ESS initial operations plan calls for the purchase of the spare target wheel, moderator/reflector plug, and proton beam window as soon as ESS operations fund become available in 2019.