Staff Observations

Jet Impingement Testing Procedure

The behavior of the flow and pressure (especially tank pressure) differences across tests was not adequately addressed. The explanation used was [ ], but there were differences that occurred [ ]. Also, the question about the [ ] was not addressed.

As a reminder, the staff notes that the test report will need to clearly justify conservative pressure at the test target for the current tests. How this is done (via comparison with two old data sets) will be an important factor in the testing acceptability. Given the variability in the tests, specific test data will need to be included for each test being used for justification.

Jet Impingement Testing of Cable

From the public meeting slides and discussion, cable debris generation occurs in the AP1000 design because cables are situated close enough to a pipe (hot leg) that is postulated to break and the pipe break jet forces were shown by test to damage the cabling and produce debris. Westinghouse describes the cable debris as [ ] that is either filtered by the screen or settles. At the meeting, Westinghouse provided a sample of [ ] piece debris (in a bag) generated during jet impingement testing. In the bag, the staff observed what appeared to be [ ]. In addition, based on other debris characterization efforts (e.g., metal and fiber insulation), staff would expect to see some amount of [ ]. While the sample of [ ] piece debris obtained during jet impingement testing is useful, relying on this testing to support the technical basis for characterizing the cable debris as [ ] is questionable given that the testing, designed to determine if cables would fail when exposed to a loss-of-coolant accident (LOCA) jet, was not designed to collect the cable debris in order to assess its characteristics.

Based on the meeting materials and discussions, the staff observed that the assumed cable debris characteristics lack a defensible technical basis (e.g., based on testing or conservative assumptions relative to head loss potential) that is consistent with previously approved debris evaluations. Characterizing the debris includes the form of the debris, transport properties, strainer head loss, and downstream effects.

During discussions (not in the slide package) the staff was informed that some cables (those that contain fiber) were being protected from a break jet such that they would not generate debris. However, no details of the protection scheme were provided. The staff expects to see a description of the protection scheme in the topical report and the supporting technical basis for why the protection scheme serves as an effective barrier to debris generation.

Submergence Testing

It is still not clear to the staff if the submergence testing included procedures capable of detecting fibers that may have been introduced into the test vessels from the insulation material. Since the filtration tests already have a dense fiber bed (filter paper), the filtration times can be used in detecting chemical precipitates that clog the filter. Filtration times may not be effective at detecting fibers in a test solution that does not contain chemical precipitates. It is the staff's understanding that detecting the presence of fibers would require a visual examination of the filters or test solution.

It is the understanding of the staff that the effect of aging on silicon release from the boron silicone will be based on test data at a maximum gamma exposure of [ ], while the calculated gamma exposure for the blocks is [ ]. Presumably this will require an extrapolation, which will need to be justified.

Design of the Shield Blocks

If the neutron absorber blocks are re-designed to be seal-welded with a small hole to release gas, the design will need to ensure that the hole is not susceptible to plugging (by distortion or movement of the neutron absorber, for example). Plugging could distort or rupture the block, possibly generating debris or blocking a flow path adjacent to the reactor vessel.

Applicability of the ANS 58.2 Standard free expansion jet model

During the September 16, 2014, meeting, Westinghouse claimed that there are conservatisms in their application of ANS 58.2 Standard jet expansion modeling and the associated jet testing. However, it is not clear to the staff regarding the conservatisms claimed as no quantitative details were presented. The staff commented and recommended that the details of how the ANS 58.2 Standard's free expansion jet model has been applied in the Westinghouse calculation and the testing configurations should be provided to demonstrate the conservatisms. The staff again noted that the ANS 58.2 jet modeling is based on the assumption of a free jet expansion. However, the plant design region of concern is within the enclosed and limited space of the reactor cavity annulus. Therefore, the staff's concern regarding the applicability of ANS 58.2 free jet modeling and the validity of the Westinghouse's jet test results and conclusions remains. The staff commented and recommended that Westinghouse provides discussion and justification regarding how the geometric configuration has been considered and whether the conservatism of their application of the ANS 58.2 model will be sufficient and adequate to address the staff's concern on the applicability of ANS 58.2 free jet modeling and the validity of the test results and conclusions.