Seabrook Annulus Debris Interceptor Approach Velocities

During our January 21, 2011 conference call with the NRC concerning fiber erosion testing for Seabrook using a method that was acceptable to the NRC (ML101540221), the NRC requested the bases that the test velocities used in the Seabrook tests are applicable to the Seabrook containment and debris interceptors.

The basis is described below.

- Containment annulus flow rates are calculated as described in Seabrook response to RAI 15.
- The RAI 15 response appeared acceptable to the NRC. (ML093350036).
- All ECCS and CS flow is conservatively assumed to enter inside the bioshield area. Flow exits the annulus area and splits to the North and to the South to the sump strainers.
- Containment annulus water height is conservatively low. Large breaks would result in a water height of 3.01 feet instead of the 2.21 feet given in the example below.
- Path flow rate, annulus debris interceptor length and containment water depth determine the debris interceptor approach velocity.
- Example:
    - DI at azimuth 250, Length = 18.5 feet, water height = 2.21 ft, flow rate =7635 gpm
    - Velocity = 7635 gal/min * min/60 sec * ft^3/7.4805 gal / (18.5 ft * 2.21 ft) = 0.416 fps.
- Debris hold up is based on testing at debris interceptor approach velocities that bound or exceeds the actual debris interceptor approach velocity.

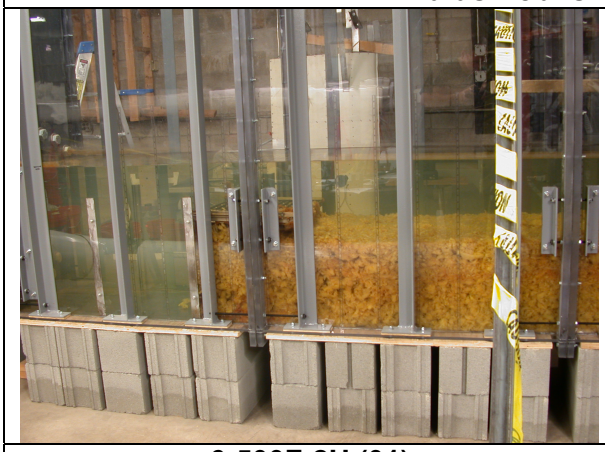
Typical fiber debris hold-up at 0.517 fps

Annulus Debris Interceptor Test Photos	
5C-1025-2H Final (01)	5C-1025-2H Final (02)

Typical fiber debris hold-up at 0.384 fps

Annulus DI Tests at 762 gpm	

Typical fiber debris hold up at 0.252 (500 gpm test flow rate) and 0.318 fps (635 gpm test flow rate)

Annulus Debris Interceptor Test Photos	
	
6-500F-2H (01)	**6-500F-2H (02)**
4-630F-2H (01)	**4-630F-2H (04)**

- At 0.318 fps and less, the debris hold up occurred ahead of the debris interceptor. The debris piled up and sunk to the floor as the flow field passed through the debris. This type of debris holdup would expose small fines to the full approach velocity.
- At 0.384 fps and above, the debris hold up occurred at the debris interceptor and formed a triangular debris pile against the debris interceptor. The face of the debris pile is exposed to the debris interceptor approach velocity.
- Of the 8 annulus debris interceptors, 5 operate at an approach velocity that exceeds 0.384 fps based on the maximum ECCS and CS recirculation flow rate. Of these, one debris interceptor is not credited for debris hold up for the maximum recirculation flow case since its approach velocity exceeds the values used in the debris interceptor tests. The remaining 3 debris interceptors fall in the 0.318 fps category.

Conclusion

Based on the type of debris piles formed behind the debris interceptors, the conservative water heights used to determine the debris interceptor approach velocity and the as-tested approach velocities, the 0.42 to 0.43 fps velocity fields used to test and determine the fines erosion fraction for Seabrook are conservative and bound the expected debris interceptor approach velocities.