

thinner point than 0.49 inches would have been observed. Thus, I believe that there is a significant chance that the drywell shell Bay 13 currently fails the very local area acceptance criterion in.

Q18. To take account of the alleged bias in the external UT measurements, AmerGen has applied a correction technique to some of the measurements. Do you believe this correction technique is appropriate?

A18. No, it is inappropriate for a number of reasons. First, it was derived using only measurements in Bay 13. Because the visual inspection shows that Bay 13 is atypical, even if this technique were appropriate for Bay 13, it would not be appropriate for the other Bays. Second, the technique is not even appropriate for Bay 13, because it is not based on any viable physical or statistical theory. Instead, the operator appears to have selected a correction factor that is larger than the average surface roughness.

Deleted: 9

Q19. Since submitting your initial testimony have you refined your assumptions about the interior corrosion rate?

A19. Yes. NRC Staff have confirmed that UT data taken in the trenches have show that a corrosion rate of approximately 0.002 inches per year occurred between 1986 and 2006. The interpretation of these results is very difficult. AmerGen's explanation that the thinning is caused by exterior corrosion seems unlikely, because Bays 5 and 17 are the least corroded Bays and the estimated corrosion rate in Bay 17 was not significant or was very small (no corrosion rate was even estimated for Bay 5). AmerGen Ex. 23. Indications are that corrosion on the interior could occur at outages or when water flows to the interior during operation. Thus, it is likely that the 2 mils per year average represents a situation where interior corrosion occurred in fits and starts over the years. Considerably higher short term corrosion rates have probably occurred. In the absence of any good information on this issue, I believe it would be prudent to allow for an interior corrosion rate that is a multiple of 0.002 inches per year, if new water is introduced onto the interior floor by repairs to control rod drives, use of the containment spray, or other sources.

Deleted: 8

Deleted: 8

Q20. Has AmerGen or NRC Staff shown that water cannot be present in the exterior of the drywell shell?

Deleted: 19

A20. No. At various times in the past there has been leakage onto the exterior of the drywell shell because the drywell cavity liner leaks and the trough that was provided to catch general leakage is very shallow, has only one drain, and was damaged. Citizens' Ex. 15 at 134-35; Citizens' Ex. 24 at 222-23; AmerGen Testimony Part 1 at A.20; AmerGen Testimony Part 3 at A.5. More recently, during the 1994 and 1996 refueling outages, the committed mitigation measures were not used and water leaked into the exterior sandbed region. AmerGen Testimony Part 4 at A.8-9; AmerGen Testimony Part 5 at A.14. Therefore, water could flow onto the exterior of the drywell shell in the sandbed region if a forced outage occurred that required the reactor cavity to be flooded without having the leakage mitigation measures applied. In addition, AmerGen has acknowledged that it has been unable to devise a means of stemming the leakage from the reactor cavity during refueling. Citizens' Ex. 24 at 219-21. In the 2006 outage around one gallon per minute of leakage was observed even after the required tape and strippable coating were applied to the fuel cavity liner. AmerGen Testimony Part 4 at A.9. However, the trough is still subject to high temperatures that could cause the concrete to deteriorate and the condition of the trough was seen to be far from ideal in the most recent outage. Citizens' Exs. 48-49. In addition, quite serious leaks have been observed in the past even after taping and strip coating. Citizens' Ex. 50. Furthermore, the intended function of the trough is to act as a backup for other components. Citizens' Ex. 24 at 220. Thus, if the trough degraded further, mitigating measures were not as effective as in 2006, or leakage was observed in other components, water could enter the drywell again, even without a forced outage. Finally, AmerGen acknowledges that use of the drywell chillers, which are used during refueling and other outages when access to the drywell is needed, could lead to condensation. AmerGen Testimony Part 4 at A.15. The potential for condensation is apparently confirmed by an analysis of water that had drained from the exterior of the sandbed region before March 2006, which showed no activity. Citizens' Ex. 23. This is consistent with the source being condensation.

Deleted: 19

Q21. Is there a chance that some of the exterior of the drywell shell is not covered by a protective epoxy coat?

Deleted: 18

A21. Yes. Internal documents we have received from AmerGen indicate that areas of the shell in the sandbed region were not coated with epoxy because they are inaccessible. Citizens' Exs. 40-41.

Deleted: 18

Q22. Do you believe that AmerGen has used valid methods to evaluate the potential for external corrosion?

Deleted: 19

A22. No. AmerGen makes a number of critical errors in its approach to estimating exterior corrosion. Most obviously, Mr. Gordon fails to consider the situation where the plant is forced to fill the drywell cavity in a forced outage. AmerGen Testimony Part 5 at A.13. Mr. Gordon also fails to allow for other forced outages, which could lead to condensation on the exterior of the drywell surface. In addition, Mr. Gordon has not used a reasonable approach to estimate the time in which any water on the exterior of the shell would evaporate, because he has used an equation which applies to pools or open ponds. Id. at A.19. Thus, the equation inherently assumes that the evaporation of the water does not affect the air into which it is evaporating (steady state equation). This assumption is invalid for the exterior of the sandbed region which has very limited air exchange. It is therefore likely that in the event of water leakage into the region, the air in the sandbed region would become fully saturated during the outage (transient phenomenon). It would then have very limited capacity to absorb moisture as the temperature increased with plant start up. Then, after the air becomes saturated at the operating temperature, it would not absorb more moisture unless air is being exchanged with the outside. The ability of new air to reach the sand pocket has been reduced by the placement of tubes leading to polystyrene bottles in the sandbed drains. Thus, it is likely that any moisture on the exterior of the shell would evaporate slowly. I do not have access to sufficient information to provide a quantitative estimate of the rate of evaporation.

Deleted: 19

Q23. In summary, are you convinced that the drywell will meet safety requirements during any extended period of operation?

Deleted: 0

A23. No. NRC Staff and AmerGen have created a miasma of uncertainty, which makes it difficult to show what the current situation is or how it could change in the future. However, I believe that the contour plots coupled with the visual observations show that it is likely that the corrosion goes beyond the envelope of the shapes modeled by GE. Furthermore, based on my

Deleted: 0

statistical analyses I believe there is a significant chance that the thinnest area of the drywell is thinner than the required amount (0.49 inches). In addition, the lower 95% confidence intervals of the external data are close to or below the criterion for mean thickness (0.736 inches). For example, based on raw UT data, I believe that Bay 15 could have a mean thickness of less than 0.736 inches at the lower 95% confidence limit and the lower 95% confidence limit of the mean thickness of Bay 13 in 1992 was 0.741 inches, a mere 0.006 inches above the requirement. There is also tremendous uncertainty in the potential corrosion rates for both interior and exterior corrosion. Thus, I believe the Board should not allow the proposed relicensing because AmerGen cannot demonstrate with any certainty that the drywell shell in the sandbed region can meet the ASME code at the start of any period of extended operation. If the Board decides to grant the license, it should ensure that AmerGen has provided an estimate of the thickness margin above each acceptance criterion that is reasonably certain. The UT monitoring frequency should be based on the smallest margin available. That frequency would be considerably less than once every four years because available margins are, at best, razor thin and such margins could be reduced to nothing in a matter of months.

Q24. Have you now completed your rebuttal testimony?

Deleted: 1

A24. Yes.

Deleted: 1