RAS 13575

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USNRC

May 4, 2007 (4:22pm)

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
E. Roy Hawkens, Chair
Dr. Paul B. Abramson
Dr. Anthony J. Baratta

In the Matter of:	)	May 4, 2007
AmerGen Energy Company, LLC	)	Docket No. 50-219
(License Renewal for Oyster Creek Nuclear Generating Station)	)	

AMERGEN MOTION TO STRIKE

In accordance with 10 C.F.R. § 2.323(a) and this Board's Order of May 1, 2007,[1] AmerGen Energy Company, LLC (AmerGen) moves to strike portions of "Citizens' Answer Opposing AmerGen's Motion for Summary Disposition" (April 26, 2007) (Answer).[2] As demonstrated below, Citizens' Answer and the supporting Memorandum of Dr. Rudolf Hausler (Hausler Memorandum) go well beyond the limited issue in contention. They impermissibly raise issues that this Board has repeatedly and unambiguously excluded from the scope of this proceeding. They also raise new issues that are outside the scope of the contention. Citizens had an obligation to amend their contention if they wished to raise these new issues. Accordingly, the Board should strike

1 Order (Granting AmerGen's Request for Leave to File Motion to Strike) (May 1, 2007) (unpublished).

2 Citizens are Nuclear Information and Resource Service, Jersey Shore Nuclear Watch, Inc., Grandmothers, Mothers and More for Energy Safety, New Jersey Public Interest Research Group, New Jersey Sierra Club, and New Jersey Environmental Federation.

the portions of the Answer and the Hausler Memorandum specified in MTS Exhibits 1 and 2, respectively.[3]

I. PREVIOUSLY REJECTED ISSUES MUST BE STRICKEN

Citizens' Answer and the Hausler Memorandum impermissibly raise three issues that this Board has excluded from this proceeding on numerous occasions; namely, challenges to: (1) the acceptance criteria; (2) AmerGen's methods for analyzing UT results in the sand bed region; and (3) the scope of UT monitoring (*i.e.*, where the UT measurements are taken).

A. Citizens' Fifth Attempt to Litigate Acceptance Criteria Must Be Rejected

Citizens are once again challenging the minimum thickness acceptance criteria for the sand bed region of the drywell shell.[4] This represents an impermissible attempt to litigate, *for the fifth time*, those acceptance criteria. The Board explicitly excluded from the admitted contention any challenge to the existing acceptance criteria,[5] and has repeatedly rejected each of Citizens' four untimely attempts to litigate this issue.[6]

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[3] The justifications for each portion to be stricken are indicated in the Exhibits, according to the following legend:

(1) Statements disputing the local area acceptance criteria (see § I.A., below);
(2) Statements disputing the statistical methods for analyzing the UT results (see § I.B.,below);
(3) Statements disputing the spatial scope of UT monitoring (see § I.C., below); and
(4) Statements addressing the October 2006 UT results (see § II below).

[4] *See, e.g.*, Answer at Section III.A; Hausler Memorandum at 7-8.

[5] Memorandum and Order (Granting Petition to File a New Contention), LBP-06-22, 64 N.R.C. __, slip op. at 10-14 (Oct. 10, 2006).

[6] *See* Memorandum and Order (Denying New Jersey's Request for Hearing and Petition to Intervene, and Granting NIRS Request for Hearing and Petition to Intervene), LBP-06-11, 63 N.R.C. 391, 398 (2006) (rejecting the challenge to the acceptance criteria raised in "Motion for Leave to Add Contentions or Supplement the Basis of the Current Contention" (Feb. 7, 2006); LBP-06-22, slip op. at 14 (rejecting two challenges to the acceptance criteria raised in "Petition to Add a New Contention" (June 23, 2006) at 4 (June 23 Petition) and "Supplement to Petition to

(footnote continued)

Unfortunately, the Board is called upon once again to rule on a pleading that has been filed in flagrant disregard of Board Orders in this proceeding.

Citizens seek to mask their most recent challenge by arguing that the local area acceptance criterion has become "more stringent."[7] Yet this challenge is identical to a challenge this Board rejected in LBP-06-22. Specifically, in their June 23 Petition Citizens sought to argue, among other things, that "AmerGen had *changed the acceptance criteria* for measurements that showed that the steel shell was already thinner than the initial 0.736 inch criterion."[8] The Board found that argument untimely then, and it is therefore impermissible for Citizens to raise it again at this late date.

Citizens also now argue that use of the local area acceptance criterion (as described in AmerGen's Motion for Summary Disposition) "could not be justified," and they list various reasons why they think that is the case.[9] Citizens, however, are prohibited from arguing that these criteria are unacceptable, as the Board recently reiterated that such arguments are precluded from litigation in this proceeding.[10]

B. Citizens Are Not Permitted to Litigate the Methods for Analyzing UT Results

Citizens also devote portions of their Answer and the Hausler Memorandum to once again challenge AmerGen's methods for analyzing the results of UT of the drywell

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Add a New Contention" (July 25, 2006) at 17-22 (July 25 Supplement); Memorandum and Order (Denying Citizens' Motion for Leave to Add a Contention and Motion to Add a Contention) at 6 (April 10, 2007) (unpublished) (April 10, 2007 Order) (rejecting the challenge to the acceptance criteria raised in "Motion for Leave to Add a Contention and Motion to Add a Contention" (Feb. 6, 2007)).

7 Answer at 6.

8 LBP-06-22, slip op. at 11 (quoting June 23 Petition at 16) (emphasis added).

9 Answer at 7.

10 April 10, 2007 Order at 6.

shell in the sand bed region.[11] This includes a challenge to the analysis of UT data from 1992, as well as UT data from the most recent refueling outage in October 2006. For example, they state that AmerGen's "procedure" for "evaluating the 1992 external [ultrasonic testing] results" is "highly arbitrary" and "masked the full extent of the corrosion."[12]

Such a claim mirrors Citizens' June 23 Petition, in which they argued, among other things, that "the average of the individual [UT] measurements taken in each grid is used to analyze the corrosion rates, leading to artificially low estimates of uncertainty; [and] it omits from the mean some of the thinnest points in the grids, leading to artificially high estimates of the current mean thickness."[13] The Board, of course, ruled that part of the Petition outside the scope of the admitted contention.[14] Citizens' efforts to wedge it back into this proceeding under guise of their Answer is exemplary of their lack of discipline and the above-cited disregard for this Board's Orders.

C. Citizens Are Not Permitted to Litigate the Scope of UT

Citizens devote portions of the Hausler Memorandum to once again challenge the scope of UT monitoring (*i.e.*, where the UT measurements are taken). For example, Dr. Hausler states:

> [S]ince the outside of the drywell in the sandbed region had been coated in 1992, corrosion in the upper regions of the sandbed (i.e. where monitoring is being proposed) has become less relevant because water accumulations (the

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[11] *See, e.g.*, Answer at Section III.B. & C; Hausler Memorandum at 8-10.

[12] Answer at 8; *see also* Hausler Memorandum, *passim*.

[13] LBP-06-22 at 33-34 (citing June 23 Petition at 11-12).

[14] *Id.* at 36.

> primary causes for corrosion) will now more likely occur towards the bottom of the former sandbed region.[15]

The Board, however, has already ruled that this argument may not be litigated in this proceeding.[16]

II. NEW ARGUMENTS ARE PRECLUDED

Section III.C of Citizens' Answer presents arguments based on alleged deficiencies in the 2006 UT measurements and in AmerGen's methods for analyzing these measurements. Yet, since the Board admitted Citizens' contention on October 10, 2006, Citizens have not amended their contention to address the results of the UT measurements taken during the subsequent October 2006 outage or the revisions to AmerGen's License Renewal Application submitted to the NRC in December 2006 addressing those results.[17]

The Board in *Duke Cogema Stone & Webster* (Savannah River Mixed Oxide Fuel Fabrication Facility), LBP-04-9, 59 N.R.C. 286 (2004), faced a similar fact pattern. The Board had admitted a contention based on DCS' initial Application, but DCS then revised the Application. DCS subsequently filed a motion for summary disposition. In response, the intervenor challenged new information that was part of DCS' revised application. The Board granted summary disposition, finding that intervenor "should have been well aware of the Board's expectation that late-filed contentions or *late-filed amended*

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15 Hausler Memorandum at 1.

16 LBP-06-22 at 36.

17 Letter, from Michael P. Gallagher, AmerGen, to NRC Document Control Desk, "Information from the October 2006 Refueling Outage Supplementing AmerGen Energy Company, LLC (AmerGen) Application for a Renewed Operating License for Oyster Creek Generating Station," (Dec. 3, 2006).

contentions should be filed promptly following the issuance of any documents containing significant new or different information."[18]

Citizens chose not to file any late-filed amendments to their contention after AmerGen submitted its revised Application in December 2006 to incorporate the results of the 2006 outage. Accordingly, AmerGen limited its Motion for Summary Disposition to Citizens' arguments as admitted by the Board in LBP-06-22. The Board should not permit Citizens to raise these issues now in an Answer to a Motion for Summary Disposition, when they had approximately five months to do so as an amendment to their contention. By doing so in their Answer for the first time, they prevent AmerGen and the Staff from providing any substantive reply. This is akin to including information in a reply brief that was not raised in an initial pleading, which the Commission has ruled is impermissible.[19] As a result, arguments addressing this new information are beyond the scope of the admitted contention, and should be stricken.[20]

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18 LBP-04-9, 59 N.R.C. at 292 (emphasis added).

19 *Louisiana Energy Servs., L.P.* (National Enrichment Facility), CLI-04-25, 60 N.R.C. 223 (2004) (upholding the Board's refusal to consider arguments presented for the first time in reply briefs, because "the reply briefs constituted a late attempt to reinvigorate thinly supported contentions by presenting entirely new arguments").

20 *See also Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), LBP-99-23, 49 N.R.C. 485, 493 (1999) ("Given there is not a material dispute over the present status of the application," intervenors' arguments challenging the revised application would "favor . . . the admission of a new contention" rather than preclude summary disposition.).

III. CONCLUSION

Because Citizens' Answer and the supporting Hausler Memorandum present issues that the Board previously has rejected and/or that are beyond the scope of the admitted contention and its bases, the Board should strike the portions of Citizens' Answer and the Hausler Memorandum indicated on the markups attached to this Motion as MTS Exhibits 1 and 2, respectively.

Respectfully submitted,

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Dated in Washington, D.C.
this 4th day of May 2007.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	May 4, 2007
AmerGen Energy Company, LLC	)	Docket No. 50-219
(License Renewal for Oyster Creek Nuclear Generating Station)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "AmerGen Motion to Strike" were served this day upon the persons listed below, by E-mail and first class mail, unless otherwise noted.

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MTS Exhibit 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:
E. Roy Hawkens, Chair
Dr. Paul B. Abramson
Dr. Anthony J. Baratta

In the Matter of	)	
	)	April 26, 2007
AMERGEN ENERGY COMPANY, LLC	)	
	)	Docket No. 50-0219-LR
(License Renewal for the Oyster Creek Nuclear Generating Station)	)	
	)	

CITIZENS' ANSWER OPPOSING AMERGEN'S MOTION FOR SUMMARY DISPOSITION

PRELIMINARY STATEMENT

Nuclear Information and Resource Service, Jersey Shore Nuclear Watch, Inc., Grandmothers, Mothers and More for Energy Safety, New Jersey Public Interest Research Group, New Jersey Sierra Club, and New Jersey Environmental Federation (collectively "Citizens" or "Petitioners") oppose the summary disposition motion (the "Motion") filed by AmerGen Energy Co. LLC ("AmerGen") on legal and factual grounds.

The facts show that summary disposition is inappropriate. AmerGen seeks summary disposition even though its own analyses, despite some inconsistency, showed that margins are narrower than 0.064 inches and potential corrosion rates are greater than 0.017 inches per year. 2 & 4
The combination of these two facts leads to a conclusion that a measurement frequency of every 4 years is too long, because corrosion in excess of the margin could occur in less than 4 years.

For the purposes of summary disposition, the facts must be construed in favor of Citizens. Thus, these two facts alone indicate that summary disposition is inappropriate at this time.

In addition, as a matter of law, summary disposition is also unavailable to AmerGen based on its pleadings. Where there is a clash of expert opinion, summary disposition is only possible where one expert's opinion is so flawed that it would be inadmissible at trial. Here, AmerGen has failed to show that the opinions of Citizens' expert are flawed. It has also proffered an affidavit regarding acceptance criteria and available margin that is contradicted by documents in the record that were written by the affiant. At this stage, AmerGen's testimony on these issues should therefore be disregarded as unreliable. Because AmerGen has failed to present any other testimony regarding the available margin, as a matter of law it has failed to meet its burden to show that there are no open issues for adjudication.

In fact, discovery in this proceeding has confirmed that there are currently four main open issues for adjudication: i) what are the acceptance criteria that must be met by the thickness results from the ultrasonic ("UT") testing in the sandbed region of the drywell shell at the Oyster Creek Nuclear Generating Station ("Oyster Creek") ii) when the results from the UT testing are compared to the acceptance criteria, what is the minimum margin iii) how fast could corrosion occur between inspections; and iv) what frequency of UT testing is required to ensure that required safety margins would be maintained during any extended license renewal period. AmerGen's inconsistent statements and methods mean that there are open issues concerning all of the above. In addition, the latest opinion from Citizens' expert shows that AmerGen has incorrectly claimed that a small number of measurements from the interior of the sandbed represent the behavior of the entire region. Careful analysis of the data actually shows that these

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2 & 4

2 & 3

measurements actually tend to overestimate the average thickness of the sandbed region. Thus, margin calculations regarding the average thickness cannot use the interior measurements alone. 2

When Citizens proffered the contention, they alleged that the margin could be as low as 0.026 inches. AmerGen continues to allege that the margin is 0.064 inches. Citizens have now compared the latest results with the latest acceptance criteria for average thickness, the thickness of local areas that are less than 0.736 inches thick, and the thickness of very localized areas. For average thickness the known margin at 95% confidence is 0.044 inches or less, because the 1, 2 & 4 uncertainty in the mean thickness measurement is plus or minus 0.02 inches at 95% confidence and these measurements may overestimate the average thickness. Furthermore, using the latest external thickness measurements in Bay 11, Citizens currently estimate the minimum margin compared to the average thickness acceptance criterion is only 0.014 inches at 95% confidence. For small areas that are greater than around two inches in diameter, but less than 12 inches by 12 inches, the current margin is highly uncertain, but may already be less than zero. For very localized areas that are than around two inches in diameter or less, the known margin at 95% confidence may also be less than zero, depending the statistical approach taken to estimate the thinnest point on the drywell shell.

The potential future corrosion rate in case of corrosive conditions occurring is also poorly defined, but Citizens' expert estimated that it could be around 0.017 inches per year, while AmerGen's expert has assumed it could be as high as 0.039 inches per year. Thus, assuming that AmerGen can establish some margin, the appropriate monitoring frequency could be more than once per year. The current proposed monitoring frequency is once every four years. Thus, the contention alleging that monitoring frequency is inadequate cannot be dismissed summarily.

With regard to the corrosion rate, AmerGen states that the 2006 results show that corrosion at 0.017 inches per year has not been occurring. That is irrelevant because Citizens did not state that corrosion had been occurring at that rate. Instead, Citizens asserted that corrosive conditions could occur between inspections during any extended licensed period of operation because the protective coating is at or close to the end of its life and water could be present. AmerGen has neither denied that corrosive conditions could occur in the future, nor that corrosion could occur at a significant rate under such conditions. Thus, AmerGen has failed to show that the potential for significant future corrosion is not an issue.

The required monitoring frequency is a function of the available margin and the potential corrosion rate. The combination of open issues regarding the acceptance criteria, the available margins and the corrosion rate mean that the contention, which concerns appropriate monitoring frequency, cannot be dismissed through summary disposition. Instead these issues must be adjudicated through a hearing or, at minimum, clarified through further document disclosure and discussion between the parties.

STATEMENT OF FACTS

I. Undisputed Issues

This proceeding concerns AmerGen's ability to ensure that the drywell shell, which forms the primary containment system at the Oyster Creek, does not corrode below acceptable safety margins during any extended period of licensed operation beyond April 2009, when the Plant is currently scheduled to close. The containment system is a safety critical component whose failure could lead to the inability to contain products from a nuclear accident and, under certain circumstances, could even initiate a nuclear accident.

II. Specific Factual Issues Already Decided By The ASLB

Citizens already demonstrated a basis for their initial contention about the lack of adequate UT testing. As recognized by the ASLB in its decision admitting the initial contention, Citizens had ample basis for the following points:

i) water could intrude into the sand bed region in the future, leading to corrosive conditions on the outside of the drywell shell, LBP-06-07 at 36;

ii) the epoxy coating that was applied to protect the sand bed is now beyond its rated life and may be deteriorating, id. at 31, 36;

iii) corrosion could occur even if the epoxy coating had not visibly deteriorated, id. at 36-37

In the decision admitting the current contention the Board reaffirmed its findings, stating that the existence of a corrosive environment was a possibility. LBP-06-22 at 15.

III. Factual Errors Made By AmerGen

In the Motion and the affidavits AmerGen makes a number of factual errors about the acceptance criteria, the remaining margins, and Citizens' statement about corrosion rates. This Section details these errors and thereby illustrates that many of the "facts" asserted by AmerGen are in dispute.

A. The Local Area Acceptance Criterion Is In Dispute

With regard to the acceptance criteria, AmerGen alleges that the "local area average thickness" criterion is 0.536 inches for a 1 square foot area, but the total area that can be thinner than 0.736 inches is *nine square feet.* Affidavit of Peter Tamburro, dated March 26, 2007 1
("Tamburro Aff.") at ¶¶ 20, 22, 23 (emphasis added). However, NRC Staff in the Safety Evaluation Report ("SER") quote AmerGen stating that the local acceptance criterion "can be applied to small areas (less than *12" by 12"*) which are less than 0.736" thick so long as the small *12" by 12"* area is at least 0.536 inches thick." Oyster Creek SER, 4-56 (March 2007)

(emphasis added). In March of 2006, Mr. Tamburro himself wrote that "the Local Wall Acceptance Criteria . . . is applicable for area up to *12 x 12*." Citizens' Ex. ANC 8 at 2 (emphasis added). Furthermore, AmerGen also stated that areas corroded to less than 0.736 inches in thickness "could be contiguous, provided their total area did not exceed *one square foot*" and their average thickness was greater than 0.536 inches. E-mail to NRC Staff dated April 5, 2006, Ex. NC 1 at 10 (available at ML060960563) (emphasis added). Thus, in contrast to Mr. Tamburro's Affidavit, AmerGen's statements, and those of the affiant himself, directly contradict the proffered affidavit and state that the local acceptance criterion only applies to [1]
small areas that are less than one square feet in area.

Given these various statements, it is therefore hardly surprising that Dr. Hausler concluded that the local area acceptance criterion meant that contiguous areas that are thinner than 0.736 inches should be less than one square foot in area. This belief was buttressed by AmerGen documents which actually purported to show that the area thinner than 0.736 inches, but thicker than 0.536 inches, was 0.68 sq. ft, and thus less than one square foot. Citizens' Ex. NC 1 at 10.

The latest calculations detailing how the UT measurements have been accepted show that since Citizens made their contention the local area acceptance criterion has become more stringent. In mid-2006, AmerGen applied a local thickness criterion of 0.636 inches to areas that are less than 12 inches square. AmerGen Ex. 3 attached to Answer dated March 5, 2006 ("1992 Acceptance Report") at 5. Most recently, in December 2006, AmerGen applied the following local acceptance criterion: "if an area is thinner than 0.736" thick, then that area shall be greater than 0.693 inches thick and shall be no larger than 6" by 6" wide." Calculation C-1302-187-E310-041, Ex. SJA 1, at 11. This is considerably more stringent than the criterion put forward by Dr. Hausler (and used previously by AmerGen) at the time Citizens proffered the admitted contention. This more stringent formulation of the local acceptance criterion provides further support for the contention because the margins calculated using this more stringent criterion will inevitably be narrower than previously estimated.

Instead of discussing the various approaches that it has actually used to determine whether the 2006 UT results are acceptable, AmerGen has stated that the total allowable area that is thinner than 0.736 inches is nine square feet. Tamburro Aff. at ¶¶ 20-23. As shown above, AmerGen's own documents contradict this assertion. Further, even if AmerGen had actually used such a criterion, it could not be justified. A uniform thickness of 0.736 inches is believed 1 by AmerGen to exactly satisfy the AMSE criteria. Citizens' Ex. ANC 2 at 6-9; Tamburro Aff. at ¶ 17. In addition, as Mr. Tamburro himself noted, when a nine square foot area thinner than 0.736 inches was modeled by General Electric, the safety factor decreased by 9.5%. Citizens' Ex. ANC 8 at 2. Thus, AmerGen cannot show that a nine square foot area thinner than 0.736 inches would meet the ASME code, because when the average thickness is close to 0.736 inches, as is currently found, the localized thickness reduction could cause the shell to fail the ASME code requirements. This appears to have been one of Mr. Tamburro's concerns when he authored ANC 8 in March, 2006. From the timing, it appears that the local acceptance criterion has become more stringent over the last year in response to these concerns. It is therefore not surprising that Mr. Tamburro's affidavit fails to give any examples of actual use of the purported local area acceptance criterion of nine square feet thinner than 0.736 inches. This is because this purported criterion has never been applied in practice. Instead, this more lax version of the local area acceptance criterion appears to have been concocted solely for this litigation.

In summary, AmerGen's own documents indicate that Mr. Tamburro is incorrect in his assertions about the local area acceptance criterion. Although AmerGen claims that Dr. Hausler was mistaken about the local acceptance criterion, Tamburro Aff. at ¶¶ 21-22, some of AmerGen's documents indicate that Dr. Hausler was correct and others show that the applied criterion is now actually more stringent than before. Thus, one issue that requires adjudication or, at minimum, further document disclosure, is the proper statement of the local area acceptance criterion. 1

B. The Measurements For Evaluation Against The Acceptance Criteria Are In Dispute 2 & 4

In addition to the dispute about the correct local acceptance criterion to use, Citizens have raised many factual issues with the way in which the margins have been calculated. In evaluating the 1992 external results, instead of using the actual measurements, AmerGen used an adjusted result based on some casts that had been taken of the dimples in the external drywell surface. *E.g.* 1992 Acceptance Report at 33-39. At the thinnest location measured, this procedure changed the evaluation thickness from 0.618 inches, which is what was measured by UT, to 0.673 inches. *Id.* at 39. The report further stated that this thickness "could conservatively exist over an area of 6 x 6 inches." *Id.* at 36.

Dr. Hausler examined this procedure in detail in his memorandum dated June 23, 2006 ("Hausler June Memo"), which supported the contention. Dr. Hausler found the procedure to be "highly arbitrary" and opined that it masked the full extent of the corrosion. Hausler June Memo at 14. Indeed, even AmerGen appears to have realized that the procedure used by AmerGen for the 1992 results is not justified because the acceptance report for the 2006 results does not utilize the approach used in 1992. Calculation C-1302-187-E310-041.

Furthermore, AmerGen misreported the 2006 external measurements. AmerGen has stated that the areas that were not measured were thicker than the areas that were measured externally. Transcript from January 18, 2007 ACRS meeting at 201. Indeed, by design, the 1992 measurements were supposed to be taken at the thinnest points. Calculation C-1302-187-E310-041, Ex. SJA 1 at 48. Unfortunately, because the locations of the points measured in 1992 were not marked on the coating, the exact locations could not be repeated. Ex. SJA 1 at 48; *see also* Ex. SJA 2 Attachment 4 at 8 (some locations not found). However, the results for 2006 show that at some points in Bays 7, 15, 17 and 19 AmerGen scanned a 0.25 inch area around the nominal location of the point. Ex. SJA 2 Attachment 4 at 8, 16, 18, 20. Strikingly, in Bay 15, the reported results were actually the maximum readings obtained. In this Bay, the minimum readings were as much as 0.068 inches less than the recorded value. *Id.* at 16. Similarly, in Bay 19 the recorded results were up to 0.07 inches more than the minimum measured value. *Id.* at 20. AmerGen Ex. 4 at 5-1. 2, 3 & 4

According to AmerGen's own consultant, scanning a small area around an uncertainly located point can help reduce locational uncertainty, if the minimum or average reading is systematically reported. AmerGen Ex. 4 at 5-1. In this case, because the objective was to find minimum values, AmerGen should have reported the minimum reading obtained in 2006 as the measurement for evaluation and marked that point as the baseline. Its failure to do so means that the statistical evaluation of whether ongoing corrosion was occurring was compromised, because the 2006 results were overstated. Furthermore, margin calculations based on the overstated results are incorrect.

C. Margins Are Less Than 0.021 Inches

AmerGen asserts that the minimum margin is 0.064 inches, calculated by subtracting the average of the measurements taken from the 6 inch by 6 inch grid in Bay 19 from the 0.736

inches acceptance criterion for the average thickness. Tamburro Aff. at 6. However, this statement is inconsistent with AmerGen's own documents. The minimum margin compared to the average thickness criterion evaluated by AmerGen to date was actually taken from the external results in Bay 11 in 1992. This showed a mean thickness of 0.792 inches, 1992 Acceptance Report at 5, 30, yielding a margin of 0.056 inches. Using the latest results taken in Bay 11, that average has now decreased to 0.783 inches. *See* Ex. SJA 2 Attachment 4 page 12. Thus, if AmerGen had determined the acceptability of the latest external results using the approach that it used in September of 2006 to evaluate the 1992 results, it would have found the minimum margin to be 0.047 inches. Furthermore, the mean of the minimum data measured at each point in Bay 15 is 0.768 inches, yielding a minimum margin of 0.032 inches. Thus, AmerGen has failed to accurately describe the results of its own calculations and has inconsistently applied the acceptance criteria to the external data. 4

In addition, these margin calculations above are overly simplistic, because they take no account of the uncertainty of the measurements. Looking first at the mean data gathered from the 49-point grids, AmerGen has admitted that it must take account of the variance of the means of these data, SER at 4-55, but it has failed to so do for the most part. One exception is that in taking account of the variability of the mean of the measured data in the trenches, AmerGen subtracted 0.02 inches before it compared the mean to the acceptance criterion. *See e.g.* Ex. SJA 2 at 8. 2 & 4

Taking a more rigorous account of the variance of the means requires explicit consideration of the number of measurements available. For the data from the interior grid at location 19A, which AmerGen used to claim that the margin is 0.064 inches, the standard deviation is around 0.06 inches, SJA 1 at 50, giving rise to a standard deviation in the mean of around 0.01 inches, because 49 points were used to calculate the mean. Thus, even if the grids were representative of the surface of each bay, which close analysis shows they are not, around 0.02 inches should be subtracted from any margin obtained to take account of the uncertainty in the determination of the mean thickness based on so few points. Thus, at best, the Bay 19 grid data quoted by AmerGen as the basis for its estimate of minimum margin could only show that the margin in that Bay is greater 0.044 inches at 95% confidence. 2 & 4

Unfortunately, as Dr. Hausler shows comprehensively, the grids measured from the interior are not representative of the mean surface and may overestimate the mean thickness. Hausler Aff. at 3-5. Therefore, it is essential to look at the external data in addition to the grids. For the external data, provided a genuine effort is used to find the points of minimum thickness and use those as the basis for the analysis, using the lower 95th percentile of the minimum points is very conservative. However, no such effort was made in 2006. Therefore, Dr Hausler believes that it is prudent to consider the 95th percentile intervals of the means of the external data. Hausler Aff. at 5. Applying this method requires derivation of the uncertainty in the means of the external data. In Bay 11, the standard deviation of the data is 0.048 inches. Because eight points were measured, the standard deviation of the mean is 0.017 inches. Therefore, the lower 95% confidence limit for the mean thickness is 0.750 inches. Thus, the 2006 external UT data show that the average thickness margin in Bay 11 is 0.014 inches with 95% confidence. More dramatically, in Bay 15, the lower 95th percentile of the mean of the corrected data is 0.731 inches, which is below the acceptable limit of 0.736 inches. 2 & 4

Turning to the local area criterion, the most recent formulation requires areas that are thinner than 0.736 inches to be thicker than 0.693 inches and smaller than 6 inches by 6 inches. In 1992, the thinnest area measured was 0.618 inches, which AmerGen stated could extend over 1 a 6 inch by 6 inch area. AmerGen Ex. 3 at 36. Even the "corrected" result, which was evaluated against the old local area criterion, was given as 0.673 inches. *Id.* Thus, if AmerGen compared 1 the 1992 results to the current local area criterion, it appears that it would be violated.

The 2006 results are even worse. The thickness in the same location measured in 1992 as 4 0.618 inches was measured in 2006 as 0.602 inches. Ex. SJA 2, Attachment 4 at 14. However, it appears that in contrast to the approach taken in September of 2006 with regard to the acceptance of the external results from 1992, AmerGen did not compare the 2006 external results with the local area acceptance criterion. *Compare* AmerGen Ex. 3 at 16-17, 35-36 *with* SJA 1 at 48-49. Citizens are unaware of any justification for this omission.

In addition, the latest results indicate that an area of around 4 square feet in Bay 13 may 1 & 4 be thinner than 0.736 inches. Hausler Aff. at 8. This also appears to violate the local acceptance criterion stated in Calculation C-1302-187-E310-041. Ex. SJA 1 at 11. Once again, it remains unclear how AmerGen decided to accept these results.

Similarly, in Bay 1 AmerGen previously calculated that a 4 inch by 4 inch area had an average thickness of 0.692 inches. AmerGen Ex. 3 at 17; Ex. NC 3 at 9. Depending on the 1 thickness of the 2 inch strip surrounding this 4 by 4 area, this zone may just have met the latest statement of the local area acceptance criterion in 1992. However, the 2006 results were around 1 & 4 0.02 inches thinner on average than the 1996 results. *See* Ex. SJA 2, Attachment 4 at 2. Thus, it is quite possible that this area has already expanded to 6 inches by 6 inches or larger. While the exact margin in unknown, it is clear that the margin compared to the local acceptance criterion must be at best extremely narrow, but that it has not been estimated by AmerGen.

In summary, since Citizens filed their contention, the local area acceptance criterion has 1 become more stringent, while the measured thickness has decreased. Thus, the latest reports and

4

results confirm that, at best, margins are razor thin and are less than the 0.021 inches which Citizens calculated when they proffered the contention. In contrast, AmerGen has not produced any new justification for its long disputed assertion that the margin is actually 0.064 inches.

D. There Is Potential For Significant Future Corrosion

AmerGen is being inconsistent about the potential for future corrosion. In the latest acceptance report for the 2006 external data, AmerGen compared the points measured in 1992 with those measured in 2006. It found that the largest apparent corrosion rate was 0.034 inches per year. Ex. SJA 1 at 49. It then calculated that at this rate the thinnest measured point would be 0.515 inches thick in 2008. *Id.* It therefore decided to take another round of external measurements in 2008.[1] *Id.* 4

In contrast, solely for the purpose of this litigation, AmerGen has alleged that a corrosion rate of 0.017 inches could not occur in the future. Tamburro Aff. at ¶ 38. However, this is inconsistent with the recommendation of Mr. Tamburro in Calculation C-1302-187-E310-041 which stated that another round of external UT measurements is prudent within 2 years to "provide additional data." Ex. SJA 1 at 49.

While AmerGen's experts reasonably show that corrosion at a rate of 0.017 inches per year has not occurred over large areas of the drywell shell between 1992 and 2006, they do not state that such a rate could not occur if the protective coating fails. They also fail to mention that NRC staff has admitted that it is possible that some corrosion could occur from the inside. SER

[1] In fact, inspection of the results shows that the thinnest measurement at this location was 0.663 inches, not the 0.681 inches reported. Using the thinnest point measured at this location, as was apparently done in 1992, would therefore yield a corrosion rate of 0.04 inches per year. Applying this rate and a single point uncertainty of 0.04 inches to the thinnest measured result in Bay 13 of 0.602 inches would mean that the very acceptance criterion for areas of less than 2 inches in diameter could be violated in just under 2 years.

at 4-51. Indeed, it was this possibility that led AmerGen to commit to further external UT monitoring in 2008. *Id.* at 3-138.

To illustrate the potential for corrosion from the outside, using a set of assumptions that included a corrosion rate of 0.039 inches per year, Mr. Gordon estimated that if the coating failed and moisture got to the metal surface, metal loss could be up to 0.042 inches in the 56 weeks following an outage. Affidavit of Barry Gordon, dated March 26 2007 at ¶ 18. Thus, Mr. Gordon appears to believe that additional corrosion at an appreciable rate could occur if the coating fails and wet conditions are present. This concurs with Citizens' belief. The difference is that because Citizens believe that that the margins are, at best, less than 0.042 inches, Citizens conclude that a monitoring frequency of every 4 years is too long. Indeed, even if Mr. Tamburro were correct that the minimum margin is 0.064 inches, a possibility that 0.042 inches could be lost each outage if coating decay commences would still indicate that monitoring should be undertaken every outage.

Mr. Cavallo in his affidavit does not dispute that deterioration of the coating could occur, indeed he admits that it is possible that repair of the coating might be necessary at some point. Affidavit of Jon R. Cavallo, dated March 26, 2007 at ¶ 22. He also states that the inspection frequency is once every four years. *Id.* at ¶ 20. In addition, Citizens have previously alleged that enough moisture to cause corrosion could be present at the surface of the drywell shell without water running in the drains. Finally, AmerGen has never been able to definitively trace the source of all the water in the drywell to the refueling cavity and has admitted that it has not yet been able devise a way to ensure that the refueling cavity does not leak. Transcript from ACRS Meeting on Feb. 1, 2007 at 217-222. In addition to the refueling cavity, water on the exterior of the drywell could come from condensation during an outage and from the equipment pool. Thus, AmerGen has not ruled out the possibility of corrosion developing between inspections.

ARGUMENT

I. Legal Standards For Summary Disposition

Summary disposition is only possible "if the filings in the proceeding, depositions, answers to interrogatories and admissions on file, together with the statements of the parties and the affidavits, if any, show that there is no genuine issue as to any material fact and the moving party is entitled to a decision as a matter of law." 10 C.F.R. §§ 2.1205(c), 2.710(d)(2). Prior NRC opinion has held that summary disposition motions under 10 C.F.R. § 2.749 (the equivalent rule prior to the revision of 2004) should be evaluated under the same standards as motions made under Federal Rules of Civil Procedure, Rule 56. *Advanced Med. Sys., Inc*, CLI-93-22, 38 N.R.C. 98, 102 (1993).

Under this rule, the moving party bears the burden of proving the absence of a genuine issue of material fact. *Adickes v. Kress & Co.*, 398 U.S. 144, 157 (1970). Because the burden of proof is on the movant, the evidence submitted "must be viewed in the light most favorable to the opposing party." *Id.* Where a moving party shows a lack of a material dispute, the party opposing summary disposition must respond by setting forth specific facts showing there is a genuine issue. 10 C.F.R. § 2.710(b). A genuine issue is one in which "the factual record, considered in its entirety, must be enough in doubt so that there is a reason to hold a hearing to resolve the issue." *Cleveland Elec. Illuminating Co.* (Perry Nuclear Power Plant, Units 1 and 2), LBP-83-46, 18 N.R.C. 218, 223 (1983).

Generally, under Rule 56, summary dispositions may not rest on credibility determinations. *Leonard v. Dixie Well Service and Supply, Inc.*, 828 F. 2d 291, 294 (5th Cir. 1987). Thus, conflicting opinions from experts generally preclude summary disposition.

However, such a conflict may be illusory, if the opinion of one expert would not be admissible at trial. Therefore, if the opinions of two experts appear to conflict with each other and there is no dispute that could be raised without the expert testimony, Federal Rule of Evidence 702 may be used to help decide whether summary disposition is appropriate. *Duke Cogema Stone & Webster (Savanna River Mixed Oxide Fuel Fabrication Facility)*, LBP-05-04, 61 N.R.C. 71, 80-81, (2005) ("DCS"). This rule permits a witness, qualified as an expert, to testify to assist the trier of fact to understand the evidence if 1) the testimony is based upon sufficient facts or data, 2) the testimony is the product of reliable principles and methods, and 3) the witness has applied the principles and methods reliably to the facts of the case. Fed. R. Evid. 702.

Generally, testimony that is based on a "reliable foundation and is relevant to the task at hand" will be admitted. *Daubert v. Merrill Dow Pharm.*, 509 U.S. 579, 597 (1973). Evidence based upon "scientifically valid principles" will meet this burden. *Id.* Federal courts have applied Rule 702 liberally, favoring the admission of expert testimony to assist the trier of fact. DCS at 15, citing *Kannankeril v. Terminix Int'l*, 128 F. 3d 802, 806 (3rd Cir. 1997).

Thus, where there are material disputes based on sound expert opinion summary disposition in unavailable as the Commission has stated:

> Where there is disagreement among competing experts over material facts, summary judgment may not be appropriate if it would require the trier of fact to untangle the expert affidavits and decide which experts are more correct. In that case, a hearing, if permitted by the applicable procedures, is the appropriate forum for the trier of fact to weigh the competing expert opinions on material facts.

DCS at 15; *see also Schering Corp v. Geneva Pharm.* 339 F. 3d 1373, 1377 (Fed. Cir. 2003) *citing Continental Can v. Montsanto*, 948 F. 2d 1264, 1269 (Fed. Cir. 1991) (resolution of disputed fact requiring expert opinion is improper on summary judgment); *Spirit Airlines v. Northwest*, 431 F. 3d 917, 931 (6th Cir. 2005) ("Our precedents hold that if the opposing party's expert provides a reliable and reasonable opinion with factual support, summary judgment is inappropriate."); *Scharf v. U.S. Atty Gen.*, 597 F. 2d 1240, 1243 (9th Cir. 1979) ("The affidavit in support of this theory was hardly convincing, but it required the court to resolve an issue of fact based on conflicting expert testimony. This is not the court's function on summary judgment."); *Sierra v. El Paso Gold Mines*, 421 F. 3d 1133, 1150 (10th Cir. 2005) ("There is a genuine issue of material fact regarding the source of pollutants discharged at the portal, and summary judgment was not appropriate.")

As discussed in more detail below, summary disposition at this stage is inappropriate because AmerGen's motion for summary disposition does not meet the movant's burden to show that there are no material issues in dispute. Moreover, the contention was supported by the record and by Dr. Rudolf Hausler's affidavit, which was based upon the facts in the record and use scientifically valid methods to assess the evidence available. Sine the contention was admitted, the evidence showing that the contention raised multiple genuine disputes of material fact has only increased.

II. Summary Disposition Is Inappropriate As A Matter Of Law

AmerGen, as the moving party, bears the burden of proving that there is no genuine issue of material fact, even when the facts are viewed in the light most favorable to Citizens. *Adickes v. Kress & Co.*, 398 U.S. 144, 157 (1970). It has failed to do so. This contention was admitted by the ALSB because sufficiently reliable evidence was presented in the form of references to the record and an expert affidavit to prove that genuine disputes of material facts existed. *Memorandum and Order*, ASLB, LBP-06-07, Feb. 27, 2006 and *Memorandum and Order*, ASLB, LBP-06-22, Oct. 10, 2006. Although AmerGen attempted to proffer new facts 1
concerning the local area acceptance criterion and the potential for future corrosion, its assertions about the formed are contradicted by the record, while its critical assertion about the latter was

made by someone who is not qualified to provide an expert option on the issue, was unsupported by the record, and contradicted AmerGen's other experts. Thus, AmerGen's current motion does not contain sufficient new information to eliminate the need for a hearing and to allow the contention to be adjudicated by summary disposition.

In particular, AmerGen relies upon the affidavit of Mr. Peter Tamburro to attempt to show that there is no material dispute regarding the current margin available. However, his affidavit is inadequate for this purpose because, as shown in detail in the Statement of Facts, pp 5-7, Mr. Tamburro's testimony regarding the local area acceptance criterion is contradicted by the record.

Furthermore, AmerGen relies upon Mr. Tamburro's affidavit to assert that a corrosion rate of 0.017 inches could not occur in the future, Tamburro Aff. at ¶ 38, but Mr. Tamburro's opinion regarding future corrosion rates is not admissible because AmerGen has failed to show that Mr. Tamburro is a corrosion expert. He cannot therefore offer hypothetical opinions about future corrosion. Moreover, Mr. Tamburro's opinion in this regard is inconsistent with the documents he has prepared that are in the record. While he denies that a corrosion rate of 0.017 inches is possible, he asserts that another round of external UT measurements would be prudent within two years to "provide additional data," because he calculated that the maximum localized historic corrosion rate was 0.0335 inches per year. Ex. SJA 1 at 49.

In contrast to Mr. Tamburro, AmerGen's corrosion experts, Mr. Barry Gordon and Mr. Jon R. Cavallo, fail to foreclose the potential for future corrosion. Mr. Gordon estimated that if the external coating failed and moisture reached the metal surface, metal loss could be up to 0.042 inches in 56 weeks. Affidavit of Barry Gordon, dated Mar. 26, 2007 at ¶ 18. Thus, Mr. Gordon's opinion admits the possibility of additional corrosion at an appreciable rate.

Mr. Cavallo also admits that deterioration of the outer coating could occur and that repair of the coating might be required in the future. Affidavit of Jon R. Cavallo, dated Mar. 26, 2007 at ¶ 22. Mr. Cavallo also admits that the current inspection frequency is once every four years. Id. at ¶ 20.

In conclusion, summary disposition is inappropriate as a matter of law. Even without any new opinion from Dr. Hausler, summary disposition would be inappropriate because the Board has already decided that Citizens have properly raised the contention and AmerGen has not shown that Dr. Hausler's opinion in support of the contention is no longer supported by the record. Thus, AmerGen's argument for summary disposition does not even properly allege that there are no genuine material issues to be adjudicated.

In particular, AmerGen has failed to produce any admissible testimony to explain why it has selected the current monitoring frequency of every four years and AmerGen has also failed to properly address the issues of the local acceptance criterion and the potential corrosion rate. Instead of clarifying the inconsistencies in the record concerning the local area acceptance criterion, AmerGen has actually added to the dispute by proffering a version of this criterion that is contradicted by the record. Without resolving this dispute, it is impossible to calculate the current margin.

Furthermore, while only one of AmerGen's affiants, Mr. Tamburro, attempted to raise a dispute with Dr. Hausler regarding the potential future corrosion rate under corrosive conditions, his opinion on this issue failed to provide any support and was outside the scope of his expertise. In contrast, Mr. Gordon and Mr. Cavallo, AmerGen's other experts, failed to foreclose the possibility that significant corrosion could occur between inspections. Indeed, AmerGen's decision to put in place an ongoing monitoring program illustrates that it also believes that future corrosion could occur. Thus, as a matter of law, AmerGen has failed to meet its burden to show that corrosion to beyond safety requirements could not occur within the 4 year interval between inspections. Therefore, the Atomic Safety and Licensing Board ("ASLB" or "Board") should dismiss AmerGen's motion for summary disposition as inadequate as a matter of law.

III. The Contention Continues To Be Soundly Based On The Record And The Opinions of Dr. Hausler

Having shown that AmerGen has failed even properly allege a lack of material dispute, this Section shows that the evidence supporting the contention has in fact strengthened during this proceeding. Thus, even if AmerGen had met its burden of properly alleging a lack of material dispute, AmerGen's motion for summary disposition would still need to be dismissed because the material disputes that the Board identified when it admitted the contention have not been resolved. Citizens' assertions about the disputed issues continue to be soundly based on the record in this proceeding and on the opinions of Dr. Rudolf H. Hausler.

The ASLB in its opinions admitting the contention currently in dispute and the previous admitted contention, accepted Dr. Hausler as a qualified expert. (See *Memorandum and Order*, ASLB, LBP-06-07, p. 44, FN 33, Feb. 27, 2006 and Memorandum and Order, ASLB, LBP-06-22, p. 21, FN 14, Oct. 10, 2006). In admitting the contentions, the Board found Dr. Hausler's opinions to be sufficiently reliable and supported by the record. Thus, there is now no question about his qualifications and it is clear that his memoranda were based squarely on the record.

The only way in which AmerGen could obtain summary judgment at this time would be to show that further discovery has shown that the factual support previously offered for the contention has become inadequate. This Answer and Dr. Hausler's new opinion provide specific citations to the record illustrating that far from contradicting the opinions contained in Dr. Hausler's June 23, 2006, Memorandum, the additional discovery shows that that opinion was entirely reasonable and reliable, and the contention continues to be fully supported by the record and Dr. Hausler's opinion.

In fact, as discussed on pp 5-12 above, far from weakening the factual foundations of the contention, further discovery has actually strengthened its basis. Since Citizens filed their motion to add the current contention, AmerGen has made the local area acceptance criterion more stringent. 1 In addition, the latest results, taken in October 2006, show that the drywell shell is now thinner than the 1992 measurements indicated. Thus, margins are now even narrower than they 2 & 4 were when Citizens filed the contention.

AmerGen's motion for summary disposition actually reads more like an attack on the basis of the contention, which is somewhat quixotic, because that basis has already been accepted by the Board and is therefore *res judicata*. The only way that such an approach could be successful is if record evidence had emerged after the contention was admitted that eliminated the original basis. Here, this approach must fail, because the opposite has happened. As the Statement of Facts shows, the record evidence is now even more favorable to Citizens than it was when the contention was admitted. Thus, to be consistent with its prior decision to admit the contention, this Board must dismiss the Motion for Summary Disposition.

IV. Summary Disposition Is Inappropriate Because Many Material Issues Are In Dispute

The Statement of Facts illustrated that many material issues are in dispute. Strangely, instead of showing a lack of material disputes, through its Motion for Summary Disposition 1 AmerGen has actually attempted to create a material dispute about the local area acceptance criterion that must be met by the thickness results from the UT testing in the sandbed region of the drywell. Furthermore, the minimum margin available when the UT testing results are 2 compared to the acceptance criteria remains in dispute, as does the potential extent and rate of future corrosion. As a consequence, the frequency of UT testing to ensure that the thickness of the drywell does not fall below safety requirements during any extended license renewal period is in dispute. Adding together the potential for corrosion to occur in the future from both the outside and the inside, Citizens continue to assert that a four year interval between UT measurements is too long. If and when Citizens are able to ascertain how AmerGen has computed the margins for all the areas that are thinner than 0.736 inches, but larger than 2 inches in diameter, they will be able to provide a more accurate estimate of the appropriate monitoring frequency. 1 & 2

As the Board has already found, and this pleading further illustrates, Citizens' arguments about these disputes are soundly based upon the record and admissible scientific testimony. On a motion for summary disposition, the Board should view the facts in the light that is most favorable for Citizens. Therefore, as a matter of fact, because there are genuine disputes about many material issues, summary disposition is inappropriate.

CONCLUSION

For the foregoing reasons, the ASLB should dismiss AmerGen's Motion for Summary Disposition.

Respectfully submitted

Richard Webster, Esq
RUTGERS ENVIRONMENTAL LAW CLINIC
Attorneys for Citizens

Dated: April 26, 2007

UNITED STATES OF AMERICA
BEFORE THE NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	Docket No. 50-0219-LR
AMERGEN ENERGY COMPANY, LLC	)	
	)	ASLB No. 06-844-01-LR
(License Renewal for the Oyster Creek Nuclear Generating Station)	)	April 26, 2007
	)	

CERTIFICATE OF SERVICE

I, Karen Hughes, of full age, certify as follows:

1. I am a paralegal at the Rutgers Environmental Law Center (RELC). The RELC represents Citizens in this matter.

2. I hereby certify that on April 26, 2007, I caused Citizens response to a summary disposition to be served via email and U.S. Postal Service on the following:

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Dated: April 26, 2007

MTS Exhibit 2

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MEMORANDUM

To: Richard Webster, ESQ
Rutgers Environmental Law Clinic
123 Washington Street
Newark, NJ, 07102

April 25, 2007

From: Rudolf H. Hausler

Subject: **Update of Current Knowledge Regarding the State of Integrity of OCNGS Drywell Liner and Comments Pertaining to Aging Management Thereof**

Summary

- The proposed aging management plan for the Oyster Creek Drywell Liner, as proposed by AmerGen, is being discussed. It is shown that the UT monitoring locations (6 by 6 inch grids inside the drywell) as defined in 1989 are not representative of the corrosion, which had occurred in the sandbed region. 3
- Furthermore, since the outside of the drywell in the sandbed region had been coated in 1992, corrosion in the upper regions of the sandbed (i.e. where monitoring is being proposed) has become less relevant because water accumulations (the primary causes for corrosion) will now more likely occur towards the bottom of the former sandbed region. 3
- The primary cause for additional damage to the drywell by continued corrosion will be the formation of defects in the epoxy coating.
- Since there is no way to assess the **rate** of deterioration of a coating, which for all intents and purposes is already past its useful life, the frequency of inspections must be increased because the coating could fail at any time.
- These changes represent a completely new paradigm for the drywell aging management. The entire program, which had been in use since1987 or 1998, needs rethinking. The best approach would be to make use of continuous moisture monitors and possible online corrosion monitors (it is possible to monitor electrochemical potentials as indications of the onset of corrosion) to supplement the UT testing.
- Frequency of monitoring depends on the remaining safety margins. It is therefore important to gain understanding of the areal extent of the existing corrosion

damage. Based on the limited understanding of the extent of locally thin areas, the 3
drywell shell could already be in unacceptable condition. Averages from point 2
measurements (UT measurements) are not the best measure to define average thickness of the whole sandbed region, because the mean itself has uncertainty attached. At minimum, the lower 95% confidence limit of the mean of a number of UT measurements over that area should be employed. A comparison between these values with the safety criteria shows that the margins have become very thin in the areas where an assessment is possible, and that therefore frequent monitoring needs to be instituted to ensure significant further corrosion is prevented.

I. Background

Since severe corrosion had been found in the late 1980's in the "sand bed area" of the drywell liner containing the nuclear reactor at the Oyster Creek power generating station, much work has gone into assessing the degree of the damage and modeling the effects of the damage on the integrity of the vessel. Since the drywell liner is a vital safety component, and in light of the pending application for re-licensing reactor operations for another 20 years, the questions surrounding the integrity of the drywell liner have come to the front and center of the stage once again.

There is no question that deterioration of the surface of the drywell shell will continue at some rate over time. Thus, at some point in the future the liner may no longer serve its intended function. This memorandum discusses how to estimate the residual life of the liner and plan an appropriate aging management program around such an estimate.

The bases for such considerations must necessarily be:

- The current state of deterioration of the liner, i.e. the extent of corrosion and how well has it been estimated in the past.
- The criteria by means of which serviceability is ascertained and the remaining margins to condemning the vessel
- The estimated potential future corrosion rate
- And finally the combination of remaining margin and potential rate of deterioration defines the minimum frequency of inspection.

While all of the above items have been estimated and hard numbers have been proffered and written in granite, there is, as will be shown below, great uncertainty surrounding all of the assertions, which have been used by Exelon/AmerGen to support its current approach of taking UT measurements once every four years in the sandbed region.

II. Current Knowledge Regarding the True State of Deterioration.

After corrosion had been found in the sandbed area a concerted effort was made to assess the corrosion rate in order to project the life of the structure. The tools in this effort were ultrasonic measurements (UT) at well-defined locations. In order to assure repeatability of the measurements, a template was constructed containing 49 openings for placement of the UT transducer. The 49 openings were spaced 1 inch apart over a 6 by 6 inch square. This 6 by 6 inch grid was placed repetitively at the inside of the drywell liner just below the vent pipe where the inside curb was lowered from about 2 feet to just over 9 inches (see Figure 1). In this manner, every bay was monitored systematically at intervals over the past 20^+ years.[1)] In 1992 the sand was removed from the sandbed, and all steel surfaces as well as the sandbed floor were coated with an epoxy resin. UT measurements using the 6 by 6 inch grid performed in 1992, 1994, 1996 and 2006, always at exactly the same position, indicated that within the accuracy of the test (measuring procedure) the continued corrosion was at most small. That should not be surprising because a) the outside steel surface was now coated, b) water would not accumulate against the vessel at the location were the measurements were made because of the drains in the sandbed floor, and c) if corrosion were to commence it would most likely be at imperfections in the coating near the sandbed floor where indeed, standing water could be present (see discussion below).[2]

There are however a number of additional monitoring techniques that were used. In 1986 trenches were dug in the reactor floor in bays 17 and 5 to a depth about equal to the sandbed floor on the outside. It is noted that these trenches were not dug in the bays where the most severe corrosion had been observed. These trenches enabled the operator to perform UT measurements below the sandbed surface (prior to removal) from the inside. Additionally, after the sandbed had been removed, and upon visual inspection of the corroded areas, UT and other thickness measurements were made from on the outside of the drywell in the sandbed area. It was believed at that point that the most corroded areas had been selected visually for these measurements. As a consequence of all these measurements the operator AmerGen assured the NRC that the locations where the "grid measurements" had been performed were quite representative of the corrosion that had occurred on the outside of the drywell in the sandbed area (Ref. 4).

We take issue with this statement. In support of this contention, an effort was made to show graphically the remaining wall thickness observed in all of these various locations. Thus Figure 2 shows, by way of example, the remaining wall thickness from the 2006 UT measurements made with the help of 6 by 6 inch grids as a function of elevation in the **trench of Bay 17**. It is understood, as is described in Ref. 3 that 6 such grids were placed one on top of the other in the trench in order to capture the corrosion from the bottom to the top of the sandbed. Hence, if the bottom of the trench had the elevation about 9 feet, then the top of the 6 grids would have had an elevation of about 12 feet, which according to Figure 1 corresponds to the top of 3 & 4

[1)] 7 Bays were monitored only with 1 by 6 inch templates – probably placed in the horizontal direction – Bay 1 was among those, even though Bay 1 was one of the most corroded Bays.

[2] Note that this region is above the concrete floor but just above or below the epoxy coating above the concrete and so is part of the sandbed region, not the embedded region.

the sandbed and is at least 9 inches higher than the top of the grid used for UT measurements from the inside. (Note, none of these elevations is terribly accurate, however, the top of the trench measurements were definitely lower (deeper pits) by a good margin than the inside grid measurements). Figure 2 plots all individual 2006 measurements from the trench in bay 17. The 6 traces represent the variation of the wall thickness in the horizontal direction while the traces themselves extend from the bottom of the trench (left hand side) to the top of the trench (right hand side). The undulations of the 6 traces, which are at times (at the same elevation) in synch and at other times out of phase clearly depict the nature of the "golf ball type" surface described in AmerGen literature (Ref. 1 pg. 4). Where the undulations are in synch one can estimate that the extent of the pit at that location extends over an area larger than just one inch in diameter[3]. It should also be noted that the average amplitude of the undulations in Fig. 2 are of the order of 0.1 inch, i.e. the roughness of the surface at this point is only of that order of magnitude. AmerGen estimated the "roughness" of the surface to be rather of the order of 0.2 inches (Ref. 5 pg. 5). 3 & 4

The most striking observation is that the corrosion is most severe at the top, almost uniform in severity over most of the depth of the sandbed and again somewhat more severe at the very bottom. **In other words, one sees already in this presentation that it would be difficult to single out one small area by means of a 6 by 6 inch grid and claim it to be representative of the corrosion having occurred in the sandbed area.** 3 & 4

In Figure 3 an effort is being made to compare the average remaining wall thickness from trench measurements (averaged over the horizontal direction) with the average of the 6 by 6 grid measurement from the inside and the direct UT measurements from the outside. Also graphed in this figure are the averages of the outside measurements for the three zones for which data are reported (Ref. 5). What one can see is that the averages for the grid and the trench data overlap quite well at the same elevation. However, the average outside measurements are significantly lower at comparable elevations.[4] This is probably because the choice of location for the external measurements was deliberately biased towards thin spots. 4

Finally in Figure 4 we see the spread of the 6 by 6 inch inside grid measurements superimposed on the averages of the other measurements. 4

<u>Conclusion:</u> What the superposition of the UT measurements in Bay 17 demonstrates is that wall loss ranges from zero to 33 percent, however, only the trench and outside measurements come close to represent the most severe corrosion at the highest elevations. The inside grid measurements give a distorted picture. It should also be remembered that the grid measurements at the inside curb cutout as well as those in the trench are only 6 inches wide. One 2, 3 & 4

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[3] AmerGen suggested that the "dimples" are about 0.5 inches in diameter (Ref. 1 pg. 4)

[4] For the outside measurement averages had to be used in the graphical representations because exact elevations (or coordinates) of each point were not known. We only had the classifications into Zones as had been described in Ref. 5.

2, 3 & 4 (entire page)

does not have, therefore any indications as to how far serious corrosion may have spread laterally around the circumference of the bay.

Figure 5 shows an analysis of the available 2006 data for Bay 13. Bay 13 is probably the second worst corroded bay apart from Bay 1. The averages for the external measurements for each zone are fairly similar, as are the 95% limits for the data spread. There is a 95% percent probability for the deepest penetration to be of the order of 48% of the original wall thickness. The superposition of the internal grid data shows a higher average and a narrower distribution of the data spread. Again one recognizes that the internal 6 by 6 inch grid measurements do not represent the worst corrosion degradation.

Finally in Figure 6 we show the distribution of the external measurements for Bay 1. One observes that the 95% lower limit of the data spread is around 40% of the original wall thickness, or indeed at a remaining wall thickness of 450 mils, which is 0.04 inches below the required sandbed thickness for the Design Pressure and Temperature. Because the external sampling in Bay 1 was designed to capture the thinnest points, this is a conservative estimate of the minimum wall thickness. However, given the need for a very high degree of confidence that the drywell shell is ready to withstand accident pressures and the uncertainty created by the sparse data set, I believe that a conservative approach is required in this case.

Conclusion: The deterioration of the drywell liner at Oyster Creek has been examined in various ways by UT measurements. These were in part systematic thickness measurements in predetermined locations (6 by 6 inch grids placed on the inside of the drywell at curb cut-outs –see Fig. 1, and in trenches dug below the inside floor to a depth roughly equal to the outside sandbed floor). These measurements were supplemented by residual wall thickness measurements performed on the outside of the drywell in locations where "visually" it had been determined that the deepest pits were located. (It must be interjected at this point that a pit of 600 mils cannot be distinguished visually from a pit of 500 mils). The location of these measurements is therefore rather arbitrary, but was presumed repeatable for the measurements in question.

All external UT measurements had been summarized by AmerGen (Ref. 7) for the purpose of determining the minimum safety margin still available. In order to better understand the prevailing corrosion mechanism the data had been separated in "zones" corresponding to increasing elevation above the sandbed floor (zone 1: < 9'4", zone 2: 9'4" to 10-'3", zone 3: 10'3" to 12'3", and zone 4 > 10'3"). The data obtained in 1992 and 2006 were combined and statistically analyzed for the following three effects: a) the two sets of measurements separated by time (and probably methodology or instrumentation), b) the effect of the elevation, and c) differences in the bays.

It was found that there is no significant effect of the time (Fig.7a). While there is a decrease of 19 mils between 1992 and 2006, this difference is not statistically significant within the variability of the data. The differences between the zones, however are significant. Zone 2 is by far the most corrosive zone. When the bays are compared, one finds as expected that some bays have experienced little corrosion in contrast to others. The importance of these observations is obvious: they point again to the fact that the intensity of corrosion is a clear function of elevation and bay. Hence, averaging data and generalization may lead to doubtful conclusions. 2, 3 & 4

In 2006 the validity of some of the external UT measurements was explored by measuring around the nominal original locations. These data were statistically evaluated in Figures 8, 9, 10 for Bays 15, 1 and Bay 19. The additional data collected in Bays 19 and 15 had been identified as "up" or "down", hence additional data sets identified as 2006 up and 2006 down were compared with the original 2006 data. It turns out for Bay 19 for instance that the UT penetrations identified as 2006 up were significantly lower than the measurements of 1992 with a probability of better than 95%. The difference between the 1992 and 2006 up data is 0.1 inch. Similarly for Bay 15 one finds that the 2006 up data are significantly lower than the original 1992 data by about 0.06 inches, although this difference is not significant at the 5% level. For Bay 1 there is practically no difference between the 2006 and the 1992 data sets, because of the two or three measurements in the non-corroded areas. Summarizing these results in Table 1, one finds that the lower 95% confidence limits for Bays 1, 15 are marginally within the 0.736-inch limit. Since one does not know exactly how extensive the "cancer of corrosion" in the sand bed area really is, it is very difficult to put this interpretation in perspective with the assessments made by AmerGen relative to areal criteria for thinned areas (see discussion below). 2 & 4

Two points must be made with regards to the evaluation of these measurements. All measurements are point measurements, and even though they are closely spaced it is nevertheless difficult to estimate the area over which the measured corrosion penetration may have occurred. This is all the more so for the external measurements. Furthermore, the pit distribution has been assumed to be random or Gaussian. 2
AmerGen chose to disregard "outliers" which were two standard deviations from the mean (of 49 points) as erroneous or atypical measurements (Ref. 6 pg 16). However, the distribution of pit depth is not necessarily normal but can be exponential, depending on the sensitivity of the measuring technique. It is therefore totally inadmissible from a statistical point of view to discard, or disregard outliers <u>for which there is no physical explanation.</u>

> *It has been observed in the oil field for instance that wall penetration may occur in pipelines as single events totally unpredicted and unpredictable by statistical means; one single event within 18 miles after 6 months surrounded by practically virgin surface.* 3

Pitting on metal surfaces may be considered random if the surrounding environment is uniform, homogenous, and clearly identifiable, because the imperfections in the metal are most likely randomly distributed. (There are of course many well-known arguments against this, such as oriented inclusions due to metalworking, however the assumptions simplify the argument without distorting it). In case of the sandbed there is no randomness because of the predictable decrease in oxygen availability with 3 increasing depth and very likely uneven water content as well. This inhomogeneity is illustrated in Figure 2, where one can see greater corrosion attack toward the top of the sandbed. Similarly, the data show that in Bay 1 the corrosion below the ventpipe occurred more or less in a band of increased corrosion. This band appears to be about 6 to 7 feet long and perhaps a foot wide, although the lowest residual wall thickness (0.669) is found much deeper in the sandbed (Ref. 3). These data shown numerously in various discussions and appendices clearly demonstrate how difficult it is to assess 3 the extent of the damaged areas as is necessary for comparison with the integrity criteria. For instance, the data gathered in Bay 1 in 2006 (and previous years) represent but a small fraction of the overall drywell liner surface exposed to the sandbed environment, and no amount of statistics can predict the pit distribution seen in Bay 1 (Fig. 5). Furthermore, again, the measurements which assess the corrosion in Bay 1 are all point measurements, and one has no way of assessing whether the pits are as local as the representation suggests or whether in fact the thin areas extend from one measurement to the next. I believe that when assessing the extent of severe corrosion, reviewers should assume that the measured points connect unless other measurements show this not to be the case.

III. The Fitness for Use Criteria 1

GE's original calculations stipulated that "if all UT wall thickness measurements in one Bay were above 736 mils, the bay would be evaluated as acceptable. In bays where measurements were below 736 mils, more detailed evaluation had to be performed" (Ref. 4, pg. 11 and Ref. 1 pg.4).

Subsequent calculations determined that if a 1 sq. ft. area were found with a thickness of 536 mils the theoretical load factor/eigenvalue would be reduced by 9.5%. The model stipulated that the1 sq. ft. area was surrounded by a tapering to 0.736 inches (Ref. 1 pg. 6) over a further one foot area. This additional area of reduced thickness contributed to the reduced load factor, hence also the stipulated safety factor. Similar calculations were performed for a reduction of the 1 sq. ft. area to 636 mils in which case the theoretical load factor and buckling stress would be reduced by 3.9%.

There are a number of questions that do arise in the context of these calculations and their application to the present situation of the OC drywell liner. We would like to make it clear from the outset that we are in no position to verify these calculations and are readily disposed to accept their veracity and results. We would, however, like to note the limitations of these results to put them in proper perspective.

1. AmerGenAmerGen states that GE established these criteria as acceptance criteria for the minimum thickness for the drywell to perform its intended function. That is incorrect, GE modeled the drywell, but the operator then derived acceptance criteria. For example, GE calculated both the 536 inch local thickness and the 636 local thickness with the same assumptions and both led to a reduced load factor. AmerGen and the previous operator then interpreted these results into the current local area acceptance criteria.

2. It is also not clear how the criteria deal with areas that are below 736 mils thick, but are not square.

While the acceptance criteria, whatever they may be, have been developed for certain well-defined geometries, one cannot immediately relate these to other geometries as they occur in real life.

Now, a new criterion has crept in which would render all previous criteria obsolete. Ref. 4 (pg 11 of 55) states that *if an area is less than 0.736 inches then that area shall be greater than 0.693 inches thick and shall be no larger than 6 inch by 6 inch wide. C-1302-187-5320-024 has previously positioned an area of the magnitude in bay 13, and within the uncertainties of measurement, such an area also exists in Bay 1.* 1

It is furthermore stated if an area is less than 0.693 inches thick then that area shall be greater than 0.490 inches thick and shall be no larger than 2 inches in diameter.

At present, if we assume that the external points measured in Bay 13 represent the surface, it appears that around 2 sq. ft. clustered around points 7, 15, 6, and 11 is less than 0.693 inches in thickness. In addition, over 4 sq. ft. containing points 12, 16, 7, 8, 11, 6, 15, and 5 appears to be less than 0.736 inches in average thickness. Similarly, in Bay 1 around 4 sq ft emcompassing points 12, 5, 13, 4, 12, 3, and 11 appear to be than less than 0.736 inches in average thickness. It is unclear how AmerGen decided that these results were acceptable, given the latest statement of the local area acceptance criterion.

IV. Statistics 2

Statistics have been used all through this discussion for different purposes. I think it is important to put the use of statistics in perspective as well. Basically there are three kinds of variabilities in the UT measurements as they have been used. First there is the variability of the instrument. The manufacturer usually specifies the "instrument error", in the case of modern UT instruments of the order of 1% of the thickness to be measured. The error usually is given as a standard deviation which means that the 95% confidence limits for the "naked" UT measurement is +/- 2% of wall thickness, in the present case about +/- 20 mils. This is the variability one would find if a calibration block was measured say 100 times. The next variability is a lot more difficult to define: It has to do with the placement of the sensor in the matrix, finding the same spot over again, holding the sensor in the same direction (vertical to the surface) each time etc. This variability (or variance) is additive to the instrumental variability. Finally the thing to be measured varies in thickness as well. This last variability is precisely the response that is desired. Because there have been no planned duplicate measurements (unless one were to assume that since 1992 no corrosion occurred) one cannot assess either the variability of the instrument nor the variability of the measuring technique. However, it is fair to say that the variability of a single measurement overall (i.e. the combination of the instrumental variance and the variance of the technique) are larger than the manufacturer's stated standard deviation, probably double. With that assumption one might expect say 100 measurements of a single location to be distributed about their mean with a 95% confidence interval of +/- 40 mils. Hence a single measurement of a true value of 800 mils might lie anywhere between 760 and 840 mils, and this is probably an optimistic estimate.

Now, it has been assumed that the pitting phenomenon observed at the Oyster Creek drywell liner in the sandbed region was occurring in a truly random manner. It has been pointed out that this is very likely not the case. Nevertheless, lets just assume that Gaussian statistics might be applicable, simply because they are easy to calculate and are the most easily understood. If one measures with single measurements, as was done in all UT measurements, a number of locations say by means of a grid (template), one obtains a series of data reflecting the variation of metal thickness over a given area. At this point it is important to understand that these measurements are not members of a common universe which can be averaged to obtain an average measurement more truly characteristic of the universe than an individual measurement. Rather each measurement is a representative of a different universe – i.e. representing different pitting (corrosion) characteristics, or kinetics. Hence it really does not make much sense to average these measurements and say that on average "this is the corrosion rate". Rather on needs to characterize the variability of the results and superimpose onto them the instrument error. Hence if a specific measurement is, say 756 mils, it is with 95% probability somewhere between 716 and 796 mils. **Therefore, in order to be on the conservative side one would compare the 716 mils to the single point acceptance criteria, rather than the reported measurement.** 3

Furthermore, using the average of the grids to represent the entire surface is problematic for many reasons. First, suppose all the sensors had been placed at the low points in the pits. In that case the estimated average would be lower than the true average surface. More importantly, if in fact the corroded surface is like a golf ball surface, how does one average the thickness over the surface area when in fact one only has point measurements within the spherical depressions? 2 & 3

Clearly the entire approach is problematic and perhaps the saving grace is that the design codes require large safety margins. Nevertheless, in this case, when it has been shown that in some situations thickness measurements have been observed well below 693 mils (+/- 40 mils) and below to the 490-mil boundary (with 95% certainty), more detailed measurements are needed. 2, 3 & 4

It has also been shown that the 6 by 6 grid measurements (let alone the 1 by 6 inch matrix measurements) do not represent the entire corroded areas. (Ref. 4: *A review of the 2006 inspection data of 106 external locations shows all the measured local thicknesses meet the established design criteria.* ***Comparison of this new data to the existing 19 locations used for corrosion monitoring leads to the conclusion that the 19 monitoring locations provide a representative sample population of drywell vessel in the sandbed.)*** This statement is patently wrong. However, it is not only 2 & 4 wrong because the measurements in the trenches and the external measurements do not agree with the grid measurements (19 monitoring locations), it is also wrong because corrosion, if it were to accelerate significantly, would now more likely occur near the bottom of the sand bed rather than the top as was the case with the sandbed in place. 2 & 4

All this not withstanding, it is also recognized that safety codes exist and that safety criteria have been developed. These codes and criteria specify the minimum thickness for *areas* while the corrosion measurements (UT) are highly localized **(points)**, and are said not to capture more than about 0.5 inches in diameter. One now has to confront the problem of translating point measurements to (average) area characteristics. This has been done by making a limited number of measurements in locations, which have been chosen by accessibility and convenience (grid locations). The measured data are then translated by averaging and assuming that the average represents the entire surface even though only 1% of the total may have been measured and even though it has been shown that the assumption won't hold. 2 & 3

It had for these reasons been suggested that the entire surface should be scanned in place of point measurements in selected areas. However, in the absence of scans it would seem prudent to maybe accept the notion that failures do not happen because of averages, but rather where there are extremes, in this case extremely thin areas. In this sense it is suggested that to use the variability of the corrosion data (spread of pit depths) and calculate the likely deepest pit or the most likely thinnest areas. Hence if an average of 10 measurements over a specific area results in a thickness of .750 inches with a variability (standard deviation) for the average of 0.03 inches, the lower 95% confidence limit for this average would be 0.69 (0.75 – 0.06). 2 & 3

In this sense the external measurements of Bays 1, 15 and 19 have been reexamined, and as Table 1 shows, at least in Bay 15 there is no additional margin for continued corrosion in the areas that have been monitored to this point. 2, 3 & 4

V. Corrosion Underneath Coating

It is pretty well established that corrosion underneath an intact epoxy coating, especially a two-layer coating, will be immeasurably small. If it were to occur it would be of the rate of either oxygen or water diffusion through the coating, and either process is very slow. Furthermore, as we have said before, corrosion is more likely to occur near the concrete floor of the sandbed above and below the epoxy coating on the floor as we have pointed out before. For this reason alone the current monitoring program could miss significant corrosion, no matter how often UT measurements are being performed. 3

The entire paradigm of the drywell aging management program needs to be changed, as we have also pointed out before.

What is clear is that any defects in the coating will lead to corrosion damage, provided that there is water present. Hence, the first line of defense is to make sure that there is no water present. This is easier said than done since leaks have occurred before and condensation has also been an issue. Since one still is not sure where the water may be coming from one can safely assume that water could be present at some time in the future and at least during each outage.

The second line of defense is to make sure that the coating is intact. Originally the coating life was quoted as being 10 years. Then AmerGen increased the coating life to 15 years, since the 10 years have already elapsed. However, a 15 year coating life will bring its end of service up to September of this year, hence the coating life has to be 20 years, or at least into the next twenty years of service. All of this has been documented in AmerGen literature. Now, we know that the coating on the floor has suffered damage. The most recent inspection has shown that the coating on the floor was cracked in some bays along with the concrete of the former sandbed floor (Ref. 6) [5]. The cause was attributed to the concrete "shifting and breaking up". However, the other possibility that the coating failed (it was applied too thick to begin with) whereupon water entered the cracks in the concrete, which were there dating back to construction, was not considered. Nevertheless, it has been established in the 2006 inspection that the floor had broken up and that water had entered the cracks underneath the coating. This is a dangerous situation, because now water can migrate in the concrete underneath the coating to the concrete – steel interface. As a consequence corrosion can occur either above or below the floor level where it had been established previously by means of measurements from the trenches that considerable corrosion had already occurred. Hence monitoring has to occur frequently in those areas. It is doubtful that UT measurements in the trenches in Bays 5 and 17 would provide enough coverage for the entire system since essentially every other bay presents worse problems. 4 3

Coatings are never 100 % perfect. There are always holidays present, albeit perhaps few. AmerGen has chosen to discount that possibility on the grounds that two layers of coatings had been applied. While extensive qualification of the coating had occurred in 1992 in a mock-up outside the system, and while test coatings were extensively tested for holidays, such tests, albeit standardized and very easy to perform, were never performed once the coating had been applied in the sandbed area. Rather AmerGen insists that relying on visual observations is sufficient. Well, visual observation did not for the past 14 years reveal the defects in the coating on the floor until 2006 and there is no telling just how much damage may have occurred as a consequence. (The coating had been found in perfect conditions in 1994, 1996, 2000 and so on until 2006 when it was found broken up). 4

The coating is apparently colored gray. It is said that visual inspection will reveal damage and rust if it occurs. That is true after the deterioration has become

[5] "During visual inspection of the drywell vessel's exterior coating in the sandbed region (Bays 1, 7, 9, 15) areas were observed to have voids. … To prevent water from seeping underneath the epoxy, an expandable (?) sealer is required for the seams/voids.

noticeable, however, the question is not whether the coating has already failed, it is how much damage might occur between inspections after the coating fails.

For that reason it is held that a four-year inspection cycle is not enough by a long shot. First, one needs to monitor for water continuously. As experience has shown on the interior, water can easily percolate through the concrete, as has indeed happened and the operator still does not know where it comes from.

Second, defects in the coating need to be established where subsequent damage is most likely to occur, i.e. on the former sand bed floor and in the crease between the floor and the outside of the liner. 3

I don't want to go into the mechanism of corrosion once a defect has occurred other than to say the following: Once a defect (crack, pinhole, holiday etc) provides access for water to the steel surface underneath, corrosion begins slowly, hardly noticeable from the surface. However, as corrosion progresses the coating will start to crack, opening up a larger defect. (Thick coatings crack more easily than thin ones). Corrosion will progress underneath the coating and cause larger blisters, which may or may not be seen visually, but can be detected with simple test methods referenced earlier. The question of course is how rapidly will corrosion occur, and what is a reasonable time interval for inspection. I venture to say that nobody knows the answer to the first question with any certainty. It is therefore a matter of making a reasonable assumption, as I did previously. Overall, the applicant must now deal with the uncertainty is has created by taking very few UT measurements over space and time and relying on ad hoc methods for detection of moisture and coating degradation. Because we are dealing with a primary safety containment for a nuclear reactor, the uncertainties must be resolved against the applicant to ensure that a reasonable assurance of safety is maintained.

Kaufman, April 25, 2007

Rudolf H. Hausler

References

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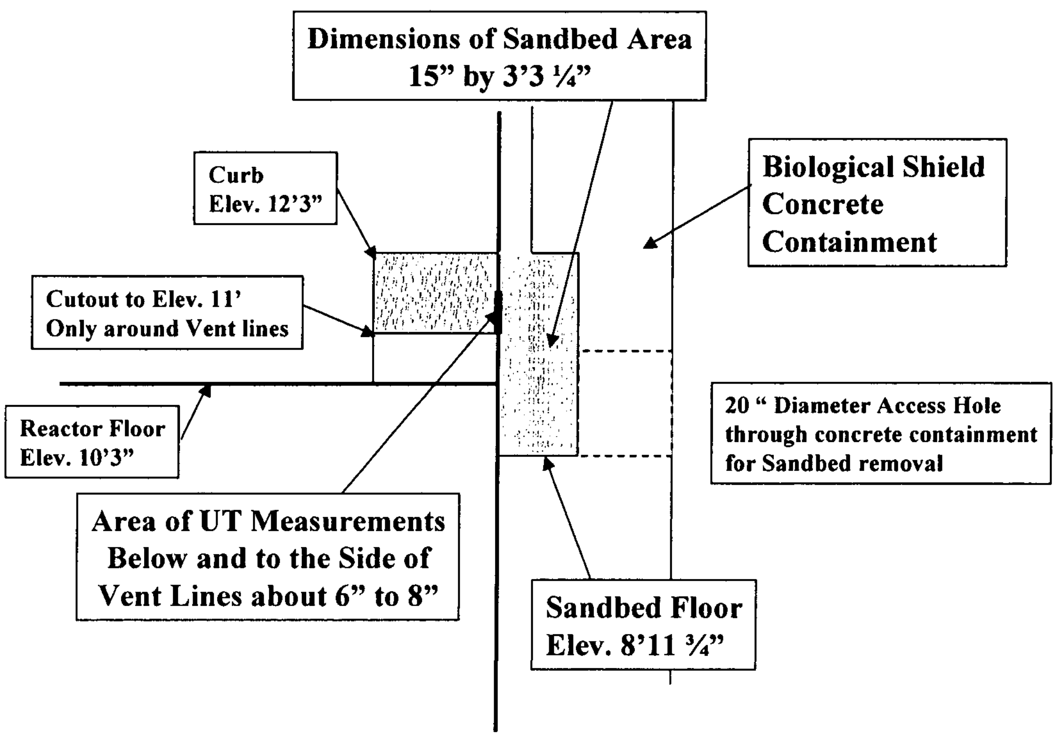
2. Affidavit of Peter Tamburro before the Atomic Safety and Licensing Board, Docket No 50-219, March 26, 2007
3. AmerGen Passport Document 005546049 07 (AR A2152754 E09), page 5, November 11, 2006
4. AmerGen Calculation sheet C-1302-187-E310-041, 2006, page 4 of 55
5. AmerGen Calculation Sheet C-1302-187-5300-01
6. OCLR R00014655

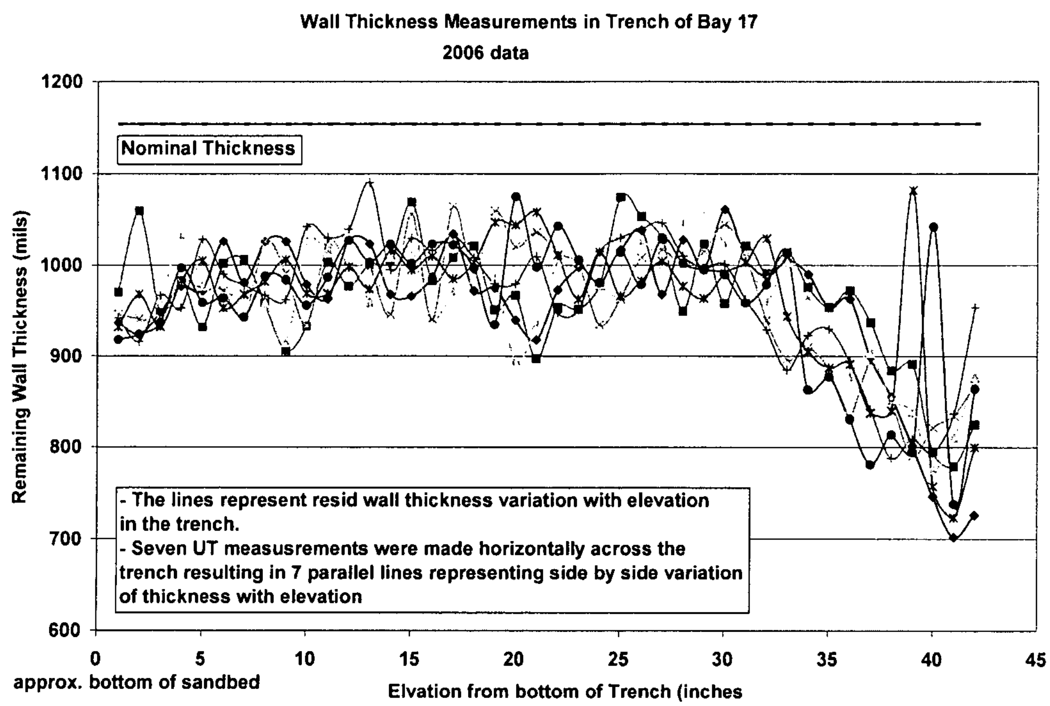
Schematic Cross Section through Sandbed Area
(not to size)

Figure 1



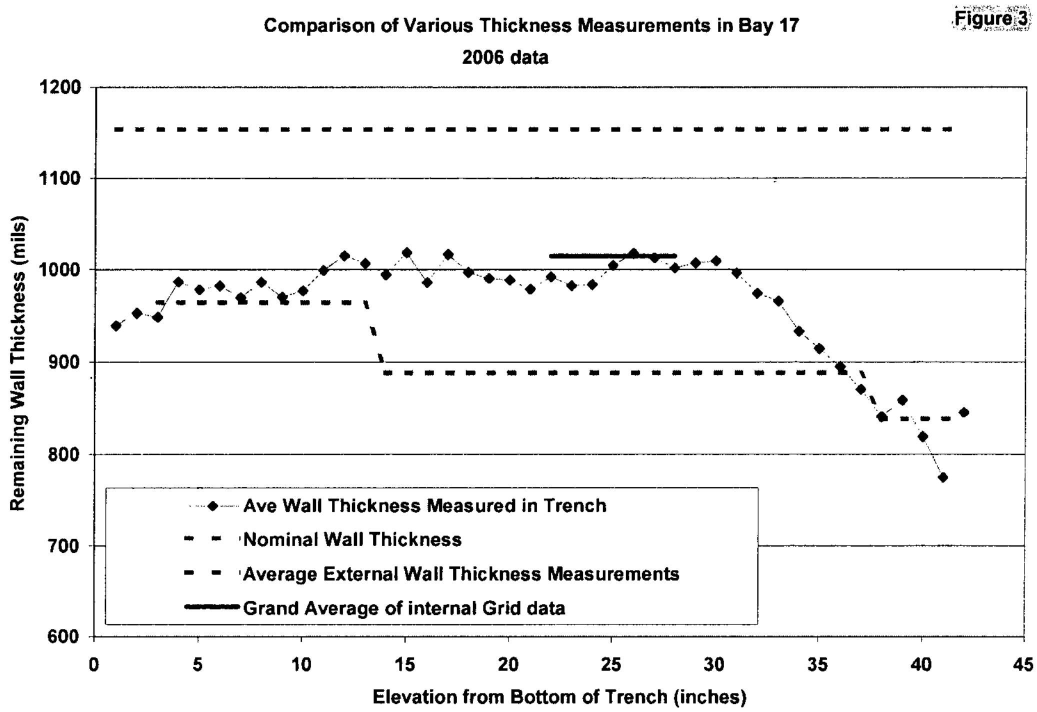
4 (entire figure)

Figure 2



2 & 4 (entire figure)

Figure 3



2 & 4 (Figures 4 & 5)

Figure 4

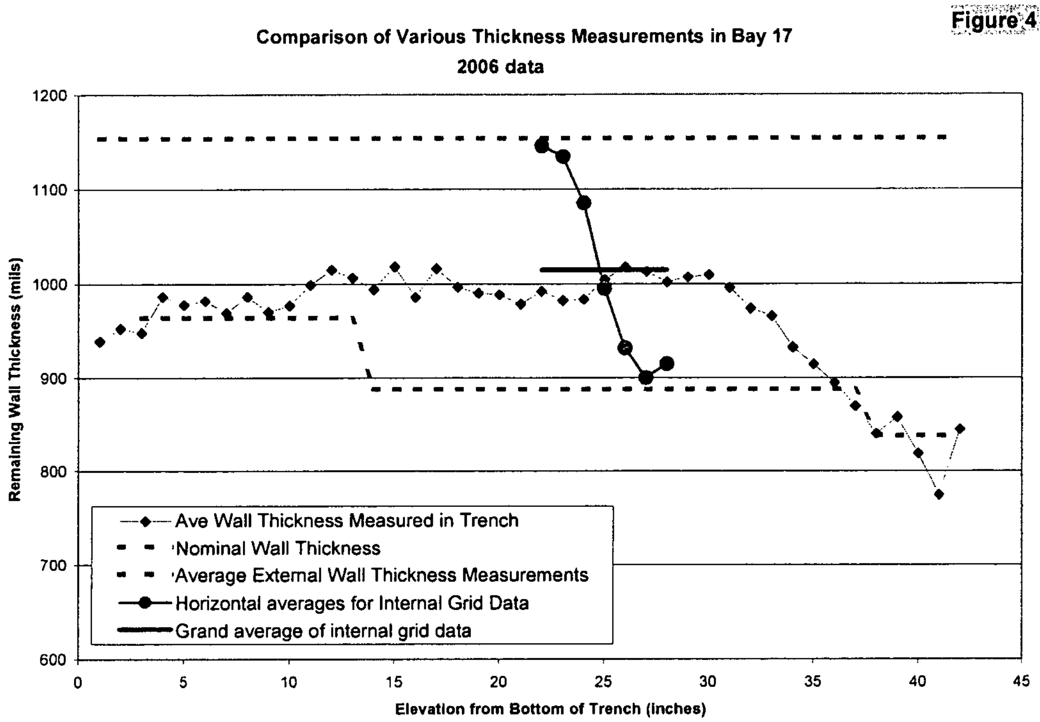
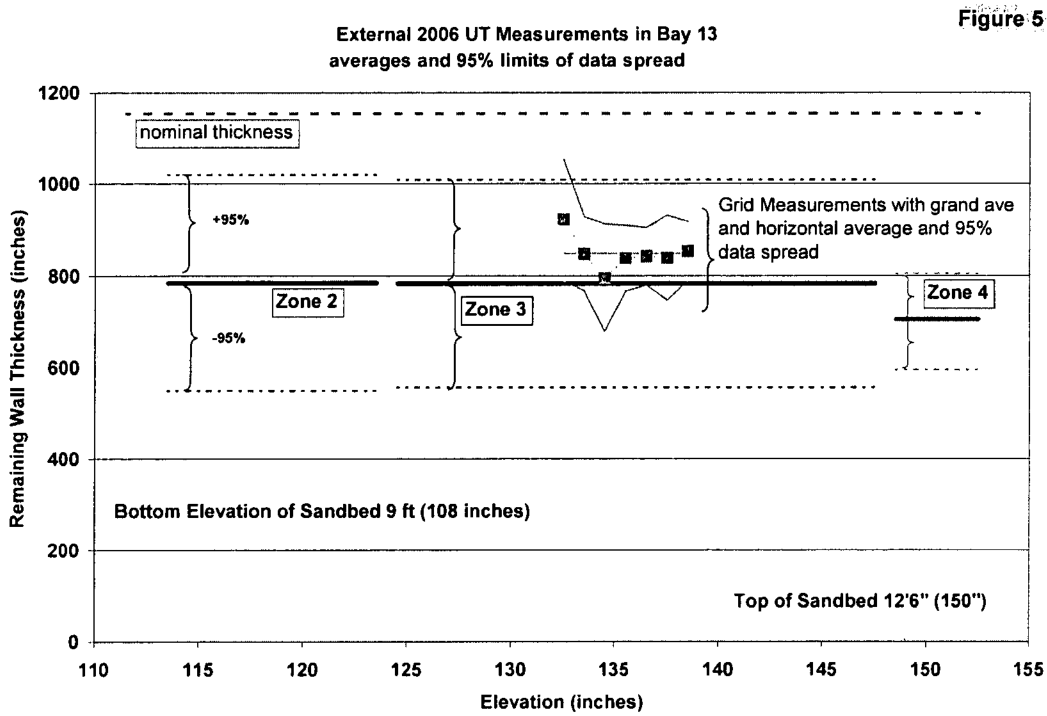


Figure 5



2 & 4 (entire figure)

Figure 6

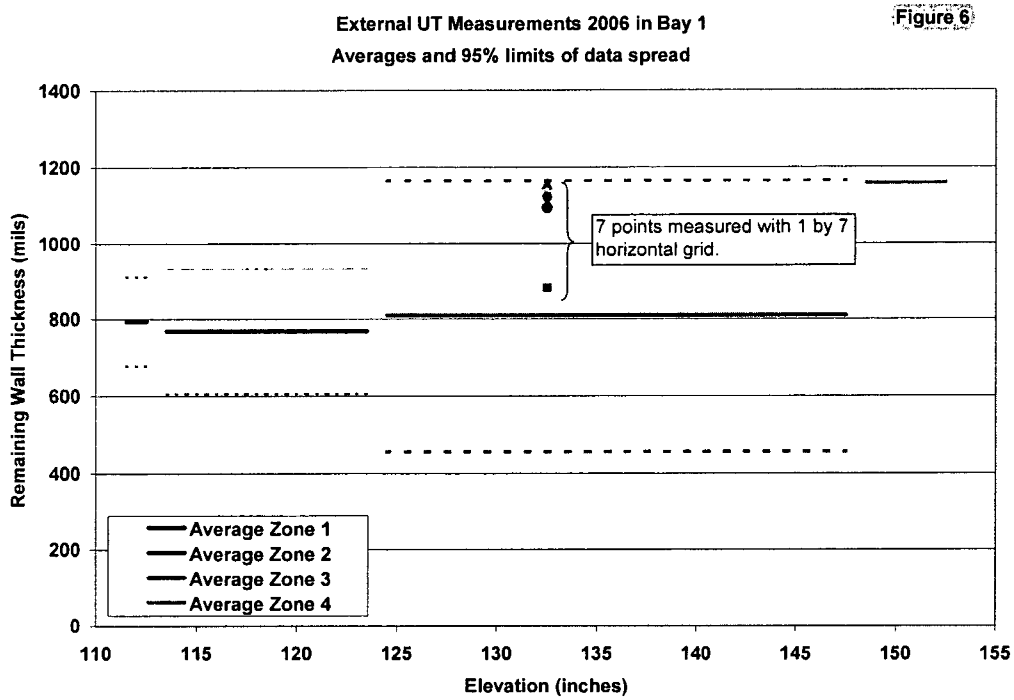


Figure 7 2 & 4 (entire figure)

Statistical Analysis of all External UT Measurements

Fig 7 a

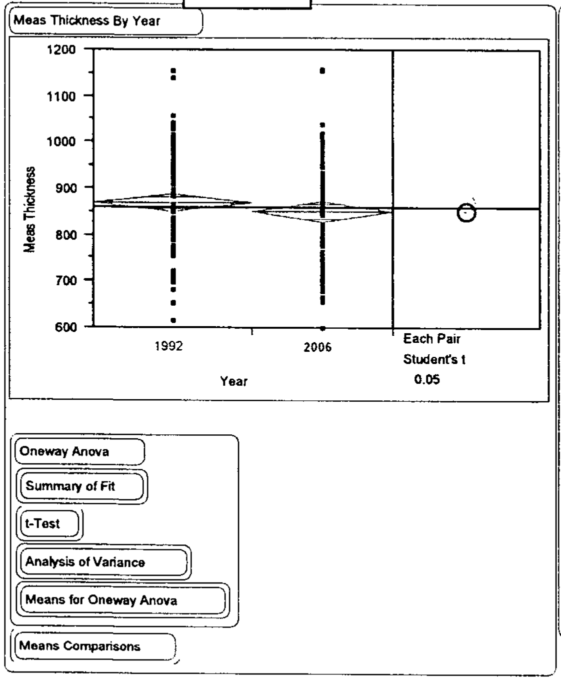


Figure 7b

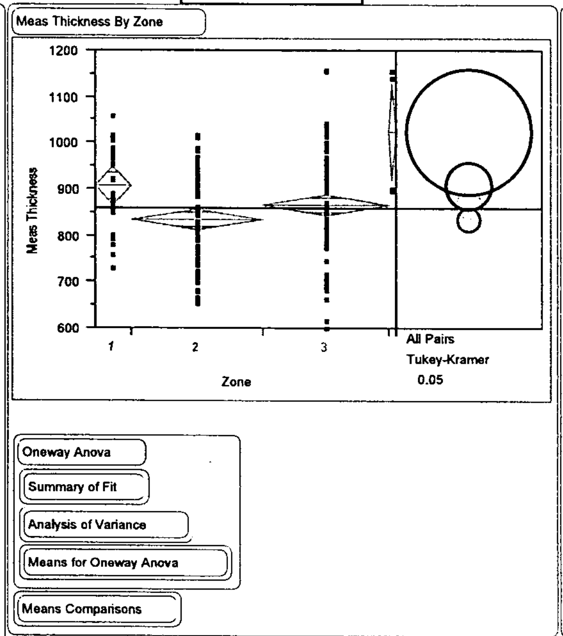
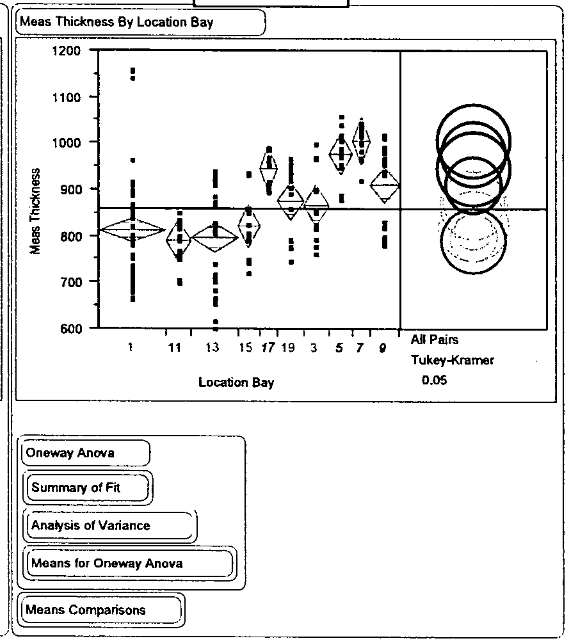


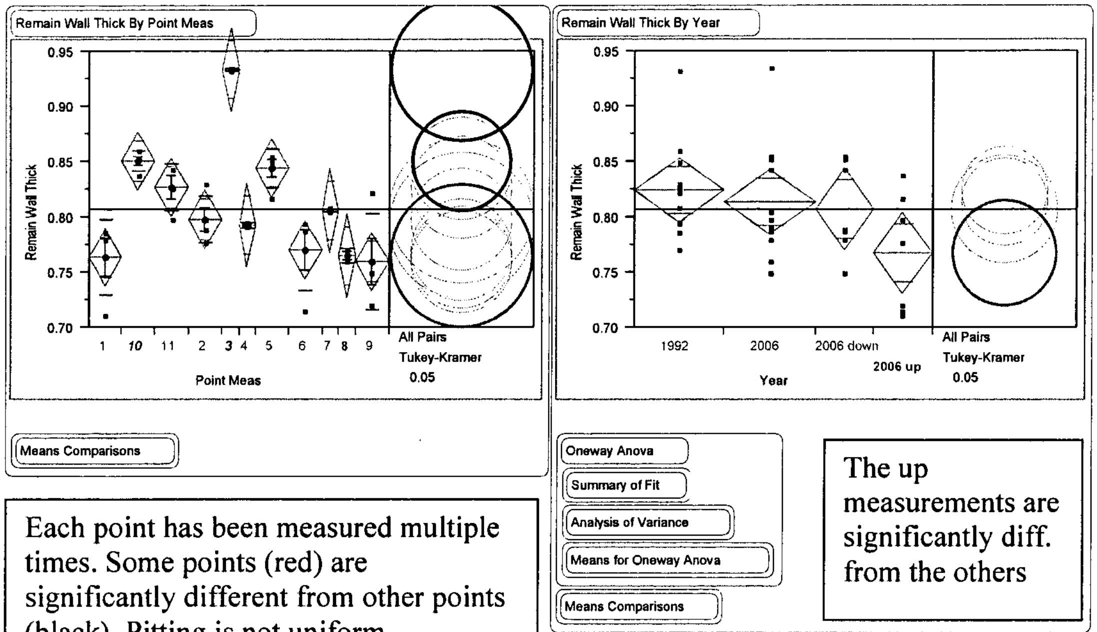
Figure 7c



Comments: Figure 7a: Comparison between measurements I 1992 and 2006 show no significant difference. The means from 1992 and 2006 show a bias of 0.018 inches, but the bias is statistically not significant despite of the many data points. Fig. 7b: The comparison between the "zones" (elevations) is significant. Zones 1 is significantly different from zones 2 and 3. For zone 4 there are not enough data for statistical significance. Fig. 7c: Some bays, red ones, are significantly different from the black ones.

Figure 8: External UT Measurements in Bay 15

2 & 4 (Figures 8 & 9)



Each point has been measured multiple times. Some points (red) are significantly different from other points (black). Pitting is not uniform.

Figure 9: External UT Measurements in Bay 1.

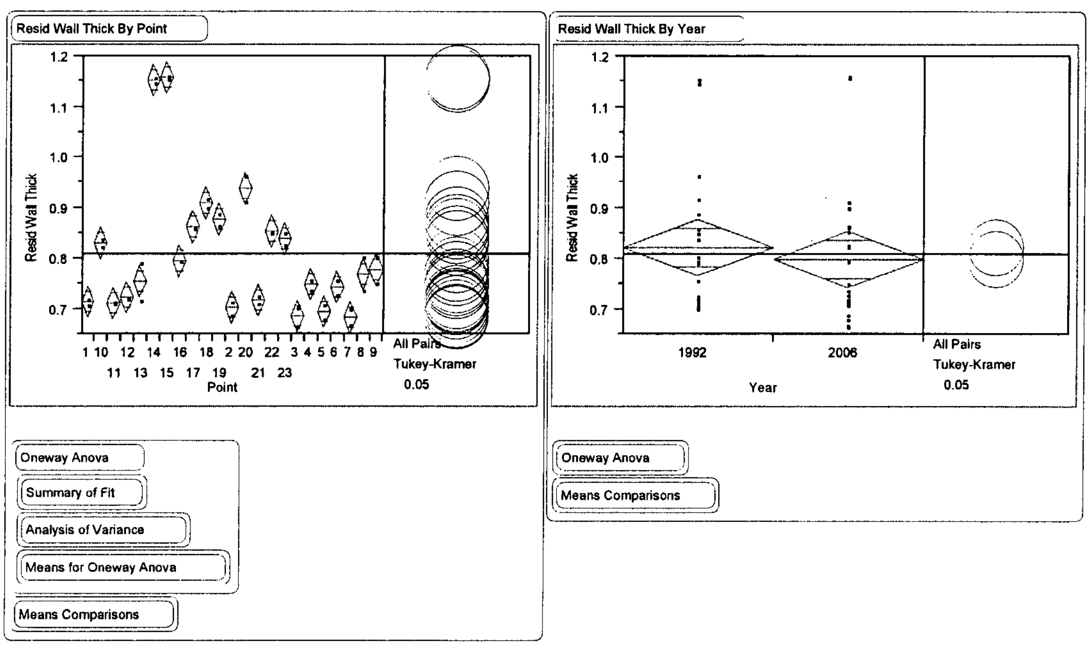
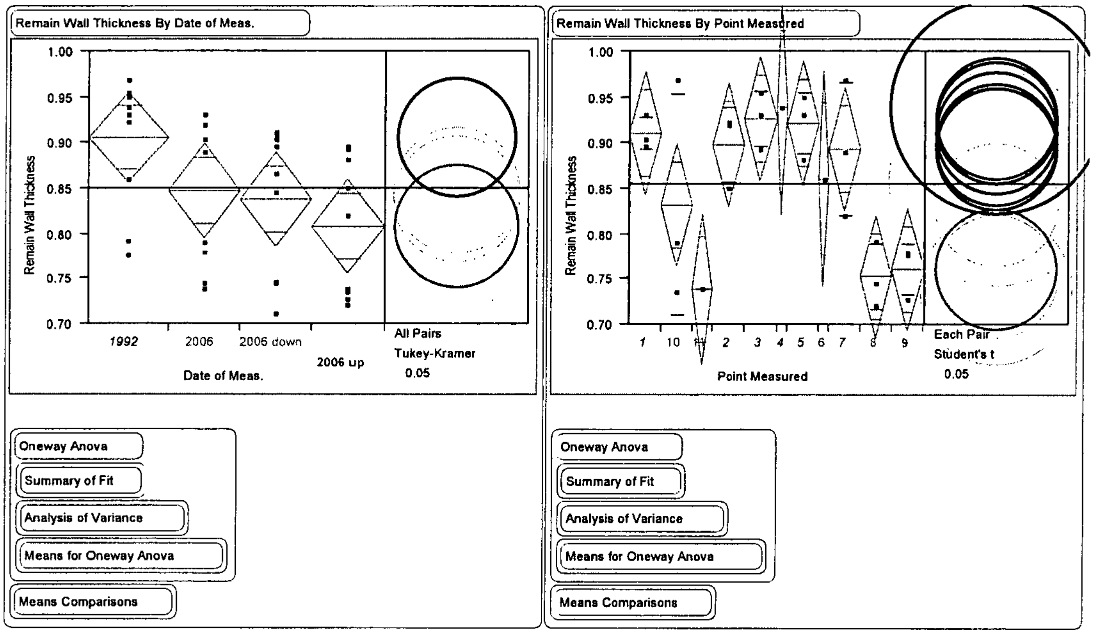


Figure 10: External UT measurements in Bay 19

2 & 4 (Figure 10 & Table 1



Again one finds that the "up" measurements are significantly lower from the 1992 measurements.

Table 1

Average Remaining Wall Thickness Measured Externally in the Sandbed Region by UT

Bay	1992		2006		2006-up		2006 down	
	Average	Std Dev	Average	Std Dev	Average	Std Dev	Average	Std Dev
1	0.822	0.027	0.8	0.027				
15	0.825	0.014	0.814	0.014	0.808	0.018	0.768	0.0184
19	0.907	0.025	0.848	0.026	0.837	0.26	0.807	0.026

95 % Confidence Limits of lowest significant measusrements

Bay 1	**0.746**
Bay 15	**0.731**
Bay 19	**0.755**