RAS H-45

DOCKETED
USNRC

June 18, 2008 (4:49pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY

BEFORE THE COMMISSION

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

NUCLEAR INFORMATION AND RESOURCE SERVICE, JERSEY SHORE NUCLEAR WATCH, GRANDMOTHERS, MOTHERS AND MORE FOR ENERGY SAFETY, NEW JERSEY PUBLIC INTEREST RESEARCH GROUP, NEW JERSEY SIERRA CLUB AND NEW JERSEY ENVIRONMENTAL FEDERATION (COLLECTIVELY "CITIZENS") REPLY TO NRC STAFF AND AMERGEN RESPONSES TO COMMISSION ORDER DATED MAY 28, 2008

Richard Webster
Eastern Environmental Law Center
744 Broad Street – Suite 1525
Newark, New Jersey 07079

Counsel for Citizens

June 18, 2008

Template Secy-035

DS-03

I. Introduction

AmerGen Energy Co. LLC ("AmerGen") and the NRC Staff both make the erroneous claim that AmerGen's commitment matches or bounds the modeling that Judge Baratta would require. In fact, AmerGen has put forward an approach that is even less conservative than the approach Judge Baratta implicitly rejected by putting forward the *additional* requirements. Furthermore, the proposed sensitivity analyses totally fail to reflect the full amount of uncertainty present. The NRC Staff's opinion that AmerGen's additional modeling would meet Judge Baratta's requirements is based on the misapprehension that AmerGen will use the latest external data to conservatively characterize the thickness of the shell and then do additional sensitivity analyses, which it will not. In any event, Judge Baratta would require AmerGen to use all of the data to generate a best estimate of the drywell thickness at each point on the drywell using a mathematical interpolation and extrapolation scheme, such as contouring. Sensitivity could then be explored automatically using a Monte Carlo simulation or manual variation of the input parameters. Finally, neither the Staff nor AmerGen discuss what will be required if further analysis does not determine compliance with the Code with sufficient certainty. In contrast, Citizens offer a solution to this problem. Citizens' Ex. CR 5, Attachment at 3-5.

II. Judge Baratta Intended To Impose Additional Requirements

Citizens submitted as hearing exhibits AmerGen documents discussing how AmerGen would derive drywell thicknesses for the required three dimensional modeling. Citizens' Ex. 45, 46, 65. The most definitive of these is a technical evaluation dated April 20, 2007, which proposed to use similar values for average thickness in the sandbed region to those AmerGen is now proposing. Affidavit of John F. O'Rourke, dated June 11, 2008 ("O'Rourke Aff.") at ¶ 16. In addition, the technical evaluation stated that there are "several locally thin areas in the sandbed" and proposed to include estimates of the extent and average thickness of those areas in the model. Citizens' Ex. 45 at 3, 6, 8-12. In contrast, Citizens suggested an approach based on contour plotting of both the internal and external data. Having heard all the evidence for and against the use of the external data and contour plotting, Judge Baratta decided to impose *additional* requirements on the proposed modeling. In particular, he endorsed using an "extrapolation scheme" that "might be similar to the one suggested by Citizens' expert Dr. Hausler, that uses contour plots generated from known thicknesses both interior and exterior." Additional Statement of Judge Baratta at 6. This amounted to a rejection of the approach outlined in the technical evaluation.

Far from heeding the words of Judge Baratta, AmerGen has now come back with a proposed modeling scheme that is even less realistic than the technical evaluation that Judge Baratta found wanting. The latest approach omits most of the local areas of severe corrosion from the base case[1] and overestimates the average thicknesses of the Bays.[2] Furthermore, AmerGen has not proposed an extrapolation scheme that is remotely akin to that set forth by Dr. Hausler. Thus, its approach is completely unresponsive to Judge Baratta's *additional* requirements for a conservative assessment of the drywell thicknesses distributed over the shell using *all* of the data, followed by a sensitivity analysis to assess the uncertainty.

III. AmerGen's Approach Does Not Provide The Best Estimate Of The Drywell Thickness At Each Point On The Shell And Fails To Fully Assess Uncertainty

The modeling conducted by General Electric ("GE") showed that that small areas (<1 square foot) of severe corrosion have a significant effect on buckling capacity. Citizens' Ex. 3 at 2 (Item 4); AmerGen Ex. 39. Thus, in addition to an acceptance criterion for the average thickness of each Bay, the licensee also developed an acceptance criterion to control small areas of severe corrosion that were less than 0.736" thick. Citizens' Ex. 3 at 2 (Item 4). Such areas of severe corrosion have been observed in six adjacent Bays. Citizens' Ex. CR 4, Attachment at Figures 3-5, 7-11. Thus, as Judge Baratta has recognized, best estimates of these areas must be included in any modeling. In addition, because the thickness and extent of these areas are not well characterized, they must also be varied in thickness and

---

[1] There is an oblique reference to a locally thinned area in Bay 19 in the base case in the description of the second sensitivity analysis proposed by AmerGen. O' Rourke Aff. at ¶ 23-24. However this is not mentioned in Table 1 which presents a "bay-by-bay explanation of . . . what thicknesses are being used in the base case." *Id.* at ¶ 16.

[2] A further memorandum from Dr. Hausler providing a detailed response to AmerGen's proposal is provided as an attachment to Citizens' Exhibit CR 4.

extent in a sensitivity analysis. Inexplicably, AmerGen has failed to even include its own estimate of the existing severely corroded areas in its modeling proposal base-case, let alone the more realistic analysis of Dr. Hausler. Although, it has proposed to add *one* such area in Bay 1 as part of the sensitivity analysis, *Id.* at ¶ 18, this is non-conservative because the size of the area will not be expanded beyond its currently estimated extent, Citizens Ex. 45 at 8, and many other severely corroded areas would be omitted from the model. The base case and the sensitivity analyses proposed by AmerGen therefore completely fail to capture the full range of uncertainty associated with the lack of knowledge about the thickness and extent of the severely corroded areas in these six Bays.

Judge Baratta recognized that the best way to include the severely corroded areas is to use spatially distributed estimates of thickenesses distributed across the drywell using contouring or a similar interpolation technique. However, even if using average thicknesses were acceptable, AmerGen has produced over-optimistic estimates of those thicknesses in part by estimating the average thickness of the shell in Bays 1, 3, 7, and 15 below the 11'3" level without using any of the measurements taken in those Bays. O'Rourke Aff. at ¶ 14, Table 1; Citizens' Ex. CR 4 Attachment at 4-7. This approach even conflicts with numerous other AmerGen documents, which derived more conservative estimates of average thickness using external measurements taken in each Bay. *E.g.* AmerGen Ex. 16 at 5.[3]

Notably, the NRC Staff does not appear to believe AmerGen's proposed approach is adequate. The Staff expected AmerGen to meet its commitment by using conservative thickness estimates for unmeasured areas. NRC Staff Br. At 3. However, in contrast to AmerGen, the Staff has rightly concluded that the 106 external thickness measurements "conservatively characterize the degraded drywell shell." Affidavit of Hansraj G. Ahsar, dated June 11, 2008 ("Ashar Aff.") at ¶ 13. Furthermore, the Staff believe that the 106 external measurements should form the base case from which the sensitivity studies should be conducted. *Id.* at ¶ 8. As shown above, AmerGen has a different view of the

[3] For example, AmerGen proposed to model the lower part of Bay 15 at thickness 0.931", O'Rourke Aff., but has previously estimated the same thickness to be 0.788", which is a very significant difference. AmerGen Ex. 16 at 5. Furthermore, O'Rourke mistakenly states that the thickness selected for Bay 1 is consistent with the external data for that Bay. The proposed average thickness is 0.826 inches, whereas the average of the external data is 0.802". Citizens Ex. 16 at 5.

commitment, because it is currently intending to rely primarily on the internal measurements, which only cover a tiny area of the shell (less than 1%) and therefore produce even more uncertain estimates of the spatially distributed thickness. Citizens CR 4 Attachment at 2, Figures 3-13. Finally, Citizens and Judge Baratta believe that both the internal and the external thickness data should be input into a mathematical extrapolation technique to derive the most accurate picture possible of the actual state of the vessel. Furthermore, once the best estimate is derived, both Citizens and Judge Baratta believe a sensitivity analysis should be carried out to illustrate the full range of uncertainty. As Dr. Hausler has suggested, this could be achieved through a Monte Carlo simulation, or, as Judge Baratta suggested, this could be done manually.

IV. At Present There Is No Reasonable Assurance That The Drywell Meets The Safety Requirements During Refueling

The Staff relies upon the GE modeling acceptance criteria and the Sandia Study to argue that there is currently reasonable assurance that the drywell meets the safety requirements. Ashar Aff. at ¶¶ 10-14. However, neither are persuasive. First, as the NRC Staff acknowledged, where there is both local thinning and generalized thinning, the acceptance criteria could allow the factor of safety to drop to 1.81. NRC Staff Ex. C1 at A54. Here, the data undoubtedly show both general thinning and local areas of severe corrosion. *See e.g.* AmerGen Ex. 16 at 5 (average wall thickness in Bay 13 is 0.786", 0.05" above the acceptance criterion for mean thickness); *see also e.g.* Citizens' Ex. C1 at A7; Citizens' Ex. 61 at 17 (the local area acceptance criterion was probably violated in Bay 13). Thus, a comparison of the measurements with the acceptance criteria cannot establish reasonable assurance that the shell is meeting the factor of safety requirements.

Second, the NRC Staff's reliance upon the Sandia Study is misplaced. The Sandia model largely used average external data to characterize the sandbed, but the average thicknesses used by Sandia are consistently higher than the latest measurements indicate. *Compare* NRC Staff Ex. 6 at 49 (Table 2-7) *with* AmerGen Ex. 16 at 5.[4] In addition, Sandia placed two small 30 inch by 18 inch locally thin areas directly under the ventlines in Bays 1 and 13. *Id.* at 49. However, Dr. Hausler's contour plots show larger and thinner severely corroded areas than assumed by Sandia well away from the vent lines in these Bays. Citizens' Ex. 61 at 14-17. Because severe corrosion away from the vent lines has more effect than areas of severe corrosion below those lines, the placement assumed by Sandia does not bound the effect of the severely corroded areas. Moreover, as discussed earlier, six Bays, not two, have local areas of severe corrosion. Even with these non-conservative assumptions, the Sandia study estimated the factor of safety during refueling as 2.15, just above the required 2.0.[5] Both the lack of conservatism in the analysis and the high degree of uncertainty in the modeled estimate of the factor of safety mean that the Sandia study cannot provide reasonable assurance that the ASME code will be met during the next refueling.

V. Conclusion

For the foregoing reasons, the Commission should require AmerGen to conduct additional analyses of the buckling capacity of the drywell shell to ensure there is sufficient certainty that the shell meets the buckling capacity requirements prior to any decision on relicensing and grant any other relief as it may see fit.

Respectfully submitted,

Richard Webster, Esq.
Eastern Environmental Law Center
Attorneys for Citizens

Dated: June 18, 2008

---

4 For example, the area comprising half of Bay 1 and half of Bay 19 was assigned a thickness of 0.858 inches by Sandia, NRC Staff Ex. 6 at 49, but in 2006 Bay 1 had an average thickness of 0.802 inches and Bay 19 had an average thickness of 0.801 inches. AmerGen Ex. 16 at 5. Similarly the area comprising half of Bay 13 and half of Bay 15 was assigned a thickness of 0.842 inches by Sandia, but in 2006 Bay 13 had an average thickness of 0.786 inches and Bay 15 had an average thickness of 0.788 inches.

5 It is not possible to argue that Sandia's rejection of the enhanced capacity reduction factor builds in any conservatism. Citizens' Ex. CR 5 at 2.

Exhibit CR 4

EXHIBIT CR 4

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of AMERGEN ENERGY COMPANY, LLC (Oyster Creek Nuclear Generating Station)	)))))))	Docket No. 50-219-LR

DECLARATION OF DR. RUDOLF HAUSLER

1. My name is Dr. Rudolf Hausler. Citizens have retained me as an expert witness in proceedings concerning the application of AmerGen Energy Company LLC to renew its operating license for the Oyster Creek Nuclear Generating Station ("Oyster Creek") for twenty years beyond the current expiration date of April 9, 2009.

2. I am an expert on the corrosion of metals during operation.

3. The attached memorandum dated June 17, 2008 represents my current opinion regarding the topics it covers.

I declare under penalty of perjury that the foregoing and the attached memorandum, dated June 17, 2008 is true and correct.

Executed this 17 day of June, 2008 at Kaufman, Texas

Rudolf H. Hausler

Rudolf Hausler, PhD

MEMORANDUM

To: Richard Webster, Esq.
Legal Director
Eastern Environmental Law Center
744 Broad Street, Suite 1525
Newark, NJ 07102

June 17, 2008

From: Rudolf H. Hausler
Corro-Consulta
8081 Diane Drive
Kaufman, TX 75142

Subject: **Discussion of Sensitivity Analyses Proposed By NRC Staff and AmerGen**

AmerGen has proposed an approach to the sensitivity analyses requested by Judge Barrata[1]. The approach would consist of modeling base case along with two sensitivity analyses. These would consist of a) defining some hypothetical remaining wall thickness in Bay 1 for an area of 51 inches in diameter 596 mils. This is an area of 14 ft^2 or 20% of the area of one Bay and b) reducing the average remaining wall thickness of Bay 19 by 50 mils to 776 mils but only for an area of 8.5 ft either side of the centerline.

The rational for these definitions is hard to understand. The base case is entirely based on the internal grid UT measurements which in the majority of the bays do not reflect the corrosion which occurred below the 11'00" elevation, i.e. in the sandbed. For the "sensitivity analyses" I cannot find any justification for either the areas over which the wall thicknesses are being reduced, or the value to which they are reduced. All of the data input to the three models is based on the internal UT measurements and some arguments as to why the measurements from adjacent bays should be controlling in those instances where the internal grid measurements returned only nominal wall thickness and where therefore judged not to be relevant. These sensitivity analyses are therefore totally unrealistic and do not address the problem Judge Barrata wanted analyzed, namely the uncertainties existing due to the limitations of the existing data.

For this reason I shall discuss below the entire existing data set in order to put in perspective the proposed AmerGen sensitivity analysis juxtaposed to the sensitivity analysis Judge Barrata had in mind when he specified the determination of the effects caused by the uncertainties in the size of the thinned areas.

[1] AmerGen Initial Brief in Response to CLI-08-10 (6/11/08)

I. Introduction

There are really several kinds of uncertainties with respect to the degree the drywell liner was thinned by corrosion. The first pertains to the size of the grid used to perform the internal UT measurements – 36 in^2 (0.25 ft^2) per Bay out of 73 ft^2 total bay area. Even two or three grid measurements would not be representative of the total bay area. Second, in many instances the internal grids simply did not reflect the actual corrosion of the respective bays. Third, the external measurements were few and far between and left open the question as to the extent of the corroded area and the nature of the remaining surface between the measured points.

The sensitivity analysis found necessary by judge Barrata in order to assess the confidence limits attached to the modeling result of the remaining safety factor attached to the buckling resistance of the Oyster Creek drywell liner, as I understand it would have been aimed at a realistic estimation of the thinning of the large areas of the sandbed region of the drywell that have not been measured. AmerGen is doing the exact opposite. They worry about modifying measured areas. In fact, they have incorrectly used "*Engineering Judgment*" instead of using objective interpolation and extrapolation techniques, such as those that I have proposed.

The following discussion outlines once more what it is that one knows for certain about the deterioration of the drywell liner at this stage. The information is extracted from AmerGen documents which have been in evidence[2)].

II. The Nature of the Data

There are basically two types of data available to assess the integrity of the liner. These are "*Internal UT Wall Thickness Measurements*" *and* "*External UT Wall Thickness Measurements*" referred to in the following simply as internal and external measurements.

The internal measurements were made by means of templates which measured 7 inch by 7 inch (see Figure 1) and contained 7 one-inch holes at one-inch spacing across in seven rows in the vertical direction. This template therefore held 49 regularly spaced holes for reproducible placing on a well marked location on the inside of the liner. In some instances templates with only seven holes in one horizontal row were used.

The external UT measurements were made in what has repeatedly been claimed to be the most corroded areas[3)]. The locations for these measurements were recorded with respect to a reference point which was located more or less in the center of the bay below the torus vent pipe, approximately at the top of the sandbed. At the hearing the relationship between the internal grid reference and the external reference was revealed. Therefore, I can now compare the two data sets within the same bay. In some bays multiple grid measurements were made.

[2)] AmerGen Ex. 19 Attachment 4; and OCLR00018581-18598.

[3)] The "most corroded areas" as has been pointed out repeated were identified visually. However, since the extent of corrosion is determined by the remaining wall thickness and the most corroded Bays have been described as having exterior surfaces like a golfball it is difficult to understand how the thinnest remaining wall thicknesses could be determined visually.

III. Discussion of the Data

The attached Table 1 summarizes all internal and external measurements by their respective averages. Thus one finds for instance that for Bay 1 the average remaining wall thickness from the 7-hole grid is 1087 mils (1.087 inches) while the external measurements averaged 801 mils. The difference between internal and external measurements is 24%. It turns out that for 3 of 6 Bays where there is comparable data, the internal and external measurements agree within the margin of error. This shows that there is no strong bias in the external data. This is hardly surprising because AmerGen has only presented evidence that a few points were overground, and has not provided any point by point data to establish any bias. However, from the point of view of sensitivity analysis this is only half the story as a closer more detailed analysis of all the data will show below.

IV. Detailed Analysis of the External data.

In order to put all these results into perspective one needs remember that the sandbed is approximately 3'0" to 3'3" high (see Fig. 2) and approximately 20 feet wide per bay (10 feet either side of the torus vent pipe) for a total area of about 73 square feet (ft^2). With this background we can proceed to discuss Figures 3 through 13, one for each bay and the respective external measurements.

Figure 1 shows a schematic of the two kinds of templates that had been used for the internal measurements.

Figure 2 attempts to show the location for the internal grid measurements. There is a concrete curb on the inside of the liner about two feet above the reactor floor. A cutout below the reinforcements for the torus vent pipe allows the placement of the UT template at 11 feet. The template measurements therefore extend from 11 feet to 11feet 7 inches. According to the design this should be well within the sandbed area and should correspond to at least some external measurements. However, a number of the 7 hole templates (see below) returned original wall thicknesses even though corrosion occurred at lower elevations. This indicates that the sand in the sandbed did probably not reach as high as required by the design and was very likely unevenly distributed. This needs to be kept in mind through out the following discussions because this unevenness is another source of the uncertainty as to where corrosion might have occurred and where it would have been most severe.

The subsequent figures represent contour plots for the remaining wall thickness based on the data as reported by AmerGen. Thus Figure 1 shows a contour plot for the Bay 1 external measurements. The vertical axis[4)] is the distance from the reference point toward the bottom of the sandbed. The numbers are in inches. The horizontal axis represents the location of a particular measurement either left or right of the reference point which usually was placed in or near the center of the bay just below the torus vent pipe.

[4)] The liner wall at this point is actually not vertical (as shown in Fig. 1) but slanted at about a 45 deg angle off horizontal.

There has been a lot of controversy regarding this approach of presenting the UT data. The reason for the controversy is the fact that these external measurements are point measurements and no effort had been made to determine the extent (x/y expanse) of the corrosion around the point of the measurement. One may therefore reasonably ask whether it should be permitted to essentially average the remaining wall thickness between two points or whether the "pits" are singular events not really affecting the remainder of the area where the pit occurred.

But this is precisely the uncertainty judge Barrata asked the parties to deal with. It may well be that the contour plots, which are based on the average (slope) UT measurements between each point and any other around it, are the proper representation of the corroded liner. It could be that they over estimate the deterioration (as AmerGen would have it), but they could also underestimate the extent of the corrosion. Judge Barrata indicated that he agreed with me that a methodology such as contouring or something similar is the best approach to deal with the uncertainty of the remaining wall thicknesses caused by the relatively sparse density of measurements.

Bay 1: The internal measurements in Bay 1 were made with a 1x7 inch template. For comparison the template was drawn into the graph at the 0/0 location (Figure 3) where it most likely was located. As it turned out the internal measurements were non-representative of the corrosion in Bay 1 and therefore irrelevant. AmerGen realized this and went ahead to characterize this Bay 1 by way of the results obtained for Bay 19 because a) they are adjacent Bays and b) because they were both the most corroded ones. However, AmerGen uses the internal grid measurements for Bay 19, the average of which was 826 mils (836 mils according to our calculations) rather than the average of the external measurements of Bay 19 the average of which was 801 mils. (As it turns out the averages of the external measurements for Bays 1 and 19 are most nearly identical.)

There is still an additional difficulty to which Judge Barrata alluded. The external measurements in Bay 1 extended over the Bay from – 40 inches of center to + 40 inches. The Bay however extends to roughly 120 inches on either side. Therefore less than 30 % of the Bay was covered with external measurements. The contours drawn in Figure 1 for Bay 1 suggest that the "bath tub ring" of severe corrosion might well extend the entire width of the Bay. This is another uncertainty which modeling must take into consideration by way of a sensitivity analysis. Finally, Judge Barrata decided that from a structural point of view it is preferable to use mathematical interpolation and extrapolation techniques to make the best possible estimate of the distribution of the thickness over the Bay, rather then averaging the remaining wall thicknesses over a broad area.

Bay 3: Figure 4 shows the contours for Bay 3. The internal grid measurements (1x7) are not representative of the corrosion in that Bay. For this reason AmerGen creates a complex argument which should justify using data from Bays 1 and 5 below 11'0" for an average of 950 mils. However, again the average for the external measurements in Bay 3 is 865 mils. AmerGen has failed to justify how 950 mils can be a conservative thickness estimate for the average thickness of this this Bay when average of the external measurements in this Bay is 865 mils.

Bay 5: Here too one finds the internal grid results to reflect no corrosion (Fig 5). It is noted that the external measurements were made very low near the bottom of the sandbed and indicate on average a 20% deterioration over the nominal wall thickness.

In this Bay a trench was dug on the inside of the containment vessel to assess the corrosion in the sandbed area through UT measurements from the inside[5)]. AmerGen finds an average of these "Trench Measurements" to be 1074 mils for the remaining wall thickness. However, as a detailed analysis in Fig 5B shows this assessment may be too optimistic for certain elevations in the sandbed. Indeed the average of the external UT measurements for Bay 5 almost near the bottom of the sandbed is 960 mils and essentially confirmed by the trench data at elevation 5 to 10 inches from the bottom corresponding to -47.5 to -42.5 inch elevation in Figure 5. Therefore, here as well, one finds that AmerGen tends to embellish the extent of the damage corrosion may have caused in Bay 5.

Bay 7: As Figure 6 shows only 7 external measurements were made in this Bay. There was additionally some confusion about certain points from 1993 which could not be repeated in 2006. Adjusting for this, the external average remaining wall thickness is 995 mils. The internal measurements returned nominal wall thickness. AmerGen however determines an average thickness of 1034 mil for the wall below 11'0", a number apparently based on some averages from Bays 5 and 9. Additionally, it appears that there was some significant corrosion in this Bay (see Fig. 6) which AmerGen choose to ignore and not further investigate.

Bay 9: As shown in Figure 7 10 external measurements were made in an area of 1.5 ft by 7 ft. or barely 15% of the total bay area. The average remaining wall thickness in that area was 905 mils or a reduction of 22% from nominal. The 1x7 internal grid showed no corrosion while the 7x7 grid returned an average of 988 with a standard deviation of 78 indicating fairly large variation between individual measurements (not instrument error). Note: AmerGen chooses the smaller of the two internal grid averages (993 mils[6)]) and disregards entirely the external measurements. Additionally, there is within the grid a top down drift toward the lower values of the external measurements indicating that the residual wall thickness in the area where the sand was is probably of the order of 903 mils rather than the 993 preferred by AmerGen.

Again one can see that AmerGen tends toward interpreting the best estimate of the average thickness UT measurements less conservatively than the data would indicate. In addition, the sensitivity analysis fails to take account of the large uncertainties.

Bay 11: Figure 10 shows that Bay 11 was actually quite corroded. Here the most corrosion is observed at one spot measured about 20" from the top at 705 mils or 40% of wall loss. This point should have been explored in greater detail, particularly since the internal grid measurements returned values of the same order of magnitude (720, 737 mils at higher elevations). Here AmerGen relies entirely on the internal measurements which led to using optimistic (860 mils) rather than conservative values for the modeling.

[5)] The trench reached down to the elevation of the sandbed floor but was only wide enough to accommodate a series of vertically stacked 7x7 grids as shown in Figure 2.

[6)] The average of the 7x7 internal grid is actually 988 rather than 993 according to their own data

Bay 13: This is one of the most corroded bays. As Figure 9 illustrates there are sizable areas with remaining wall thickness below 700 mils, nearly 40% loss of wall thickness. The average of the external measurements is 785 mils. AmerGen chooses to use the average of the two 7x7 internal Grids which is 907 mils. However, as Fig. 11 illustrates the grid measurements are well outside the elevation where the most corrosion occurred and can therefore hardly be representative of the corrosion which occurred in this Bay.

AmerGen again chooses to ignore their own data and chooses an overly optimistic approach.

Bay 15: Figure 10 indicates that this bay may be corroded throughout its entire depth. It would seem therefore that it should not be permissible to characterize this bay entirely by the internal measurements which were made well above the corroded zone. Nevertheless, AmerGen chooses values from adjacent bays to characterize this one. Hence, AmerGen uses 931 mils as the average thickness for this bay when in fact 797 mils would be more appropriate.

Bay 17: This Bay (Figure 11)does not appear to be badly corroded on average, however, as has happened before in other bays, the one spot, where residual wall thickness of less than 700 mils was observed, was not further investigated, leaving open the possibility that serious corrosion might indeed extend beyond that point.

A trench had been dug in this bay from the inside of the containment vessel as well. Again, the residual wall thickness had been UT measured using a series of 7x7 inch grids stacked one on top of each other. These measurements are shown in Figure 12 in comparison to the (regular) internal 7x7 grids (see also Table 1). The trench data indicate that most of the corrosion occurred at the highest elevation from the bottom of the sandbed. In fact here the remaining wall thicknesses correspond to the results of one set of grid data. And since the top of the trench and the grids were not at the same peripheral location in this bay it is reasonable to assume that the corrosion was wide spread on the top of the sand bed, which in this case must have reached up quite high.

AmerGen uses a convoluted argument to arrive at a representative residual wall thickness for this bay of 954 mils. The actual data would suggest, however, large parts of the wall in this bay are substantially thinner and more of the order of 800 to 850 mils.

Bay 19: Figure 13 shows the data for this bay. It turns out that the most severe corrosion occurred toward the top of the sandbed. Internal and external averages appear to agree, but the fact that there is very likely an area of severe corrosion between the top of the external measurements and the bottom of the internal ones suggests that perhaps the average wall thickness chosen by AmerGen (826 mils) is somewhat too high and the average of the external measurements, 801 mils may be more appropriate.

V. Summary

The overall conclusion from this discussion is that AmerGen has disregarded the external UT wall thickness measurements in the sandbed region as not representative. Conversely, AmerGen has found the internal grid measurements to be representative of the present state of the drywell. It is a fact, however, that the internal grids (0.25 ft^2) cover a tiny area in comparison to the entire bay and the fact that over 0.25 ft^2 49 measurements are made does not help the lack of information with regards to the rest of the surface. It is precisely here where additional information gained from the external measurements could have helped. In addition it turns out that nearly half the internal measurements could not be used because the templates were placed too high above the actual (not nominal) top of the original sandbed. In these cases, rather than using the external data, complex averages were calculated by AmerGen, using the data from adjacent bays under the assumption that a certain uniformity of corrosion existed. That this was not the case, and that this assumption, explicit or implicit, was not realistic, is amply demonstrated by the graphical representation of the external measurements in the attached figures.

As a consequence I think that AmerGen avoided the real question judge Barrata asked: How can one model the real surface on the basis of the very small available data density. This question has been discussed with a number of structural, metallurgical engineers and statisticians. The answer unanimously was that the available information is not sufficient for the task. All the bays should be surveyed with modern methods to properly assess the residual wall thickness and the variations thereof. That this can be done effectively with modern automated UT and MFL (magnetic flux leakage) equipment has been amply demonstrated in the literature and in pertinent company brochures.

Overall, I have come to the conclusion that AmerGen overestimates the remaining wall thickness of the drywell liner in the sandbed area by 10 to 15% for what they call the base case. As pointed out above the proposed sensitivity analyses are quite unrealistic as well because they do not mirror the actual nature of the corrosion suffered by the drywell liner in the sand bed area where up to 40% of wall thickness loss has been observed by point measurements without having been further explored.

Table1

External Data				Internal Data					Nominal WT (mils) 1154
Bay	Average	Std Dev	No of Points	Bay	Average	Std Dev	No of Points	Comparison between External and Internal UT Measurements [int-ext]/[int]	Total Extent of Corrosion from ext. averages
Bay 1	801	135	23	1D *	1087	87	7	26%	31%
Bay 3	865	85	8	3D *	1180	14	7	27%	25%
Bay 5	960	39	8	5D *	1185	5	7	19%	17%
Bay 7	1007	28	5	7D *	1133	16	7	11%	13%
Bay 9	905	88	10	9D	988	78	49	8%	22%
				9A *	1154	10	7	22%	
Bay 11	783	48	8	11C	898	88	49	13%	32%
				11A	846	123	49	7%	
B ay 13	784	111	22	13C *	1143	8	7	31%	32%
				13A	846	57	49	7%	
				13D	968	174	49	19%	
Bay 15	788	65	11	15A *	1121	41	7	30%	32%
				15D	1064	62	49	26%	
Bay 17	890	95	10	17D	833	87	49	-7%	23%
				17/19	969	28	49	8%	
				17A	1015	106	49	12%	
Bay 19	801	76	9	19A	822	94	49	3%	31%
				19B	849	59	49	6%	
				19C	839	103	49	5%	

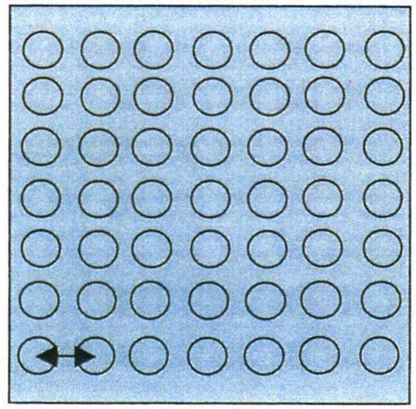
Comments:

- The (*) indicates that the internal measurements reflect the nominal wall thickness and. The template was set too high above the sandbed
- The difference between internal and external averages where nominal wallthicknes was measured internally indicates greater corrosion further down in the sandbed or, alternatively that the sandbed did not reach as high as the design might have required

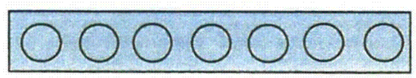
Figure 1

Templates used for Internal UT Measurements

1 inch diameter holes spaced 1 inch center to center



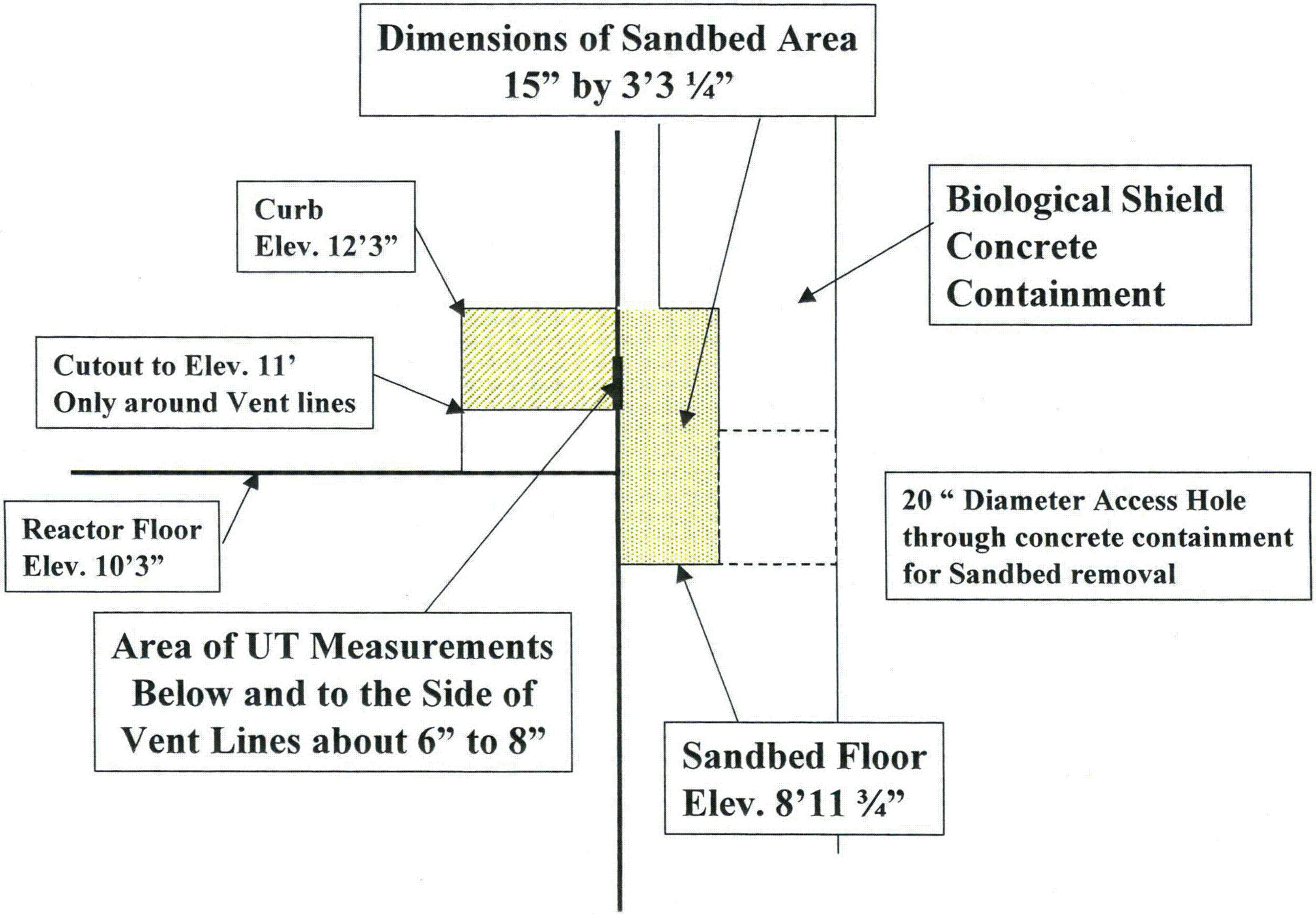
7-hole template used in some instances (see table 1)



Schematic Cross Section through Sandbed Area

(not to size, actual drywell liner wall is slanted at about a 45^0 angle in this area)

Figure 2



Contour Plot for Bay 1
External UT Measurements 2006

Figure 3

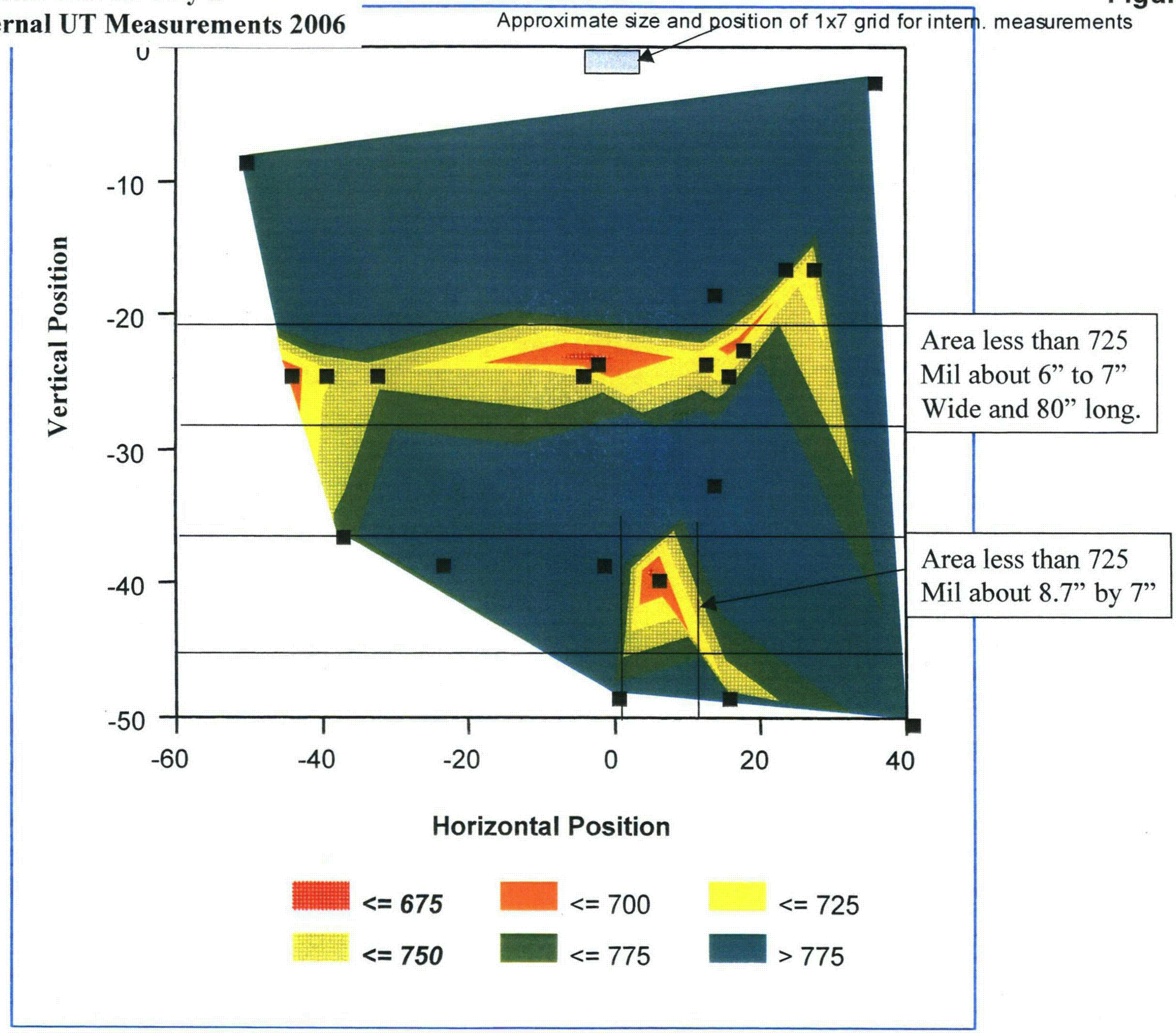
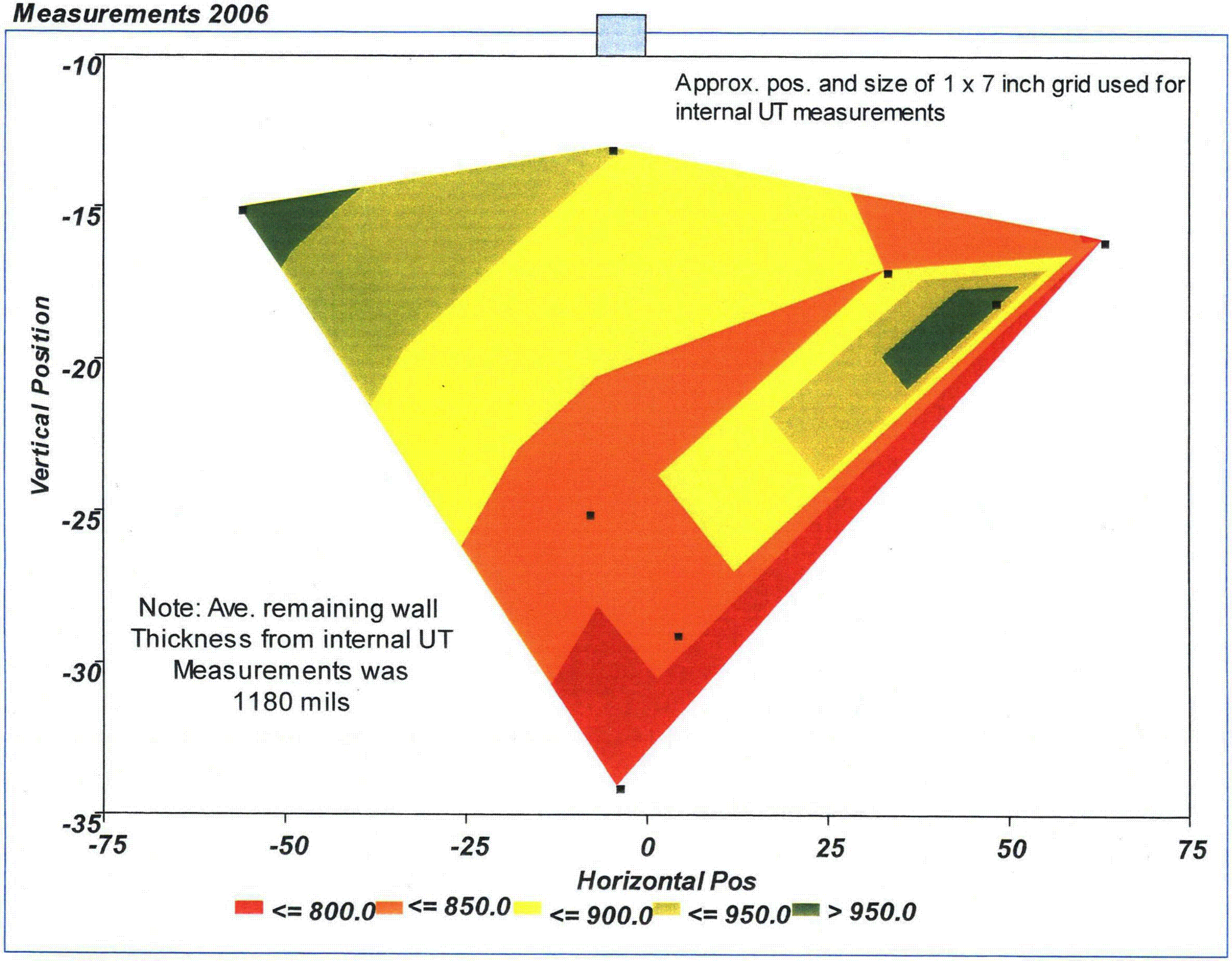


Figure 4

Contour Plot for Bay 3

Measurements 2006



Contour Plot for Bay 5

Measurements 2006

Figure 5

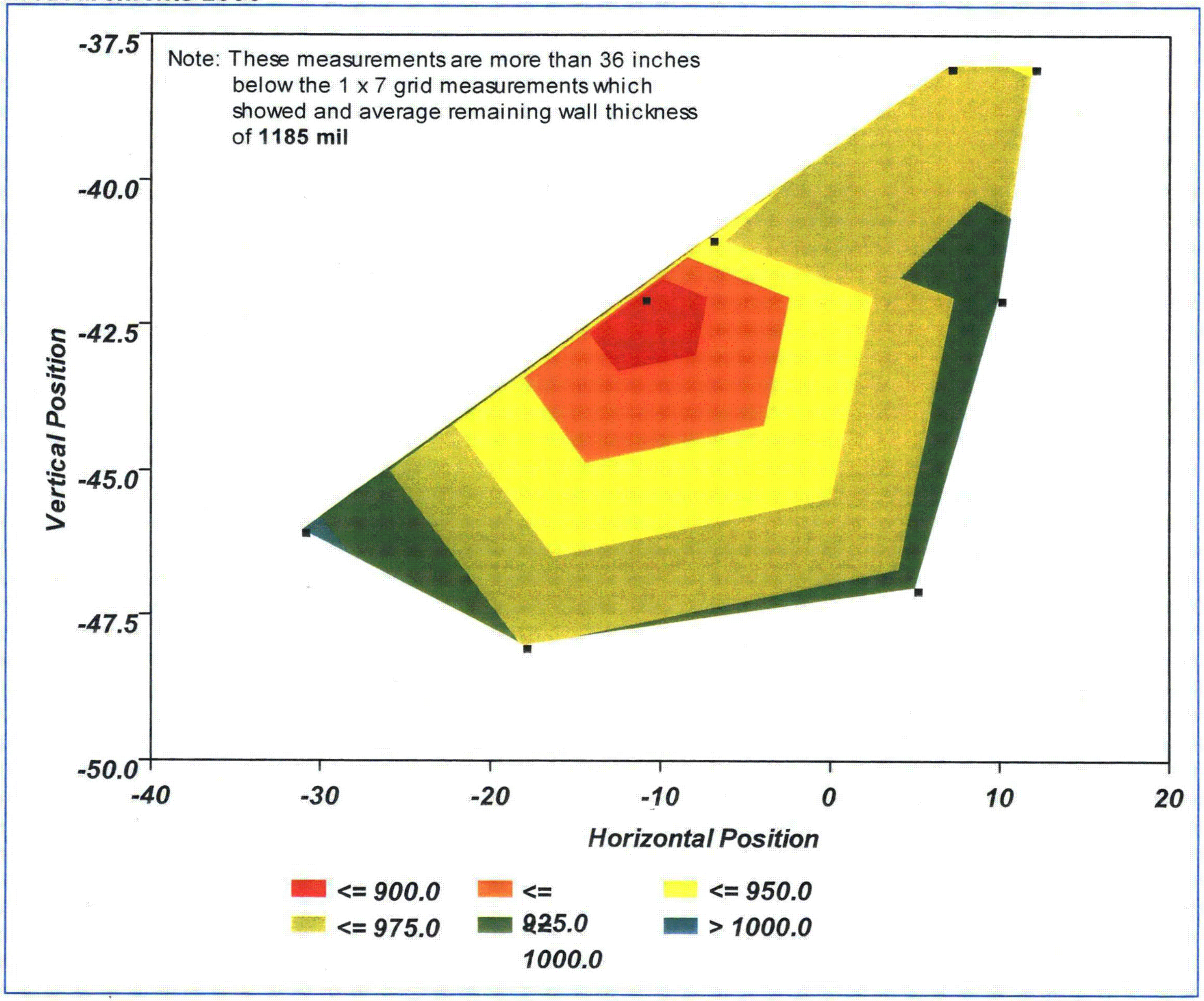


Figure 5B

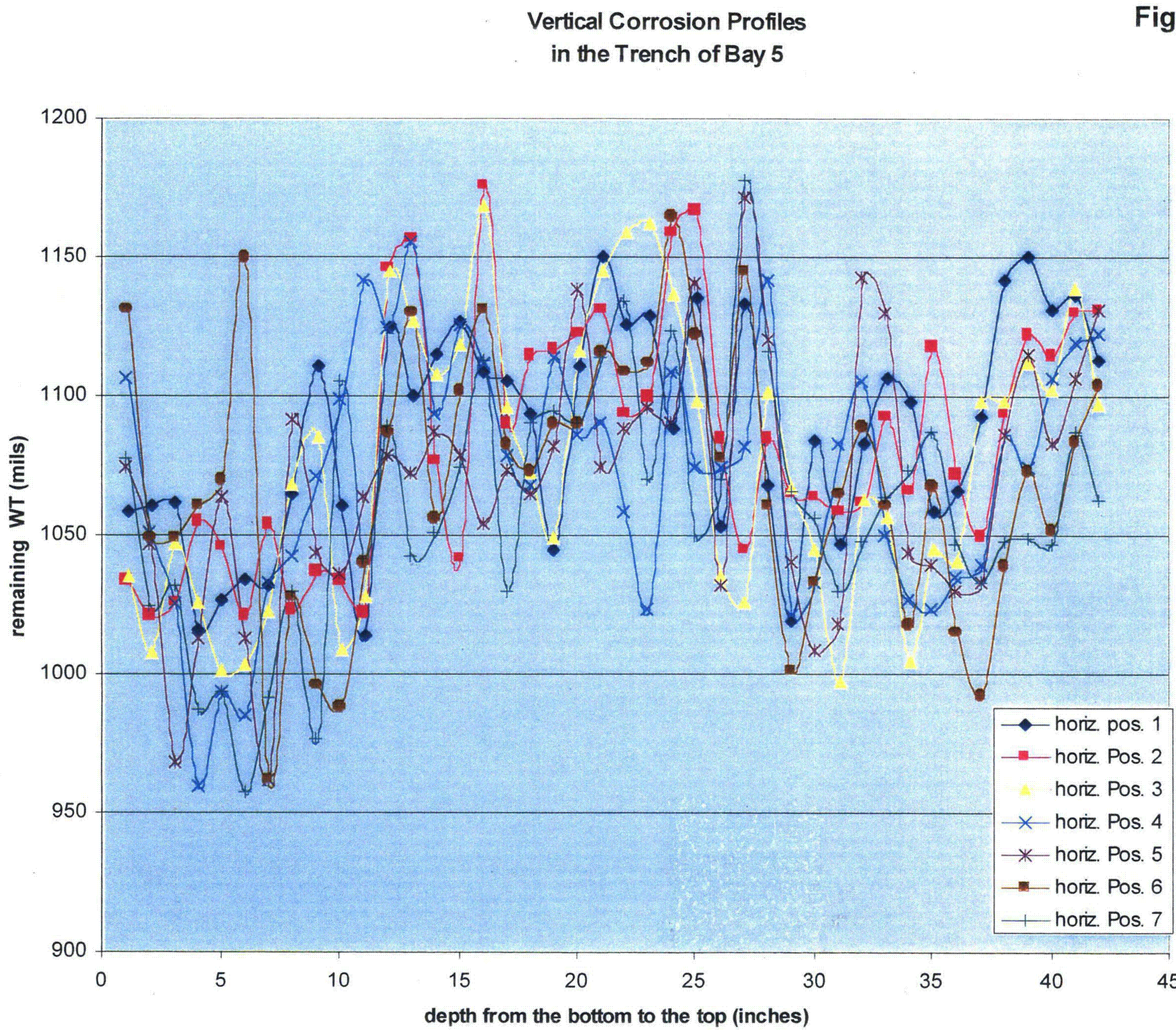

Vertical Corrosion Profiles
in the Trench of Bay 5
remaining WT (mils)
1200
1150
1100
1050
1000
950
900
0
5
10
15
20
25
30
35
40
45
depth from the bottom to the top (inches)
horiz. pos. 1
horiz. Pos. 2
horiz. Pos. 3
horiz. Pos. 4
horiz. Pos. 5
horiz. Pos. 6
horiz. Pos. 7

Figure 6

Contour Plot for Bay 7

2006 data

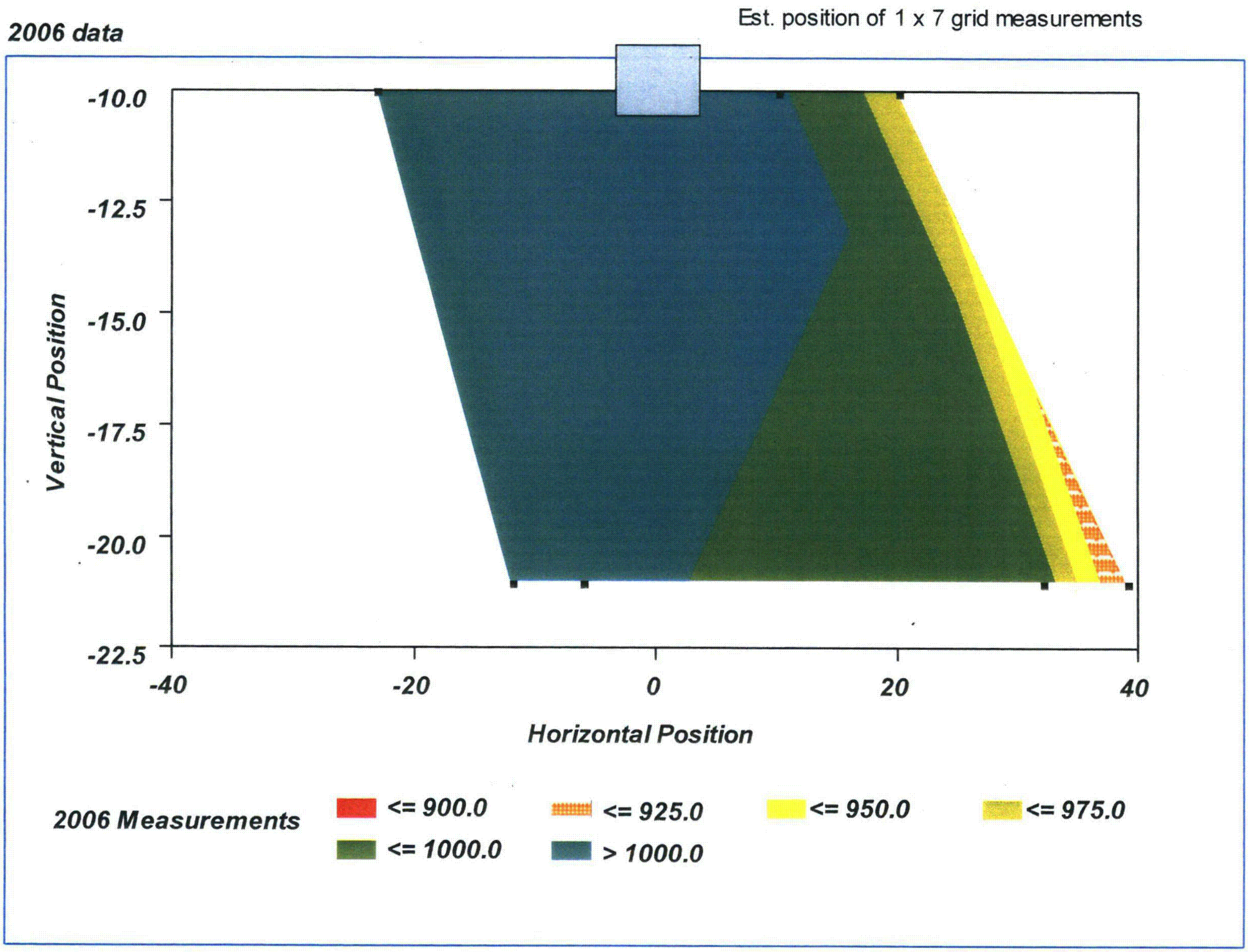
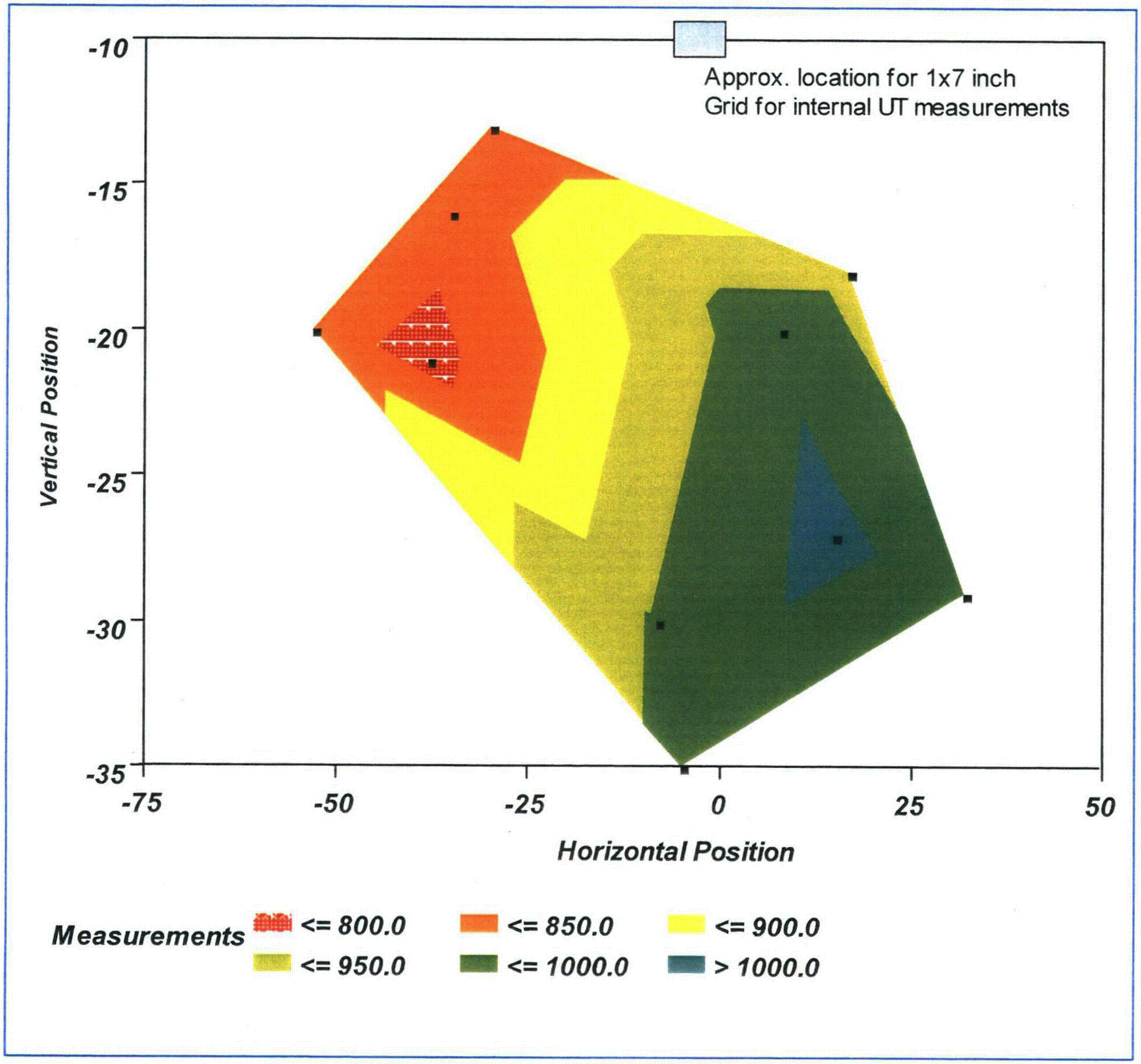


Figure 7

Contour Plot for Bay 9 using 2006 Data



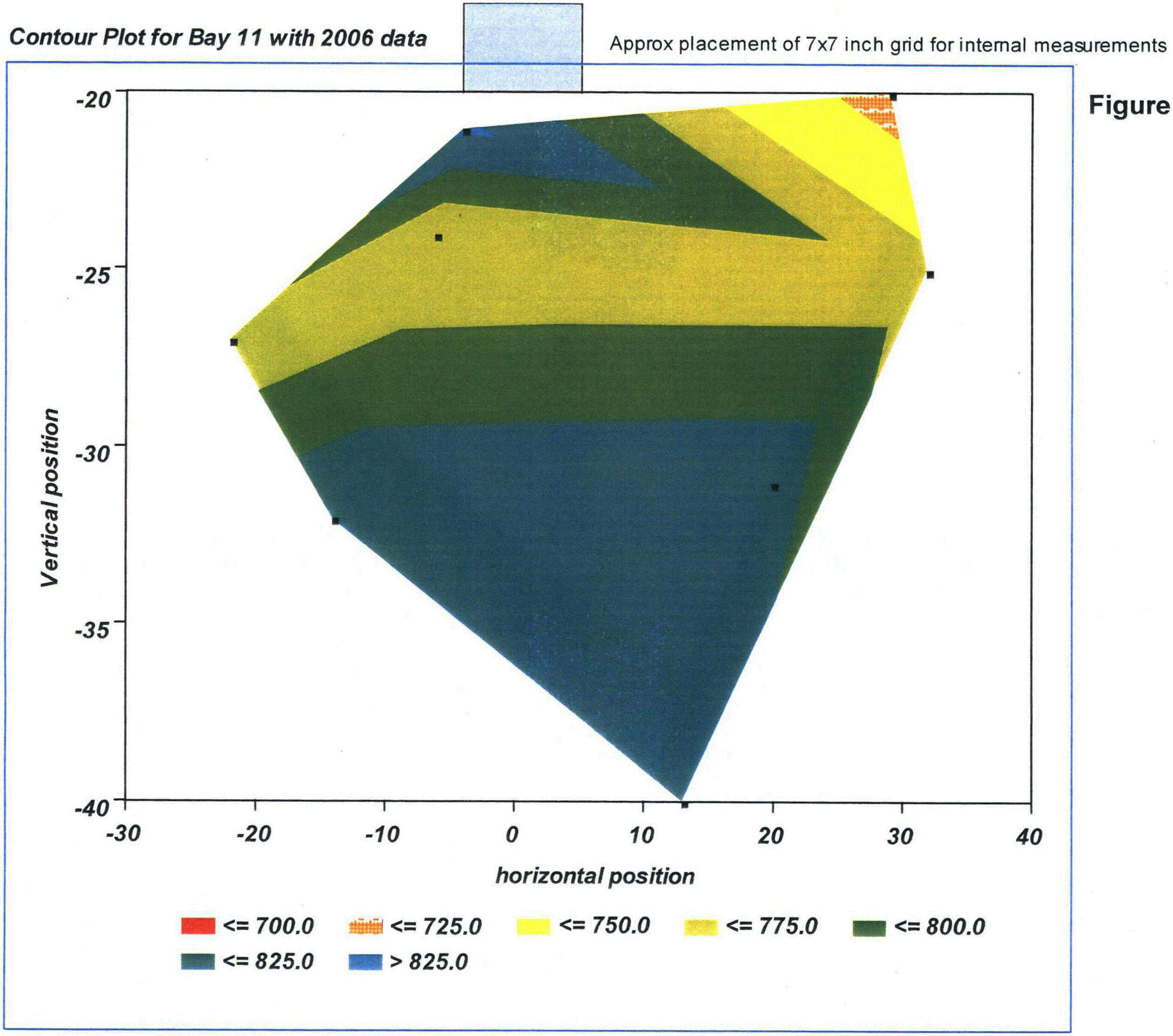
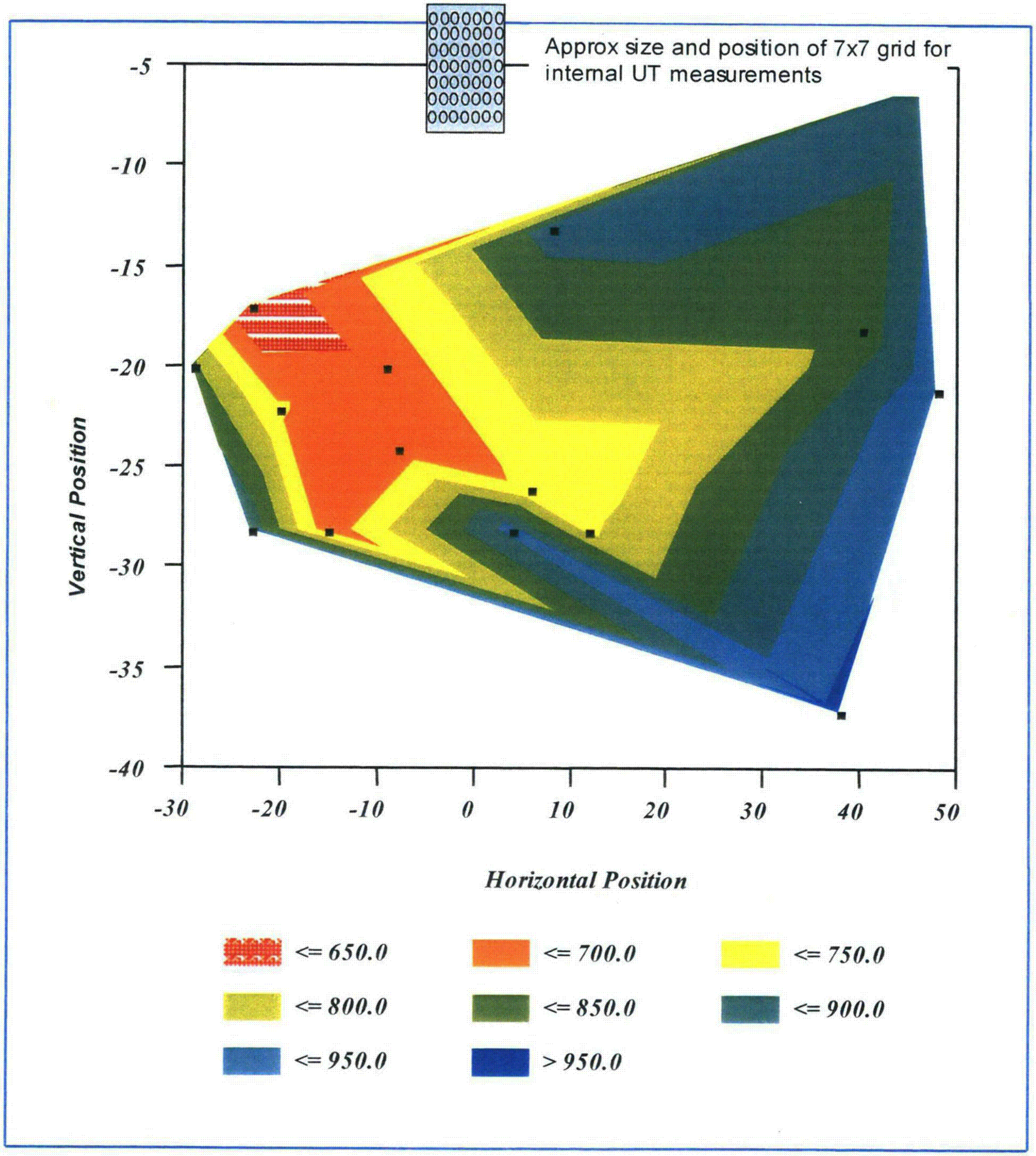

Contour Plot for Bay 11 with 2006 data
Approx placement of 7x7 inch grid for internal measurements
-20
-25
-30
-35
-40
Vertical position
-30
-20
-10
0
10
20
30
40
horizontal position
<= 700.0
<= 725.0
<= 750.0
<= 775.0
<= 800.0
<= 825.0
> 825.0

Figure 8

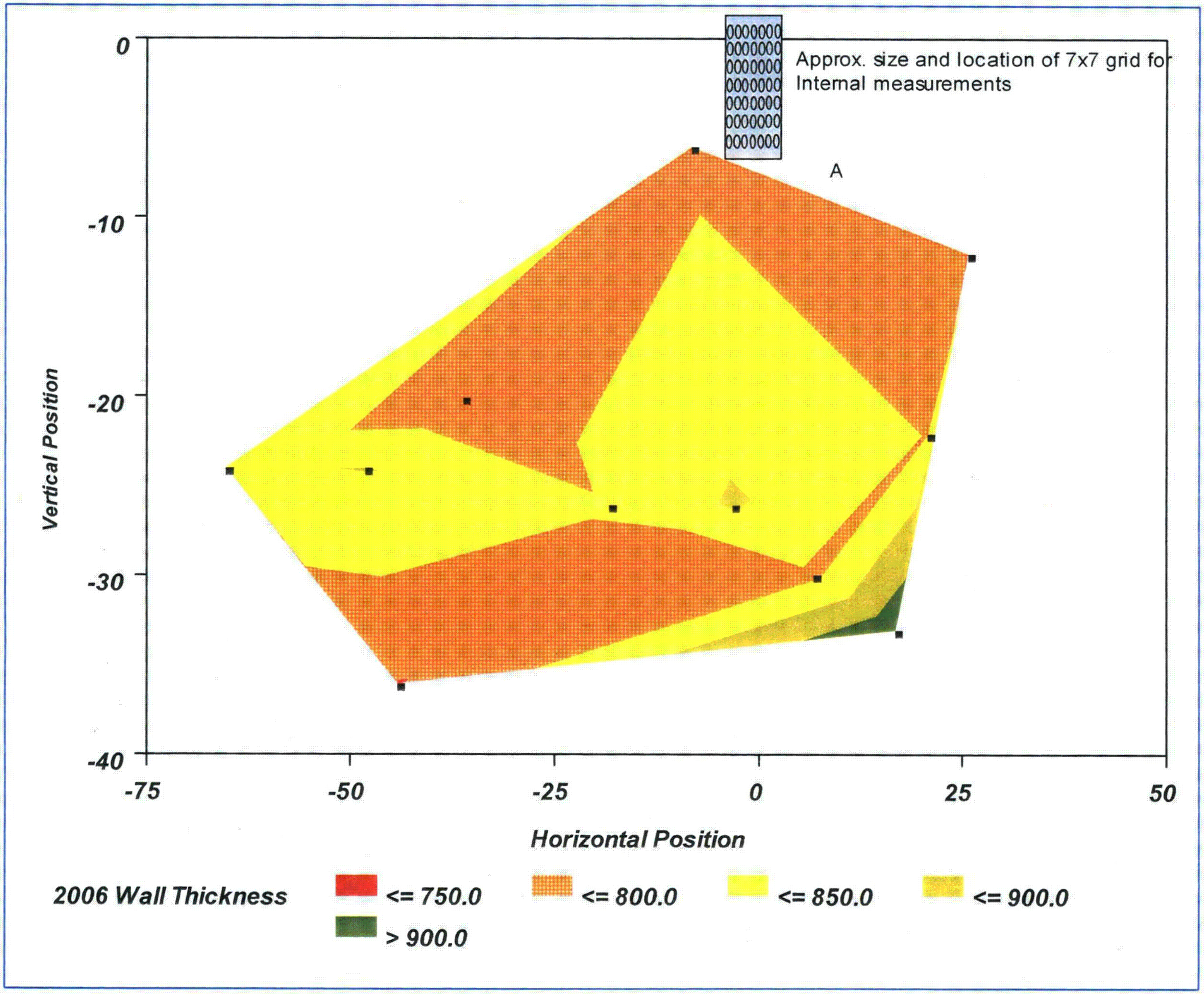
Contour Plot for Bay 13 External Corrosion 2006 Data

Figure 9



Contour Plot Bay 15

Figure 10



Contour Plot for Bay 17 using 2006 data

Figure 11

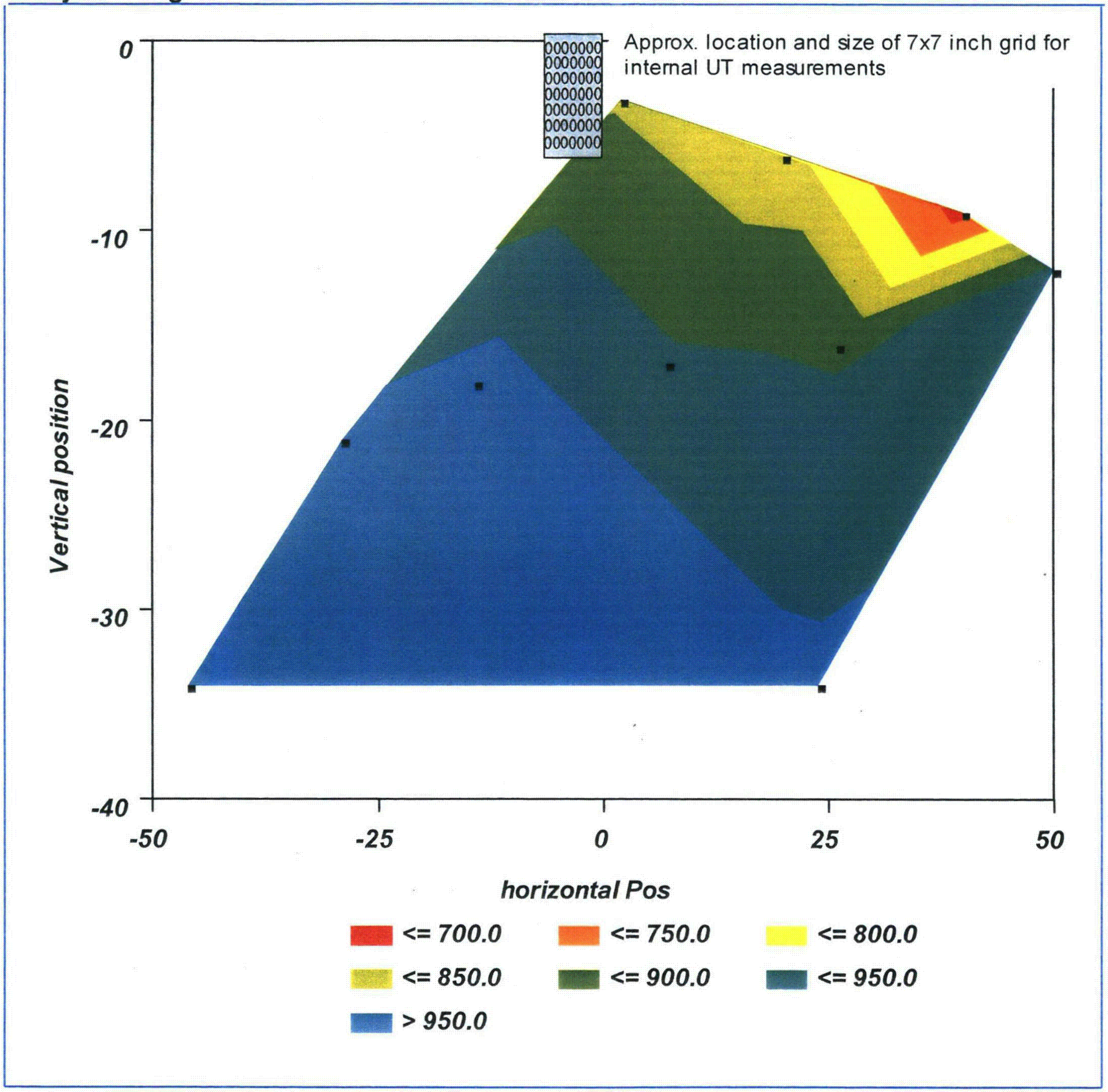
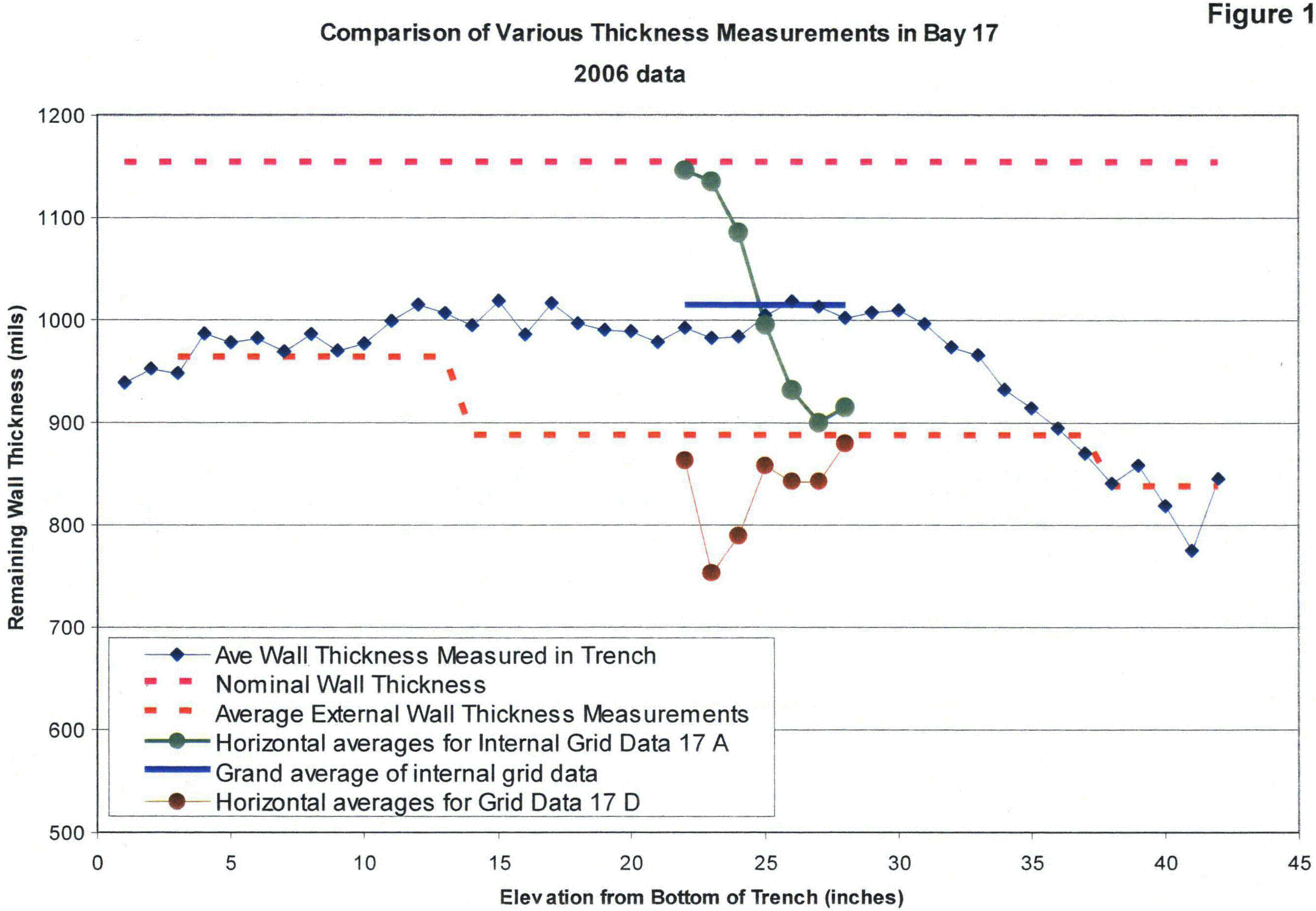


Figure 12



Comparison of Various Thickness Measurements in Bay 17
2006 data
Remaining Wall Thickness (mils)
1200
1100
1000
900
800
700
600
500
0
5
10
15
20
25
30
35
40
45
Elevation from Bottom of Trench (inches)
Ave Wall Thickness Measured in Trench
Nominal Wall Thickness
Average External Wall Thickness Measurements
Horizontal averages for Internal Grid Data 17 A
Grand average of internal grid data
Horizontal averages for Grid Data 17 D

Figure 13

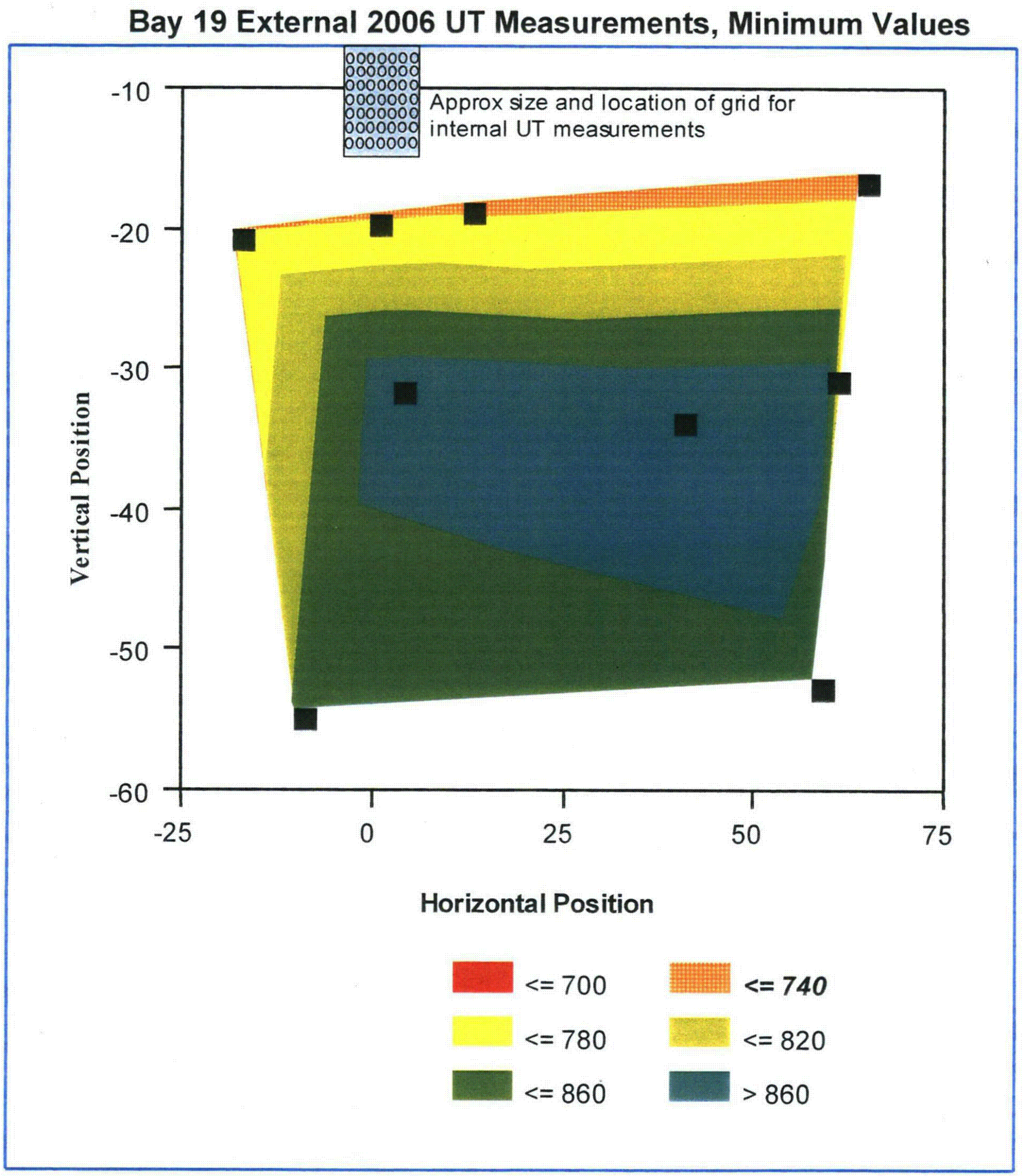

Bay 19 External 2006 UT Measurements, Minimum Values
Approx size and location of grid for internal UT measurements
Vertical Position
-10
-20
-30
-40
-50
-60
Horizontal Position
-25
0
25
50
75
<= 700
<= 740
<= 780
<= 820
<= 860
> 860

Exhibit CR 5

EXHIBIT CR 5

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of AMERGEN ENERGY COMPANY, LLC (Oyster Creek Nuclear Generating Station)	)))))))	Docket No. 50-219-LR

DECLARATION OF J. KIRK BROWNLEE P.E.

1. My name is J. Kirk Brownlee, P.E. Citizens have retained me and my colleague Richard C. Biel P.E. as a expert witnesses in proceedings concerning the application of AmerGen Energy Company LLC to renew its operating license for the Oyster Creek Nuclear Generating Station ("Oyster Creek") for twenty years beyond the current expiration date of April 9, 2009.

2. Mr. Biel and I are experts on determining the structural integrity of pressure vessels.

3. The attached memorandum dated June 17, 2008 represents our current opinion regarding the topics it covers.

I declare under penalty of perjury that the foregoing and the attached memorandum, dated June 17, 2008 is true and correct.

Executed this 17th day of June, 2008 at Houston, Texas

Jam K. Brownlee 6/17/08

J. Kirk Brownlee, P.E.

STRESS ENGINEERING SERVICES INC.
13800 Westfair East Drive, Houston, Texas 77041-1101
Phone: (281) 955-2900 Fax: (281) 955-2638 Website: www.stress.com
HOUSTON • CINCINNATI • NEW ORLEANS • CHICAGO

June 17, 2008

Mr. Richard Webster
Legal Director
Eastern Environmental Law Center
744 Broad Street, Suite 1525
Newark NJ, 07102
Tel. 973 424-1166
Fax 973 710-4653
rwebster@kinoy.rutgers.com

SES Project No.: 131377

Subject: Technical Commentary on Structural Analyses, Oyster Creek Drywell Vessel

Dear Mr. Webster:

In July 2006, you requested that Stress Engineering Services, Inc. consider several documents that you provided as well as others that were made available to us through internet link references from the U. S. Nuclear Regulatory Commission (NRC). These documents were concerned with the condition of the Oyster Creek Nuclear Generating Station drywell shell, its structural adequacy, and with license renewal for the facility, which is owned and operated by AmerGen Energy Company, LLC (AmerGen). Specifically, you asked Stress Engineering Services, Inc. (Stress) to comment on the appropriateness of the drywell structural analyses that was performed previously by General Electric (GE).

Since our 2006 report, the license renewal process has progressed significantly, and various organizations have provided the NRC and related entities with technical commentaries and testimony on the original GE analysis, including updated estimates of the current condition of the drywell shell. For example, analysts at Sandia National Laboratory (Sandia) analysts have questioned GE's utilization of enhanced capacity reduction factors in their analysis. Others, such as Dr. Rudolf Hausler have questioned AmerGen's estimates of remaining thickness in what has been termed the "bathtub ring section" of the drywell shell. Combined, these questions have resulted in significant uncertainty (by some) regarding the remaining margin of safety against buckling of the lower, spherical section of the drywell shell. This uncertainty was echoed in an Additional Statement issued by Technical Judge, Hon. Anthony J. Baratta following a recent hearing on Citizens' challenge to the license renewal.

In his statement, Judge Baratta questioned whether AmerGen had provided reasonable assurance that the factor of safety required by the regulations will be met throughout the next period of extended operation. In connection with this statement, Judge Baratta asked AmerGen to provide a conservative best estimate analysis of the remaining (actual) thickness of the drywell shell. He also asked that AmerGen perform a three-dimensional (3-D) finite element analysis using modern methods and the current thickness of the drywell shell, which AmerGen agreed to perform. The analysis ordered by Judge Baratta was also to include some sensitivity analyses to determine the degree to which uncertainties in the size(s) of thinned areas affect Code margins for the drywell shell.

Both AmerGen and the NRC Staff prepared responses to the Judge's requests in which they indicate that the base case 3-D finite element analysis and the sensitivity analyses that AmerGen has already performed "matches or bounds" the scope of Judge Baratta's order. As such, you asked Stress Engineering Services, Inc. (Stress) to review the AmerGen and NRC Staff briefs and to prepare additional technical commentary on the following items:

1. You asked Stress to confirm whether Sandia's decision not to use enhanced capacity reduction factors (CRFs) was appropriate for the type of analysis they performed.
2. You asked Stress to amplify upon the briefs related to the reliance on Code margins to offset analytical uncertainties in the analysis.
3. You asked Stress to discuss the necessity of performing an uncertainty analysis whenever a best estimate analysis is used to assess structural integrity.
4. You asked Stress to reiterate our previous position that the best approach would be to take more measurements of the drywell's remaining thickness and current shape to improve existing estimates of the factor of safety on buckling.

Following are our responses to these requests:

Item 1 – Sandia's Decision Against Using Enhanced Capacity Reduction Factors
Stress has only conducted a severely limited technical review of the Sandia analyses of the drywell shell. However, based upon our understanding of finite element analysis techniques and shell buckling, we tend to agree that Sandia's decision not to use enhanced CRFs was appropriate in this instance, provided the Sandia model included the effects of internal pressure on shell loading.

Item 2 – Reliance on Code Safety Margins
Still at issue is whether the ASME Code[1], which establishes rules of safety relating only to pressure integrity and governing the construction[2] of boilers, pressure vessels, transport tanks, and nuclear components, is the best tool available for determining the drywell's continued fitness for service.

The safety margin on buckling in the Code is based, at least in part, on knowledge of the original shell thickness and other variables to one degree of certainty or another, as embodied in the CRFs. Due to the documented external corrosion of the drywell shell as well as to the limited number of measurements of remaining thickness that have been made on the drywell shell to date, the degree of uncertainty with which the remaining thickness of the drywell shell is known

[1] ASME Boiler and Pressure Vessel Code, Section III, *Nuclear Components*, and Section VIII, *Rules for Construction of Pressure Vessels*, American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016

[2] *Construction*, as used in the Code, is an all-inclusive term comprising materials, design, fabrication, examination, inspection, testing, certification, and pressure relief.

has increased significantly since the drywell was first commissioned. Moreover, this degree of uncertainty may continue to increase during the next extended period of operation, either due to additional metal loss or to deformations in the bathtub region due to the combination of corrosion and operational loads. Therefore, it is certainly arguable whether the degree of conservatism represented by the use of Code-mandated safety margins is still adequate for the drywell shell. A buckling analysis conducted in accordance with API 579/ASME FFS 1[3] rules along with a risk assessment such as the one described by Reinert and Apostolakis[4] may prove to be the most effective approach for revealing the actual remaining resistance to buckling of the Oyster Creek Nuclear Generating Station drywell shell.

Item 4 – Necessity of Performing Uncertainty Analyses and Required Level of Uncertainty

Due to the financial and time constraints imposed on this study, Stress is unable to address whether the levels of uncertainty associated with the analyses that have been performed on the drywell shell to date meet consensus and other standards utilized in the nuclear industry. Nevertheless, it is clear that significant differences exist between the safety margins predicted by Sandia and GE, and we believe these differences should be resolved. Since a major portion of the differences appear to be the result of different assumptions about the extent of drywell shell corrosion and remaining drywell shell thickness, perhaps the best way to resolve these differences is to accurately map the extent and depth of corrosion using a combination of laser scanning and automated ultrasonic thickness measurement techniques. Stress believes that utilization of so-called "point cloud surface mapping" techniques along with ultrasonic thickness measurements that represent the remaining wall thickness of the shell will give the most accurate structural analysis results possible, with the lowest uncertainty, using current technology.

Item 5 – Reiteration and Amplification of Recommended Approach to Improve Estimates of Margin of Safety on Buckling

The structural analysis results presented by AmerGen and the NRC as matching or bounding Judge Baratta's order utilized analytical techniques that were typical for the period of time in which the original analysis was performed. Due mainly to the limited computational power that was readily available in the early 1990s, GE utilized relatively small slices of the vessel along with idealized geometries (perfect spheres, cylinders, etc.) and other computationally efficient techniques. Calculated buckling load behaviors for the idealized slices of the drywell geometry were subsequently adjusted using assumptions or "capacity reduction factors" to account for surface irregularities, plasticity, and local buckling; and the resulting adjusted values were taken as representative of the actual buckling load. GE compared the calculated buckling loads with the imposed loads, and safety margins were determined for comparison to ASME Code minimum requirements. Thus, GE's original use of CRFs was probably equally related to the levels of uncertainty in drywell shape and remaining thickness (structural stiffness) and the need for computational efficiency. Primarily because of these computational limitations, the original finite element analysis performed by GE on the drywall vessel may not be adequate to capture its global behavior, which may be some combination of symmetrical and asymmetrical buckling.

[3] API 579-1/ASME FFS-1, *Fitness-for- Service,* June 5, 2007 Ed., (API 579 Second Edition), American Petroleum Institute.
[4] Reinert, Joshua M. and Apostolakis, George E., Including model uncertainty in risk-informed decision making, Annals of Nuclear Energy, 33, 2006, pp. 354-369.

The state-of-the-art has progressed far beyond the methods available to structural analysts in the early 1990s. Today, when structural analysts are engaged to perform fitness-for-service analyses of existing structures such as the drywell shell, it is routine to use laser devices to generate "point clouds", *i.e.*, groups of points in space, that fully define the surfaces in question, including any irregularities. Provided one can generate sufficient data about the surfaces in question, there is no longer any need to "guess" about how these surface irregularities might affect buckling behavior.

Since 2006, Stress has performed at least five structural analyses of pressure vessels utilizing laser-generated point clouds. A brief description of the process followed by Stress follows:

- Generate point cloud(s) for surface(s) of interest,
- Generate remaining thickness data,
- Convert point cloud(s) and remaining thickness data into mathematical representation(s) of actual surface shape(s),
- Utilize shape(s) to build three-dimensional model,
- Mesh the model, *i. e.*, convert it into a form that is suitable for further processing using finite element analysis (FEA),
- Assign corroded thicknesses and future corrosion allowance to specific points (nodes) or areas where they occur,
- Select a FEA mesh density as fine as needed to capture the stiffness that resists buckling (locally and globally, as required),
- Apply combinations of simulated loads as required by applicable fitness for service (FFS) codes
- Increase the loads on a rational basis until the structure buckles i.e. the structure is no longer "statically admissible"
- Compare the design (or actual loads) to the largest statically admissible or buckling load to determine the resulting margin of safety.

Elastic, or more commonly elastic-plastic, material properties are used in these analyses. The analyst calculates the buckling load and the collapse shape directly, without imposed perturbations or adjustments for anything except the measured geometry and thicknesses. Since the model already accounts for actual surface waviness, unevenness, bulges, facets, and other potentially deleterious geometric surface conditions, there is no need to resort to the use of CRFs or other approximations, either enhanced or otherwise, to determine buckling loads for vessels such as the drywall shell, as the GE analysts were apparently forced to do. Therefore, utilization of point cloud surface mapping techniques along with measurements that represent the actual wall thickness is still thought to give the most accurate structural analysis results possible, with the lowest uncertainty, using current technology. Three-dimensional thin shell analyses can be done today with few assumptions concerning stiffness and in a way that complies with Case N-284-1-1320.

Respectfully Submitted:

Richard C. Biel, P. E.
Staff Consultant
Stress Engineering Services, Inc.

J. Kirk Brownlee, P. E.
Staff Consultant
Stress Engineering Services, Inc.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of	)	
	)	Docket No. 50-0219-LR
AMERGEN ENERGY COMPANY, LLC	)	
	)	
(License Renewal for the Oyster Creek Nuclear Generating Station)	)	June 18, 2008
	)	

CERTIFICATE OF SERVICE

I, Richard Webster, of full age, certify as follows:

I hereby certify that on June 18, 2008, I caused Citizens' Reply to NRC Staff and Amergen Responses to Commission Order dated May 28, 2008 to be served via email and U.S. Postal Service (as indicated) on the following:

Secretary of the Commission (Email and original and 2 copies via U.S Postal Service)
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Rulemaking and Adjudications Staff
E-mail: HEARINGDOCKET@NRC.GOV

Office of Commission Appellate Adjudication (Email and U.S. Postal Service)
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
Attention: Rulemaking and Adjudications Staff
E-mail: OCAAMail@nrc.gov

Administrative Judge
E. Roy Hawkens, Chair (Email and U.S. Postal Service)
Atomic Safety and Licensing Board Panel
Mail Stop – T-3 F23
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: erh@nrc.gov

Administrative Judge
Dr. Paul B. Abramson (Email and U.S. Postal Service)
Atomic Safety and Licensing Board Panel
Mail Stop – T-3 F23
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: pba@nrc.gov

Administrative Judge
Dr. Anthony J. Baratta (Email and U.S. Postal Service)
Atomic Safety and Licensing Board Panel
Mail Stop – T-3 F23
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: ajb5@nrc.gov

Law Clerk
Emily Krause (Email and U.S. Postal Service)
Atomic Safety & Licensing Board Panel
Mail Stop – T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: DAW1@nrc.gov

Office of General Counsel (Email and U.S. Postal Service)
United States Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: OGCMAILCENTER@NRC.GOV

James E. Adler (Email and U.S. Postal Service)
U.S. Nuclear Regulatory Commission
Office of the General Counsel
Mail Stop: O-15 D21
Washington, DC 20555-0001
E-mail: jeal@nrc.gov

Mary C. Baty (Email and U.S. Postal Service)
U.S. Nuclear Regulatory Commission
Office of the General Counsel
Mail Stop: O-15 D21
Washington, DC 20555-0001
E-mail: mcb1@nrc.gov

Alex S. Polonsky, Esq. (Email and U.S. Postal Service)
Morgan, Lewis, & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004
E-mail: apolonsky@morganlewis.com

Kathryn M. Sutton, Esq. (Email and U.S. Postal Service)
Morgan, Lewis, & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004
E-mail: ksutton@morganlewis.com

Donald Silverman, Esq. (Email and U.S. Postal Service)
Morgan, Lewis, & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004
E-mail: dsilverman@morganlewis.com

J. Bradley Fewell (Email and U.S. Postal Service)
Exelon Corporation
200 Exelon Way, Suite 200
Kennett Square, PA 19348
E-mail: bradley.fewell@exceloncorp.com

John Covino, DAG (Email and U.S. Postal Service)
State of New Jersey
Department of Law and Public Safety
Office of the Attorney General
Hughes Justice Complex
25 West Market Street
P.O. Box 093
Trenton, NJ 08625
E-mail: john.corvino@dol.lps.state.nj.us

Valerie Gray (Email)
State of New Jersey
Department of Law and Public Safety
Office of the Attorney General
Hughes Justice Complex
25 West Market Street
P.O. Box 093
Trenton, NJ 08625
E-mail: valerie.gray@dol.lps.state.nj.us.

Paul Gunter (Email and U.S. Postal Service)
c/o Nuclear Information and Resource Service
6930 Carroll Ave., Suite 340
Takoma Park, MD 20912-4446
E-mail: paul@beyondnuclear.org

Edith Gbur (Email)
Jersey Shore Nuclear Watch, Inc.
364 Costa Mesa Drive. Toms River, New Jersey 08757
E-mail: gburl@comcast.net

Paula Gotsch (Email)
GRAMMIES
205 6th Avenue
Normandy Beach, New Jersey 08723
E-mail: paulagotsch@verizon.net

Jeff Tittel (Email)
New Jersey Sierra Club
139 West Hanover Street
Trenton New Jersey 08618
E-mail: Jeff.Tittel@sierraclub.org

Peggy Sturmfels (Email)
New Jersey Environmental Federation
1002 Ocean Avenue
Belmar, New Jersey 07319
E-mail: psturmfels@cleanwater.org

Michele Donato, Esq. (Email)
PO Box 145
Lavalette, NJ 08735
E-mail: mdonato@micheledonatoesq.com

Signed: ______________________
Richard Webster

Dated: June 18, 2008