OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL COVER SHEET
Complete Only Applicable Items

1. QA: QA

2. ☐ Analysis	☒ Engineering ☐ Performance Assessment ☐ Scientific	3. ☐ Model	☐ Conceptual Model Documentation ☐ Model Documentation ☐ Model Validation Documentation

4. Title:
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Changes to the document are indicated with a revision bar in the left margin.

No change has been included into electronic forms of Excel files WPflaws.xls (data tracking number : M09910SPAFWPWF.001) and Seq-Trees.xls (data tracking number : MO9910SPAWPJFR.000) when passing this analysis to REV 01A.

It should be noted that this revision of the analysis accounts for editorial corrections. It does not affect a discipline or functional area other than the original organization. Therefore. per Section 5.56. of Procedure AP-3.10Q/Rev.1/ICN1, no review under procedure AP-2.14Q is required.

2. Analysis or Model Title:

Analysis of Mechanisms for Early Waste Package Failure

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4. Revision/Change No.	5. Description of Revision/Change
00	Initial issue
01	For the most part, changes to the document are adaptation to requirements of procedure AP-3.10Q Revision 1. ICN 1. and addition of complementary justifications of assumptions used and calculations performed in the analysis. Furthermore, this revision includes editorial corrections and modifications on title or pages of references. They are indicated with a revision bar in the left margin. No change has been included into electronic forms of Excel files WPflaws.xls (data tracking number : ~09910SPAFWPWF.001) and Seq-Trees.xls (data tracking number : M09910SPAWPJFR.000) when passing this analysis to REV 01A.

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1. PURPOSE

In accordance with AP-2.13Q, a work plan was developed, issued, and used in the preparation of this document (CRWMS M&O 1999b and CRWMS M&O 1999h, p. 1).The purpose of this analysis is to evaluate the types of defects or imperfections that could occur and potentially lead to early failure of some waste packages (WPs). An early failure is defined as failure of a WP, due to manufacturing- or handling-induced defects, at a time earlier than would be predicted by mechanistic degradation models for a defect-free package. All components generally exhibit high failure rates for a period early in their life as a result of manufacturing or handling-induced defects. Many types of active components are subjected to a "burn-in" phase where they are initially operated in the factory under conditions more severe than normal operating conditions so that components susceptible to early failure will fail during "burn-in" testing. The failure rate later drops to a level associated with random causes of component failure, followed eventually by an increase in the failure rate as the component enters the wear-out phase at the end of its design life. This failure rate behavior has been traditionally referred to as the "bathtub" curve. Figure 1-1 provides a conceptual illustration of the "bathtub" curve.

This analysis takes a failure modes and effects analysis approach to evaluating mechanisms that might lead to an early failure of a WP. First, a literature review was performed to obtain information on the rate of manufacturing defect-related failures in various types of welded metallic containers, the types of defects that produce these failures, and the mechanisms that cause defects to propagate to failure. Next, the types of defects that are applicable to WPs were identified. For each applicable type of defect, the probability of its occurrence on a WP was estimated. General discussion of the potential consequences to the long-term performance of the package if the defect is present is provided. However, specific details on how the defect will affect corrosion rates will be provided in separate analyses.

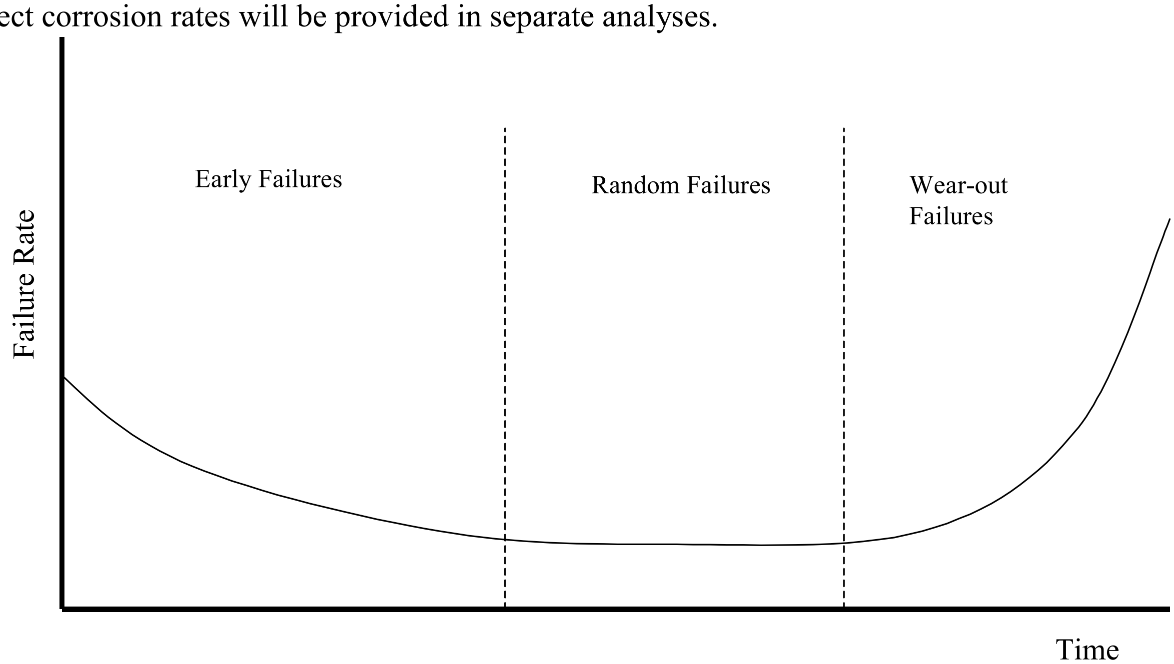


Figure 1-1. Conceptual Illustration of Typical "Bathtub" Curve Behavior of Failure Rates

2. QUALITY ASSURANCE

This analysis was prepared in accordance with the Office of Civilian Radioactive Waste Management (OCRWM) Quality Assurance (QA) program. The information provided in this analysis will be used for evaluating the postclosure performance of the Monitored Geologic Repository (MGR) WP and engineered barrier segment. The QAP-2-3 (*Classification of Permanent Items*) evaluation entitled *Classification of the MGR Uncanistered Spent Nuclear Fuel Disposal Container System* (CRWMS M&O 1999g, p. 7) has identified the WP as an MGR item important to radiological safety and waste isolation. The Waste Package Operations manager has evaluated the technical document development activity in accordance with QAP-2-0, *Conduct of Activities*. The QAP-2-0 activity evaluation, *Commercial SNF WP Reference Designs - SR* (CRWMS M&O 1999a), has determined that the preparation and review of this technical document is subject to *Quality Assurance Requirements and Description* (DOE 1998) requirements. There is no determination of importance evaluation developed in accordance with Nevada Line Procedure, NLP-2-0, since the report does not involve any field activity.

This document and its conclusions may be affected by technical product information that require confirmation. Any changes to the document or its conclusions that may occur as a result of completing the confirmation activities will be reflected in subsequent revisions. The status of the input information quality may be confirmed by review of the Document Input Reference System database.

3. COMPUTER SOFTWARE AND MODEL USAGE

3.1 Software Approved for QA Work

Not used.

3.2 Software Routines

Microsoft Excel 97, loaded on a Pentium II PC with Windows 95. Calculations of the probability of occurrence for various types of WP defects were performed electronically in this spreadsheet software package. Calculations of the probability of the occurrence of various size weld flaws were performed in the WPflaws.xls spreadsheet. Calculations of the probability of other types of defects were performed in the Seq-Trees.xls spreadsheet. The spreadsheet was used in the same manner as a hand calculator would be used; a result was obtained from a single set of inputs using a formula entered by the user. The location of the electronic copy of both spreadsheets containing all inputs and outputs is given in Section 8, and Attachments II and III provide a hard copy. All calculations performed in these spreadsheets are described in Section 6 and may also be examined electronically (see Section 8). Documentation that the software calculations provide correct results for the range of input parameters is given in Attachment I.

4. INPUTS

4.1 Parameters

4.1.1 Human Error Probabilities

Table 4-1 summarizes the human error probabilities used in Section 6. These probabilities were obtained from the *Handbook of Human Reliability Analysis with Emphasis on Nuclear Power Plant Applications* (Swain and Guttmann 1983). Specific pages referenced are indicated in Table 4-1. As indicated in AP-SIII.2Q, this information is from a handbook and is considered accepted data.

Table 4-1. Selected Human Error Probabilities

Action	Human Error Probability	Error Factor	S&G 1983 Page
Failure to follow written procedure under normal conditions	0.010	3	20-22
Error of commission in reading and recording quantitative data from an unannunciated digital display	0.001	3	20-26
Failure of checker using written procedures to find an error made by others	0.100	5	20-38
Failure of operator to detect a stuck manual valve with no means of position indication	0.010	3	20-30
Writing an item incorrectly in a formal procedure	0.003	5	20-21
Error of commission – Improperly mating a connector	0.003	3	20-28

Source : S&G 1983 = Swain and Guttmann 1983, Chapter 20

A human error probability of 0.006 for misloading an assembly into a WP has also been used (CRWMS M&O 1997, Attachment VII, p. 12). This human error probability is considered accepted data, because it has been developed based on a simple combination of error probabilities from the above mentioned handbook, as follows : misloading an assembly into a WP results either from a conceptual error (the operator fails to determine the adequate disposal container designed to receive the assembly), or from a selection error (the operator has determined which disposal container to use, but he selects a wrong one). The human error probability associated with the conceptual error is approximated by a rule-based action after diagnosis. From Swain and Guttman (1983, Table 20-2), the corresponding probability is 0.05 following an abnormal event. Since this occurs under normal operating conditions, assume the probability at its lower bound, 0.005 (i.e., divide by an error factor of 10). There is no unusual or stress conditions requiring an additional multiplier (in the form of a performance shaping factor). The human error probability associated with the selection error is approximated by an error of commision in selecting the wrong control on a panel of similar looking controls that are arranged in well defined functional group. The corresponding probability is 0.001 (Swain and Guttman, 1983, Table 20-12). Therefore, the resulting global probability is 0.005+0.001=0.006. Any recovery action is assumed to occur during the verification step.

4.1.2 Equipment Failure Rates

Table 4-2 summarizes the equipment failure rates used in Section 6. These failure rates were obtained from IEEE Standard 500-1984, the *IEEE Guide to the Collection and Presentation of Electrical, Electronic, Sensing Component, and Mechanical Equipment Reliability Data for Nuclear-Power Generating Stations* (IEEE 1984). Specific pages referenced are indicated in Table 4-2. As indicated in procedure AP-SIII.2Q, this information is from a standard and may be considered accepted data.

Table 4-2. Selected Component Failure Rates (hr^{-1})

Component	Low	Mean	High	IEEE 1984 Page
Heater, catastrophic, all Modes	$6x10^{-8}$	$1.3x10^{-6}$	$2.5x10^{-5}$	283
Thermostat, all Modes	$1.2x10^{-6}$	$5.8x10^{-6}$	$1.7x10^{-5}$	543

4.1.3 Reliability of Ultrasonic Examination

Information on the probability that an ultrasonic examination would fail to detect a given size flaw was obtained from Bush (1983, pp. 13A.5.6 to 9) and from Heasler and Doctor (1996, pp. xv and 6.1.). This information is summarized in Section 6.2.1, and will not be repeated here. Associated To-Be-Verified (TBV) numbers are TBV-3446 and TBV-3460.

4.1.4 Weld Flaw Frequencies, Size Distributions, and Orientations

Information on the frequency of occurrence of weld flaws and their size distribution was obtained from Khaleel et al. (1999, pp. 127, 131, 133, 144, Tables 5 and 6). Information on the orientation of weld flaws was obtained from Chapman and Simonen (1998, pp. A.4 to A.19). Information on flaw aspect ratios, and the causes and frequency of base metal flaws relative to weld flaws was obtained from Monteleone, S (1998, p. 12). This information is summarized in Section 6.2.1, and will not be repeated here. Associated TBVs are TBV-3461, TBV-3448, TBV-3459 and TBV-3462.

4.2 Criteria

Nuclear Regulatory Commission requirements that pertain to the conduct of performance assessments are applicable to this evaluation. The proposed rule 10 CFR Part 63 (NRC 1998b) indicates in section 63.102(j) that:

> "[T]he features, events and processes considered in the performance assessment should represent a wide range of both beneficial and potentially adverse effects on performance … Those features, events, and processes expected to materially affect compliance with 63.113(b) or be potentially adverse to performance are included, while events of very low probability of occurrence (less than one chance in 10,000 over 10,000 years) can be excluded from the analysis."

Since there will be approximately 10,000 WPs in the repository (CRWMS M&O 1999c, p. O-13), the above requirement would indicate that any feature, event, or process that has a probability of occurrence of less than 10^{-8} per WP over 10,000 years can be excluded from the performance assessment. Thus, for the purposes of this analysis, any mechanism for early failure of a WP that is estimated to occur with a probability of less than 10^{-8} per WP will be excluded from further consideration.

Furthermore, the NRC Container Life and Source Term Issue Resolution Status Report (CLST IRSR; NRC 1999) specifically includes acceptance criteria related to incorporation of mechanisms for early failure in WP lifetime evaluations. Subissue 1 of the CLST IRSR (NRC 1999, Section 4.1) does not specifically address early failures, but requires that variability in WP fabrication processes be considered in assessing the performance of the package. Subissue 2 of the CLST IRSR (NRC 1999, Sections 4.2 and 5.2.3) specifically requires that the impact of initial defects that could be introduced during fabrication or handling of the WP be considered in assessing its performance. This analysis partially satisfies both of these subissues by identifying the types of defects that can occur and estimating the probability that they will be present on a specific WP barrier. The consequences to performance of the package for a specific type of defect will be addressed in a separate analysis.

4.3 Codes and Standards

Not applicable.

5. ASSUMPTIONS

5.1 The following assumptions were used in Section 6.2.1 to support the development of the probability of having various size weld flaws in the WP shell and lid welds:

- It is assumed that the weld flaw density and size distribution information for tungsten-inert-gas (TIG) welded stainless steel (SS) can be applied to TIG welded Alloy 22 (UNS N06022). This assumption is required because there is no specific information in the open literature on the density or size distribution of flaws in Alloy 22 weld metal. The basis for this assumption is that welding of Alloy 22 has been identified as being a very similar process to welding of austenitic stainless steel (ASM 1993, p. 740). However, since the same reference also indicated that nickel based alloys do not flow as well as steels during welding, this assumption will require further confirmation.

- It is assumed that all flaws detected by post-weld inspections are perfectly repaired. The basis for this assumption is that the flaw rejection criteria for WP welds will likely be based on the flaw size of concern for postclosure performance.
- It is assumed that the information on the reliability of radiographic, ultrasonic, and dye-penetrant testing is applicable to the materials and inspection methods that will be used for WPs. The basis for this assumption is that this information is based on older reliability studies of these non-destructive examination (NDE) methods (Bush

1983 ; Heasler and Doctor 1996) and it would be expected that future improvements in the inspection technology would result in increases in the probability of flaw detection. Associated TBVs are TBV-3446 and TBV-3460.

- It is assumed that embedded weld flaws are not a concern for postclosure performance. The basis for this assumption is that the WP will not be subjected to cyclic fatigue, which is the primary mechanism for causing these types of flaws to grow through-wall in boilers and pressure vessels.

5.2 It is assumed that the human error probabilities listed in Section 4.1 and used throughout Section 6 are applicable to the types of human actions for which they were used. The basis for this assumption is that human error probabilities have not been quantified for the specific actions discussed in this document, and the information listed in Section 4.1.1 represents accepted human error probabilities for similar types of actions.

5.3 The following assumptions were used in Section 6.2.2 to support the development of the probability of improper material in the WP Alloy 22 shell or lid welds:

- It is assumed that a field verification of the chemical composition of weld wire will be performed prior to its use in fabricating any weld on the WP. It is further assumed that such field verification will use new instrumentation, such as portable x-ray spectroscopy equipment, which is assumed to work perfectly. The basis for this assumption is the technology for these types of measurements is currently available and used in a variety of similar commercial applications.
- It assumed that the outer Alloy 22 barrier contains approximately 200 kg of weld material (including the closure weld). This is based on the weld joint descriptions provided in CRWMS M&O (1998e, pp. 7-11).

5.4 The following assumptions on the heat treatment process were used in Section 6.2.3 to support the development of an event sequence tree for quantifying the probability that a WP is subjected to an improper heat treatment:

- It is assumed that there is one heat treatment/annealing operator. It is further assumed that the furnace is manually controlled (not computer-controlled).
- It is assumed that there is a written operations procedures for the ramp-up/hold-time phase and for the quench phase.
- It is assumed that the operator needs to initially match the WP components (to be heat treated) with the appropriate heat treatment written operating procedures via some type of digital identification code.
- It is assumed that if the operator has a mismatch between the components and the procedure that the ramp-up and hold-time will be inappropriate for the components subject to the heat treatment.
- It is assumed that the heat-up and hold-time procedures can be treated as one procedure (and hence modeled with a single human error probability).
- It is assumed that a QA check of the furnace occurs after the ramp-up and hold-time, and can identify an error in implementing the ramp-up/hold-time written operating procedure.

- It is assumed that the QA check of the furnace can not identify a non-catastrophic (ramp-up/hold-time) equipment failure.
- It is assumed the components are annealed with a quench following the QA check. It is further assumed that the quench is done with nozzles and hoses (rather than submerging into a tank). Also, it is assumed that there is no credible non-catastrophic failure of the quench equipment.
- It is assumed the independent lab check can identify failures due to non-catastrophic equipment failures, not following the heat-up/hold-time written operating procedures, or not following the quench procedures.
- It is assumed the furnace has two failure modes: catastrophic, which is immediately detected (so no components will be processed) and non-catastrophic, where the components would be processed (this would only be detectable via a lab test). It is further assumed that the annealing time is approximately 24 hours, during which any failure in the furnace could lead to an improper heat treatment.

These assumptions are needed because the specific procedures and equipment for heat treating a WP, and verifying proper heat treatment, have not yet been formally identified. They are based on the general description of the heat treatment process provided in Cogar (1999). Associated TBV is TBV-3450.

5.5 The following assumptions were used in Section 6.2.4 to support the development of the probability of having corrosion enhancing surface contamination on the WP:

- It is assumed that there are different operators (cleaners) for each cleaning occurrence.
- It is assumed that each cleaning is independent of the other cleanings.
- It is assumed that procedures exist to prohibit cleaners that could have a corrosion-enhancing affect on WP metal, such that if an improper cleaning agent was present, it was due to mislabeling or misunderstanding of the requirements.
- It is assumed that the following cleanings occur for the Alloy 22 barrier (for a total of seven):
  - Each of the three welds (two longitudinal and one circumferencial)
  - Heat treatment/annealing
  - Shipping
  - Prior to loading of spent nuclear fuel (SNF)
  - Prior to emplacement
- It is assumed that there is a written operating procedure to perform the cleaning process.
- It is assumed that an incorrect cleaning process (e.g., forgetting or incorrectly performing a step) with proper cleaning agents *cannot* leave a residue that can have adverse affects on the metal.
- It is assumed that a check of the cleaning *process* occurs (separate from the actual cleaning procedure). This is a check of the process, not the actual surface of the metal as the presence of a contaminant is generally not visibly apparent (e.g., cracking may occur at a later time). It is further assumed that this process is more rigorous when there is contamination of the WP. The basis is that there will be some

physical evidence of whatever caused the contamination (e.g., damaged plastic wrap).

These assumptions are needed because the specific procedures and equipment for cleaning a WP, and verifying proper cleaning, have not yet been formally identified. They are based on the general description of the cleaning process provided in Cogar (1999). Associated TBV is TBV-3450.

5.6 The following assumptions were used in Section 6.2.5 to support the development of the probability of a WP being emplaced with unidentified handling damage:

- It is assumed that the probability that a WP is significantly gouged or dented during transport or handling at the repository is equivalent to the rate at which fuel assembly failures occurred due to handling damage, as indicated in Section 6.1.2.
- It is assumed that the WP will at least be inspected for handling damage upon arrival at the repository and upon final emplacement in the drift.
- It is assumed that if handling damage occurs and is identified, the WP is either completely repaired or scrapped.

The basis for the first part of this assumption is that a WP will be subjected to a similar amount of handling steps, with a similar degree of care, as a fuel assembly experiences at a reactor site. The basis for the last two parts of this assumption is that specific procedures for at-repository inspection and repair/replacement of the package have not yet been developed, and these appear to be reasonable hold-points and repair practices.

5.7 The following assumptions were used in Section 6.2.6.1 to support the development of the probability of a WP having a thermal output outside of the expected range as a result of a misload:

- It is assumed that it is possible to load the WP in such a manner that it will be outside of the thermal design basis of 9.8 kW ±20% using only the population of fuel available in the pool at any given time. The basis for this assumption is that it is conservative.
- It is assumed that more than one assembly misload will be required to cause the WP thermal output to vary by more than ±1.8 kW (20%) from the mean value. The basis for this assumption is that since the average assembly heat output is approximately 550 W (based on average WP heat output divided by the number of assemblies in the WP from CRWMS M&O 1999e, Table 6-1), multiple assembly misloads will be required to produce the required delta heat output.
- It is assumed that a loading diagram is developed for each WP (similar to a written procedure) and that any failure in the development of the loading diagram will lead to a misloaded WP if it is not identified by a QA check or independent verification. The basis for this assumption is that it is conservative.
- It is assumed that QA checks are performed for the loading diagram development and for the loaded WP.
- It is assumed that if a thermal verification of the WP is performed, the operator will simply read the measured thermal output from a digital display (e.g., WP surface

temperature after a specified holding time), and that any failure of the measurement instrumentation will be readily detectable.

- It is assumed that any WP that is found to be misloaded will be reloaded such that it is within the allowable thermal output range.

The basis for the last three parts of this assumption is that specific procedures for loading of a WP have not yet been developed, and these appear to be reasonable QA checks and recovery options.

5.8 The following assumptions were used in Section 6.2.6.2 to support the development of the probability of having a gap (a large separation between drip shield segments that would allow any dripping water above the gap to directly fall onto the package below) in the drip shield over a WP as a result of human error during placement:

- It is assumed that the operator remotely emplacing the drip shield performs a self-check of his work.
- It is assumed that a remote QA inspection of the emplaced drip shield is performed.
- It is assumed that once a gap in the drip shield has been identified, that it is perfectly repaired, and a new gap is not introduced anywhere along the length of the drift as a result of moving all of the drip shields from the drift opening to the point where the gap occurred.

The basis for these assumptions is that specific procedures for emplacement of drip shields and recovery from misplaced drip shields have not yet been developed, and these appear to be reasonable inspection and repair practices.

5.9 It is assumed that the dimensions, materials, and masses of the components indicated on the sketches of the WP and drip shield in Attachments IV and V may be used for this analysis. The basis for this assumption is that qualified drawings of WP and drip shield components have not yet been produced, and these sketches represent the best available source of information at the time that this analysis was performed. This assumption is used throughout Section 6.

5.10 The following assumptions were used in Section 6.2.1 to support the development of the probability of having various size base metal flaws in the WP shell and lid welds:

- It is assumed that all base metal flaws occur as a result of weld repairs made to base metal. The basis for this assumption is that weld repair of base metal has been known to be performed following the removal of temporary attachments used to assist in forming the material (see Section 6.1.5). In contrast, no information regarding the types or frequency of flaws inherent to base metal could be obtained.
- It is assumed that the most likely location for base metal flaws will be along the edge of the plate material. The basis for this assumption is that it is the most likely location for forming aids to be attached.
- It is assumed that fabricator procedures will restrict the attachment of forming aids to base metal regions that will be removed prior to completion of the WP fabrication.

The basis for this assumption is that CRWMS M&O (1999d, p. 8) restricts the use of such attachments and requires that the fabricator obtain approval prior to performing weld repair of the base metal.

- It is assumed that a quality control check of the fabrication process will be performed that will be capable of identifying base metal weld repairs that were not performed according to the fabrication procedure. The basis for this assumption is that identifying such procedure violations is the purpose of such a quality check.

6. ANALYSIS/MODEL

6.1 Review of Defect Related Failures of Containers in Various Industries

This section presents the results of a literature review performed to determine the rate of manufacturing defect-related failure for various types of containers. In addition to providing examples of the rate at which defective containers occur, this information provides insight into the various types of defects that can occur and the mechanisms that cause defects to propagate to failure.

6.1.1 Boilers and Pressure Vessels

Pressure vessels are similar to WPs in the sense that they are welded, metallic components of similar thickness that are typically fabricated in accordance with accepted standards and inspected prior to entering service. In addition, there are several sources of statistics on the number and types of failures that have occurred in a fairly large population.

One study (Doubt 1984, p. 7) examined data on 229 failures of United Kingdom (UK) pressure vessels that had occurred in a population of 20,000 vessels (Smith and Warwick 1978). The vessels were all welded or forged unfired pressure vessels with wall thicknesses greater than 9.5 mm (3/8 inch) and working pressure in excess of 725 kPa (105 psi). The vessels included in the study were indicated as being less than 40 years old as of 1976 (Smith and Warwick 1978, p. 22) and were constructed to Class I requirements of various UK standards. Doubt (1984, p.7) identified 17 instances of external leakage or rupture in-service that were indicated as being caused by pre-existing defects in weld or base metal, or by incorrect material. Failures that were indicated as being due to thermal or mechanical fatigue, corrosion, internal leaks, and part-through cracks found by visual examination or non-destructive examination (NDE) were excluded. This yielded an estimated failure rate due to manufacturing defects of $8.5x10^{-4}$ per vessel. Further examination of the data (Smith and Warwick 1978, pp. 37-52) indicate that four of the failures were attributed to use of incorrect material in the weld, one to improper heat treatment, one to improper joint design, and the remaining failures were due to weld flaws. In all of the cases involving weld flaws, the vessels were in service for several years prior to failure, which suggests that fatigue was also the cause of the flaws propagating through-wall. In some cases, failures that were attributed to fatigue, and thus not included in the calculation of the above failure rate, also involved propagation of pre-existing defects. Overall, approximately 29% of the failures appear to have involved a pre-existing defect of some kind. Finally, it should be noted that the original source of the failure data (Smith and Warwick 1978, p. 24) indicates that many of the defects occurred in areas where it was not the practice at the time of construction, even with Class I Standard vessels, for NDE to be performed. Since WPs are not subject to cyclic stresses, and will be volumetrically examined, application of the above failure data to the direct determination of an early failure rate would be extremely conservative.

Another source of information on failures is available from the National Board of Boiler and Pressure Vessel Inspectors (NBBPVI 1999). The NBBPVI maintains records on all boilers and pressure vessels that carry a National Board-registered stamping. For the period of 1919 through 1997, a total of 27,618,733 registrations have been filed (NBBPVI 1999). For the period of 1992 to 1997, incident reports indicate the number of failures that have occurred as a result of various causes. For the category of "Faulty Design or Fabrication" the average incident rate is 83 per year. Assuming that this rate is constant over the 78 years in which vessels were registered, a point estimate probability of 2.3×10^{-4} per vessel for failure due to fabrication or design defects can be calculated. Unfortunately, the NBBPVI information does not contain information on the cause of failure, and thus, its utility for this analysis is limited.

Data from the above sources, and from similar databases in Germany, have been used in various studies to calculate the annual probability of vessel failure for use in risk assessments. The expected value for disruptive failure rates range from 2×10^{-6} to 4×10^{-5} per vessel-year, and the upper bound (99% confidence) failure rates range from 5×10^{-6} to 8×10^{-5} per vessel-year (Tschoepe 1994 et al., pp. 2-9 through 2-11). In general, these rates were not based on actual failures that had occurred, but on reports on the size of the weld defects observed during inspection, and the perceived consequences had the vessel been returned to service without repair of the defect. Therefore, since these rates involve significant interpretation as to the effect of weld flaws on component life under a specific set of operating conditions, they cannot be directly used to determine a WP early failure rate.

Finally, two instances were also found in the literature where cracking of stainless steel cladding on the interior surface of reactor coolant system components occurred as a result of human-induced defects that occurred during fabrication or transport. In one case, during a post-hot-functional test visual exam conducted in March 1975, Indian Point-3 personnel noted rust colored deposits in the primary water boxes of all four steam generators (S.M. Stoller and Company 1976). A detailed chemical and metallurgical analysis of cladding samples was performed, and three distinct types of cracking were identified: 1) longitudinal interbead cracks in the upper parts of the heads that propagated along grain boundaries, 2) transverse cracks adjacent to repair welds, and 3) extensive cracking in the lower half of the heads. Studies of the cladding samples identified stress corrosion and dilution of the clad deposit with base metal as possible causes for the imperfections. The supposition of stress corrosion was supported by the fact that the channel heads were accidentally exposed to seawater during shipment.

In a second instance, microfissures were found in the cladding of two straight and two elbow sections of reactor coolant system piping during construction of Oconee 1 (B&W 1970a and 1970b). The fissures were found during a routine dye penetrant exam while they were being reworked to accommodate the installation of Westinghouse reactor coolant pumps (e.g., they would likely not have been found before operation if the original Bingham pumps were installed). The cracks in the straight sections were caused by low delta ferrite levels that resulted from use of an improperly manufactured batch of flux in the submerged-arc weld cladding of these sections. The cracking that occurred on the two elbow sections was attributed to the improper use of acidic etchants in the identification and removal of surface contamination. Evidence suggested that a full-strength copper sulfate etchant (Strauss solution) may have been used, rather than the dilute solution normally permitted. The Indian Point 3 and Oconee 1 cases were the only examples of contamination related failures found in the nuclear industry literature, and no efforts to determine their frequency of occurrence have been previously made.

While this review has provided general information on the reliability of large, welded, pressure retaining components, the failure rate data cannot be directly applied to WPs due to significant differences in operational conditions and degree of inspection performed prior to service. However, this review has identified several types of manufacturing defects that may be applicable to WPs. These types of defects are:

- Weld flaws
- Base metal flaws
- Use of improper material in welds
- Improper heat treatment of welded or cold-worked areas
- Improper weld flux material
- Poor joint design
- Contaminants

The applicability of these types of defects to WPs, and their potential consequences to postclosure performance, are discussed in Section 6.2.

6.1.2 Nuclear Fuel Rods

Nuclear fuel rods are conceptually similar to WPs in the sense that they are manufactured in large numbers, are subjected to rigorous quality controls and inspections, and have radionuclide containment as one of their primary functions. As such, it is useful to review the reliability of these components and the rate at which manufacturing-induced defects occur. However, they are also simple, single-barrier components, with a very small wall thickness compared to WPs, and significantly different operating conditions and a much shorter period of operation. Thus, the failure rate information presented here cannot be directly used to develop a WP early failure rate.

Since a significant amount of scrutiny by utilities, vendors, and the Nuclear Regulatory Commission (NRC) follows any report of failure in nuclear fuel, there is a large database on the number and causes of fuel rod failures. The fuel rod failure rate for both Pressurized Water Reactor (PWR) and Boiling Water Reactor (BWR) fuel through 1985 ranged from $2x10^{-4}$ to $7x10^{-4}$ per rod (EPRI 1997, p. 4-1). As a result of vendor efforts to develop improved fuel designs to address some of the causes of failure, the current range of failure rates is from $6x10^{-5}$ to $3x10^{-4}$ per rod (EPRI 1997, p. 4-2). The failures of fuel rods have been caused by a variety of mechanisms. These include: handling damage, pellet-clad interaction, debris, baffle plate jetting, grid fretting, primary hydriding, delayed hydride cracking, crudding/corrosion, cladding creep collapse, and undetected manufacturing defects (Yang 1997, p. 10, FCF 1996, pp. 4-2 through 4-7). Debris and grid fretting appear to be the dominant causes of failure in PWRs, while pellet-clad interaction and crud-induced corrosion appear to be the dominant causes of failure in

BWRs.

Only two of the fuel rod failure mechanisms identified above are applicable to WPs. These are handling damage and manufacturing defects. Handling damage represents a relatively minor cause of fuel failures. It can occur during fabrication if loaded fuel rods are subjected to excessive flexing that causes defects which lead to in-core failure, or as a result of drops, or other handling accidents which could occur at the utility. During the period from 1989 through 1995, there were a total of 10 handling damage failures in a population of 21,810 PWR assemblies (a rate of 4.6×10^{-4} per assembly; Yang 1997, p. 10). In each case, only a few rods in each assembly were actually damaged.

Manufacturing defects also represent a small fraction of fuel failures. Types of manufacturing defects associated with the cladding include: contamination by solvents, oils or filings, flawed or missing seal welds, flawed, missing or mislocated endcap welds, base metal flaws (stringers, inclusions), and out-of-spec material (FCF 1996, Section 5). Rates of fuel rod failure due to manufacturing defects are generally around 10^{-5} per rod. General Electric reports only 47 manufacturing defect-related failures in 4,734,412 rods fabricated between 1974 and 1993 (Potts and Proebstle 1994, p. 92), which yields a rate of 9.9×10^{-6} per rod. As of October 1990, Advanced Nuclear Fuels (now owned by Siemens) had experienced 7 BWR fuel rod failures and 9 PWR fuel rod failures related to manufacturing defects out of 570,200 BWR fuel rods and 1,391,740 PWR fuel rods placed into service (Tschoepe et al. 1994, pp. 2-4). The resulting rates are 1.2×10^{-5}, 6.4×10^{-6}, 8.2×10^{-6} for BWR, PWR, and combined failures, respectively. Framatome Cogema Fuels (FCF) does not have a manufacturing defect category, but reports only one failure due to unknown causes out of 400,000 Mark-BW rods fabricated between 1987 and 1999 (FCF 1996, pp. 3-1 and 3-3). This yields a rate of 2.5×10^{-6} unknown (possibly manufacturing defect) failures per rod. The only defect-specific occurrence rate was obtained from FCF, where there was one occurrence of a missing weld that was not found by inspection, out of approximately 2.3 million rods fabricated to present (FCF 1996, p. 5-5). This yields a rate of 4.3×10^{-7} per rod for this defect. Unfortunately, none of the other sources provided data on the occurrence rate of specific manufacturing defects.

While this review has provided general information on the reliability of fuel rods, the failure rate data cannot be directly applied to WPs due to significant differences in construction and operational conditions. However, general types of manufacturing defects were identified in the review that may be applicable to WPs. These types of defects are:

- Weld flaws
- Base metal flaws
- Mislocated welds
- Contamination
- Missing welds
- Material out-of-specification
- Handling damage

The applicability of these types of defects to WPs, and their potential consequences to postclosure performance, are discussed in Section 6.2.

6.1.3 Underground Storage Tanks

A substantial amount of information was also available on causes of early failure for underground storage tank (UST) systems. The most extensive data source, compiled by the Environmental Protection Agency, provides data on a large population of bare steel, clad/coated steel, and fiberglass reinforced plastic tank systems through 1987 (EPA 1987a and 1987b). While overfilling and leakage of attached piping are dominant contributors to leakage from UST systems, failure of the tank itself is also a significant contributor. The majority of the tanks in service at the time were bare steel tanks, and 95% of those failures were indicated as being caused by corrosion (EPA 1987a, p. 7). One interesting observation was that many bare steel tanks that have been unearthed were found to have corrosion holes that were plugged with corrosion product and showed no signs of leakage (EPA 1987a, p. 6).

The study also indicates that 5 to 7% of bare steel tanks actually leaked when they were tested for the first time (EPA 1987a, p. 6) due to manufacturing or installation defects. However, failures found during such a leak test would generally be repaired, and the fraction of the total population initially failed by unidentified defects would be much lower. The study indicates that 4% of a population of 980 tanks were found to be leaking, and 0.9% of 24,452 leaking tanks were found to be leaking in within 0 to 5 years of being placed into service (EPA 1987a, p. 8). This suggests an upper bound of approximately 0.04% on the fraction of the total population initially failed by an unidentified defect. Additional information provided by the Steel Tank Institute indicates that the fraction of the population failed by unidentified manufacturing defects is closer to 0.0003% (Grainawi 1999). Types of non-corrosion defects identified as causing failure include installation damage (EPA 1987a, p. 10) or failure of weld seams (EPA 1987b, p. 82).

While this review has provided general information on the fraction of the total population of USTs that may be initially failed, rates of early failure by defects are generally obscured by the high rate of early corrosion failures. The information obtained is not directly applicable to WPs because bare steel USTs are basically a single, less robust, non-corrosion resistant barrier to release. However, it still indicates that even commercial grade quality controls can produce components that have a relatively low rate of unidentified failures entering service. In addition, general types of manufacturing defects were identified in the review that may be applicable to WPs. These types of defects are:

- Weld flaws
- Handling/installation damage

The applicability of these types of defects to WPs, and their potential consequences to postclosure performance, are discussed in Section 6.2.

6.1.4 Radioactive Cesium Capsules

During the period between 1974 and 1983, 1,600 radioactive cesium capsules were fabricated at the Department of Energy’s Hanford facility for use by commercial companies as gamma sources (Tschoepe et al. 1994, pp. 2-7). One of these capsules failed during 1988 as a result of its use in environmental conditions that were drastically different from those for which the capsules were designed and from the development test conditions. An investigation into this failure concluded that, despite other deficiencies that were found, the capsule would not have failed if it had operated in the environment for which it was designed. The remaining capsules were recalled to Hanford after this incident, and there have been no other failures to date. Thus, the failure rate to date is 6.3×10^{-4} per capsule.

While this type of administrative/operational error does not represent an actual defect in the fabrication of the component, it, nonetheless, caused an early failure. Therefore, the applicability of this type of defect to WPs, and its potential consequences to postclosure performance, are discussed in Section 6.2.

6.1.5 Dry Storage Casks for Spent Nuclear Fuel

Dry storage casks that are sealed with a closure weld (as opposed to bolting) represent the closest analog to WPs that can be found. Examples include the Dry Shielded Canister that is part of TransNuclear's NUHOMS system, and the Ventilated Storage Cask Model No. 24 (VSC-24) system fabricated by Sierra Nuclear Corporation (Hodges, M.W. 1998). While there have been no recorded cases of closure welds failing after casks were placed into service, there have been four cases where cracks in closure welds have been identified during post-weld inspection of the cask (Hodges, M.W. 1998). All of these cases have been associated with the VSC-24, of which there were 19 in service through July 1998. Table 6.1-1 summarizes relevant information on each of the cracking events. Figure 6.1-1 provides an illustration of the VSC-24 closure welds. A VSC-24 Owners Group weld review team, composed of industry experts in metallurgy, welding, and NDE, evaluated each of the four weld cracking events to identify the root cause(s).

Table 6.1-1. Summary of VSC-24 Weld Cracking Events

Facility	Date	Detection	Location	Crack Description
Palisades	3/95	Helium leak test	Shield lid-to-shell weld	About 6 inches long by 1/8 inch deep that extended from about 1/8 inch above the shield lid-to-shell weld fusion line into the shell base metal
Point Beach	5/96	Dye-penetrant test	Structural lid-to-shell weld Structural lid-to-shield lid weld	Three cracks, each less than 1 inch long, located along the center of the root pass at locations where the fit-up gap between the lid and the backing ring was widest. In addition, cracking and weld porosity were found in the structural lid-to-shield lid seal weld (fillet weld associated with the vent port covers)
Arkansas Nuclear One	12/96	Helium leak test	Shield lid-to-shell weld	About 4 inches long located along the weld fusion line
Arkansas Nuclear One	3/97	Dye-penetrant test	Shield lid-to-shell weld	About 18 inches long located along the weld fusion line of the root pass

The team concluded that the Palisades weld crack was caused by an existing condition in the rolling plane of the shell material that was opened up by the process of making the shield lid weld (Hodges, M.W. 1998). Metallographic analysis revealed a crack that propagated along prior austenitic grain boundaries of a pre-existing weld of unknown origin (the weld had not been documented during fabrication). This defect may have resulted from improper repair, or incomplete removal, of temporary low quality welds used to facilitate the fabrication process (i.e., attachment of strong backs to assist in the rolling of plate material).

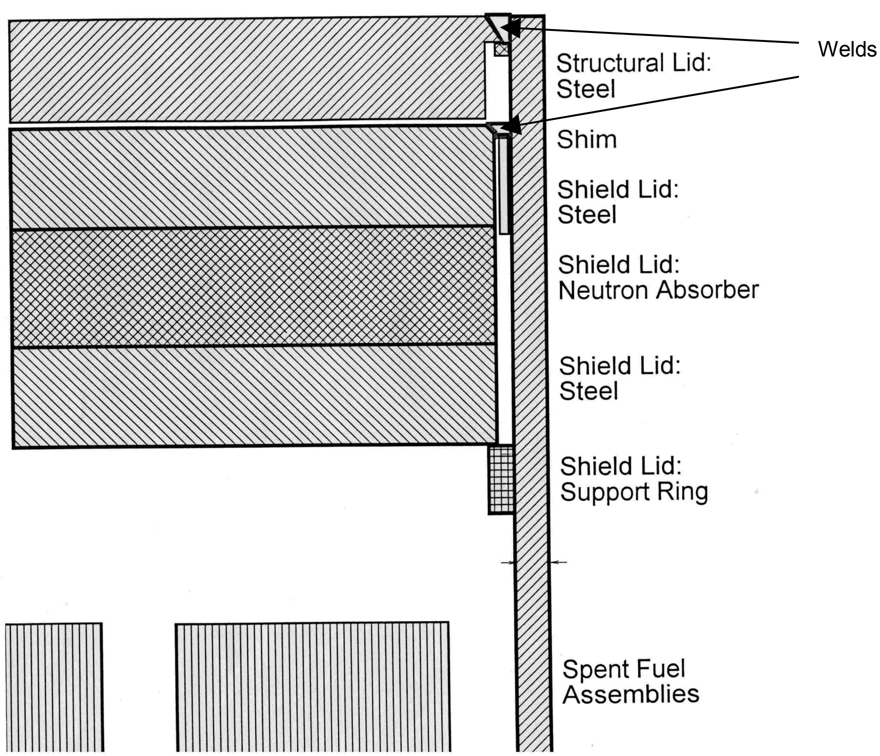


Figure 6.1-1. Illustration of Closure Welds for the VSC-24 Dry Storage Cask

The causes of the weld cracks at Point Beach were found to be associated with weld flaws caused by poor welding technique and moisture contamination (Hodges, M.W. 1998). The cracks on the root pass of the structural lid-to-shell weld were caused by wide fit-up gaps that were not properly filled by the welding technique. The cracking and weld porosity found in the structural lid-to-shield lid seal weld were found to be caused by moisture contamination of the weld. The moisture came from water forced out of the drain line during cask loading. The team concluded that none of the cracks at Point Beach were caused by the mechanism that produced the Palisades cracks.

The crack in the shield lid-to-shell weld for the first cask loaded at Arkansas Nuclear One was initially attributed to lamellar tearing based on visual observations of the crack by the welders before it was repaired (Hodges, M.W. 1998). However, it was later shown that this crack was similar in appearance to the second crack that was discovered, which was attributed to hydrogen-induced cracking (HIC). The HIC was attributed to 1) high hydrogen content of the weld wire, 2) susceptible microstructure of the steel welded, and 3) a highly restrained weld joint configuration leading to residual stresses at or near the yield level.

General types of manufacturing defects were identified in the review that may be applicable to WPs. These types of defects are:

- Weld flaws
- Base metal flaws
- Contamination

The applicability of these types of defects to WPs, and their potential consequences to postclosure performance, are discussed in Section 6.2.

6.1.6 Tin-plate Cans

Another source of data on the reliability of welded metallic containers was obtained by contacting the canning industry. SST Food Machinery reports that 0.15 mm resistance-welded tin-plate cans that are fabricated and inspected using automation have a failure rate of 1.5 in 10,000 cans at the leak tester, and essentially a “zero” failure rate thereafter (Ros 1998). No information was provided on the causes of failure. While this information is not directly applicable to WPs due to differences in fabrication methods and materials, it still indicates that even commercial grade quality controls can produce components that have a relatively low rate of unidentified failures entering service.

6.1.7 Summary

Table 6.1-2 briefly summarizes the information obtained from the literature search on the rate and causes of manufacturing defects in welded metallic containers. In general, eleven generic types of defects were identified. These are:

- Weld flaws
- Base metal flaws

- Improper weld material
- Improper heat treatment
- Improper weld flux material
- Poor weld joint design
- Contaminants
- Mislocated welds
- Missing welds
- Handling/installation damage
- Administrative/operational error

Weld flaws (e.g., slag inclusions, porosity, lack of fusion, hydrogen induced cracking) were a dominant contributor to early failure, but usually required an external stimulus (e.g., cyclic fatigue) or environmental condition to cause the flaw to propagate to failure. In many cases, components with unidentified defects entered service not because the defect was missed by an inspection, but because no inspection for that type of defect was required at the time they were fabricated. For dry storage casks, all of the defects were identified by post-weld inspection prior to commencement of the storage phase, and thus do not represent true instances of early failure as it is defined for this analysis. The eleven types of defects are reviewed for their applicability to WPs in Section 6.2. The probability of occurrence and consequences for postclosure performance of the package are assessed for the applicable defects.

As indicated above, many of the defects require an external stimulus, or the component was not subjected to inspections that would have identified the defect. Furthermore, there is insufficient information available to defensibly relate the cumulative effect of the environment or stresses that the component was subjected to that of the WP (e.g., are the cumulative effects of the stresses and environmental conditions experienced by a pressure vessel in a 40 to 60 year life equivalent to 100, 1,000, or 10,000 years of WP lifetime?). Accordingly, the information on the fraction of components that experienced defect-related failure during their intended service life is not directly applicable to WPs. In addition, these population-based failure rates do not provide any insight into the time distribution of early failures. However, in some cases, information on the occurrence rate of particular types of defects was obtained from the literature search. This information proved useful in the WP defect probability and consequence portion of the analysis.

Table 6.1-2. Summary of Defect-Related Failures in Various Welded Metallic Containers

Container Type	Failure Data	Types of Defects Leading to Early Failure
Boilers and Pressure Vessels	17 out of 20,000 UK pressure vessels fabricated between 1938 and 1978 failed due to manufacturing defects (dominant cause was fatigue growth of weld flaws) SS cladding on some RCS components for two nuclear units (different fabricators) cracked due to surface contamination remaining from transport or fabrication	- Weld flaws - Base metal flaws - Improper weld material - Improper heat treatment - Improper weld flux - Poor weld joint design - Contaminants
Nuclear Fuel Rods (PWR and BWR)	Undetected manufacturing defect-related failure rate approximately one rod per 100,000 Overall failure rates in the range of 2 to 7 rods per 10,000 before 1985, 0.6 to 3 rods per 10,000 from 1985 to 1997	- Weld flaws - Base metal flaws - Mislocated welds - Contamination - Missing welds - Improper weld material - Handling damage
Underground Storage Tanks	Fraction of population initially failed due to manufacturing or handling defects in the range of 0.04% to 0.0003%	- Handling/installation damage - Weld flaws
Radioactive Cesium Capsules	One failure out of 1,600 capsules	- Administrative error resulting in unanticipated operating environment
Dry Storage Casks for Spent Nuclear Fuel	4 out of 19 Sierra Nuclear VSC-24 casks found to have cracked closure welds during post-weld inspection (dye-penetrant and helium leak test only)	- Weld flaws - Base metal flaws - Contamination
Tin-plate Cans	1.5 resistance welded cans per 10,000 fail leak testing; "zero" reported failures after leak testing	Information not supplied

6.2 Mechanisms for Waste Package Early Failure

The review of early failures of various types of welded metallic containers in Section 6.1 identified eleven generic types of defects. Many of these same types of defects could also be introduced to a WP during fabrication, transport to the repository, storage, loading, or emplacement. However, the following generic defect types are considered not applicable to WPs:

- *Improper weld flux material* – WP welds will employ a tungsten-inert-gas (TIG) welding method that does not use weld flux material.
- *Poor joint design* – A significant amount of development and testing will have gone into the final closure weld joint design selected. Lessons learned from the types of closure weld problems that have been experienced in the dry storage cask systems (see Section 6.1.5) would be expected to be incorporated in the design of closure welds for WPs. Therefore, it is not expected that generic problems with the design of the weld joint for the WPs will be an issue. This does not exclude weld flaws or other types of weld related defects that could occur during the closure process.
- *Missing welds* – Data on the occurrence of this type of defect in fuel rods presented in Section 6.1.2 indicated that it occurred at a rate on the order of 10^{-7} per rod. A missing weld on a WP would be easier to identify than on a fuel rod, and would have a noticeable effect on the configuration of the WP (i.e., a missing closure weld could cause the lid to fall off when the WP is rotated to a horizontal position). Therefore, it

is expected that the occurrence rate of this defect for a WP would be much less than 10^{-8} per WP.

- *Mislocated welds* – This defect is mainly applicable to very small, single pass welds (i.e., fuel rod end caps). For larger multi-pass welds, such as those on the WP, any significant mislocation of the electrode would cause the weld arc to not strike. This would be immediately obvious to both the operator and the control system for the automated welder.

The remaining defects are evaluated in the following subsections. Similar types of defects, such as weld and base metal flaws, have been grouped together. For each category of defects, the probability of occurrence in a WP and the consequences to the long-term performance of the package, should it occur, are estimated. Users of this information should verify that the assumptions made in Section 5 regarding WP fabrication and inspection methods are applicable to the WP design being considered.

6.2.1 Weld and Base Metal Flaws

Probability

Of the various types of defects that could be present on the WP, weld flaws have been the most extensively studied. This research has been directed toward providing inputs that describe the number and sizes of flaws in welds to support probabilistic structural mechanics models for predicting the reliability of piping and reactor vessels. Work performed by Pacific Northwest National Laboratory and Rolls-Royce has lead to the development of the RR-PRODIGAL weld simulation code (Chapman, Khaleel, and Simonen 1996, p. 375). This code uses mathematical models and expert elicitation results to simulate the weld manufacture, the errors that lead to different types of flaws, and the reliability of various inspection methods for identifying flaws. Types of flaws simulated include centerline cracking, heat affected zone cracking (hydrogen induced cracking), lack of fusion, slag inclusions, and porosity. Flaw densities and size distributions are then developed from the simulated weld. Comparisons of flaw frequencies predicted by RR-PRODIGAL with observed flaws found in actual piping and vessel welds have been performed in an effort to benchmark the code. The results provided by RR-PRODIGAL were found to be consistent with measured flaw data, or conservative by a factor as large as ten (Simonen and Chapman 1999, p. 105).

Recently, the Nuclear Regulatory Commission has sponsored research, using RR-PRODIGAL, to support the development of NRC guidance for the implementation of risk-informed inservice inspection of piping. A matrix of cases were run to investigate the effects of weld thickness, material, welding method, and post-weld inspection(s) of flaw density and size distribution (Khaleel et al. 1999, p. 127). The results of this study will provide the information necessary to allow initial estimates of flaw frequency and size distribution to be performed for the WP barriers. The calculations presented in this section were performed in the Excel 97 spreadsheet, WPflaw.xls, provided in Attachment III. Section 5.1 details the assumptions that were made for this calculation.

The above mentioned study determined that the lognormal distribution provided the best fit to the flaw size data (Khaleel et al. 1999, p. 131). Least squares fits of the data for TIG welded stainless steel (Khaleel et al. 1999, p. 144) provided the following expressions for the median flaw size (in inches) and shape parameter (σ; standard deviation of ln[x]) of the lognormal distribution as a function of weld thickness (x, in inches):

$$median = 0.1159 - 0.0445x + 0.00797x^2$$

$$\sigma = 0.09733 + 0.3425x - 0.07288x^2$$

The lognormal cumulative distribution function has the form:

$$F(a) = \frac{1}{\sigma\sqrt{2\pi}} \int_0^a \frac{1}{\theta} \exp\left[-\frac{1}{2} \frac{(\ln\theta - \mu)^2}{\sigma^2} \right] d\theta$$

Using the above expressions, complementary cumulative lognormal distributions (CCDFs) of flaw depth were calculated in the "Weld Data" sheet of the Excel 97 spreadsheet WPflaw.xls using the LOGNORMDIST function. Since this Excel function uses a form of the lognormal distribution that uses the mean (μ) rather than the median, the mean was taken to be ln(median). This was done for 20 mm (shell) and 25 mm (lid) thick welds in the Alloy 22 barrier, and the 50 mm (shell) and 95 mm (lid) thick welds in the 316 stainless steel barrier. Probability density functions were then numerically derived from each of the CCDFs.

Next, the total flaw density (flaws per meter of weld) was estimated. A base flaw density of 0.6839 flaws/meter of weld for a 1-inch thick stainless steel TIG weld performed in the shop (as opposed to field conditions) and subjected to radiographic (RT) and dye-penetrant (PT) exams was selected (Khaleel et al. 1999, Table 5, Case 5). The resulting flaw density after credit for RT and PT examinations was eliminated was 8.8271 flaws/meter of weld for a 1-inch thick stainless steel shop TIG weld. Shop conditions were considered to be representative of the highly controlled environment that will be present at the fabricator and in the waste handling building disposal container cell. The information on the effect of weld thickness on flaw density was used to adjust the base flaw density to the weld thickness being evaluated (Khaleel et al. 1999, Table 6). This information, which has been normalized to a weld thickness of 1 inch, is summarized in Figure 6.2-1.

To develop an estimate of the flaw density for an uninspected weld, the base flaw density was increased by the sum of the flaw reduction factors provided by RT and PT exams. A radiographic exam, and subsequent weld repair, reduces the flaw density by a factor of 12.8 (Khaleel et al. 1999, p. 133). A PT exam, and subsequent weld repair, reduces the density of outer surface breaking flaws by a factor of 31.4 (Khaleel et al. 1999, Table 5, Cases 1 and 8). Since, on average, 0.34% of flaws are surface breaking (Khaleel et al. 1999, Table 5), this provides an additional increase factor of 0.1 to the total flaw density if a penetrant exam is not performed.

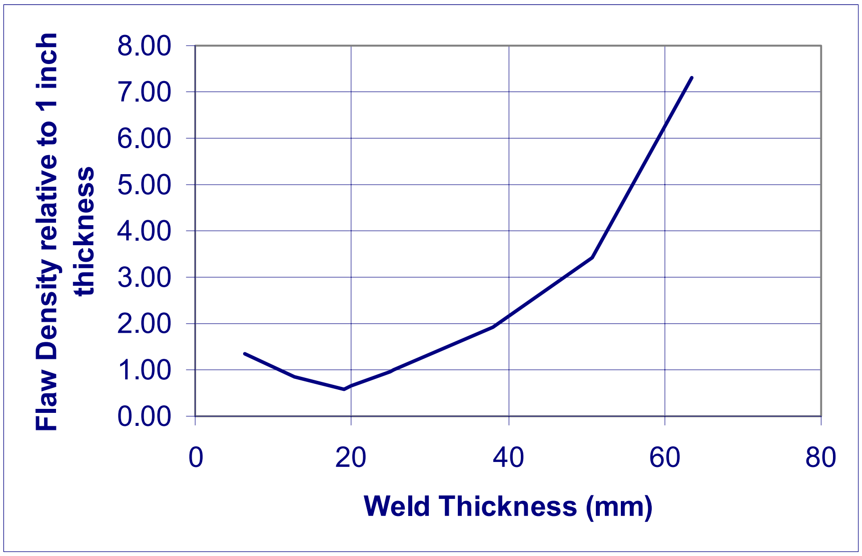


Figure 6.2-1. Effect of Weld Thickness on Flaw Density Normalized to a Thickness of 25.4 mm

Finally, since the WP closure weld will be performed in a hot cell, and subjected to only an ultrasonic exam (UT), information on the reliability of UT methods must be obtained. Since the version of RR-PRODIGAL used for the NRC study did not include information on UT reliability, a literature search was performed to obtain UT probability of non-detection (PND) as a function of flaw depth. The resulting distributions identified during this search are summarized in Figure 6.2-2. Most of the data presented are from NUREG/CR-3110, and represent data collected on UT reliability for detecting intergranular stress corrosion cracking (IGSCC) cracks in stainless steel through 1978 (Bush 1983, pp. 13A.5.8-9). This reference summarizes the results of previous studies on UT reliability, and provides parameters for a modified lognormal function giving the probability of non-detection as a function of flaw depth:

$$PND(a) = \varepsilon + 0.5*(1 - \varepsilon)*erfc(\nu*\ln(a/a^{*}))$$

where ε is the lower limit of PND (0.005 based on Bush 1983, p. 13A.5.7), erfc is the complementary error function, a is the crack depth in mm, a* is the crack depth in mm with a PND of 0.5, and ν is a unitless shape factor (Bush 1983, p. 13A.5.6). A more recent study on UT detection of IGSCC cracks in stainless steel, reported in NUREG/CR-5068, shows significantly improved reliability (Heasler and Doctor 1996, p. xv). This reference provides the parameters for a complementary logistic function giving probability of non-detection as a function of crack depth for near-side IGSCC. This distribution has the form:

$$PND(x) = 1 - (1 + \exp(-\beta_1-\beta_2*x))^{-1}$$

where β_1 = -2.67, β_2 = 16.709 cm^{-1}, and x is crack depth in cm (Heasler and Doctor 1996, pp. 6.1 and 5.9). All of the references reviewed indicate that the probability of non-detection for various size defects is dependent on a number of variables such as the type of material, operator skill, access to the weld, and type of defect. Therefore, since these variables cannot be completely defined at this time, the modified lognormal distribution showing a 50% probability of detection for a 2.5 mm defect, and a more conservative non-detection probability for larger defects, was selected for use. This distribution essentially represents the mid-point between the most optimistic and pessimistic distributions for probability of non-detection.

Using the information on linear flaw density, flaw size distribution, and inspection reliability presented above, and information on various weld lengths (based on barrier dimensions given in Attachment IV), frequencies of various size outer surface breaking weld flaws have been estimated. The procedure is essentially the same for all cases. First, the total flaws per type of WP weld was calculated by multiplying the weld length by the linear flaw density and by an adjustment factor for the weld thickness from Figure 6.2-1. The base linear flaw density with credit for RT and PT inspections was used for the shell and bottom lid welds, and the uninspected flaw density was used for the top lid closure weld. Next, the flaw size distribution for that weld thickness was used to determine the probability that a flaw would have a size within a given range. A range size of 0.5% of the weld thickness was used. This was the largest range size that could be used without introducing any significant (within 2 significant figures) amount numerical error associated with discretizing a continuous size distribution. The probability for each range was then multiplied by the total number of flaws per weld to determine the expected number of flaws within that size range. For welds subjected to a UT inspection, the expected number of flaws within each range was then reduced by multiplying by the PND for the lower end of the size range (this is conservative because the PND is higher for smaller flaws). Since the UT PND is based on a single angle UT examination, and a multi-angle examination is planned for the lid welds (possibly as many as four different angles; see CRWMS M&O 1998e, p. 12), the square of the PND was used for the lid welds (this effectively treats a multi-angle exam as two independent examinations). For all cases, each range was then multiplied by 0.34% to yield the expected number of outer surface breaking flaws within that range (the expected number of embedded and inner surface breaking flaws are also estimated in Attachment III). Finally, the expected number of outer surface breaking flaws in each size range were summed to determine a new value for total flaws per weld which accounts for the UT inspections. A complementary cumulative distribution of outer surface breaking flaw size was also determined. These results are summarized in Figure 6.2-3 for the Alloy 22 barrier shell welds, and in Figure 6.2-4 for the Alloy 22 barrier lid welds. Results for the stainless steel barrier shell and lids are presented in Attachment III.

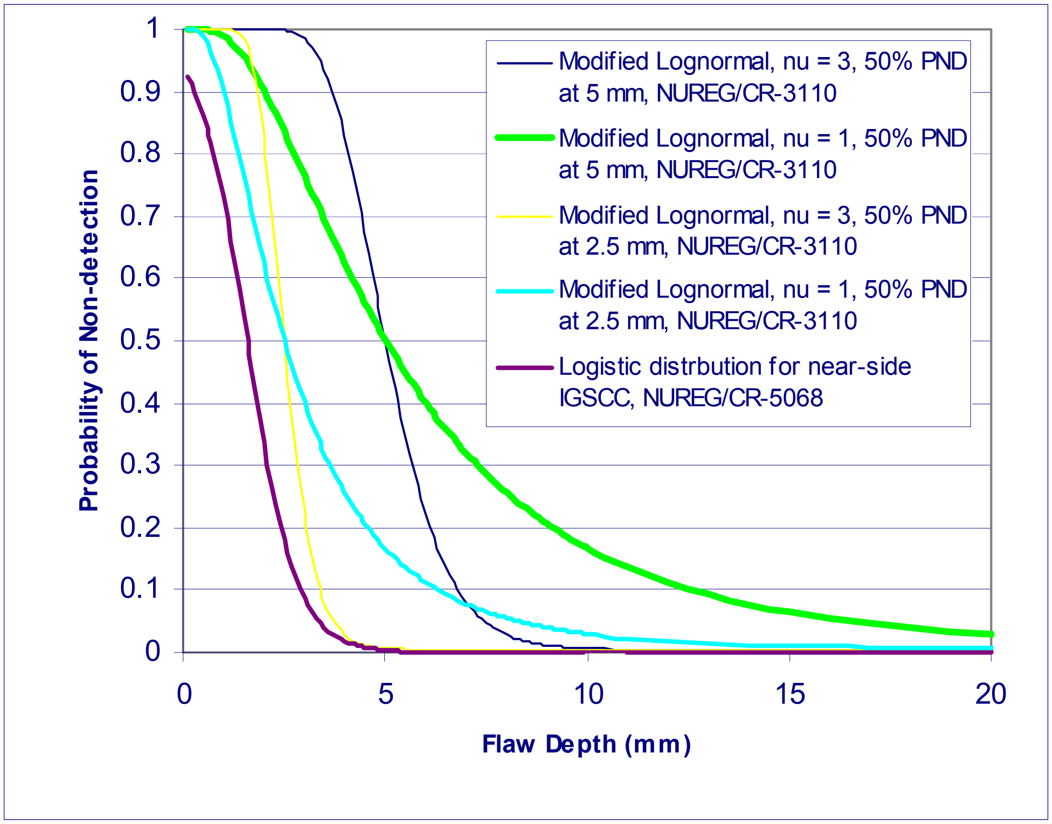


Figure 6.2-2. Probability of Non-Detection for Ultrasonic Examination from Various Sources

In addition to the depth of the flaw, the length and orientation of the flaw may also be of interest. Flaw aspect ratios (ratio of flaw length to flaw depth) were reported in one series of pressure vessel weld examinations (total of 2,500 flaws found) to be uniformly distributed between ratios of 2:1 to 10:1, with the deeper flaws tending to have somewhat smaller aspect ratios (Monteleone, S. 1998, p. 12). Information was also found on the angle between the plane of the flaw and a line normal to the surface of the weld (Chapman and Simonen 1998, pp. A.4 to A.19). For most flaw types, a beta distribution between +5° and -5° from a line normal to the surface is indicated. For shrinkage cracks, the distribution is between ±15°, and for slag or lack of fusion between weld runs, the distribution is between 70° and 90° from a line normal to the weld surface. No information was found in the literature regarding angle of the flaw from a line parallel to the direction of the weld. However, most planar defects, such as lack of fusion and slag inclusions would logically be expected to be oriented within a few degrees of the same direction in which the weld head is moving.

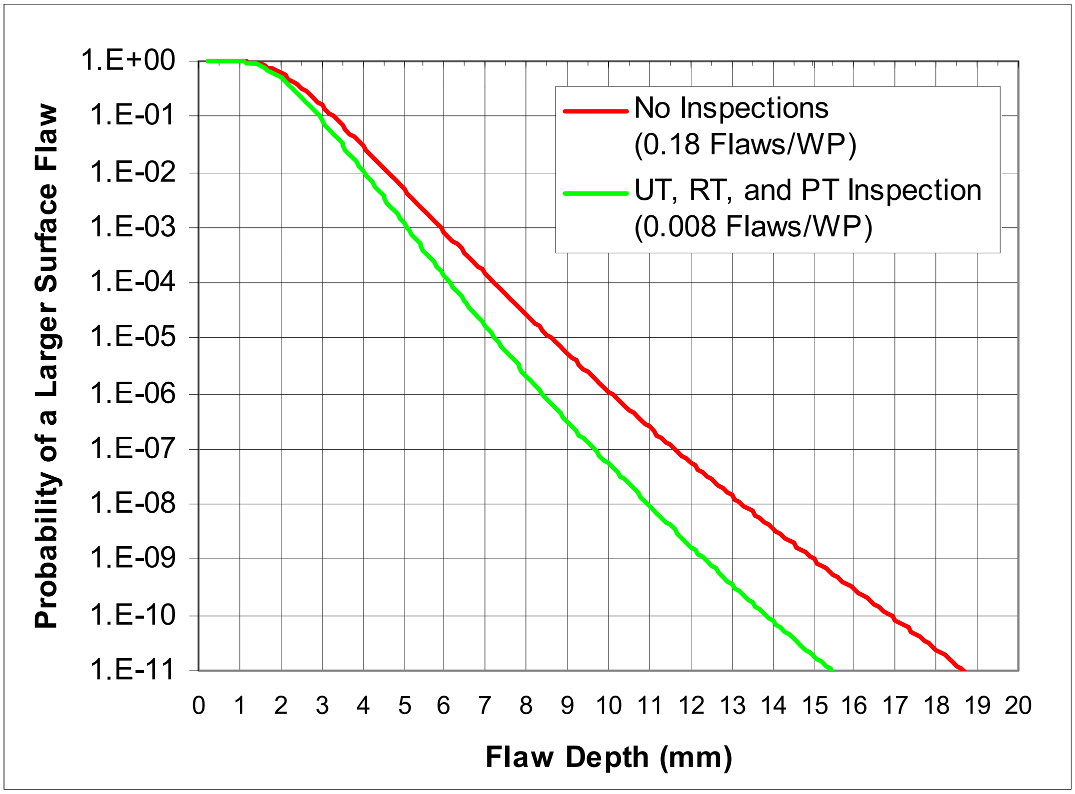


Figure 6.2-3. Size Distribution for Indicated Frequency of Occurrence for Outer Surface Breaking Flaws in WP Alloy 22 Shell Welds

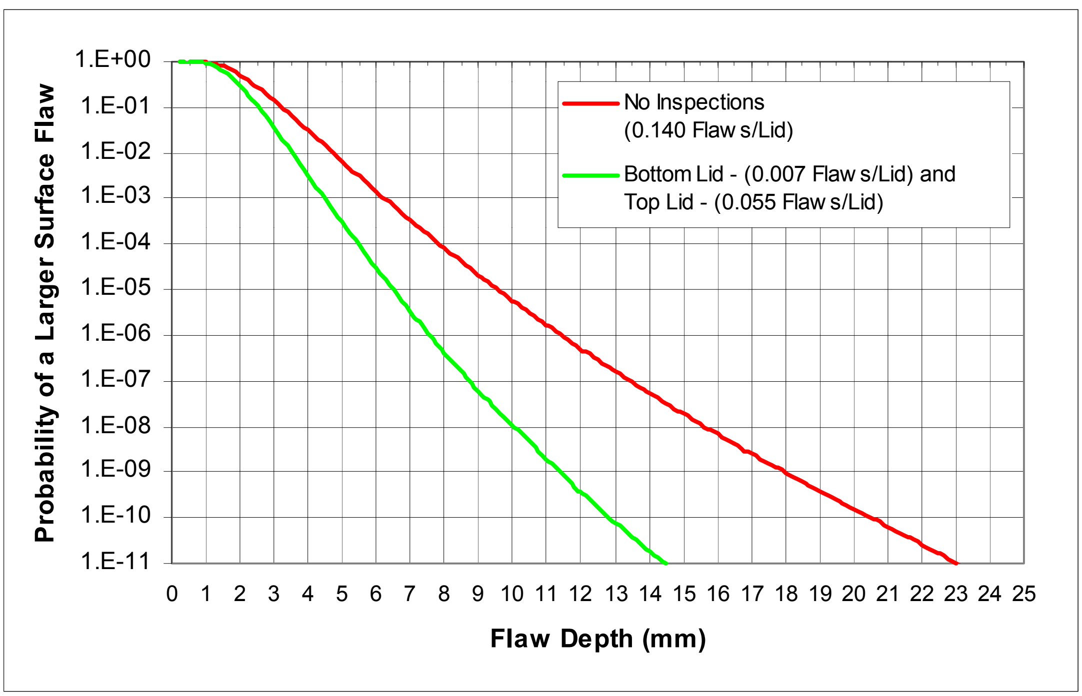


Figure 6.2-4. Size Distribution for Indicated Frequency of Occurrence of Outer Surface Breaking Flaws in WP Alloy 22 Lid Welds

In contrast to the wealth of information on the occurrence of weld flaws, information on the occurrence of flaws in base metal material is sparse. The only recorded data on the occurrence of base metal flaws was obtained from detailed ultrasonic examination of an unused reactor pressure vessel (Monteleone, S. 1998, p. 12). While the primary emphasis of this study was to obtain data on the density and size distribution of weld flaws, flaw densities in the base metal regions just outside of the heat affected zone were also examined. Flaw densities in the base metal region were found to be about an order of magnitude lower than flaw densities in the weld region (Monteleone, S. 1998, p. 12). However, since metallographic studies of the base metal were not performed, the percentage of flaws inherent to the base metal, versus those associated with weld repair of the base metal, was not determined.

Several assumptions were made to develop the probability of base metal flaws occurring on a WP. These assumptions are summarized in Section 5.10. If base metal flaws are considered to occur only as a result of weld repairs in regions near welds, and CRWMS M&O 1999d indicates that use of such weld repairs on permanent base metal sections will be strictly controlled, then such flaws can only occur as a result of the failure to follow the fabrication procedure relating to base metal forming and weld repair. The human error probability for failing to follow a written operating procedure is estimated to be 0.01 (Swain and Guttmann 1983, pp. 20-22) and the failure probability that the quality control check of the fabrication process will fail to find a violation of the fabrication procedure is estimated to be 0.1 (Swain and Guttmann 1983, pp. 20-38). Therefore, the frequency of occurrence of base metal flaws is estimated to have a probability of occurrence that is four orders of magnitude lower than the occurrence rate of flaws in uninspected welds for the lid and shell (see Figures 6.2-3 and 6.2-4). The uninspected flaw occurrence rate is used because weld repairs that are performed in violation of the fabrication procedure would not be likely to have been inspected. The size distribution of these flaws may be taken to be the same as that for weld flaws in an uninspected weld shown in Figures 6.2-3 and 6.2-4 (Monteleone, S. 1998, p. 12).

Consequences

Any outer surface breaking flaws, in combination with the presence of an aggressive environment and high (near yield) residual stresses from the weld could potentially lead to stress corrosion cracking of the barrier. A determination of the flaw size that could lead to stress corrosion cracking for the WP lid and shell welds, and base metal material, will be performed in a separate analysis.

Another possible consequence of the surface flaws of any size is the growth of these flaws into deeper pits or crevices. This, however, is highly unlikely in view of the high resistance of the materials such as Alloy 22 to pitting under the expected repository conditions. The critical pitting temperature for Alloy 22 in much more aggressive environments has been measured to be higher than 150 °C (Gdowski 1991, p. 33, Table 25). Therefore the surface flaws are not expected to grow by pitting mechanisms under the repository conditions. However, the potential for growth of surface breaking flaws by pitting or crevice corrosion mechanisms will be evaluated in detail in a separate analysis.

6.2.2 Improper Weld Material

Probability

While the improper weld material defect was responsible for early failures in several of the container types examined in Section 6.1, there is little information to support the development of its probability of occurrence for a WP. Section 5.3 summarizes the assumptions made in this section to estimate the probability of an improper weld material defect occurring on a WP.

The only well documented occurrence of the extent to which a weld population was affected by improper weld material is described in Babcock and Wilcox's response to NRC Bulletin 78-12 (B&W 1979). This inspection of all vendors' welding records was prompted by the discovery that the weld chemistry of a portion of the Crystal River 3 surveillance block weld did not meet the specification requirements. Out of a 1,706,556 lb of low alloy steel weld wire (B&W 1979, p. I-6) that was used by B&W to make 47 reactor vessels from 1965 to 1975 (B&W 1979, Table 1), it was estimated that 65 lb (one spool) to 350 lb (half of a drum) of weld wire was affected (B&W 1979, p. 2). Since this population of vessels represents approximately 30% of the vessels fabricated for use in the United States (ANS 1999, pp. 52-55), and no other instances of improper weld material were reported in other vendors' responses to NRC Bulletin 78-12, the total mass of weld material used in this estimate is increased to 5,688,520 lb. Based on this information, the estimated probability of occurrence for improper weld material ranges from $1\text{x}10^{-5}$ to $6\text{x}10^{-5}$ per lb of weld material. A mean probability of $3.5\text{x}10^{-5}$ per lb will be used for this analysis.

The general conclusion of the B&W response to NRC Bulletin 78-12 was that the evolution of shop practices as of 1979 had virtually eliminated the possibility that off-chemistry weld material would be used in the fabrication of a reactor vessel. New instrumentation, such as portable x-ray spectroscopy equipment, makes it possible to perform quick field measurements of material compositions (ASM International 1990, pp. 1030-1032). However, there is still the possibility that the operator performing such verifications fails to perform the operation correctly. This human error probability can be approximated by the probability of improperly checking a digital display, 0.001 (Swain and Guttmann 1983, pp. 20-27). Therefore, based on the assumption that such verifications will be performed for WP weld material, the above probability of improper weld material is reduced to $3.5\text{x}10^{-8}$ per lb of weld material.

Using an assumed mass (see Section 5.3) of weld material in the Alloy 22 barrier of 200 kg (440 lb), this yields an estimated probability of $1.5\text{x}10^{-5}$ per WP for this defect. Since the stainless steel structural barrier is little over twice the thickness of the Alloy 22 barrier, but has a smaller outer diameter, it is estimated that the probability of the use of improper weld material is approximately twice that of the outer barrier.

Consequences

In the case of the improper weld material used in the reactor vessel weld discussed above, the substituted material had a composition that was only slightly different than the specified material, and further evaluation indicated that no impact on performance would be expected (B&W 1979). However, Section 6.1 indicates that there have been pressure vessel failures associated with the use of incorrect weld material, although it is not stated whether the specified material was incorrect, or the material used was not that which was specified. In the case of the WP, it is expected that any use of incorrect material would be similar to the reactor vessel case, and simply result in the use of another nickel based alloy for the outer barrier, or another stainless steel alloy for the structural barrier. However, such substitution could still have an impact on the corrosion performance of the barrier. This will be evaluated in detail in a separate analysis.

6.2.3 Improper Heat Treatment

Probability

To quantify the probability of a WP being put into service that was subject to an improper heat treatment, an event sequence tree was developed focusing on human errors. The decision points are mainly human errors; there is one hardware failure.

Many assumptions have been made to develop the event sequence tree. These assumptions are listed in Section 5.4. The information provided by Cogar (1999) on the general elements of the heat treatment (annealing) process for WP components was also used in the development of the event sequence tree. The following human error probabilities (HEPs) and equipment failure rates have been used to quantify the tree:

- Failure to match components with proper written procedures is approximated by failing to read a digital display with an HEP of 0.001 (Swain and Guttmann 1983, pp. 20-26).
- Failure to follow a written operating procedure has an HEP of 0.01 (Swain and Guttmann 1983, pp. 20-22); improper heat treatment from failure to follow a written procedure considered to require two failures of the procedure or a single failure and a failure of self-recovery – either way, an HEP of (0.01)(0.01) = $1x10^{-4}$ is used.
- Failure of QA is approximated by a check failure using written materials with an HEP of 0.1 (Swain and Guttmann 1983, pp. 20-38).
- Failure of the independent lab check is approximated by failure to follow a written operating procedure with an HEP of 0.01 (Swain and Guttmann 1983, pp. 20-22).
- The probability of a catastrophic failure for the furnace is estimated to be 0.001; the probability of a non-catastrophic failure for the furnace is 0.002. The former probability is developed by considering a simple/conceptual furnace composed of a heater, with a failure rate of $2.5x10^{-5}$ per hour (high, catastrophic rate from IEEE 1984, p. 283), and a thermostat, with a failure rate of $1.7x10^{-5}$ per hour (high, all-modes rate from IEEE 1984, p. 543). If failure of either of these components during the WP heat treatment is considered to lead to catastrophic failure of the furnace, the resulting probability of furnace failure during WP heat treatment is 0.001 ([1.7 + 2.5] x 10^{-5}/hr x 24 hr = 0.001). The non-catastrophic failure rate was conservatively taken to be twice the catastrophic failure rate. Based on a review of the failure data for a

variety of components in IEEE (1984), the non-catastrophic failure rate for most components is generally no more than twice the catastrophic failure rate, and is often lower.

Table 6.2-1 provides detailed descriptions of the actions in the improper heat treatment event sequence tree. Figure 6.2-5 shows the event sequence tree in its entirety. This tree was quantified in the "Improper Heat Treatment" sheet of the Excel 97 spreadsheet Seq-Trees.xls (see Attachment II).

Table 6.2-1. Description of Actions in Improper Heat Treatment Event Sequence Tree

Identifier	Description (success-oriented)
A	The operator is able to match the WP component with the current heat treatment written operating procedure by matching an identification code associated with the component to the a specific heat treatment procedure.
B	A place-holder event that assumes with a probability of 1.0 that if the operator is using a mismatched procedure (i.e., failure of event A), then the ramp-up and/or hold times will be incorrect for the component being subjected to the heat treatment. This is a conservative assertion.
C	The QA process that occurs after the furnace step (ramp-up and hold-time) and prior to quenching successfully identifies an error in ramp-up/hold-time process.
C'	A place-holder event when there is no error for the QA process to detect or when the error is assumed to not be detectable by the QA process (e.g., a non-catastrophic equipment failure, F2).
D	The operator correctly follows the written operational procedure for quenching.
E	The independent laboratory correctly identifies that the component was subjected to improper heat treatment.
E'	A place-holder event when there is no improper heat treatment for the independent laboratory to uncover.
F1	The furnace works correctly.
F2	The furnace suffers from a non-catastrophic (non-detectable) failure.
F3	The furnace suffers from a catastrophic (detectable) failure.
G	The operator correctly follows the written operational procedure for ramp-up and hold-time.

The event sequence tree shows 23 developed sequences; each is labeled with an identification number, an end-state status, and an end-state probability. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. There are three end-state status indicators, which are described in Table 6.2-2.

Table 6.2-2. End-state Status Indicators for Improper Heat Treatment Event Sequence Tree

End-state Status	Description
OK-W	This end-state results when no actions in the event sequence tree could cause the component to be subjected to an improper heat treatment. At worst, such a component could be incorrectly rejected via either the QA process or the independent laboratory. (Neither of these events are modeled in the tree. This would have economic consequence, but would not place into service a WP with an improper heat treatment.
OK-R	This end-state results when a component that is subjected to an improper heat treatment is discovered via the QA process or the independent laboratory results. In these cases, the component/WP will be either reworked or scrapped.
NOK	This end-state results when a component that is subjected to an improper heat treatment is not discovered by any of the means available, and is put into service. The probabilities for these end-states are summed to produce the total probability.

Note that some of the sequences are truncated (only partially developed). These are sequences (4, 13, 18, 19) that logically end with some discovery (i.e., QA result, catastrophic failures). The probability of a sequence that results in a WP with improper heat treatment being placed in service is shaded. The sum of these sequences, that is, the probability that a WP (both barriers) will be placed into service with an improper heat treatment is 2.2×10^{-5}. Note that 95% of this probability comes from a single sequence (#10) in which a non-catastrophic equipment failure produces a defect in the metal during ramp-up/hold-time that is **not** identifiable during the QA check (since this is not a procedure error). There is only one opportunity (with this model) to uncover the defect in the independent laboratory check.

There is some subjectivity in estimating the human error probabilities; as such, the Excel spreadsheet has been developed to facilitate sensitivity analyses. Any of the failure probabilities (except where "none" is indicated) can be changed in the table to the left of the event sequence tree, except for the F-series actions that were itemized separately on the table. For example, if events D and G are multiplied by 3^2 (the error factor in Swain and Guttmann (1983)) to a human error probability of (0.01)(0.01), the resulting failure probability is 3.2×10^{-5}. (Note there is no absolute linear effect; the sum of failure probabilities increase by a factor of 1.4.)

It should be noted that the probability of improper heat treatment developed here is independently corroborated by the pressure vessel failure statistics reported in Section 6.1.1. Those statistics indicated that 1 vessel in 20,000 experienced failure due to improper heat treatment. This yields a probability of 5×10^{-5} per vessel for this type of defect.

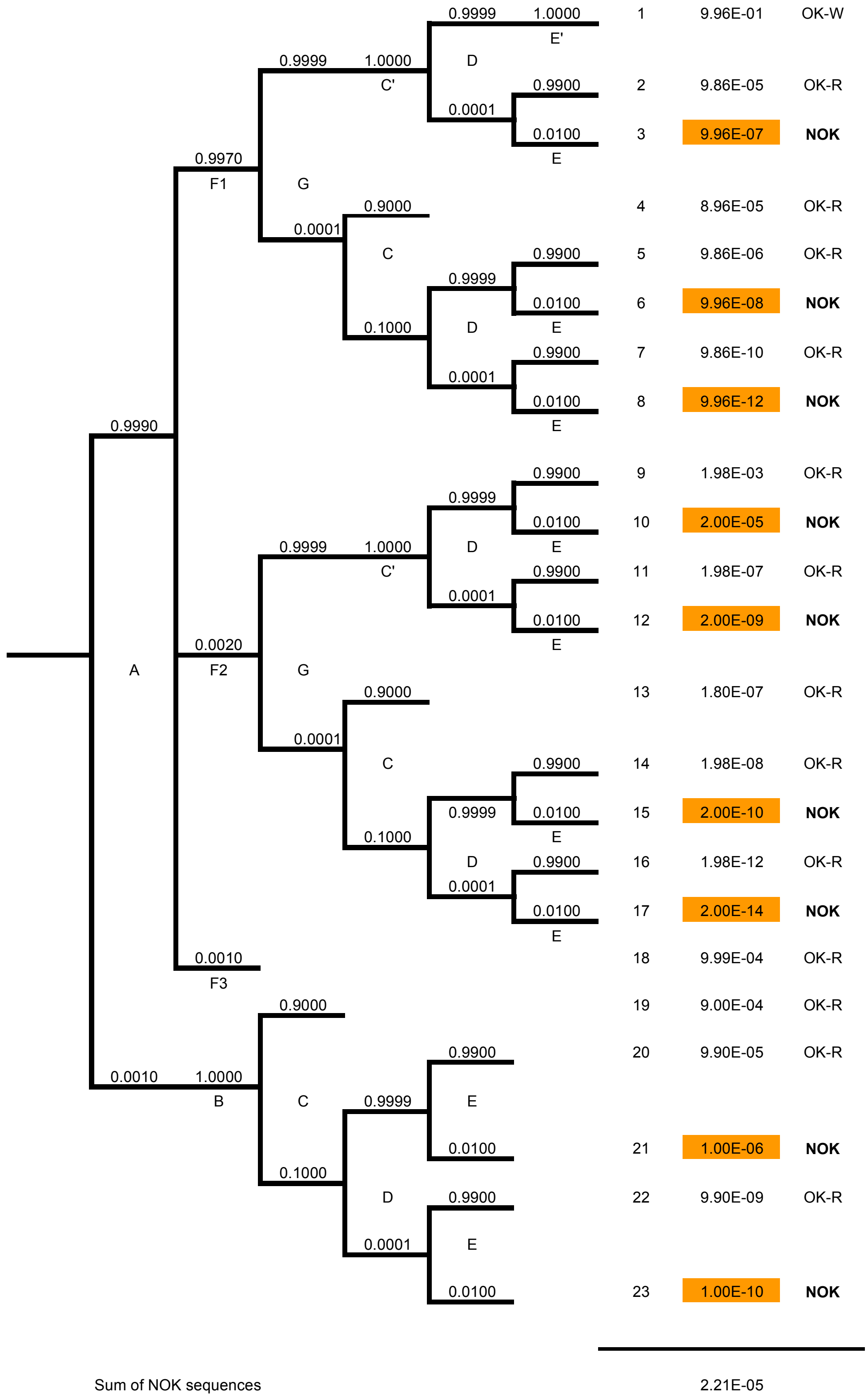


Figure 6.2-5. Event Sequence Tree for Estimating Probability of Improper Heat Treatment

Consequences

While the likelihood of improper heat treatment is extremely small due to both administrative (procedural) controls and multiple checks, the consequences of improper heat treatment can be significant depending upon the nature of the error. Improper rate of cooling of alloys such as Alloy 22 may result in the precipitation of carbides and intermetallic phases in the grain boundaries. A review of the isothermal time-temperature-precipitation diagram for Alloy 22 suggests that the cooling down to 700-750 °C, from the solution temperature of 1121 °C within the first 0.1 hour (6 minutes) is required to avoid formation of grain boundary precipitates (Gdowski 1991, Figure 13).

In Alloy 22, formation of grain boundary precipitates and long range ordering can lead to several different adverse consequences. Under the repository conditions, the WP is expected to experience temperatures in the range of 200-250 °C for hundreds of years and during this period, ordering and precipitation of the carbides and intermetallic phases will continue. Formation of grain boundary precipitates is accompanied by depletion of Cr and Mo near the grain boundaries, and as a result, the susceptibility of the material to localized corrosion by attack along the grain boundaries is increased (Agarwal and Herda 1997, p. 546, Tables 7a and 7b). The potential impact of this defect on localized corrosion mechanisms will be evaluated in detail in a separate analysis.

Formation of grain boundary precipitates also enhances the susceptibility of the material to stress corrosion cracking. Improper heat treatment is also a problem for the stainless steel structural shell. This material could suffer from the same type of grain boundary precipitation of carbides and fail by IGSCC (Clarke and Gordon 1973, p. 6, Fig. 8). The potential impact of grain boundary precipitates on stress corrosion cracking of the Alloy 22 barrier will be performed in a separate analysis.

6.2.4 Contamination

Probability

To quantify the probability of a WP being put into service after being subjected to (corrosion enhancing) surface contamination, an event sequence tree was developed. For the introduction of this defect (contamination), the event sequence tree estimates the probability that contamination *occurred on a per cleaning basis*. This probability is then multiplied by the number of cleanings for the outer barrier. The last cleaning of the outer barrier also considers the probability that a WP *already* contaminated was not properly cleaned (leaving a foreign material on the WP).

Many assumptions have been made to develop the event sequence tree and subsequent calculations (as discussed below). These assumptions are summarized in Section 5.5. The input provided in CRWMS M&O (1999d, Section 6.15) on the general elements of the cleaning process for WP components was used in the development of the event sequence tree. The following human error probabilities and equipment/process failure rates have been used to quantify the tree:

- Failure to have the proper (approved) cleaning agents on site is estimated to be 0.001. This is based on the expectation that mislabeling of cleaning supplies or misunderstanding what are allowable supplies by the person stocking the storage room is similar to failure to follow a written procedure (0.01 from Swain and Guttmann (1983, pp. 20-22)) and that the stocking person also fails to recover during a self-check of his activities (0.1 from Swain and Guttmann (1983, pp. 20-38)).
- Failure of the operator to check the cleaner and failure of the post-cleaning check are approximated by a check failure using written procedures with an HEP of 0.1 (Swain and Guttmann 1983, pp. 20-38); the lower limit 0.1/5 = 0.02 is used for the more rigorous check.
- Failure of the cleaning process is approximated by a failure to follow a written operating procedure with an HEP of 0.01 (Swain and Guttmann 1983, pp. 20-22).
- The probability that there is contamination on the WP just prior to its final cleaning is 0.0163. This is a high probability based on limited data from the commercial nuclear industry, and should be considered very conservative. This probability is based on the two examples of contamination identified in Section 6.1, the Indian Point 3 steam generators and the nuclear fuel rods. In the first case, a total of four contaminated steam generators were discovered. Comparable components include reactor coolant system (RCS) hot and cold legs, the reactor vessel, and the pressurizer. Since the four failures were identical and commonly caused, treat each of the five major components as five single entities. There have been approximated 75 operating PWRs operating in the U.S. (ANS 1999, pp. 52-56). Thus, a rough probability of a contaminated component is: 1/(75 x 5), where the "5" represents the five RCS entities. This probability (0.0027) represents the event that a contaminated component was put into service after cleaning, so the probability that a contaminated component exists is 0.0027 divided by the failure of the cleaning process, for which 0.01 has been used above, or 0.0027/0.01 = 0.27. In the case of the fuel rods, Section 6.1.2 reports that the rate of manufacturing defect failure in fuel rods is generally in the range of 10^{-5}, and that a significant contributor is internal contamination. Conservatively assuming that all manufacturing defect related failures of fuel rods are related to contamination, and using the 0.01 probability of placing a contaminated component into service, yields a contamination occurrence rate of 10^{-3}. The 0.0163 probability of initial contamination of a WP was taken to be the logarithmic midpoint between the RCS component and fuel rod contamination probabilities estimated above.

Table 6.2-3 provides detailed descriptions of the actions in the surface contamination event sequence tree. Figure 6.2-6 shows the event sequence tree in its entirety. This tree was quantified in the "Contamination" sheet of the Excel 97 spreadsheet Seq-Trees.xls (see Attachment II).

Table 6.2-3. Description of Actions in Surface Contamination Event Sequence Tree

Identifier	Description (success-oriented)
A	Proper cleaning agents are available to the operators.
B	The operator checks to ensure that the proper cleaning agents are being used.
B'	A place-holder event when the proper cleaning agents are being used.
C	The operator correctly follows the written operational procedure for cleaning.
D	A checker reviews the cleaning process after the cleaning has occurred.
D'	A checker rigorously reviews the cleaning process after the cleaning has occurred. The review is more rigorous because of the assumed physical evidence that leads to potential contamination.
E	A contaminated component is put into service.

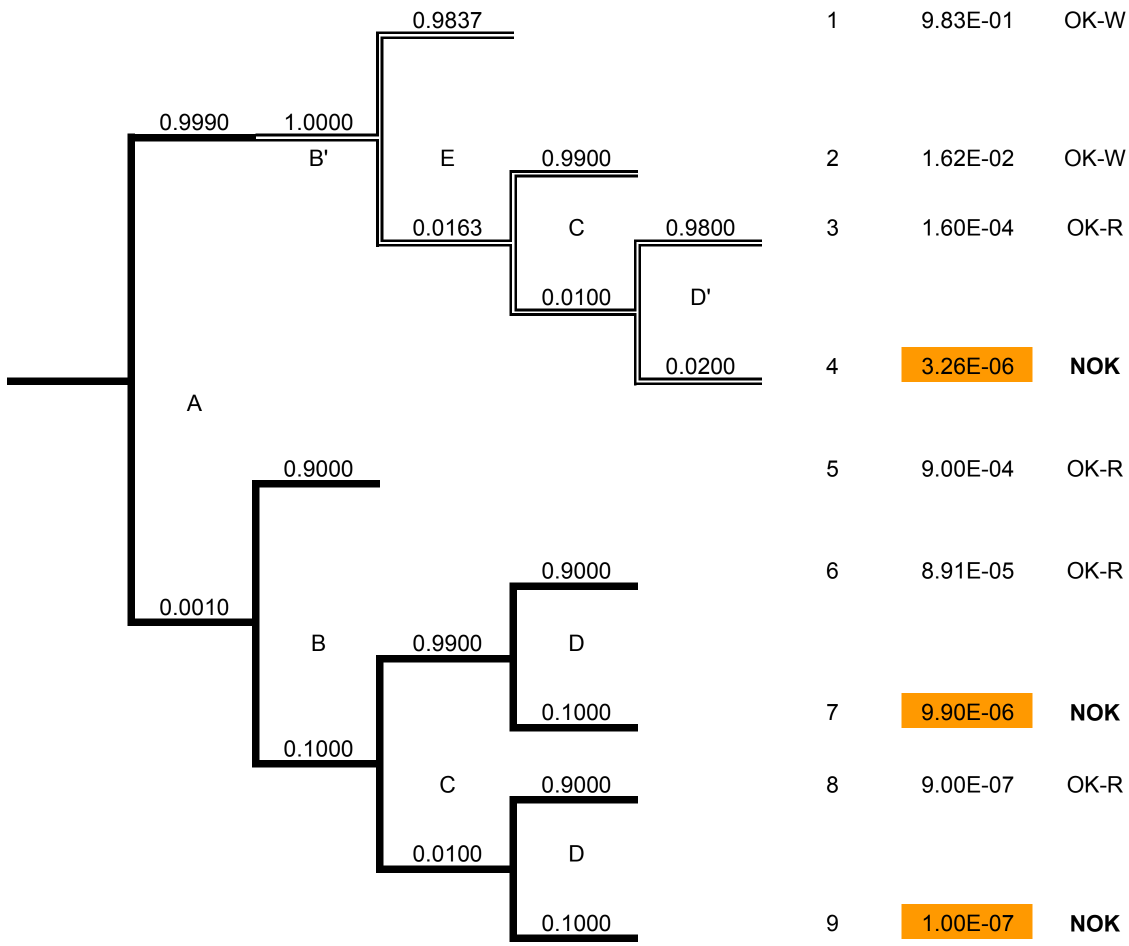
The event sequence tree shows nine developed sequences; each is labeled with an identification number, an end-state status, and an end-state probability. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. There are three end-state status indicators, as indicated in Table 6.2-4.

Table 6.2-4. End-state Status Indicators for Surface Contamination Event Sequence Tree

End-state Status	Description
OK-W	This end-state results when no actions in the event sequence tree could cause the component to be subjected to contamination. At worst, such a component could be incorrectly rejected via the checking process. This would have economic consequence, but would not place into service a WP with contamination.
OK-R	This end-state results when a component that is subjected to contamination and discovered via the checking process. In these cases, the component/WP will be either reworked or the cleaning agent will be replaced.
NOK	This end-state results when a component that is subjected to contamination that is not discovered by any of the means available, and is put into service. The probabilities for these end-states are summed to produce the total probability.

Note that three of the sequences are truncated (only partially developed). In sequence (1) the correct cleaning agent is used on a component with no contamination; there can be no failure state no matter how poorly the cleaning or subsequent check is performed. In sequence (2), while there is a contaminated component, the cleaning process is successful in removing it; the check can only verify this. At worst, an incorrect check will remove an acceptable component from service. The last sequence, (5) ends with the discovery of an improper cleaning agent prior to use.

The contamination probability per cleaning estimated by the event sequence tree is 1.0×10^{-5}; the probability estimated for the last cleaning is 1.3×10^{-5}. It is estimated that the outer barrier will be subjected to six cleanings prior to the final cleaning before emplacement (three welds, prior to heat treatment/annealing, prior to shipping, and prior to SNF loading). Therefore, the total probability for a WP with a contaminated Alloy 22 outer barrier is: $6 \times 1.0 \times 10^{-5} + 1.3 \times 10^{-5} = 7.3 \times 10^{-5}$. Since the inner stainless steel barrier would only be subjected to four cleanings (three welds and prior to fit into inner barrier), the probability of contamination is lower: $4 \times 1.0 \times 10^{-5} = 4 \times 10^{-5}$ per WP.



Note: double lines only applies to the last cleaning

Sum of the NOK sequences	1.00E-05
Sum of NOK sequence (with last cleaning)	1.33E-05

Figure 6.2-6. Event Sequence Tree for Estimating Probability of Surface Contamination

Consequences

The specification for fabrication of the WPs will restrict the chemical compositions of the cleaning materials and solvents (CRWMS M&O 1999d, Sections 6.2 and 6.15). Currently the allowable materials are restricted as follows:

> "Expendable materials such as cleaning solvents, temperature indication sticks, tapes, nondestructive examination (NDE) penetrant materials, and other compatible materials that contact stainless steel or Inconel surfaces shall be low chloride/halogen (less than 100 parts per million [ppm]) and shall not contain more than 200 ppm total of metal and metal salts such as zinc, lead, copper, cadmium, mercury or other low melting metals.

> This concentration shall be determined as the net concentration of these metals, regardless of whether they are present as metals, alloys, salts, or other compounds. In addition, no halogenated cleaning agents or solvents shall be used on austenitic stainless steel or Inconel except technical grade trichlorotrifluoroethane (FREON TF)."

The fabrication process also calls for removal of all contaminants prior to heat treatment, and other operations. However, as indicated above, human error could cause either the cleaning to be insufficiently carried out or not carried out at all. This could potentially lead to surfaces contaminated with dried solvents. The consequence of this error is not expected to be significant from the corrosion standpoint. The WP materials have been undergoing long-term corrosion tests in concentrated (1,000 times) environments expected in the repository, and these test environments include significantly high chloride concentrations (~7,000 ppm) and acidic conditions (pH of 2.7) compared to the potential contamination and do not exhibit increased corrosion rates (McCright 1998, Table 2.2-8). However, the potential impact of contamination by restricted materials, unremoved solvents, or on localized corrosion mechanisms will be evaluated in detail in a separate analysis.

6.2.5 Improper Handling

Probability

This section estimates the probability that a WP is subjected to handling damage during transport to the repository or during subsequent handling at the repository. Handling damage is defined as any gouging or denting of the WP surface that is significant enough to affect postclosure performance of the Alloy 22 barrier. For this analysis, it is considered that damage significant enough to cause penetration of the barrier would so deform the package that it would not fail to go unnoticed (malicious intent is not considered). Furthermore, such a breach occurring after SNF had been loaded would be likely to activate alarms that would facilitate its identification more readily than a passive inspection.

To develop the probability of handling damage, an event sequence tree focusing on human errors was constructed. The probability of this defect is estimated on a per WP basis. Several assumptions have been made to develop the event sequence tree and subsequent calculations (as discussed below). These assumptions are summarized in Section 5.6. The following human error probabilities and equipment/process failure rates have been used to quantify the tree:

- Handling damage during transport of the WP or handling at the repository occurs with a probability of 0.0005 based on the rate of PWR fuel assembly handling damage (see Assumption 5.6 and Section 6.1.2).
- Failure of the operator moving the WP to realize that he has caused damage to the package as a result of a handling error is taken to be 0.01. NRC (1983, pp. 4-24) indicates that most tasks performed in nuclear industry environments have very low human error probabilities, typically on the order of 10^{-3}. This has been conservatively increased by a factor of 10, to 0.01, for this situation. This is further supported by HEPs that are available for events where an operator fails to notice that a component

being manually operated has not functioned properly. For example, the HEP for a person failing to detect a stuck manual valve with no means of position indication is 0.01 (Swain and Guttmann 1983, pp. 20-30).

- Failure of the inspections for damage are approximated by a check failure using written procedures with an HEP of 0.1 (Swain and Guttmann 1983, pp. 20-38).

Table 6.2-5 provides detailed descriptions of the actions in the handling damage event sequence tree. Figure 6.2-7 shows the event sequence tree in its entirety. This tree was quantified in the "Handling Damage" sheet of the Excel 97 spreadsheet Seq-Trees.xls (see Attachment II).

Table 6.2-5. Description of Actions in Handling Damage Event Sequence Tree

Identifier	Description
A	DC is transported from the fabricator to the repository without damage.
B	Inspection of DC at arrival finds damage.
B'	No failure to identify.
C	WP is handled at repository without damage.
D	Operator moving package realizes damage occurred.
D'	Operator makes no error to identify.
E	Final inspection of package identifies damage.
E'	No failure to identify.

Note : DC – A disposal container is an empty WP.

The event sequence tree shows ten developed sequences; each is labeled with an identification number, an end-state status, and an end-state probability. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. There are three end-state status indicators (OK-W, OK-R, and NOK) that follow the same pattern as in Tables 6.2-2 and 6.2-4 for WPs that are placed into service with unidentified handling damage. The resulting probability that a WP is emplaced with unidentified handling damage is 5.1×10^{-6}. Discussion of the truncated sequences and uncertainty is similar to the discussion provided for the improper heat treatment and surface contamination sequence event trees. Note, in particular, that sequence 5 is truncated after damage due to transport is discovered; the WP would then be removed from the stream to be repaired and later re-enter the WP stream.

The probability of damage to the inner stainless steel barrier is much lower than for the outer Alloy 22 barrier, because it can only be scratched or gouged prior to fit-up with the outer barrier at the fabricator. The probability of stainless steel barrier damage can be estimated simply by inspection of the upper portion of the event tree in Figure 6.2-7 (the success path from A). The probability of damage would essentially be the same as that for sequence 4 in Figure 6.2-7, except that the first event in the sequence must be removed (set A=1). Events B, C, and D would then represent handling and inspection of the inner barrier at the fabricator prior to fit-up. The resulting probability of unidentified stainless steel barrier handling damage is 5×10^{-7} per WP.

Consequences

Gouges on the WP outer surface may provide sites for crevice corrosion of the Alloy 22. This would also be the case for gouges on the outer surface of the stainless steel barrier once the Alloy 22 barrier has been penetrated. The potential impact of gouges on localized corrosion mechanisms will be evaluated in detail in a separate analysis.

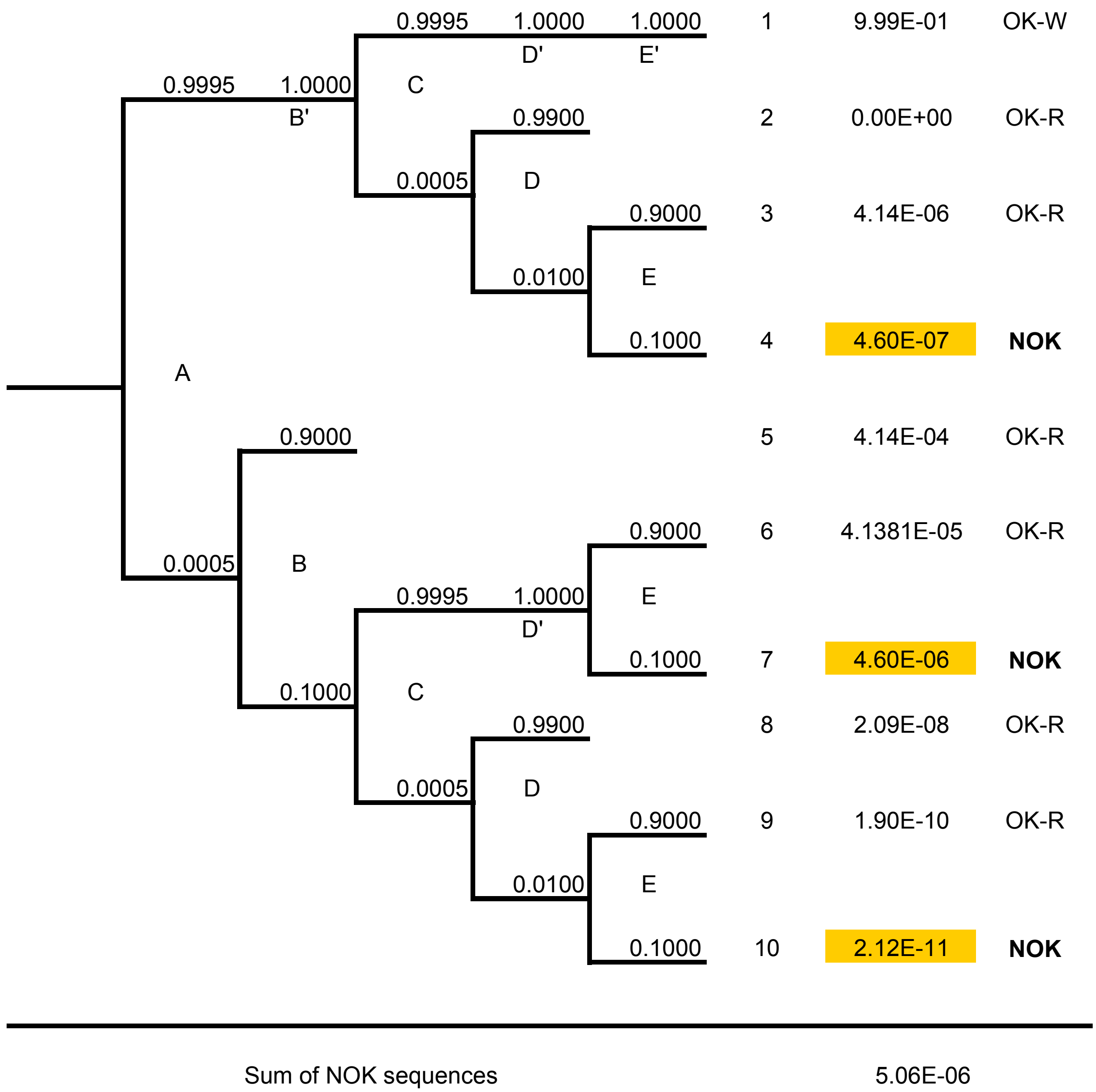


Figure 6.2-7. Event Sequence Tree for Estimating Probability of Handling Damage

6.2.6 Administrative Error Leading to Unanticipated Conditions

The administrative error leading to an unanticipated operating environment must be more specifically defined for a WP so it can be evaluated. The types of administrative errors that could lead to unanticipated operating conditions are those that could affect the WP surface temperature and humidity history and thus impact corrosion rates, result in placement in prohibited areas, or allow water to contact the WP at times earlier than expected.

The first type of error could result if the WP were accidentally misloaded such that its thermal output is not within the expected range. For the second type of error, the only current prohibition on WP placement relates to placement across faults. Since only a small fraction of WPs could even be subjected to such an error, and the probabilistic seismic hazards analysis (CRWMS M&O 1998d, Table ES-3) has determined that the mean fault displacement with an annual return probability of 10^{-4} is < 1 mm (TBV-3454), there is no consequence expected for postclosure performance. Therefore, this event will not be considered further. The last type of error could result if human error during placement of the drip shield results in a gap between drip shield segments. The following subsections will evaluate the probability and consequences of these types of administrative errors.

6.2.6.1 Waste Package Outside of Thermal Design Basis Due to Misload

Probability

The probability that a WP is accidentally loaded with fuel that is not within its thermal design basis was previously estimated in the *Waste Package Design Basis Events Analysis* (CRWMS M&O 1997, p. 53) for the Viability Assessment (VA) WP loading strategy. The probability/frequency estimates considered two types of human errors that the operator might commit when selecting the WP and/or the fuel assembly to be loaded: conceptual and selection. A conceptual error represents intentionally selecting the wrong item based on the erroneous belief that it is the correct item. The latter (selection error) represents simply an unintentional selection of the wrong item while trying to select the correct one. The previous analysis estimated the probability that one assembly exceeded the thermal design basis of the WP being loaded was 3.5×10^{-5} per WP for PWR packages, and 7.8×10^{-3} per WP for BWR packages. The probability that an entire package was misloaded with fuel that exceeded its design basis was estimated to be 5×10^{-5} per WP for both types of SNF.

Since the above estimates were performed for the VA loading strategy (sorting based on assembly heat output), they are not directly applicable to the current strategy of blending fuel to achieve a desired range of heat output (CRWMS M&O 1999c, p. O-13). Blending has the potential to increase the probability of misloads because desired thermal output is no longer guaranteed simply by selecting the correct assemblies. Instead, the assemblies to be loaded into each package must be planned out before loading begins to ensure that the resulting heat output is within the acceptable range (e.g., a loading diagram must be developed), leading to an additional potential source of error.

Many assumptions have been made to develop the event sequence tree and subsequent calculations (as discussed below). These assumptions are summarized in Section 5.7. The following human error probabilities have been used to quantify the tree:

- The probability that an error is made in the development of the loading diagram is approximated with an HEP of 0.003, for writing an item incorrectly in a formal procedure (Swain and Guttmann 1983, pp. 20-21).

- Failure of the loading diagram check, and the check of a loaded WP, are approximated by a check failure using written procedures with an HEP of 0.1 (Swain and Guttmann 1983, pp. 20-38).
- The HEP analysis (selection + conceptual errors) for misloading an assembly is 0.006 (CRWMS M&O 1997, Attachment VII, p. 12).
- Failure to match components with proper written procedures is approximated by failing to properly read a digital display with an HEP of 0.001 (Swain and Guttmann 1983, pp. 20-26).

Table 6.2-6 provides detailed descriptions of the actions in the thermal misload event sequence tree. Figure 6.2-8 shows the event sequence tree in its entirety. This tree was quantified in the "Thermal Misload" sheet of the Excel 97 spreadsheet Seq-Trees.xls (see Attachment II).

Table 6.2-6. Description of actions in WP Thermal Misload Event Sequence Tree

Identifier	Description
A	Development of WP loading diagram.
B	QA check of WP loading diagram (if the QA check is successful, the loading diagram will be modified to reflect the correct information).
B'	No failure to be uncovered by loading diagram check.
C	Loading of proper SNF (conceptual and selection errors).
C'	Guaranteed failure due to improper loading diagram.
D	QA check of loaded WP against loading diagram.
D'	No failure to be uncovered by loading check (consistent with loading diagram).
E	Verification that WP thermal output is within allowable range.
E'	No failure to be uncovered by WP thermal verification.

The event sequence tree shows ten developed sequences; each is labeled with an identification number, an end-state status, and an end-state probability. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. There are three end-state status indicators (OK-W, OK-R, and NOK) that follow the same pattern as in Tables 6.2-2 and 6.2-4 for WPs that are placed into service with a thermal misload. For this event sequence tree, there is an additional set of end-state probabilities showing the effect of no WP thermal verification step. Note that sequences 3&4, 7&8, and 9&10 each collapse into a single sequence. The probability of misload is estimated to be approximately 1×10^{-3} per WP by summing the NOK sequence probabilities. This probability could be reduced to 1×10^{-6} per WP if a thermal measurement of the loaded WP is made to verify that it is within the allowable limit. These probabilities are expected to be conservative because the probability that the pool contains fuel that could cause the WP thermal limits to be violated if it were misloaded, or the probability that the operator selects such an assembly rather than a benign one, has not been considered. Discussion of the truncated sequences and uncertainty is similar to the discussion provided for the improper heat treatment and surface contamination sequence event trees.

Consequence

A WP with a thermal output that is above the allowable limit would be expected to have a somewhat different surface temperature history than may be assumed in performance assessment modeling. Since corrosion models for WP materials typically include surface temperature as one of the inputs, thermal misload has the potential for affecting the failure time of the package.

Figure 6.2-9 provides the WP surface temperature as a function of time for WPs of varying thermal output in the 83 MTU/acre VA repository. Based on this information, it is evident that WP surface temperatures are roughly equivalent after the first 200 years, regardless of the initial thermal output of the WP. Thus, a thermal misload would not be expected to have any significant consequences for postclosure performance of the WP barriers.

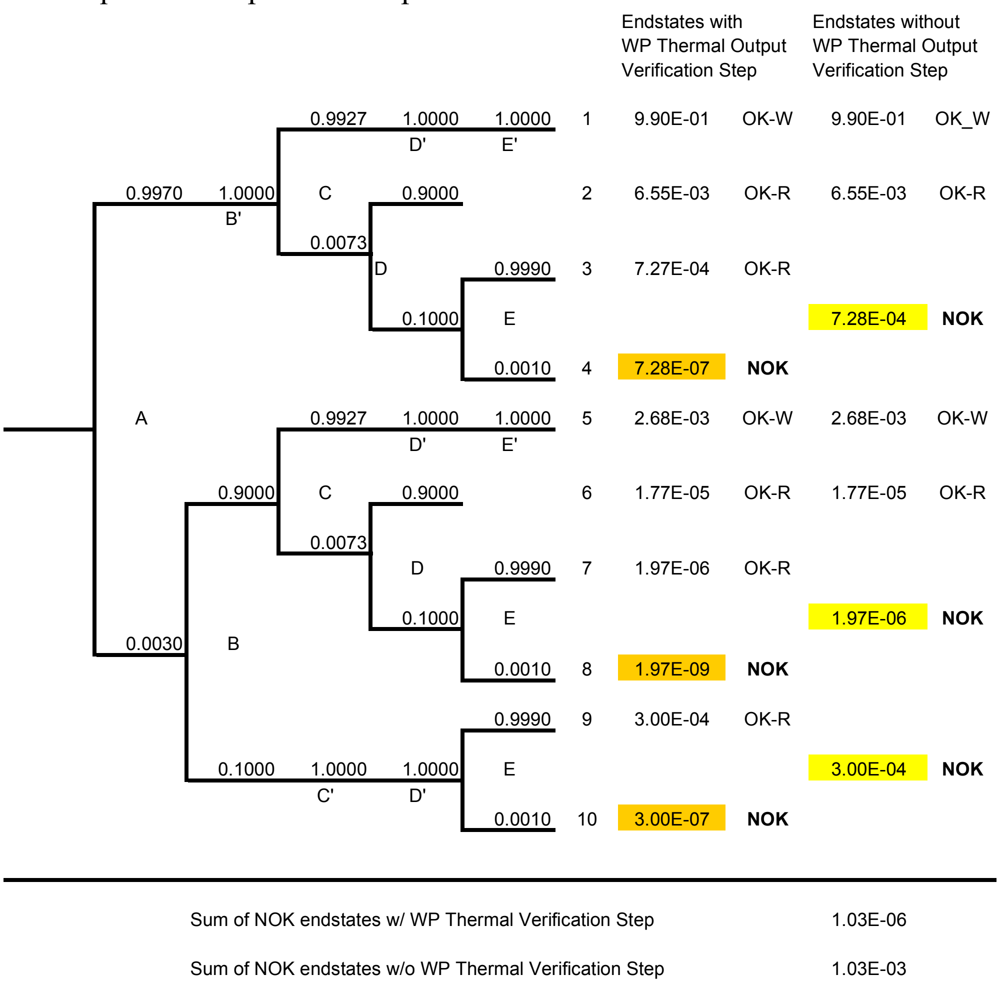


Figure 6.2-8. Event Sequence Tree for Estimating Probability of Thermal Misload

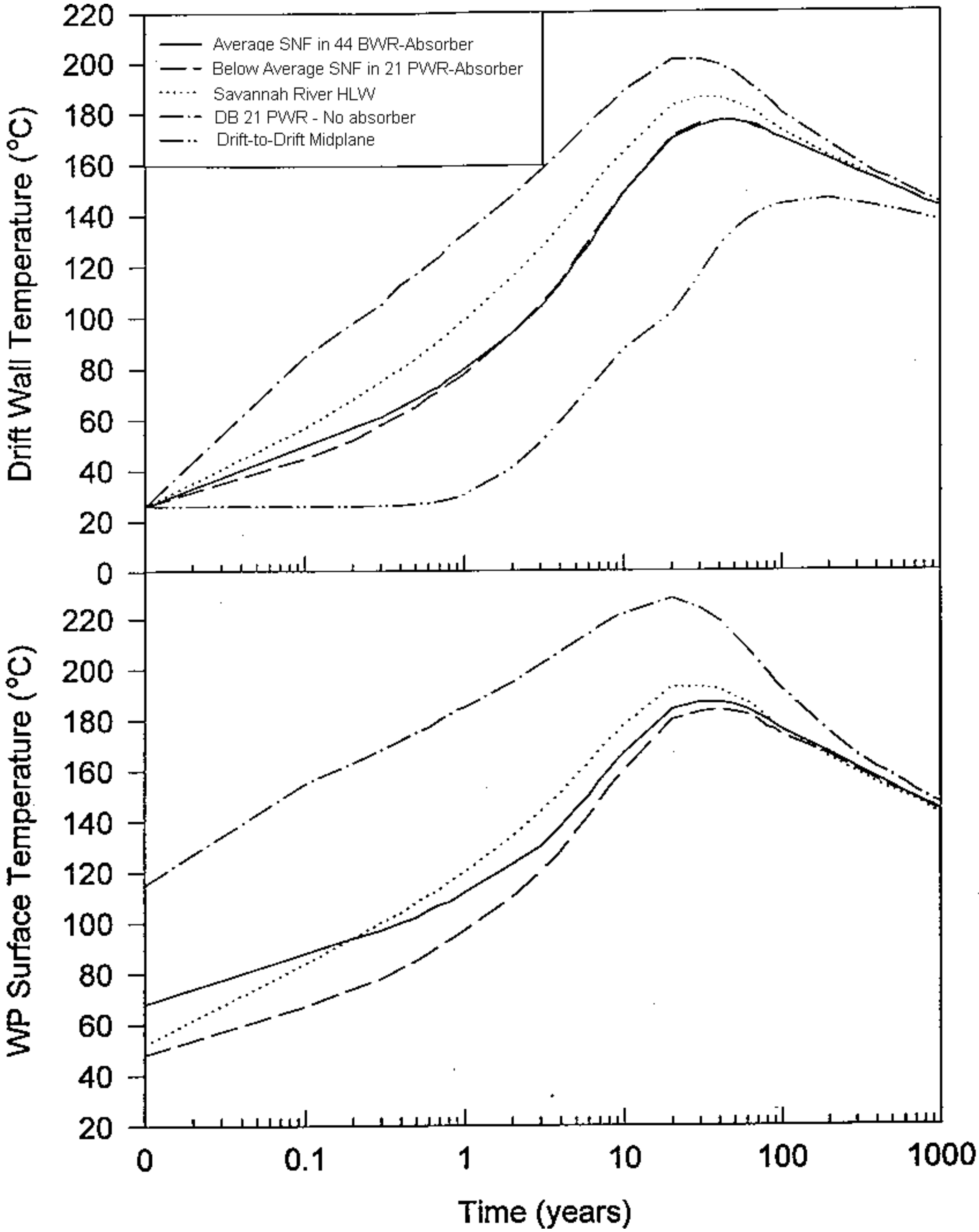


Figure 6.2-9. Effect of Thermal Output on Emplaced WP Surface Temperature
(CRWMS M&O 1998b, p. 33)

6.2.6.2 Drip Shield Emplacement Error

Probability

The current engineered barrier design (CRWMS M&O 1999c, p. O-13) includes a titanium drip shield that would be placed over the WPs at the time of repository closure to provide defense-in-depth for postclosure performance. The drip shield will be continuous down the entire length of the drift, and will be fabricated and emplaced in 1.8 meter long segments (see Attachment V). Emplacement of the drip shield will be accomplished remotely by using a mobile gantry (CRWMS M&O 1998c, p. 24). Each segment will slightly overlap the previously emplaced segment. Installation of the drip shield segments will occur just prior to closure of the MGR. Once the drip shield has been installed down the entire length of the drift, backfill will be placed over the drip shield using a belt conveyor on a mobile gantry (CRWMS M&O 1998c, p. 15).

The benefits of the drip shield could be diminished for a particular package if the operator fails to overlap the drip shield with the previously emplaced segment, such that a large separation exists that would allow any dripping water above it to directly fall onto the package below. To estimate the probability of this occurring, the event sequence tree shown in Figure 6.2-10 was developed. The assumptions used to develop the event sequence tree are summarized in Section 5.8. The following human error probabilities have been used to quantify the tree:

- The probability that the operator fails to properly place the drip shield such that it overlaps the previously placed drip shield is based on the HEP for improperly mating a connector, 0.003 (Swain and Guttmann 1983, pp. 20-28). Since there are two drip shield joints per package for 1.8 m drip shield segments, the probability of having at least one improperly mated joint over a WP is 0.006. Since the drip shield is larger than the type of connector for which the HEP was developed, and is being mated remotely, the maximum error factor of 3 (Swain and Guttmann 1983, pp. 20-28) is applied, for a final probability of 0.0178 per WP for a misplaced drip shield.
- Failure of the operator self-check, and the QA check of emplaced drip shields, are approximated by a check failure using written procedures with an HEP of 0.1 (Swain and Guttmann 1983, pp. 20-38).

Table 6.2-7 provides detailed descriptions of the actions in the drip shield emplacement error event sequence tree. This tree was quantified in the “Drip Shield” sheet of the Excel 97 spreadsheet Seq-Trees.xls (see Attachment II).

Table 6.2-7. Description of Actions in the Drip Shield Emplacement Error Event Sequence Tree

Identifier	Description
A	Operator properly mates drip shield to previously emplaced drip shield.
B	Operator finds gap during self-check of his work.
B'	No failure to be found by self-check.
C	QA check of emplaced drip shields finds gap.
C'	No failure to be found by QA check.

The event sequence tree shows four developed sequences; each is labeled with an identification number, an end-state status, and an end-state probability. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. There are three end-state status indicators (OK-W, OK-R, and NOK) that follow the same pattern as in Tables 6.2-2 and 6.2-4 for misplaced drip shields. The probability is calculated by multiplying the probabilities of each of the events that appear in a given sequence. Only one sequence leads to a misplaced drip shield, with a probability of 1.8×10^{-4} per WP. Discussion of the truncated sequences and uncertainty is similar to the discussion provided for the improper heat treatment and surface contamination sequence event trees.

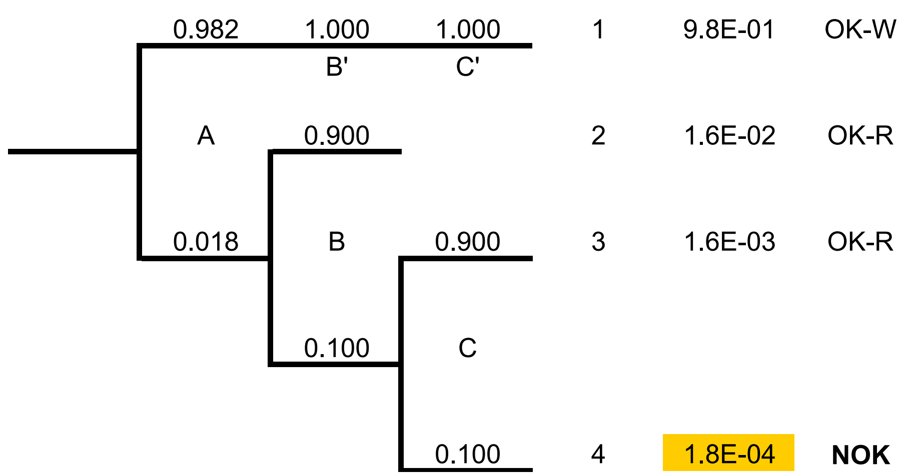


Figure 6.2-10. Event Sequence Tree for Estimating Probability of Drip Shield Emplacement Error

Since the drip shield design presented in Attachment V represents a conceptual design that is subject to change, a simple sensitivity study has been performed. As indicated above, the drip shield dimension that affects this probability is the drip shield length. If a fixed length drip shield is used for all packages (which has thus far been a common trait of all drip shield designs discussed), then this translates directly to the number of drip shield segment joints per WP. If the drip shield segment length is increased to approximately the same length as a commercial SNF WP, then the frequency of joints being located over a WP will be less than one per package. Figure 6.2-11 shows the effect of the frequency of drip shield segment joints on the probability of drip shield emplacement error. This figure was produced simply by varying the number of drip shield joints per WP in cell D29 of the "Drip Shield" sheet of the Excel spreadsheet Seq-

Trees.xls.

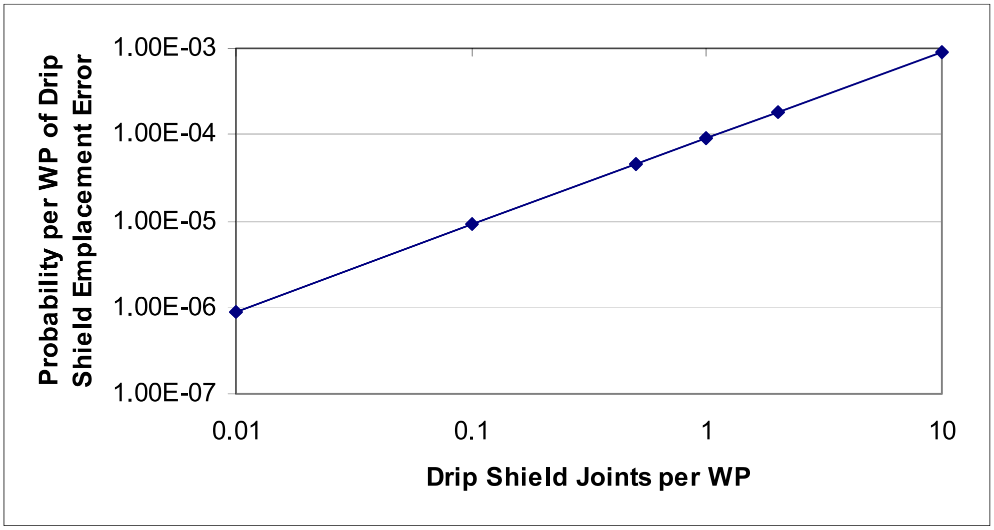


Figure 6.2-11. Effect of the Drip Shield Segment Joint Frequency on the Drip Shield Emplacement Error Probability

Consequences

A drip shield emplacement error that results in a gap between adjacent segments will essentially allow dripping water to contact the WP as soon as dripping begins above the location of the gap.

6.3 Uncertainty Estimates

The inputs used to estimate the probability of various defects (potentially leading to early failures of a WP) are open to interpretation and uncertainty. In particular, the human error probabilities used to quantify the event sequence tree represented an approximate match from Swain and Guttmann (1983, Chapter 20) to the actions that could lead to a WP defect. To develop an upper bound for an event sequence probability based on the uncertainty of the modeled human actions, an uncertainty analysis was performed. This analysis only applies to those defects for which probabilities were estimated using event sequence trees, namely: drip shield emplacement error, WP handling error, WP surface contamination, thermal misload, and improper heat treatment.

The method used to establish an upper bound value for event sequences combines the human error rates probabilistically to develop an "upper bound." Uncertainties were considered only for human error probabilities related to failures. Probability components for success are treated at their nominal level, which produces conservative results. (When considering the upper bound of a failure probability, the success probability would be lowered, ultimately lowering the event sequence probability in which success appears. Accordingly, treating the “success” probabilities at their nominal probability is conservative.) No upper bounds were estimated for other failure probabilities related to mechanical failure or based on historical data. Accordingly, the upper bound for event sequence probability is adjusted for only human error probability uncertainty.

Swain and Guttmann (1983, pp. 2-17 through 2-19) discusses the meanings and assumptions associated with basic event human (nominal) error probabilities (X_m) and their range factors (RF). Specifically, it is assumed that the human error probabilities for each task are distributed lognormally (or approximately so). The nominal human error probability is designated as the median of the lognormal distribution, while the lower uncertainty bound (X_m/RF) represents the 5^{th} percentile on the lognormal distribution, and the upper uncertainty bound (RF*X_m) represents the 95^{th} percentile. These lognormal values, with their normal distribution equivalents are shown in the table below. Note that the logarithm of the median (X_m) is the mean of the associated normal distribution (or the median of the lognormal distribution equal e^{μ}, where : is the first distribution parameter of the lognormal distribution or the mean of the associated normal distribution; see Patel 1976, pp. 28-29).

Table 6.3-1. Normal Distribution Equivalents Of Lognormal Percentiles

Distribution Percentile	5%	Location parameter	95%
Value	X_m/RF	X_m (median)	RF * X_m
Normal distribution equivalents	$\ln(X_m) - \ln(RF)$	$\ln(X_m)$ (mean)	$\ln(X_m) + \ln(RF)$

From this information, the standard deviation, F, of the associated normal distribution can be estimated:

$$F = (x_{95\%} - :)/1.645 \quad \text{(Eq. 1)}$$

$$= \left\{\ln(X_m) + \ln(RF) - \ln(X_m)\right\} / 1.645$$

$$= \ln(RF) / 1.645 \quad \text{(Eq. 2)}$$

Snedecor and Cochran (1967, pp. 35-39), discusses the normal distribution and its use, and provides the basis for the relationship shown in equation [1].

The conversion to logarithms permits the use of summing the logarithms of the median error rates to establish the nominal logarithm for the sequence, $Y_{sequence}$, through the properties of logarithms. Treating the variability of this additive relationship involves summing the variance estimates of the branch events, S^2_{branch} to obtain $S^2_{sequence}$, assuming these are independent. The validity of the summing of means and variances is easily shown by examining a case where R = XYZ, and x, y and z are distributed lognormally. This can be restated as $\ln(r) = \ln(x) + \ln(y) + \ln(z)$, with ln(x) being normally distributed with mean μ_x and variance σ_x^2, ln(y) being normally distributed with mean μ_y and variance σ_y^2, and ln(z) being normally distributed with mean μ_z and variance σ_z^2. It follows directly that the distribution of ln(r) is normal, with mean $\mu_r = \mu_x + \mu_y + \mu_z$ and variance $\sigma_r^2 = \sigma_x^2 + \sigma_y^2 + \sigma_z^2$.

The desired final result for a sequence is the 95th percentile. Again, from Snedecor and Cochran (1967), this is:

$$Y_{Sequence} + 1.645\ S_{Sequence}$$

An example calculation is shown below. Assume an event tree sequence consists of three human error probabilities/range factors:

A	0.1	5
B	0.01	3
C	0.001	5

The nominal probability for the sequence is $0.1 * 0.01 * 0.01 = 1x10^{-5}$

The mean of the lognormal distribution representing the event sequence probability, $Y_{sequence}$, is:

$$\ln(0.1) + \ln(0.01) + \ln(0.01) = -11.51$$

The variance, $S^2_{sequence}$, of this distribution is (from equation [2]):

$$(\ln(5)/1.645)^2 + (\ln(3)/1.645)^2 + (\ln(5)/1.645)^2 = 2.36$$

From these values, using equation [1], the 95th percentile value (upper uncertainty bound (UCB)) for the lognormal distribution representing the event sequence probability (i.e., the product of the individual human error probabilities) is:

$$\begin{aligned} UCB\ (x_{95\%}) &= \exp\{\ Y_{sequence} + 1.645 * \mathrm{sqrt}(S^2_{sequence})\ \} \\ &= \exp\ \{\ -11.51 + 1.645 * \mathrm{sqrt}(2.36)\ \} \\ &= \exp\ \{\ -8.98\ \} = 1.3x10^{-4} \end{aligned}$$

This process for calculating the sequence UCB was applied to each NOK sequence of the event sequence tree. The details of the calculations are contained in the Excel spreadsheet Seq-Trees.xls (see Attachment II), and shown in the column labeled "95th Percentile." The spreadsheet also shows that for non-human error probabilities and human success probabilities, an "n/a" was placed in the "range factor" slot, indicating that no uncertainty calculation was performed. These unaffected probabilities were multiplied together (and shown in the column labeled "Branches not subject to uncertainty"), and then multiplied by the UCB for the adjusted human error probabilities to generate an upper bound value for the entire sequence. The upper bound value for the sequences are summed to generate the upper bound value for the event sequence tree. The upper bound value for the Contamination event sequence tree, however, is not a simple sum. As discussed in Section 6.2.4, the event sequence tree estimates the probability of contamination *occurring on a per-cleaning basis*. Therefore, the upper bound value for the contamination tree is a function of the number of cleanings, and is calculated in the same manner as the nominal value. The original event sequence tree probabilities (nominal values), and the results of the uncertainty calculations are provided in Table 6.3-1.

Table 6.3-1 does not include uncertainty estimates for weld or base metal flaws, or improper weld material. These defect probabilities were estimated directly from information on the occurrence rate of the flaw per unit length or mass of material. As such, a Poisson process may be applied to estimate the probability that the defect will occur a given number of times on a single WP.

Table 6.3-2. Summary of Uncertainty Results for Failure Probabilities

Early Failure Mechanism	Sum of NOK sequences (nominal)	Sum of NOK sequences (adjusted for HEP uncertainties)
Drip Shield Emplacement Error	1.8×10^{-4}	2.3×10^{-3}
Handling Damage	5.1×10^{-6}	3.6×10^{-5}
Surface Contamination	7.3×10^{-5}	1.4×10^{-3}
Thermal Misload (w/Thermal Verification)	1.0×10^{-6}	7.4×10^{-6}
Thermal Misload (w/o Thermal Verification)	1.0×10^{-3}	3.9×10^{-2}
Improper Heat Treatment	2.2×10^{-5}	1.7×10^{-4}

7. CONCLUSIONS

The first part of this analysis (Section 6.1) performed a review of available literature on defect-related early failures of welded metallic components. Types of components examined included: boilers and pressure vessels, nuclear fuel rods, underground storage tanks, radioactive cesium capsules, dry-storage casks for spent nuclear fuel, and tin-plate cans. The fraction of the total population that failed due to defect-related causes during the intended lifetime of the component was generally in the range of 10^{-3} to 10^{-6} per container. In most cases, defects that led to failure of the component required an additional stimulus to cause failure (i.e., the component was not failed when it was placed into service). In fact, there were several examples that indicated that even commercial standards of quality control could reduce the rate of initially failed components well below 10^{-4} per container.

The literature review also identified eleven generic types of defects that caused early failures in the components examined. These are: weld flaws, base metal flaws, improper weld material, improper heat treatment, improper weld flux material, poor weld joint design, contaminants, mislocated welds, missing welds, handling/installation damage, and administrative error resulting in an unanticipated environment. However, the duration of time required for a defect of a given type and severity to lead to failure is highly dependent on the service conditions in which the component is subjected. As a result, there is insufficient information available in the literature to defensibly relate the cumulative effect of the environment or stresses to which the examined components were subjected to the WP. In addition, factors such as the differing degrees of inspection and the extent to which different materials are affected by a given type of defect, make direct extrapolations of defect-related failure rates indefensible. Accordingly, the information on the fraction of components that experienced defect-related failure during their intended service life were not directly applied to WPs. However, information on the frequency of occurrence of particular types of defects was related to a WP in some cases.

The second part of the evaluation (Section 6.2) focused on estimating the probability that specific defect types will occur on a WP barrier despite a set of quality controls designed to prevent their occurrence. This was done for seven of the eleven generic defect types identified in the literature review. The remaining four defect types (improper weld flux, missing welds, mislocated welds, and poor joint design) were judged to be inapplicable to WPs (see Section 6.2 for details) or estimated to have a sufficiently low enough probability such that they could be considered incredible. The estimated probabilities for applicable/credible defect types are summarized in Table 7-1 for both the Alloy 22 and stainless steel barriers. In the case of weld and base metal flaws, the probability of occurrence is dependent on the depth of the flaw, and Figures 6.2-3 and 6.2-4 should be consulted to determine the probability of the specific flaw depth in question. Sections 6.2.1 through 6.2.6 summarize the methods used to develop the probabilities for all of the defect types. Users of the information presented in these tables and figures should verify that the assumptions made in Section 5 regarding WP fabrication and inspection methods are applicable to the WP design being considered. Furthermore, several TBV inputs have been used in the analysis and are listed in section 8.1.

Section 6.2 also provided general information on the consequences of a particular defect type on the postclosure performance of the WP. A summary of this information is provided in Table 7-1. The detailed consequences of defects that impact localized corrosion, or stress corrosion cracking, degradation mechanisms for a particular barrier will be evaluated as part of separate analyses that specifically address these degradation mechanisms.

Table 7-1. Summary of Estimated Probabilities and Performance Consequences for Various Types of WP Defects

WP Defect Type		**Probability per WP**		**Possible Consequences for Post-Closure Performance**				
		Alloy 22 Barrier	**SS Structural Barrier**	**Minimal Effect**	**Degraded Mechanical Properties**	**Pitting or Crevice Corrosion**	**SCC**	**Early Water Contact**
Weld Flaws (Outer Surface Breaking Only)		< 10^{-4} for flaws > 4 mm (see Figures 6.2-3 and 6.2-4)	< 10^{-4} for flaws > 10 mm (see Att. III)			X	X	
Base Metal Flaws		Factor of 10^{-4} lower than uninspected weld flaw rate (see Figures 6.2-3 & 6.2-4)				X	X	
Improper Weld Material		1.5×10^{-5}	3.0×10^{-5}		X	X		
Improper Heat Treatment		2.2×10^{-5}			X	X	X	
Surface Contamination		7.3×10^{-5}	4.0×10^{-5}			X		
Handling Damage		5.1×10^{-6}	5.1×10^{-7}			X		
Administrative Error Leading to Unanticipated Environment	Thermal Misload of WP	1.0×10^{-3} to 1.0×10^{-6}		X				
	Drip Shield Emplacement Error	1.8×10^{-4}						X

8. INPUTS AND REFERENCES

8.1 TBVs Used in the Analysis and Assumptions to be Confirmed

The TBVs used in the analysis are listed hereafter :

TBV-3446 : Reliability of UT inspection
TBV-3448 : Information on the distribution of the flaw angle from a line normal to the surface of the weld
TBV-3450 : WP heat treatment process description; WP cleaning process description
TBV-3454 : Estimate of the mean fault displacement with a given annual return probability
TBV-3459 : Use of flaw size distribution, flaw aspect ratios
TBV-3460 : Reliability of UT detection of IGSCC cracks in stainless steel
TBV-3461 : Weld flaw density and size distributions
TBV-3462 : RR-Prodigal results

In addition, the assumptions which were used in the analysis and will require further confirmation are listed hereafter :

Assumption 5.1 : Assumption that the weld flaw density and size distribution information for tungsten-inert-gas (TIG) welded stainless steel can be applied to TIG welded Alloy 22 (UNS N06022).

Assumption 5.9 : Assumption that the dimensions, materials, and masses of the components indicated on the sketches of the WP and drip shield in Attachments IV and V may be used for this analysis.

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8.3 List of Attachments

Attachments to this document are listed in Table 8-1 below.

Table 8-1. List of Attachments

Attachment Number	Description	Size (pages)
I	Test cases for verification of Excel calculations	4
II	Excel spreadsheet Seq-Trees.xls	17
III	Excel spreadsheet WPflaw.xls	65
IV	Sketch of Single CRM 21-PWR WP	1
V	Sketch of Corrugated Drip Shield	1

The following attachments are in electronic form. Each file is identified by its name, size (in bytes), and the date and time of last access.

DOS Filename	byte size	date	time	WIN95 filename	Data Tracking Number
WPFLAWS XLS	1,025,024	10-06-99	9:50p	WPflaws.xls	MO9910SPAFWPWF.001
SEQ-TR~2 XLS	82,432	10-06-99	9:50p	Seq-Trees.xls	MO9910SPAWPJFR.000

This attachment is aimed at verifying that Excel spreadsheets WPflaws.xls and Seq-Trees.xls provide correct results for the range of input parameters used in the analysis.

Verification for Excel Spreadsheet WPflaws.xls :

The spreadsheet WPflaws.xls has been developed to calculate the probabilities associated to various size flaws located on outer surface of Alloy 22 shell and lid welds. This attachment is a verification of the calculation of WPflaws.xls.

Several types of input parameters are used in these hand calculations. These are :

- Weld thickness : ranging from 20 to 25 mm,
- Total weld length : ranging from 4.56 to 4.78 m,
- Total flaw density for a 1-inch thick weld : ranging from 0.6839 (with RT and PT inspection) to 8.8271 (without RT and PT inspection) flaws per meter of weld,
- Flaw density factor relative to 1-inch thickness : ranging from 0.64 to 0.97,
- Flaw density repartition factor, according to flaw location : 0.34% of the flaws are located on outer surface,
- UT PND : ranging from 0 to 1,
- Flaw depth : ranging from 0 to 100% of the weld thickness.

The probability that a flaw depth be comprised between x-0.5 and x percent of the weld thickness has been assessed for three different values of x, representative of its range : 3%, 50%, 97%. This evaluation has been perfomed for outer surface of Alloy 22 shell and lid welds, with and without PT, RT and UT inspections accounted for. The calculations have been performed on a hand calculator following the approach explained below :

- As mentioned in Section 6.2.1, the flaw size follows a lognormal distribution. The parameters of the associated normal distribution, i.e. : median (or mean *m*) and standard deviation (or shape parameter σ) of ln(x), can be expressed as :

  $$m = 0.1159 - 0.0445a + 0.00797a^2$$

  and :

  $$\sigma = 0.09733 + 0.3425a - 0.07288a^2$$

  where a is the weld thickness (in inches)

  The following table summarizes the values of the median and the standard deviation for Alloy 22 shell and lids of the WP :

Table I-1. Summary table of median flaw size and shape parameter

	Weld thickness (mm)	Weld thickness (inches)	Median flaw size (*m*)	Shape parameter (□)
Alloy 22 shell	20	0.79	8.58E-02	3.22E-01
Alloy 22 lid	25	0.98	7.98E-02	3.64E-01

- The probability p_x that the flaw size be comprised between x and x-0.5 percent of weld thickness *a* can be expressed as :

$$p_x = Norm\left[\frac{\ln\left(\frac{x}{100}\times a\right)-\ln(m)}{\sigma}\right] - Norm\left[\frac{\ln\left(\left(\frac{x}{100}-0.005\right)\times a\right)-\ln(m)}{\sigma}\right]$$

where Norm represents the standard normal cumulative distribution.

The following table shows the probabilities obtained for different flaw size range on Alloy 22 shell and lids. It should be noted that the values shown are rounded and do not reflect actual precision used in calculations.

Table I-2. Weld flaw size probability

	Probability (Alloy 22 shell)	Probability (Alloy 22 lid)
flaw depth between 2.5% and 3% of weld thickness	2.83E-05	2.53E-03
flaw depth between 49.5% and 50% of weld thickness	1.83E-07	4.42E-08
flaw depth between 96.5% and 97% of weld thickness	6.49E-13	4.73E-13

- Next, the number of flaws in the considered part of the WP (outer surface of Alloy 22 shell or lid) is calculated. This is the product of the total flaw density for a 1-inch thick weld (8.8271 flaws per meter of weld without credit for RT and PT examinations and 0.6839 flaws per meter of weld with credit for RT and PT examinations) by the total weld length, and two correction factors : the flaw density factor relative to 1-inch thickness (i.e. : correction factor accounting for the different weld thicknesses), and the flaw density repartition factor (0.34% of the flaw are located on the outer surface). An additional factor, accounting for UT probability of non-detection (UT PND), may also be considered. The value of this factor is read in cells E248 to E367 of worksheet "Weld Data" (see Attachment III), as a function of the flaw depth. In order to account for multiple UT inspections, the square of the PND is taken as correction factor for Alloy 22 lid.

The following tables shows the parameters used and the results obtained. It should be noted that the values shown are rounded and do not reflect actual precision used in calculations.

Table I-3. Number of flaws on weld outer surface, with credit for RT and PT inspections

0.6839 flaws per meter of weld and 0.34% of the flaws on outer surface	Weld thickness (mm)	Total weld length (m)	Flaw density factor relative to 1-inch thickness	Number of flaws on outer surface
Alloy 22 shell	20	9.333	0.64	1.38E-02
Alloy 22 lid	25	4.775	0.97	1.08E-02

Table I-4. Number of flaws on weld outer surface, without credit for RT and PT inspections

8.8271 flaws per meter of weld and 0.34% of the flaws on outer surface	Weld thickness (mm)	Total weld length (m)	Flaw density factor relative to 1-inch thickness	Number of flaws on outer surface
Alloy 22 shell	20	9.333	0.64	1.78E-01
Alloy 22 lid	25	4.775	0.97	1.39E-01

Table I-5. Number of flaws on weld outer surface, with credit for RT, PT and UT inspections

	Weld thickness (mm)	UT PND	Number of flaws on outer surface
Alloy 22 shell – flaw depth : 3%	0.6	0.9783	1.35E-02
Alloy 22 shell – flaw depth : 50%	10	0.02984	4.12E-04
Alloy 22 shell – flaw depth : 97%	19	0.007054	9.73E-05
Alloy 22 lid – flaw depth : 3%	0.7	0.9643	1.00E-02
Alloy 22 lid – flaw depth : 50%	12	0.0182	3.58E-06
Alloy 22 lid – flaw depth : 97%	24	0.005687	3.49E-07

- It is then possible to assess the number of flaws of a given range and located on outer surface of Alloy 22 shell or lid, with or without credit for PT, RT and UT inspections :
  - ➢ With no inspection, this number is calculated as the product of the probability given in Table I-2 by the number of flaws on outer surface given in Table I-4. This leads to the following results :

Table I-6. Comparison of results from a hand calculator and Excel spreadsheet on Alloy 22 shell and lid, without credit for RT, PT and UT inspections

	Number of flaws (calculation on hand calculator)	Number of flaws (calculation on Excel spreadsheet)
Alloy 22 shell – flaw depth : 3%	5.03E-06	5.04E-06
Alloy 22 shell – flaw depth : 50%	3.25E-08	3.26E-08
Alloy 22 shell – flaw depth : 97%	1.16E-13	1.16E-13
Alloy 22 lid – flaw depth : 3%	3.52E-04	3.53E-04
Alloy 22 lid – flaw depth : 50%	6.17E-09	6.18E-09
Alloy 22 lid – flaw depth : 97%	6.59E-14	6.61E-14

- With credit for PT, RT and UT inspections, this number is calculated as the product of the probability given in Table I-2 by the number of flaws on outer surface given in Table I-5. This leads to the following results :

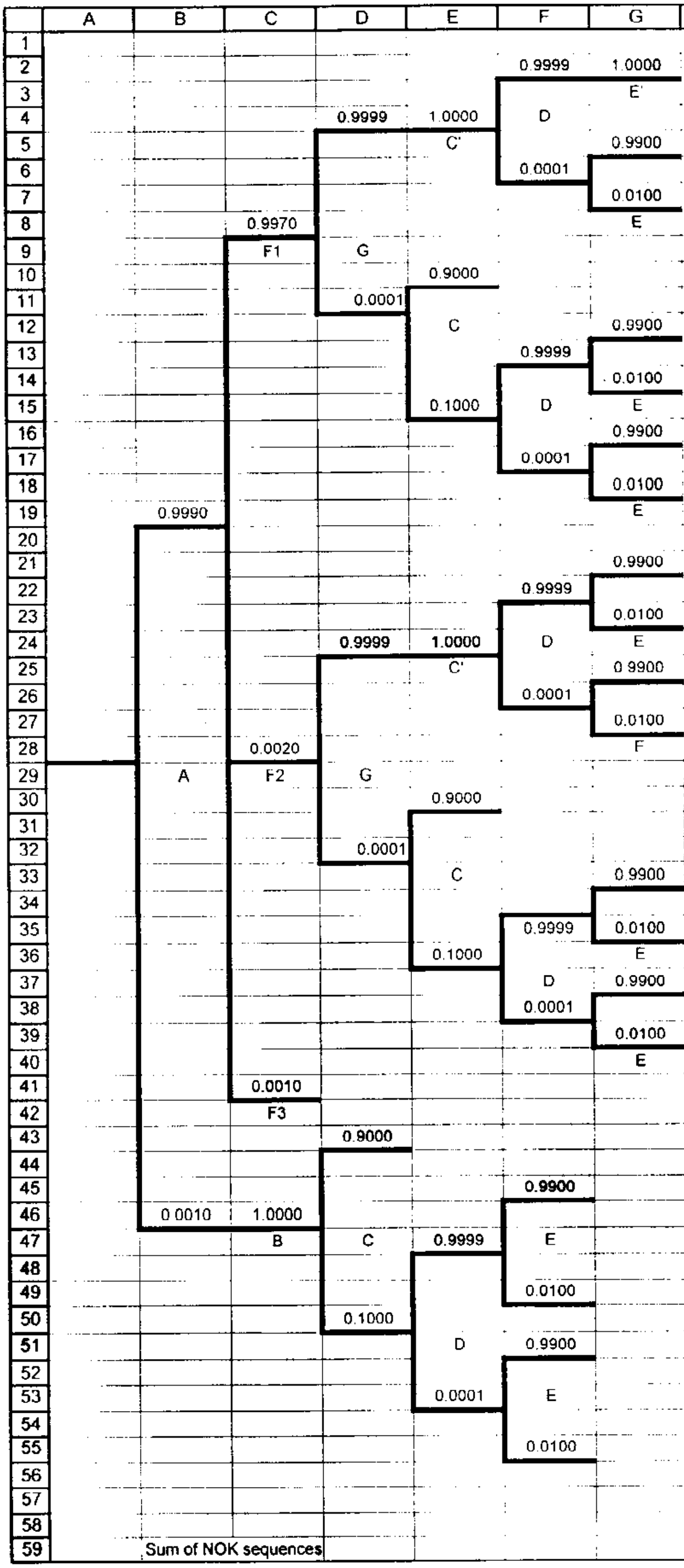
Table I-7. Comparison of results from a hand calculator and Excel spreadsheet on Alloy 22 shell and lid, with credit for RT, PT and UT inspections

	Number of flaws (calculation on hand calculator)	Number of flaws (calculation on Excel spreadsheet)
Alloy 22 shell – flaw depth : 3%	3.81E-07	3.82E-07
Alloy 22 shell – flaw depth : 50%	7.52E-11	7.54E-11
Alloy 22 shell – flaw depth : 97%	6.31E-17	6.33E-17
Alloy 22 lid – flaw depth : 3%	2.53E-05	2.54E-05
Alloy 22 lid – flaw depth : 50%	1.58E-13	1.59E-13
Alloy 22 lid – flaw depth : 97%	1.65E-19	1.66E-19

The results from calculation on a hand calculator and those obtained from Excel Spreadsheet Wpflaws.xls are compatible. Furthermore, these calculations cover the range of input parameters used in the analysis. Therefore, it can be concluded that Excel spreadsheet WPflaws.xls provides correct results over the range of input parameters considered.

Verification for Excel Spreadsheet Seq-Trees.xls :

The operations performed in this Excel spreadsheet are simple multiplication and logarithmic operations and have been recalculated indepedently by means of a hand calculator and the results proved to be identical. Therefore, Excel spreadsheet Seq-Trees.xls provides correct results over the range of input parameters considered.



H	I	J
1	9.96E-01	OK-W
2	9.86E-05	OK-R
3	[redacted]	NOK
4	8.96E-05	OK-R
5	9.86E-06	OK-R
6	[redacted]	NOK
7	9.86E-10	OK-R
8	[redacted]	NOK
9	1.98E-03	OK-R
10	[redacted]	NOK
11	1.98E-07	OK-R
12	[redacted]	NOK
13	1.80E-07	OK-R
14	1.98E-08	OK-R
15	[redacted]	NOK
16	1.98E-12	OK-R
17	[redacted]	NOK
18	9.99E-04	OK-R
19	9.00E-04	OK-R
20	9.90E-05	OK-R
21	[redacted]	NOK
22	9.90E-09	OK-R
23	[redacted]	NOK
Sum of NOK sequences	2.21E-05	

	K	L	M	N	O	P	Q	R	S	T	U
1			Success	Failure	Description						
2		A	0.9990	0.0010	Match WP with correct HT procedure						
3		B	1.0000	n/a	Wrong HT procedure used						
4		C	0.9000	0.1000	QA check prior to quench						
5		C'	1.0000	n/a	QA check prior to quench (no detectable subsequent falures)						
6		D	0.9999	0.0001	Quench procedure						
7		E	0.9900	0.0100	Lab reports identifies improper HT						
8		E'	1.0000	n/a	No failures to identify with lab report						
9		F1	0.9970	n/a	Equipment works						
10		F2	n/a	0.0020	Equipment fails undected						
11		F3	n/a	0.0010	Equipment fails catastropically						
12		G	0.9999	0.0001	Ramp-up/Hold-time procedure						
13											
14											
15				Furnace							
16				Failur Rate /hr							
17				1.74E-05	Thermostat (all modes, high failure rate) from IEEE 500, p. 543						
18				2.50E-05	Heater (catastrophic failure) from IEEE 500 p. 283						
19				0.0010	Sum times 24 hr mission time						
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
42											
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44											
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49											
50											
51											
52											
53											
54											
55											
56											
57											
58											
59											

	V	W	X	Y	Z	AA	AB	AC	AD
1									
2	Sequence		Branch A	Branch F*	Branch G	Branch C/C'	Branch D	Branch E	
3	3	Error Rate	0.9990	0.9970	0.9999	1.0000	0.0001	0.0100	
4		Range Factor	n/a	n/a	n/a	n/a	9	3	
5		ln(Error Rate)					-9.210	-4.605	
6		(ln(Range Factor)/1.645)^2					1.784	0.446	
7									
8	6	Error Rate	0.9990	0.9970	0.0001	0.1000	0.9999	0.0100	
9		Range Factor	n/a	n/a	9	5	n/a	3	
10		ln(Error Rate)			-9.210	-2.303		-4.605	
11		(ln(Range Factor)/1.645)^2			1.784	0.957		0.446	
12									
13	8	Error Rate	0.9990	0.9970	0.0001	0.1000	0.0001	0.0100	
14		Range Factor	n/a	n/a	9	5	9	3	
15		ln(Error Rate)			-9.210	-2.303	-9.210	-4.605	
16		(ln(Range Factor)/1.645)^2			1.784	0.957	1.784	0.446	
17									
18	10	Error Rate	0.9990	0.0020	0.9999	1.0000	0.9999	0.0100	
19		Range Factor	n/a	n/a	n/a	5	n/a	3	
20		ln(Error Rate)				0.000		-4.605	
21		(ln(Range Factor)/1.645)^2				0.957		0.446	
22									
23	12	Error Rate	0.9990	0.0020	0.9999	1.0000	0.0001	0.0100	
24		Range Factor	n/a	n/a	n/a	5	9	3	
25		ln(Error Rate)				0.000	-9.210	-4.605	
26		(ln(Range Factor)/1.645)^2				0.957	1.784	0.446	
27									
28	15	Error Rate	0.9990	0.0020	0.0001	0.1000	0.9999	0.0100	
29		Range Factor	n/a	n/a	9	9	n/a	3	
30		ln(Error Rate)			-9.210	-2.303		-4.605	
31		(ln(Range Factor)/1.645)^2			1.784	1.784		0.446	
32									
33	17	Error Rate	0.9990	0.0020	0.0001	0.1000	0.0001	0.0100	
34		Range Factor	n/a	n/a	9	5	9	3	
35		ln(Error Rate)			-9.210	-2.303	-9.210	-4.605	
36		(ln(Range Factor)/1.645)^2			1.784	0.957	1.784	0.446	
37									
38									
39									
40									
41			Branch A	Branch B	Branch C	Branch D	Branch E		
42	21	Error Rate	0.0010	1.0000	0.1000	0.9999	0.0100		
43		Range Factor	3	n/a	5	n/a	9		
44		ln(Error Rate)	-6.908		-2.303		-4.605		
45		(ln(Range Factor)/1.645)^2	0.446		0.957		1.784		
46									
47	23	Error Rate	0.0010	1.0000	0.1000	0.0001	0.0100		
48		Range Factor	3	n/a	5	9	9		
49		ln(Error Rate)	-6.908		-2.303	-9.210	-4.605		
50		(ln(Range Factor)/1.645)^2	0.446		0.957	1.784	1.784		
51									
52									
53									
54									
55									
56									
57									
58									
59									

	AE	AF	AG	AH	AI	AJ	AK	AL
1				Branches not	Event seq.			
2	Mean, Variance		95th Percentile	subject to	prob. adjusted for		Sequence	
3				uncertainty	HEP uncertainty		3	
4								
5	-13.816							
6	2.230		1.17E-05	9.96E-01	1.16E-05			
7								
8							6	
9								
10	-16.118							
11	3.187		1.89E-06	9.96E-01	1.88E-06			
12								
13							8	
14								
15	-25.328							
16	4.971		3.92E-10	9.96E-01	3.90E-10			
17								
18							10	
19								
20	-4.605							
21	1.403		7.02E-02	2.00E-03	1.40E-04			
22								
23							12	
24								
25	-13.816							
26	3.187		1.89E-05	2.00E-03	3.77E-08			
27								
28							15	
29								
30	-16.118							
31	4.014		2.70E-06	2.00E-03	5.39E-09			
32								
33							17	
34								
35	-25.328							
36	4.971		3.92E-10	2.00E-03	7.83E-13			
37								
38								
39								
40								
41								
42							21	
43								
44	-13.816							
45	3.187		1.89E-05	1.00E+00	1.89E-05			
46								
47							23	
48								
49	-23.026							
50	4.971		3.92E-09	1.00E+00	3.92E-09			
51								
52								
53				Total=	1.73E-04			
54								
55								
56								
57								
58								
59								

	A	B	C	D	E	F	G	H	I
1									
2									
3				0.9837			1	9.83E-01	OK-W
4									
5									
6		0.9990	1.0000						
7			B'	E	0.9900		2	1.62E-02	OK-W
8									
9				0.0163	C	0.9800	3	1.60E-04	OK-R
10									
11					0.0100	D'			
12									
13						0.0200	4	**3.26E-06**	**NOK**
14		A							
15									
16			0.9000				5	9.00E-04	OK-R
17									
18									
19					0.9000		6	8.91E-05	OK-R
20		0.0010							
21			B	0.9900	D				
22									
23					0.1000		7	**9.90E-06**	**NOK**
24			0.1000						
25				C	0.9000		8	9.00E-07	OK-R
26									
27				0.0100	D				
28									
29					0.1000		9	**1.00E-07**	**NOK**
30									
31		Note: double lines only applies to the last cleaning							
32									
33									
34		Sum of the NOK sequences					1.00E-05		
35		Sum of NOK sequence (with last cleaning)					1.33E-05		
36									
37				**Outer barrier**					
38		Cleanings							
39		Weld		3					
40		Prior to HT/Annealing		1					
41		Prior to shipping		1					
42		Prior to loading		1					
43		Prior to emplacement		1					
44									
45		Total		7					
46		Prob.		7.33E-05					

	J	K	L	M	N	O	P	Q	R	S
1			Success	Failure	Description					
2		A	0.9990	0.0010	Proper cleaner available for use					
3		B	0.9000	0.1000	Operator checks for proper cleaner					
4		B'	1.0000	n/a	No failure to be uncovered by operator check					
5		C	0.9900	0.0100	Written cleaning process followed (error in cleaning leaves residue or contaminant)					
6		D	0.9000	0.1000	Process check					
7		D'	0.9800	0.0200	Process check (lower limit)					
8		E	0.9837	0.0163	Surface metal is contaminated					
9										
10										
11			After	Before						
12			Inspection	Inspection						
13		RCS components	0.0027	0.2667	-1.3218					
14		midpoint		0.0163	-4.1148					
15		Fuel Rods	1.00E-05	0.0010	-6.9078					
16										
17										
18										
19										
20										
21	Sequence		Branch A	Branch B	Branch E	Branch C	Branch D'		Mean, Variance	
22	4	**Error Rate**	0.9990	1.0000	0.0163	0.0100	0.0200			
23		**Range Factor**	n/a	n/a	n/a	3	5			
24		**ln(Error Rate)**				-4.605	-3.912		-8.517	
25		**(ln(Range Factor)/1.645)^2**				0.446	0.957		1.403	
26										
27			Branch A-1	Branch A-2	Branch B	Branch C	Branch D			
28	7	**Error Rate**	0.0100	0.1000	0.1000	0.9900	0.1000			
29		**Range Factor**	3	5	5	n/a	5			
30		ln(Error Rate)	-4.605	-2.303	-2.303		-2.303		-11.513	
31		(ln(Range Factor)/1.645)^2	0.446	0.957	0.957		0.957		3.318	
32										
33	9	**Error Rate**	0.0100	0.1000	0.1000	0.0100	0.1000			
34		**Range Factor**	3	5	5	3	5			
35		ln(Error Rate)	-4.605	-2.303	-2.303	-4.605	-2.303		-16.118	
36		(ln(Range Factor)/1.645)^2	0.446	0.957	0.957	0.446	0.957		3.764	
37										
38										
39										
40										
41										
42										
43										
44										
45										
46										

	T	U	V	W	X	Y	Z	AA	AB
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20		Branches not	Event seq.						
21	95th Percentile	subject to	prob. adjusted for		Sequence				
22		uncertainty	HEP uncertainty		4				
23									
24									
25	1.40E-03	1.63E-02	2.29E-05						
26									
27									
28					7				
29									
30									
31	2.00E-04	9.90E-01	1.98E-04						
32									
33					9				
34									
35									
36	2.43E-06		2.43E-06						
37									
38									
39		Total =	1.43E-03						
40									
41									
42									
43									
44									
45									
46									

	A	B	C	D	E	F	G	H	I	J	K
1											
2								Endstates with		Endstates without	
3								WP Thermal Output		WP Thermal Output	
4								Verification Step		Verification Step	
5											
6				0.9927	1.0000	1.0000	1	9.90E-01	OK-W	9.90E-01	OK_W
7					D'	E'					
8											
9		0.9970	1.0000	C	0.9000		2	6.55E-03	OK-R	6.55E-03	OK-R
10			B'								
11				0.0073							
12					D	0.9990	3	7.27E-04	OK-R		
13											
14					0.1000	E				7.28E-04	NOK
15											
16						0.0010	4	7.28E-07	NOK		
17											
18		A		0.9927	1.0000	1.0000	5	2.68E-03	OK-W	2.68E-03	OK-W
19					D'	E'					
20											
21			0.9000	C	0.9000		6	1.77E-05	OK-R	1.77E-05	OK-R
22											
23				0.0073							
24					D	0.9990	7	1.97E-06	OK-R		
25											
26					0.1000	E				1.97E-06	NOK
27		0.0030	B								
28						0.0010	8	1.97E-09	NOK		
29											
30						0.9990	9	3.00E-04	OK-R		
31											
32			0.1000	1.0000	1.0000	E				3.00E-04	NOK
33				C'	D'						
34						0.0010	10	3.00E-07	NOK		
35											
36											
37											
38			Sum of NOK endstates w/ WP Thermal Verification Step							1.03E-06	
39											
40			Sum of NOK endstates w/o WP Thermal Verification Step							1.03E-03	
41											
42											

	L	M	N	O	P	Q	R	S	T
1		No. Assemblies in WP			21				
2		Max. assys. that can be misloaded before WP exceeds limit						1	
3									
4		Success	Failure	Description					
5	A	0.9970	0.0030	Development of WP loading diagram					
6	B	0.9000	0.1000	QA Check of WP Loading Diagram & Recovery					
7	B'	1.0000	n/a	No failure to be uncovered by loading diagram check					
8	C	0.9927	0.0073	Loading of Proper SNF (conceptual and selection errors					
9	C'	n/a	1.0000	Guaranteed failure due to improper loading diagram					
10	D	0.9000	0.1000	QA Check of loaded WP against loading diagram					
11	D'	1.0000	n/a	No failure to be uncovered by loading check (consistant w/ diagram)					
12	E	0.9990	0.0010	Verification that WP thermal output within allowable range					
13	E'	1.0000	n/a	No failure to be uncovered by WP thermal verification					
14									
15									
16					n	Prob. of n or fewer assys exceeding limit			
17					0	8.816E-01			
18					1	9.927E-01			
19					2	9.997E-01			
20					3	1.000E+00			
21					4	1.000E+00			
22					5	1.000E+00			
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									

	U	V	W	X	Y	Z	AA	AB
1		With Thermal Verification Step						
2								
3	Sequence		Branch A	Branch B/B'	Branch C/C'	Branch D/D'	Branch E	
4	4	**Error Rate**	0.9970	1.0000	0.0073	0.1000	0.0010	
5		**Range Factor**	n/a	n/a	n/a	5	3	
6		ln(Error Rate)				-2.303	-6.908	
7		(ln(Range Factor)/1.645)^2				0.957	0.446	
8								
9	8	**Error Rate**	0.0030	0.9000	0.0073	0.1000	0.0010	
10		**Range Factor**	3	n/a	n/a	5	3	
11		ln(Error Rate)	-5.809			-2.303	-6.908	
12		(ln(Range Factor)/1.645)^2	0.446			0.957	0.446	
13								
14	10	**Error Rate**	0.0030	0.1000	1.0000	1.0000	0.0010	
15		**Range Factor**	3	5	n/a	n/a	3	
16		ln(Error Rate)	-5.809	-2.303			-6.908	
17		(ln(Range Factor)/1.645)^2	0.446	0.957			0.446	
18								
19								
20								
21								
22		Without Thermal Verification Step						
23								
24								
25	Sequence		Branch A	Branch B/B'	Branch C/C'	Branch D/D'		
26	4	**Error Rate**	0.9970	1.0000	0.0073	0.1000		
27		**Range Factor**	n/a	n/a	n/a	5		
28		ln(Error Rate)				-2.303		
29		(ln(Range Factor)/1.645)^2				0.957		
30								
31	8	**Error Rate**	0.0030	0.9000	0.0073	0.1000		
32		**Range Factor**	3	n/a	n/a	5		
33		ln(Error Rate)	-5.809			-2.303		
34		(ln(Range Factor)/1.645)^2	0.446			0.957		
35								
36	10	**Error Rate**	0.0030	0.1000	1.0000	1.0000		
37		**Range Factor**	3	5	n/a	n/a		
38		ln(Error Rate)	-5.809	-2.303				
39		(ln(Range Factor)/1.645)^2	0.446	0.957				
40								
41								
42								

	AC	AD	AE	AF	AG	AH	AI	AJ
1								
2				Branches not	Event seq.			
3	Mean, Variance		95th Percenti	subject to	prob. adjusted for		Sequence	
4				uncertainty	HEP uncertainty			
5								
6	-9.210							
7	1.403		7.02E-04	7.28E-03	5.11E-06		4	
8								
9								
10								
11	-15.019							
12	1.849		2.81E-06	6.57E-03	1.85E-08		8	
13								
14								
15								
16	-15.019							
17	1.849		2.81E-06	1.00E+00	2.81E-06		10	
18								
19								
20				Total =	7.94E-06			
21								
22								
23								
24				Branches not	Event seq.			
25	Mean, Variance		95th Percenti	subject to	prob. adjusted for			
26				uncertainty	HEP uncertainty		Sequence	
27								
28	-2.303							
29	0.957		5.00E-01	7.28E-03	3.64E-03		4	
30								
31								
32								
33	-8.112							
34	1.403		2.11E-03	6.57E-03	1.38E-05		8	
35								
36								
37								
38	-8.112							
39	1.403		2.11E-03	1.00E+00	2.11E-03		10	
40								
41								
42				Total =	5.76E-03			

	A	B	C	D	E	F	G	H	I	J	K
1											
2											
3		0.982	1.000	1.000	1	9.8E-01	OK-W				
4			B'	C'							
5											
6		A	0.900		2	1.6E-02	OK-R				
7											
8											
9		0.018	B	0.900	3	1.6E-03	OK-R				
10											
11											
12			0.100	C							
13											
14											
15				0.100	4	1.8E-04	NOK				
16											
17											
18	Identifier	Success	Failure	Description							
19	A	0.9820	0.0180	Operator properly mates drip shield to previously emplaced drip shield							
20	B	0.9000	0.1000	Operator finds gap during self-check of his work							
21	B'	1.0000	n/a	No failure to be found by self-check							
22	C	0.9000	0.1000	QA check of emplaced drip shield finds gap							
23	C'	1.0000	n/a	No failure to be found by inspection							
24											
25											
26	Package Length			4775	mm						
27	Drip Shield Section Length			1818	mm						
28	Drip Shields per WP			2.6							
29	Potential Gaps per WP			2							
30											

	L	M	N	O	P	Q	R	S	T	U	V
1											
2	Sequence		Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Branch 6	Mean, Variance		95th Percentile
3	1	Error Rate	0.018	0.100	0.100						
4		Range Factor	3	5	5						
5		ln(Error Rate)	-4.017	-2.303	-2.303				-8.623		
6		(ln(Range Factor)/1.645)^2	0.446	0.957	0.957				2.360		2.25E-03
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

	L	M	N	O	P	Q	R	S	T	U	V
1											
2	Sequence		Branch 1	Branch 2	Branch 3	Branch 4	Branch 5	Branch 6	Mean, Variance		95th Percentile
3	1	**Error Rate**	0.018	0.100	0.100						
4		**Range Factor**	3	5	5						
5		ln(Error Rate)	-4.017	-2.303	-2.303				-8.623		
6		(ln(Range Factor)/1.645)^2	0.446	0.957	0.957				2.360		2.25E-03
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5									
6				0.9995	1.0000	1.0000	1	9.99E-01	OK-W
7					D'	E'			
8		0.9995	1.0000	C					
9			B'		0.9900		2	0.00E+00	OK-R
10									
11				0.0005	D				
12						0.9000	3	4.14E-06	OK-R
13									
14					0.0100	E			
15									
16						0.1000	4	4.60E-07	NOK
17		A							
18									
19			0.9000				5	4.14E-04	OK-R
20									
21									
22						0.9000	6	4.1381E-05	OK-R
23		0.0005	B						
24				0.9995	1.0000	E			
25					D'				
26						0.1000	7	4.60E-06	NOK
27			0.1000	C					
28					0.9900		8	2.09E-08	OK-R
29									
30				0.0005	D				
31						0.9000	9	1.90E-10	OK-R
32									
33					0.0100	E			
34									
35						0.1000	10	2.12E-11	NOK
36									
37									
38									
39			Sum of NOK sequences					5.06E-06	

	A	B	C	D	E	F	G	H	I
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57		Success	Failure						
58	A	0.9995	0.0005	Damage occurs to DC during transport from fabricator					
59	B	0.9000	0.1000	Inspection of DC at arrival finds damage					
60	B'	1.0000	n/a	No failure to identify					
61	C	0.9995	0.0005	WP is handled at repository without damage					
62	D	0.9900	0.0100	Operator moving package realizes damage occurred					
63	D'	1.0000	n/a	Operator makes no error to identify					
64	E	0.9000	0.1000	Final inspection of package identifies damage					
65	E'	1.0000	n/a	No failure to identify					
66									
67									
68									
69									

	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
1																
2												Branches not	Event seq.			
3	Sequence		Branch A	Branch B	Branch C	Branch D	Branch E		Mean, Variance		95th Percentile	subject to	prob. adjusted for		Sequence	
4	4	**Error Rate**	0.9995	1.0000	0.0005	0.0100	0.1000					uncertainty	HEP uncertainty		4	
5		**Range Factor**	n/a	n/a	n/a	3	5									
6		ln(Error Rate)				-4.605	-2.303		-6.908							
7		(ln(Range Factor)/1.645)^2				0.446	0.957		1.403		7.02E-03	4.60E-04	3.23E-06			
8																
9	7	**Error Rate**	0.0005	0.1000	0.9995	1.0000	0.1000								7	
10		**Range Factor**	n/a	5	n/a	n/a	3									
11		ln(Error Rate)		-2.303			-2.303		-4.605							
12		(ln(Range Factor)/1.645)^2		0.957			0.446		1.403		7.02E-02	4.60E-04	3.23E-05			
13																
14	10	**Error Rate**	0.0005	0.1000	0.0005	0.0100	0.1000								10	
15		**Range Factor**	n/a	5	n/a	3	5									
16		ln(Error Rate)		-2.303		-4.605	-2.303		-9.210							
17		(ln(Range Factor)/1.645)^2		0.957		0.446	0.957		2.360		1.25E-03	2.12E-09	2.65E-12			
18																
19													3.55E-05	(Total)		
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																

	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54					Intentionally Left Blank											
55																
56																
57																
58																
59																
60																
61																
62																
63																
64																
65																
66																
67																
68																
69																

	A	B	C	D
1	**WELD DATA FROM KHALEEL, CHAPMAN, HARRIS, AND SIMONEN 1999**			
2				
3	TOTAL FLAW DENSITY (flaws/meter of weld)			
4	Shop Weld, Good Access, no inspection	8.8271		
5	Shop Weld, Good Access	0.6839	Table 5 Case 5 (1 inch SS MMA weld with RT&PT)	
6	Field Weld, Average Access	1.0078	Table 5 Case 1 (1 inch SS MMA weld with RT&PT)	
7				
8	DISTRIBUTION OF FLAW LOCATION			Flaws per Meter
9	Table 5 Flaw Density by Location	Inner Surface	Embeded Inner 1/4	Embedded Center
10	Case 5, 1inch, SS, MMA, RT&PT, Shop	0.0051395	0.0704	0.3703
11	Case 1, 1inch, SS, MMA, RT&PT, Field	0.0153	0.1028	0.5252
12	Case 3, 2.5 inch, SS, MMA, RT&P, Field	0.0174	0.8572	4.1551
13	Distribution	Inner Surface	Embeded Inner 1/4	Embedded Center
14	Case 5, 1inch, SS, MMA, RT&PT, Shop	0.75%	10.29%	54.14%
15	Case 1, 1inch, SS, MMA, RT&PT	1.52%	10.20%	52.11%
16	Case 3, 2.5 inch, SS, MMA, RT&PT	0.22%	10.85%	52.61%
17	Average Distribution	0.83%	10.45%	52.96%
18				
19	EFFECT OF THICKNESS ON FLAW DENSITY (Table 6)			
20	(italics show interpolated or extrapolated values)		Flaw density w/ RT	Flaw Density w/o RT
21	Weld Thickness (inches)	Weld Thickness (mm)	relative to 1 inch thickness	relative to 1 inch thickness
22	0.25	6.35	1.34	1.34
23	0.5	12.7	0.86	0.86
24	0.75	19.05	0.57	0.57
25		*20*	*0.64*	*0.64*
26		*25*	*0.97*	*0.97*
27	1	25.4	1.00	1.00
28	1.5	38.1	1.91	1.92
29	2	50.8	3.43	3.43
30	2.5	63.5	7.31	7.31
31		*65*	*7.77*	
32		*95*	*16.95*	
33				
34	FLAW DENSITY INCREASE FACTORS			
35	No RT inspection	12.8	from page 8	
36	No PT inspection (outer surface flaws only)	31.4	Based on ratio of Table 5 cases 1 and 8	

	A	B	C	D
37				
38	LOGNORMAL DISTRIBUTIONS OF FLAW SIZE FOR DIFFERENT WELD THICKNESSES			
39	distribution parameters calculated for each weld thickness based on information in Figure 7 for SS TIG welds			
40	Weld Thickness (mm)	25	Alloy 22 Barrier	20
41	Median Flaw Size (in)	0.07982174	Lid Welds	0.08580204
42	Shape Parameter (SD(ln a))	0.363833658		0.321829349
43			Complementary CDF	Defect Size x
44	Defect > x% Through wall	Defect Size x (mm)	Prob. Flaw Size >= x	(mm)
45	1.0%	0.3	0.999999996	0.2
46	1.50%	0.4	1.00E+00	0.3
47	2.00%	0.5	1.00E+00	0.4
48	2.50%	0.6	9.99E-01	0.5
49	3.00%	0.8	9.97E-01	0.6
50	3.50%	0.9	9.90E-01	0.7
51	4.00%	1.0	9.74E-01	0.8
52	4.50%	1.1	9.47E-01	0.9
53	5.00%	1.3	9.08E-01	1
54	5.50%	1.4	8.57E-01	1.1
55	6.00%	1.5	7.96E-01	1.2
56	6.50%	1.6	7.28E-01	1.3
57	7.00%	1.8	6.57E-01	1.4
58	7.50%	1.9	5.85E-01	1.5
59	8.00%	2.0	5.15E-01	1.6
60	8.50%	2.1	4.49E-01	1.7
61	9.00%	2.3	3.87E-01	1.8
62	9.50%	2.4	3.32E-01	1.9
63	10.00%	2.5	2.82E-01	2
64	10.50%	2.6	2.39E-01	2.1
65	11.00%	2.8	2.01E-01	2.2
66	11.50%	2.9	1.69E-01	2.3
67	12.00%	3.0	1.41E-01	2.4
68	12.50%	3.1	1.17E-01	2.5
69	13.00%	3.3	9.73E-02	2.6
70	13.50%	3.4	8.07E-02	2.7
71	14.00%	3.5	6.67E-02	2.8
72	14.50%	3.6	5.51E-02	2.9
73	15.00%	3.8	4.55E-02	3
74	15.50%	3.9	3.75E-02	3.1

	A	B	C	D
37				
38	LOGNORMAL DISTRIBUTIONS OF FLAW SIZE FOR DIFFERENT WELD THICKNESSES			
39	distribution parameters calculated for each weld thickness based on information in Figure 7 for SS TIG welds			
40	Weld Thickness (mm)	25	Alloy 22 Barrier	20
41	Median Flaw Size (in)	0.07982174	Lid Welds	0.08580204
42	Shape Parameter (SD(ln a))	0.363833658		0.321829349
43			Complementary CDF	Defect Size x
44	Defect > x% Through wall	Defect Size x (mm)	Prob. Flaw Size >= x	(mm)
45	1.0%	0.3	0.999999996	0.2
46	1.50%	0.4	1.00E+00	0.3
47	2.00%	0.5	1.00E+00	0.4
48	2.50%	0.6	9.99E-01	0.5
49	3.00%	0.8	9.97E-01	0.6
50	3.50%	0.9	9.90E-01	0.7
51	4.00%	1.0	9.74E-01	0.8
52	4.50%	1.1	9.47E-01	0.9
53	5.00%	1.3	9.08E-01	1
54	5.50%	1.4	8.57E-01	1.1
55	6.00%	1.5	7.96E-01	1.2
56	6.50%	1.6	7.28E-01	1.3
57	7.00%	1.8	6.57E-01	1.4
58	7.50%	1.9	5.85E-01	1.5
59	8.00%	2.0	5.15E-01	1.6
60	8.50%	2.1	4.49E-01	1.7
61	9.00%	2.3	3.87E-01	1.8
62	9.50%	2.4	3.32E-01	1.9
63	10.00%	2.5	2.82E-01	2
64	10.50%	2.6	2.39E-01	2.1
65	11.00%	2.8	2.01E-01	2.2
66	11.50%	2.9	1.69E-01	2.3
67	12.00%	3.0	1.41E-01	2.4
68	12.50%	3.1	1.17E-01	2.5
69	13.00%	3.3	9.73E-02	2.6
70	13.50%	3.4	8.07E-02	2.7
71	14.00%	3.5	6.67E-02	2.8
72	14.50%	3.6	5.51E-02	2.9
73	15.00%	3.8	4.55E-02	3
74	15.50%	3.9	3.75E-02	3.1

	A	B	C	D
75	16.00%	4.0	3.09E-02	3.2
76	16.50%	4.1	2.55E-02	3.3
77	17.00%	4.3	2.10E-02	3.4
78	17.50%	4.4	1.73E-02	3.5
79	18.00%	4.5	1.42E-02	3.6
80	18.50%	4.6	1.17E-02	3.7
81	19.00%	4.8	9.64E-03	3.8
82	19.50%	4.9	7.95E-03	3.9
83	20.00%	5.0	6.55E-03	4
84	20.50%	5.1	5.40E-03	4.1
85	21.00%	5.3	4.46E-03	4.2
86	21.50%	5.4	3.68E-03	4.3
87	22.00%	5.5	3.05E-03	4.4
88	22.50%	5.6	2.52E-03	4.5
89	23.00%	5.8	2.08E-03	4.6
90	23.50%	5.9	1.73E-03	4.7
91	24.00%	6.0	1.43E-03	4.8
92	24.50%	6.1	1.19E-03	4.9
93	25.00%	6.3	9.87E-04	5
94	25.50%	6.4	8.20E-04	5.1
95	26.00%	6.5	6.82E-04	5.2
96	26.50%	6.6	5.68E-04	5.3
97	27.00%	6.8	4.74E-04	5.4
98	27.50%	6.9	3.95E-04	5.5
99	28.00%	7.0	3.30E-04	5.6
100	28.50%	7.1	2.76E-04	5.7
101	29.00%	7.3	2.31E-04	5.8
102	29.50%	7.4	1.93E-04	5.9
103	30.00%	7.5	1.62E-04	6
104	30.50%	7.6	1.36E-04	6.1
105	31.00%	7.8	1.14E-04	6.2
106	31.50%	7.9	9.60E-05	6.3
107	32.00%	8.0	8.08E-05	6.4
108	32.50%	8.1	6.80E-05	6.5
109	33.00%	8.3	5.73E-05	6.6
110	33.50%	8.4	4.84E-05	6.7
111	34.00%	8.5	4.09E-05	6.8
112	34.50%	8.6	3.45E-05	6.9

	A	B	C	D
113	35.00%	8.8	2.92E-05	7
114	35.50%	8.9	2.48E-05	7.1
115	36.00%	9.0	2.10E-05	7.2
116	36.50%	9.1	1.78E-05	7.3
117	37.00%	9.3	1.51E-05	7.4
118	37.50%	9.4	1.29E-05	7.5
119	38.00%	9.5	1.09E-05	7.6
120	38.50%	9.6	9.31E-06	7.7
121	39.00%	9.8	7.93E-06	7.8
122	39.50%	9.9	6.77E-06	7.9
123	40.00%	10.0	5.78E-06	8
124	40.50%	10.1	4.93E-06	8.1
125	41.00%	10.3	4.22E-06	8.2
126	41.50%	10.4	3.61E-06	8.3
127	42.00%	10.5	3.09E-06	8.4
128	42.50%	10.6	2.65E-06	8.5
129	43.00%	10.8	2.27E-06	8.6
130	43.50%	10.9	1.95E-06	8.7
131	44.00%	11.0	1.68E-06	8.8
132	44.50%	11.1	1.44E-06	8.9
133	45.00%	11.3	1.24E-06	9
134	45.50%	11.4	1.07E-06	9.1
135	46.00%	11.5	9.21E-07	9.2
136	46.50%	11.6	7.95E-07	9.3
137	47.00%	11.8	6.86E-07	9.4
138	47.50%	11.9	5.93E-07	9.5
139	48.00%	12.0	5.12E-07	9.6
140	48.50%	12.1	4.43E-07	9.7
141	49.00%	12.3	3.84E-07	9.8
142	49.50%	12.4	3.32E-07	9.9
143	50.00%	12.5	2.88E-07	10
144	50.50%	12.6	2.50E-07	10.1
145	51.00%	12.8	2.17E-07	10.2
146	51.50%	12.9	1.88E-07	10.3
147	52.00%	13.0	1.64E-07	10.4
148	52.50%	13.1	1.42E-07	10.5
149	53.00%	13.3	1.24E-07	10.6
150	53.50%	13.4	1.08E-07	10.7

	A	B	C	D
151	54.00%	13.5	9.41E-08	10.8
152	54.50%	13.6	8.21E-08	10.9
153	55.00%	13.8	7.17E-08	11
154	55.50%	13.9	6.26E-08	11.1
155	56.00%	14.0	5.47E-08	11.2
156	56.50%	14.1	4.78E-08	11.3
157	57.00%	14.3	4.18E-08	11.4
158	57.50%	14.4	3.66E-08	11.5
159	58.00%	14.5	3.21E-08	11.6
160	58.50%	14.6	2.81E-08	11.7
161	59.00%	14.8	2.46E-08	11.8
162	59.50%	14.9	2.16E-08	11.9
163	60.00%	15.0	1.90E-08	12
164	60.50%	15.1	1.67E-08	12.1
165	61.00%	15.3	1.47E-08	12.2
166	61.50%	15.4	1.29E-08	12.3
167	62.00%	15.5	1.13E-08	12.4
168	62.50%	15.6	9.99E-09	12.5
169	63.00%	15.8	8.80E-09	12.6
170	63.50%	15.9	7.75E-09	12.7
171	64.00%	16.0	6.84E-09	12.8
172	64.50%	16.1	6.03E-09	12.9
173	65.00%	16.3	5.33E-09	13
174	65.50%	16.4	4.70E-09	13.1
175	66.00%	16.5	4.16E-09	13.2
176	66.50%	16.6	3.68E-09	13.3
177	67.00%	16.8	3.25E-09	13.4
178	67.50%	16.9	2.88E-09	13.5
179	68.00%	17.0	2.55E-09	13.6
180	68.50%	17.1	2.26E-09	13.7
181	69.00%	17.3	2.00E-09	13.8
182	69.50%	17.4	1.77E-09	13.9
183	70.00%	17.5	1.57E-09	14
184	70.50%	17.6	1.40E-09	14.1
185	71.00%	17.8	1.24E-09	14.2
186	71.50%	17.9	1.10E-09	14.3
187	72.00%	18.0	9.80E-10	14.4
188	72.50%	18.1	8.72E-10	14.5

	A	B	C	D
189	73.00%	18.3	7.76E-10	14.6
190	73.50%	18.4	6.91E-10	14.7
191	74.00%	18.5	6.15E-10	14.8
192	74.50%	18.6	5.48E-10	14.9
193	75.00%	18.8	4.88E-10	15
194	75.50%	18.9	4.35E-10	15.1
195	76.00%	19.0	3.88E-10	15.2
196	76.50%	19.1	3.47E-10	15.3
197	77.00%	19.3	3.10E-10	15.4
198	77.50%	19.4	2.77E-10	15.5
199	78.00%	19.5	2.47E-10	15.6
200	78.50%	19.6	2.21E-10	15.7
201	79.00%	19.8	1.98E-10	15.8
202	79.50%	19.9	1.77E-10	15.9
203	80.00%	20.0	1.58E-10	16
204	80.50%	20.1	1.42E-10	16.1
205	81.00%	20.3	1.27E-10	16.2
206	81.50%	20.4	1.14E-10	16.3
207	82.00%	20.5	1.02E-10	16.4
208	82.50%	20.6	9.14E-11	16.5
209	83.00%	20.8	8.20E-11	16.6
210	83.50%	20.9	7.36E-11	16.7
211	84.00%	21.0	6.61E-11	16.8
212	84.50%	21.1	5.94E-11	16.9
213	85.00%	21.3	5.34E-11	17
214	85.50%	21.4	4.80E-11	17.1
215	86.00%	21.5	4.31E-11	17.2
216	86.50%	21.6	3.88E-11	17.3
217	87.00%	21.8	3.49E-11	17.4
218	87.50%	21.9	3.14E-11	17.5
219	88.00%	22.0	2.83E-11	17.6
220	88.50%	22.1	2.55E-11	17.7
221	89.00%	22.3	2.30E-11	17.8
222	89.50%	22.4	2.07E-11	17.9
223	90.00%	22.5	1.87E-11	18
224	90.50%	22.6	1.69E-11	18.1
225	91.00%	22.8	1.52E-11	18.2
226	91.50%	22.9	1.37E-11	18.3

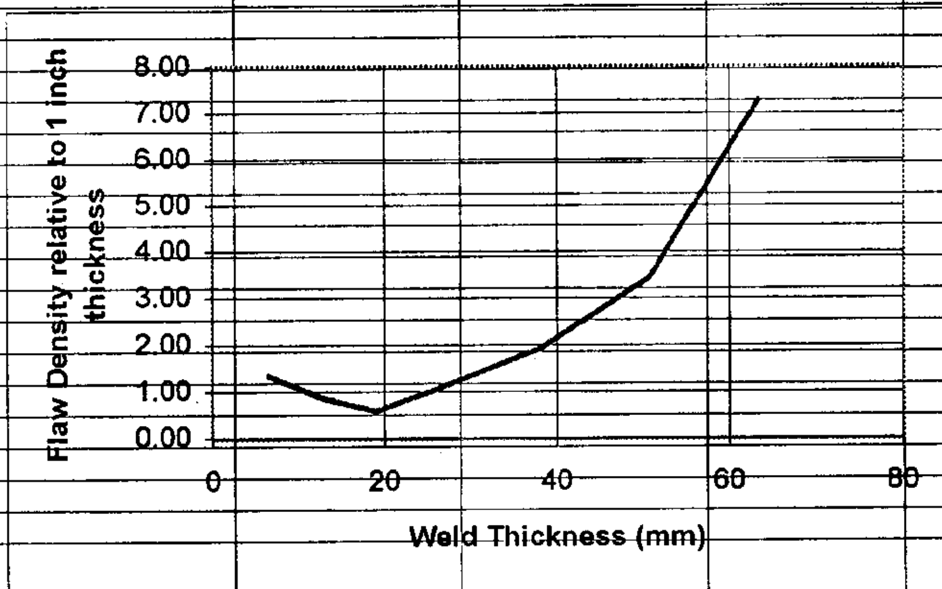
	A	B	C	D
227	92.00%	23.0	1.24E-11	18.4
228	92.50%	23.1	1.12E-11	18.5
229	93.00%	23.3	1.01E-11	18.6
230	93.50%	23.4	9.15E-12	18.7
231	94.00%	23.5	8.28E-12	18.8
232	94.50%	23.6	7.49E-12	18.9
233	95.00%	23.8	6.77E-12	19
234	95.50%	23.9	6.13E-12	19.1
235	96.00%	24.0	5.55E-12	19.2
236	96.50%	24.1	5.03E-12	19.3
237	97.00%	24.3	4.55E-12	19.4
238	97.50%	24.4	4.13E-12	19.5
239	98.00%	24.5	3.74E-12	19.6
240	98.50%	24.6	3.39E-12	19.7
241	99.00%	24.8	3.08E-12	19.8
242	99.50%	24.9	2.79E-12	19.9
243	100.00%	25.0	2.53E-12	20
244				
245	UT Probability of Non-Detection as a Function of Flaw Depth (From NUREG/CR-3110, Reliability of Nondestructive Examination, Vol. 3, p. 13			
246		nu=3, a*=5	n=1, a*=5	nu=3, a*=2.5
247	Flaw depth (mm)	Modified Lognormal, nu = 3, 50	Modified Lognormal, nu = 1, 50	Modified Lognormal, nu = 3, 50
248	0.1	1	1	1
249	0.2	1	1	1
250	0.3	1	1	1
251	0.4	1	0.9998	1
252	0.5	1	0.9994	1
253	0.6	1	0.9987	1
254	0.7	1	0.9973	1
255	0.8	1	0.9952	1
256	0.9	1	0.9924	1
257	1	1	0.9886	0.9999
258	1.1	1	0.984	0.9998
259	1.2	1	0.9783	0.9991
260	1.3	1	0.9718	0.9972
261	1.4	1	0.9643	0.9931
262	1.5	1	0.9559	0.985
263	1.6	1	0.9467	0.971
264	1.7	1	0.9368	0.9494

	A	B	C	D
265	1.8	1	0.9261	0.9187
266	1.9	1	0.9148	0.8785
267	2	0.9999	0.903	0.829
268	2.1	0.9999	0.8906	0.7714
269	2.2	0.9998	0.8778	0.7077
270	2.3	0.9995	0.8646	0.64
271	2.4	0.9991	0.8511	0.5709
272	2.5	0.9984	0.8373	0.5025
273	2.6	0.9972	0.8234	0.4368
274	2.7	0.9956	0.8092	0.3752
275	2.8	0.9931	0.7949	0.3187
276	2.9	0.9896	0.7806	0.2681
277	3	0.985	0.7662	0.2235
278	3.1	0.9788	0.7517	0.1848
279	3.2	0.971	0.7373	0.1517
280	3.3	0.9612	0.723	0.1238
281	3.4	0.9494	0.7087	0.1005
282	3.5	0.9352	0.6945	0.08133
283	3.6	0.9187	0.6805	0.06562
284	3.7	0.8998	0.6666	0.05289
285	3.8	0.8785	0.6528	0.04264
286	3.9	0.8548	0.6392	0.03446
287	4	0.829	0.6257	0.02796
288	4.1	0.8011	0.6125	0.02283
289	4.2	0.7714	0.5994	0.0188
290	4.3	0.7402	0.5865	0.01565
291	4.4	0.7077	0.5739	0.01319
292	4.5	0.6742	0.5614	0.01129
293	4.6	0.64	0.5492	0.009816
294	4.7	0.6055	0.5372	0.008682
295	4.8	0.5709	0.5254	0.00781
296	4.9	0.5365	0.5138	0.007141
297	5	0.5025	0.5025	0.006629
298	5.1	0.4692	0.4914	0.006238
299	5.2	0.4368	0.4805	0.00594
300	5.3	0.4054	0.4698	0.005713
301	5.4	0.3752	0.4594	0.00554
302	5.5	0.3463	0.4492	0.005409

	A	B	C	D
303	5.6	0.3187	0.4392	0.00531
304	5.7	0.2927	0.4294	0.005234
305	5.8	0.2681	0.4198	0.005177
306	5.9	0.2451	0.4104	0.005134
307	6	0.2235	0.4013	0.005101
308	6.1	0.2034	0.3923	0.005077
309	6.2	0.1848	0.3836	0.005058
310	6.3	0.1676	0.375	0.005044
311	6.4	0.1517	0.3667	0.005033
312	6.5	0.1372	0.3585	0.005025
313	6.6	0.1238	0.3506	0.005019
314	6.7	0.1116	0.3428	0.005014
315	6.8	0.1005	0.3352	0.005011
316	6.9	0.09046	0.3278	0.005008
317	7	0.08133	0.3205	0.005006
318	7.1	0.07307	0.3134	0.005005
319	7.2	0.06562	0.3065	0.005004
320	7.3	0.05891	0.2998	0.005003
321	7.4	0.05289	0.2932	0.005002
322	7.5	0.04748	0.2868	0.005002
323	7.6	0.04264	0.2805	0.005001
324	7.7	0.03832	0.2744	0.005001
325	7.8	0.03446	0.2684	0.005001
326	7.9	0.03102	0.2626	0.005001
327	8	0.02796	0.2569	0.005
328	8.1	0.02524	0.2513	0.005
329	8.2	0.02283	0.2459	0.005
330	8.3	0.02069	0.2406	0.005
331	8.4	0.0188	0.2354	0.005
332	8.5	0.01712	0.2304	0.005
333	8.6	0.01565	0.2254	0.005
334	8.7	0.01434	0.2206	0.005
335	8.8	0.01319	0.2159	0.005
336	8.9	0.01218	0.2114	0.005
337	9	0.01129	0.2069	0.005
338	9.1	0.0105	0.2025	0.005
339	9.2	0.009816	0.1983	0.005
340	9.3	0.009212	0.1941	0.005

	A	B	C	D
341	9.4	0.008682	0.1901	0.005
342	9.5	0.008217	0.1861	0.005
343	9.6	0.00781	0.1822	0.005
344	9.7	0.007453	0.1785	0.005
345	9.8	0.007141	0.1748	0.005
346	9.9	0.006868	0.1712	0.005
347	10	0.006629	0.1677	0.005
348	11	0.005409	0.1368	0.005
349	12	0.005101	0.1123	0.005
350	13	0.005025	0.09286	0.005
351	14	0.005006	0.07732	0.005
352	15	0.005002	0.06483	0.005
353	16	0.005	0.05474	0.005
354	17	0.005	0.04655	0.005
355	18	0.005	0.03986	0.005
356	19	0.005	0.03437	0.005
357	20	0.005	0.02984	0.005
358	21	0.005	0.0261	0.005
359	22	0.005	0.02298	0.005
360	23	0.005	0.02038	0.005
361	24	0.005	0.0182	0.005
362	25	0.005	0.01636	0.005
363	30	0.005	0.01061	0.005
364	35	0.005	0.007947	0.005
365	40	0.005	0.006629	0.005
366	45	0.005	0.005939	0.005
367	50	0.005	0.005561	0.005

	E	F	G
1			
2			
3			
4			
5			
6			
7			
8			
9	Embeded Outer 1/4	Outer Surface	Total
10	0.2347	0.0033768	0.6839163
11	0.3605	0.004	1.0078
12	2.8582	0.0104	7.8983
13	Embeded Outer 1/4	Outer Surface	Total
14	34.32%	0.49%	100.00%
15	35.77%	0.40%	100.00%
16	36.19%	0.13%	100.00%
17	35.43%	0.34%	100.00%
18			
19			
20			
21	Flaws/inch with RT	Flaws/inch w/o RT	
22	0.0047	0.0602	
23	0.003	0.0384	
24	0.002	0.0256	
25			
26			
27	0.0035	0.0448	
28	0.0067	0.0858	
29	0.012	0.1536	
30	0.0256	0.3277	
31			
32			
33			
34			
35			
36			



	E	F	G	H	I	J	K
37							
38							
39							
40	Alloy 22 Barrier	50	SS Barrier	65	SS Barrier	95	SS Barrier
41	Shell Welds	0.059185387	Shell Welds	0.054215689	Lid Weld	0.054215689	Lid Weld
42		0.489132034		0.496532523	12 PWR ST	0.496532523	21 PWR/44 BWR
43	Complementary CDF	Defect Size x	Complementary CDF	Defect Size x	Complementary CDF	Defect Size x	Complementary CDF
44	Prob. Flaw Size >= x	(mm)	Prob. Flaw Size >= x	(mm)	Prob. Flaw Size >= x	(mm)	Prob. Flaw Size >= x
45	0.9999999999999	0.5	0.987792989	0.65	0.934730475	0.95	0.772679602
46	1.00E+00	0.75	9.22E-01	0.975	7.57E-01	1.425	4.73E-01
47	1.00E+00	1	7.98E-01	1.3	5.46E-01	1.9	2.58E-01
48	1.00E+00	1.25	6.47E-01	1.625	3.69E-01	2.375	1.36E-01
49	1.00E+00	1.5	5.02E-01	1.95	2.42E-01	2.85	7.15E-02
50	1.00E+00	1.75	3.78E-01	2.275	1.56E-01	3.325	3.79E-02
51	9.99E-01	2	2.80E-01	2.6	1.00E-01	3.8	2.05E-02
52	9.97E-01	2.25	2.05E-01	2.925	6.46E-02	4.275	1.13E-02
53	9.92E-01	2.5	1.49E-01	3.25	4.19E-02	4.75	6.32E-03
54	9.83E-01	2.75	1.08E-01	3.575	2.73E-02	5.225	3.62E-03
55	9.68E-01	3	7.89E-02	3.9	1.80E-02	5.7	2.11E-03
56	9.46E-01	3.25	5.75E-02	4.225	1.20E-02	6.175	1.26E-03
57	9.15E-01	3.5	4.20E-02	4.55	8.04E-03	6.65	7.59E-04
58	8.77E-01	3.75	3.08E-02	4.875	5.45E-03	7.125	4.66E-04
59	8.32E-01	4	2.27E-02	5.2	3.73E-03	7.6	2.91E-04
60	7.80E-01	4.25	1.68E-02	5.525	2.57E-03	8.075	1.84E-04
61	7.24E-01	4.5	1.25E-02	5.85	1.79E-03	8.55	1.18E-04
62	6.65E-01	4.75	9.33E-03	6.175	1.26E-03	9.025	7.65E-05
63	6.05E-01	5	7.01E-03	6.5	8.88E-04	9.5	5.02E-05
64	5.46E-01	5.25	5.28E-03	6.825	6.33E-04	9.975	3.33E-05
65	4.88E-01	5.5	4.00E-03	7.15	4.55E-04	10.45	2.24E-05
66	4.34E-01	5.75	3.05E-03	7.475	3.29E-04	10.925	1.52E-05
67	3.82E-01	6	2.33E-03	7.8	2.39E-04	11.4	1.04E-05
68	3.35E-01	6.25	1.79E-03	8.125	1.75E-04	11.875	7.16E-06
69	2.92E-01	6.5	1.38E-03	8.45	1.29E-04	12.35	4.98E-06
70	2.53E-01	6.75	1.07E-03	8.775	9.59E-05	12.825	3.50E-06
71	2.18E-01	7	8.31E-04	9.1	7.15E-05	13.3	2.47E-06
72	1.87E-01	7.25	6.49E-04	9.425	5.36E-05	13.775	1.76E-06
73	1.60E-01	7.5	5.08E-04	9.75	4.04E-05	14.25	1.26E-06
74	1.37E-01	7.75	4.00E-04	10.075	3.06E-05	14.725	9.12E-07

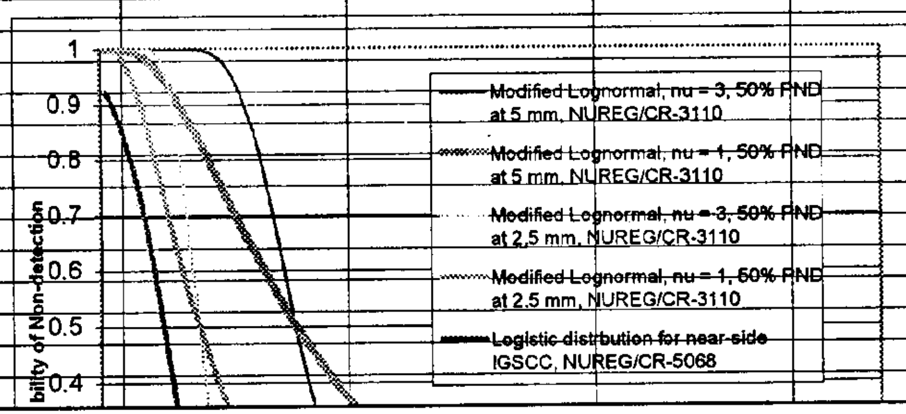
	E	F	G	H	I	J	K
75	1.16E-01	8	3.16E-04	10.4	2.33E-05	15.2	6.63E-07
76	9.87E-02	8.25	2.50E-04	10.725	1.78E-05	15.675	4.84E-07
77	8.35E-02	8.5	1.99E-04	11.05	1.37E-05	16.15	3.56E-07
78	7.05E-02	8.75	1.59E-04	11.375	1.06E-05	16.625	2.63E-07
79	5.94E-02	9	1.27E-04	11.7	8.20E-06	17.1	1.96E-07
80	5.00E-02	9.25	1.02E-04	12.025	6.38E-06	17.575	1.46E-07
81	4.20E-02	9.5	8.19E-05	12.35	4.98E-06	18.05	1.10E-07
82	3.53E-02	9.75	6.61E-05	12.675	3.91E-06	18.525	8.28E-08
83	2.96E-02	10	5.35E-05	13	3.08E-06	19	6.28E-08
84	2.48E-02	10.25	4.35E-05	13.325	2.43E-06	19.475	4.78E-08
85	2.08E-02	10.5	3.54E-05	13.65	1.92E-06	19.95	3.65E-08
86	1.74E-02	10.75	2.89E-05	13.975	1.53E-06	20.425	2.80E-08
87	1.45E-02	11	2.36E-05	14.3	1.22E-06	20.9	2.16E-08
88	1.21E-02	11.25	1.94E-05	14.625	9.76E-07	21.375	1.67E-08
89	1.01E-02	11.5	1.59E-05	14.95	7.83E-07	21.85	1.30E-08
90	8.47E-03	11.75	1.31E-05	15.275	6.30E-07	22.325	1.01E-08
91	7.08E-03	12	1.09E-05	15.6	5.09E-07	22.8	7.91E-09
92	5.91E-03	12.25	8.98E-06	15.925	4.12E-07	23.275	6.21E-09
93	4.94E-03	12.5	7.45E-06	16.25	3.34E-07	23.75	4.89E-09
94	4.12E-03	12.75	6.20E-06	16.575	2.72E-07	24.225	3.86E-09
95	3.44E-03	13	5.16E-06	16.9	2.22E-07	24.7	3.06E-09
96	2.88E-03	13.25	4.31E-06	17.225	1.81E-07	25.175	2.43E-09
97	2.41E-03	13.5	3.61E-06	17.55	1.48E-07	25.65	1.94E-09
98	2.01E-03	13.75	3.02E-06	17.875	1.22E-07	26.125	1.55E-09
99	1.68E-03	14	2.54E-06	18.2	1.00E-07	26.6	1.24E-09
100	1.41E-03	14.25	2.13E-06	18.525	8.28E-08	27.075	9.97E-10
101	1.18E-03	14.5	1.80E-06	18.85	6.85E-08	27.55	8.03E-10
102	9.86E-04	14.75	1.52E-06	19.175	5.67E-08	28.025	6.49E-10
103	8.25E-04	15	1.28E-06	19.5	4.71E-08	28.5	5.25E-10
104	6.92E-04	15.25	1.09E-06	19.825	3.92E-08	28.975	4.26E-10
105	5.80E-04	15.5	9.22E-07	20.15	3.27E-08	29.45	3.47E-10
106	4.86E-04	15.75	7.84E-07	20.475	2.73E-08	29.925	2.83E-10
107	4.08E-04	16	6.67E-07	20.8	2.28E-08	30.4	2.31E-10
108	3.43E-04	16.25	5.68E-07	21.125	1.91E-08	30.875	1.89E-10
109	2.88E-04	16.5	4.85E-07	21.45	1.61E-08	31.35	1.55E-10
110	2.42E-04	16.75	4.15E-07	21.775	1.35E-08	31.825	1.28E-10
111	2.03E-04	17	3.55E-07	22.1	1.14E-08	32.3	1.05E-10
112	1.71E-04	17.25	3.04E-07	22.425	9.61E-09	32.775	8.68E-11

	E	F	G	H	I	J	K
113	1.44E-04	17.5	2.61E-07	22.75	8.12E-09	33.25	7.18E-11
114	1.21E-04	17.75	2.25E-07	23.075	6.88E-09	33.725	5.95E-11
115	1.02E-04	18	1.93E-07	23.4	5.83E-09	34.2	4.94E-11
116	8.63E-05	18.25	1.67E-07	23.725	4.95E-09	34.675	4.11E-11
117	7.28E-05	18.5	1.44E-07	24.05	4.21E-09	35.15	3.43E-11
118	6.15E-05	18.75	1.24E-07	24.375	3.59E-09	35.625	2.86E-11
119	5.20E-05	19	1.07E-07	24.7	3.06E-09	36.1	2.39E-11
120	4.39E-05	19.25	9.31E-08	25.025	2.61E-09	36.575	2.00E-11
121	3.72E-05	19.5	8.07E-08	25.35	2.24E-09	37.05	1.68E-11
122	3.15E-05	19.75	7.01E-08	25.675	1.91E-09	37.525	1.41E-11
123	2.67E-05	20	6.09E-08	26	1.64E-09	38	1.19E-11
124	2.26E-05	20.25	5.30E-08	26.325	1.41E-09	38.475	1.00E-11
125	1.92E-05	20.5	4.62E-08	26.65	1.21E-09	38.95	8.45E-12
126	1.63E-05	20.75	4.03E-08	26.975	1.04E-09	39.425	7.15E-12
127	1.38E-05	21	3.51E-08	27.3	9.00E-10	39.9	6.05E-12
128	1.17E-05	21.25	3.07E-08	27.625	7.76E-10	40.375	5.13E-12
129	9.98E-06	21.5	2.69E-08	27.95	6.71E-10	40.85	4.35E-12
130	8.50E-06	21.75	2.35E-08	28.275	5.80E-10	41.325	3.70E-12
131	7.23E-06	22	2.06E-08	28.6	5.02E-10	41.8	3.15E-12
132	6.16E-06	22.25	1.81E-08	28.925	4.36E-10	42.275	2.69E-12
133	5.25E-06	22.5	1.59E-08	29.25	3.78E-10	42.75	2.29E-12
134	4.48E-06	22.75	1.40E-08	29.575	3.28E-10	43.225	1.96E-12
135	3.83E-06	23	1.23E-08	29.9	2.86E-10	43.7	1.68E-12
136	3.27E-06	23.25	1.08E-08	30.225	2.49E-10	44.175	1.44E-12
137	2.79E-06	23.5	9.53E-09	30.55	2.17E-10	44.65	1.23E-12
138	2.39E-06	23.75	8.40E-09	30.875	1.89E-10	45.125	1.06E-12
139	2.04E-06	24	7.42E-09	31.2	1.65E-10	45.6	9.08E-13
140	1.75E-06	24.25	6.56E-09	31.525	1.44E-10	46.075	7.82E-13
141	1.50E-06	24.5	5.80E-09	31.85	1.26E-10	46.55	6.74E-13
142	1.28E-06	24.75	5.13E-09	32.175	1.11E-10	47.025	5.81E-13
143	1.10E-06	25	4.55E-09	32.5	9.70E-11	47.5	5.02E-13
144	9.46E-07	25.25	4.03E-09	32.825	8.51E-11	47.975	4.34E-13
145	8.12E-07	25.5	3.58E-09	33.15	7.48E-11	48.45	3.75E-13
146	6.98E-07	25.75	3.18E-09	33.475	6.57E-11	48.925	3.25E-13
147	6.00E-07	26	2.82E-09	33.8	5.78E-11	49.4	2.82E-13
148	5.16E-07	26.25	2.51E-09	34.125	5.09E-11	49.875	2.45E-13
149	4.44E-07	26.5	2.23E-09	34.45	4.49E-11	50.35	2.12E-13
150	3.83E-07	26.75	1.99E-09	34.775	3.96E-11	50.825	1.85E-13

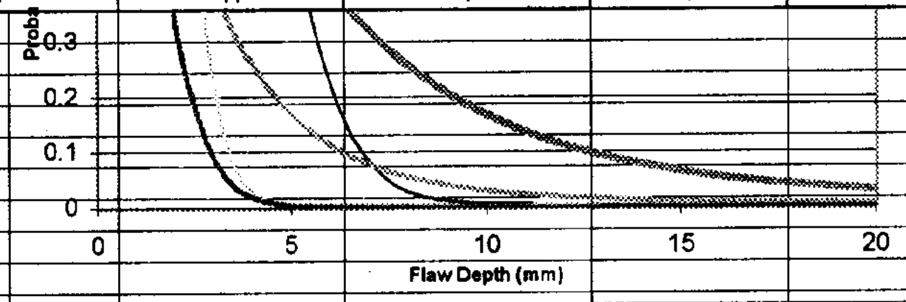
	E	F	G	H	I	J	K
151	3.30E-07	27	1.77E-09	35.1	3.49E-11	51.3	1.61E-13
152	2.84E-07	27.25	1.58E-09	35.425	3.09E-11	51.775	1.40E-13
153	2.45E-07	27.5	1.41E-09	35.75	2.73E-11	52.25	1.22E-13
154	2.12E-07	27.75	1.26E-09	36.075	2.41E-11	52.725	1.07E-13
155	1.83E-07	28	1.13E-09	36.4	2.14E-11	53.2	9.33E-14
156	1.58E-07	28.25	1.01E-09	36.725	1.89E-11	53.675	8.15E-14
157	1.37E-07	28.5	9.01E-10	37.05	1.68E-11	54.15	7.13E-14
158	1.18E-07	28.75	8.07E-10	37.375	1.49E-11	54.625	6.25E-14
159	1.02E-07	29	7.23E-10	37.7	1.32E-11	55.1	5.47E-14
160	8.87E-08	29.25	6.49E-10	38.025	1.18E-11	55.575	4.81E-14
161	7.69E-08	29.5	5.82E-10	38.35	1.05E-11	56.05	4.22E-14
162	6.67E-08	29.75	5.23E-10	38.675	9.32E-12	56.525	3.71E-14
163	5.79E-08	30	4.69E-10	39	8.31E-12	57	3.26E-14
164	5.02E-08	30.25	4.22E-10	39.325	7.40E-12	57.475	2.88E-14
165	4.36E-08	30.5	3.80E-10	39.65	6.60E-12	57.95	2.53E-14
166	3.79E-08	30.75	3.42E-10	39.975	5.89E-12	58.425	2.23E-14
167	3.29E-08	31	3.08E-10	40.3	5.26E-12	58.9	1.97E-14
168	2.87E-08	31.25	2.77E-10	40.625	4.70E-12	59.375	1.73E-14
169	2.49E-08	31.5	2.50E-10	40.95	4.21E-12	59.85	1.53E-14
170	2.17E-08	31.75	2.25E-10	41.275	3.76E-12	60.325	1.35E-14
171	1.89E-08	32	2.03E-10	41.6	3.37E-12	60.8	1.20E-14
172	1.65E-08	32.25	1.84E-10	41.925	3.02E-12	61.275	1.07E-14
173	1.44E-08	32.5	1.66E-10	42.25	2.71E-12	61.75	9.44E-15
174	1.25E-08	32.75	1.50E-10	42.575	2.43E-12	62.225	8.33E-15
175	1.10E-08	33	1.36E-10	42.9	2.18E-12	62.7	7.44E-15
176	9.57E-09	33.25	1.23E-10	43.225	1.96E-12	63.175	6.55E-15
177	8.36E-09	33.5	1.11E-10	43.55	1.76E-12	63.65	5.88E-15
178	7.31E-09	33.75	1.01E-10	43.875	1.58E-12	64.125	5.22E-15
179	6.39E-09	34	9.13E-11	44.2	1.42E-12	64.6	4.66E-15
180	5.59E-09	34.25	8.28E-11	44.525	1.28E-12	65.075	4.11E-15
181	4.90E-09	34.5	7.51E-11	44.85	1.15E-12	65.55	3.66E-15
182	4.29E-09	34.75	6.82E-11	45.175	1.04E-12	66.025	3.22E-15
183	3.76E-09	35	6.19E-11	45.5	9.38E-13	66.5	2.89E-15
184	3.29E-09	35.25	5.63E-11	45.825	8.46E-13	66.975	2.55E-15
185	2.89E-09	35.5	5.12E-11	46.15	7.64E-13	67.45	2.33E-15
186	2.53E-09	35.75	4.65E-11	46.475	6.90E-13	67.925	2.11E-15
187	2.23E-09	36	4.23E-11	46.8	6.23E-13	68.4	1.89E-15
188	1.95E-09	36.25	3.85E-11	47.125	5.63E-13	68.875	0.00E+00

	E	F	G	H	I	J	K
189	1.72E-09	36.5	3.51E-11	47.45	5.09E-13	69.35	0.00E+00
190	1.51E-09	36.75	3.20E-11	47.775	4.61E-13	69.825	0.00E+00
191	1.33E-09	37	2.91E-11	48.1	4.17E-13	70.3	0.00E+00
192	1.17E-09	37.25	2.66E-11	48.425	3.78E-13	70.775	0.00E+00
193	1.03E-09	37.5	2.42E-11	48.75	3.43E-13	71.25	0.00E+00
194	9.05E-10	37.75	2.21E-11	49.075	3.11E-13	71.725	0.00E+00
195	7.97E-10	38	2.02E-11	49.4	2.82E-13	72.2	0.00E+00
196	7.03E-10	38.25	1.85E-11	49.725	2.56E-13	72.675	0.00E+00
197	6.20E-10	38.5	1.69E-11	50.05	2.32E-13	73.15	0.00E+00
198	5.47E-10	38.75	1.54E-11	50.375	2.11E-13	73.625	0.00E+00
199	4.82E-10	39	1.41E-11	50.7	1.92E-13	74.1	0.00E+00
200	4.26E-10	39.25	1.29E-11	51.025	1.74E-13	74.575	0.00E+00
201	3.76E-10	39.5	1.18E-11	51.35	1.59E-13	75.05	0.00E+00
202	3.32E-10	39.75	1.08E-11	51.675	1.44E-13	75.525	0.00E+00
203	2.94E-10	40	9.90E-12	52	1.31E-13	76	0.00E+00
204	2.60E-10	40.25	9.08E-12	52.325	1.20E-13	76.475	0.00E+00
205	2.30E-10	40.5	8.32E-12	52.65	1.09E-13	76.95	0.00E+00
206	2.03E-10	40.75	7.63E-12	52.975	9.94E-14	77.425	0.00E+00
207	1.80E-10	41	7.00E-12	53.3	9.06E-14	77.9	0.00E+00
208	1.59E-10	41.25	6.43E-12	53.625	8.27E-14	78.375	0.00E+00
209	1.41E-10	41.5	5.90E-12	53.95	7.55E-14	78.85	0.00E+00
210	1.25E-10	41.75	5.42E-12	54.275	6.88E-14	79.325	0.00E+00
211	1.11E-10	42	4.98E-12	54.6	6.29E-14	79.8	0.00E+00
212	9.84E-11	42.25	4.58E-12	54.925	5.75E-14	80.275	0.00E+00
213	8.73E-11	42.5	4.21E-12	55.25	5.25E-14	80.75	0.00E+00
214	7.75E-11	42.75	3.87E-12	55.575	4.81E-14	81.225	0.00E+00
215	6.88E-11	43	3.56E-12	55.9	4.40E-14	81.7	0.00E+00
216	6.12E-11	43.25	3.28E-12	56.225	4.02E-14	82.175	0.00E+00
217	5.43E-11	43.5	3.02E-12	56.55	3.69E-14	82.65	0.00E+00
218	4.83E-11	43.75	2.78E-12	56.875	3.38E-14	83.125	0.00E+00
219	4.30E-11	44	2.56E-12	57.2	3.09E-14	83.6	0.00E+00
220	3.82E-11	44.25	2.36E-12	57.525	2.83E-14	84.075	0.00E+00
221	3.40E-11	44.5	2.18E-12	57.85	2.60E-14	84.55	0.00E+00
222	3.03E-11	44.75	2.01E-12	58.175	2.39E-14	85.025	0.00E+00
223	2.70E-11	45	1.85E-12	58.5	2.19E-14	85.5	0.00E+00
224	2.40E-11	45.25	1.71E-12	58.825	2.01E-14	85.975	0.00E+00
225	2.14E-11	45.5	1.58E-12	59.15	1.84E-14	86.45	0.00E+00
226	1.91E-11	45.75	1.46E-12	59.475	1.69E-14	86.925	0.00E+00

	E	F	G	H	I	J	K
227	1.70E-11	46	1.34E-12	59.8	1.55E-14	87.4	0.00E+00
228	1.52E-11	46.25	1.24E-12	60.125	1.43E-14	87.875	0.00E+00
229	1.36E-11	46.5	1.15E-12	60.45	1.31E-14	88.35	0.00E+00
230	1.21E-11	46.75	1.06E-12	60.775	1.21E-14	88.825	0.00E+00
231	1.08E-11	47	9.82E-13	61.1	1.11E-14	89.3	0.00E+00
232	9.65E-12	47.25	9.08E-13	61.425	1.02E-14	89.775	0.00E+00
233	8.62E-12	47.5	8.41E-13	61.75	9.44E-15	90.25	0.00E+00
234	7.71E-12	47.75	7.78E-13	62.075	8.66E-15	90.725	0.00E+00
235	6.89E-12	48	7.21E-13	62.4	7.99E-15	91.2	0.00E+00
236	6.17E-12	48.25	6.67E-13	62.725	7.33E-15	91.675	0.00E+00
237	5.52E-12	48.5	6.18E-13	63.05	6.77E-15	92.15	0.00E+00
238	4.94E-12	48.75	5.73E-13	63.375	6.22E-15	92.625	0.00E+00
239	4.42E-12	49	5.31E-13	63.7	5.77E-15	93.1	0.00E+00
240	3.96E-12	49.25	4.92E-13	64.025	5.33E-15	93.575	0.00E+00
241	3.55E-12	49.5	4.57E-13	64.35	4.88E-15	94.05	0.00E+00
242	3.18E-12	49.75	4.24E-13	64.675	4.55E-15	94.525	0.00E+00
243	2.85E-12	50	3.93E-13	65	4.22E-15	95	0.00E+00
244							
245		From NUREG/CR-5068					
246	n=1, a*=2.5	Logistic Distribution					
247	Modified Lognormal, nu = 1, 50	Logistic distrbution for near-side IGSCC, NUREG/CR-5068					
248	1	0.92434557					
249	0.9998	0.911800506					
250	0.9987	0.897406099					
251	0.9952	0.88096916					
252	0.9886	0.86230287					
253	0.9783	0.841236879					
254	0.9643	0.817629654					
255	0.9467	0.791382668					
256	0.9261	0.76245565					
257	0.903	0.730881591					
258	0.8778	0.696779766					
259	0.8511	0.660364731					
260	0.8234	0.621949238					
261	0.7949	0.581939419					
262	0.7662	0.540821436					
263	0.7373	0.499140001					
264	0.7087	0.457470515					



	E	F	G	H	I	J	K
265	0.6805	0.416387723					
266	0.6528	0.376434441					
267	0.6257	0.338093908					
268	0.5994	0.301768614					
269	0.5739	0.267767308					
270	0.5492	0.236300516					
271	0.5254	0.207483748					
272	0.5025	0.181346701					
273	0.4805	0.157846402					
274	0.4594	0.136882257					
275	0.4392	0.118311275					
276	0.4198	0.1019622					
277	0.4013	0.087647767					
278	0.3836	0.075174708					
279	0.3667	0.064351478					
280	0.3506	0.054993854					
281	0.3352	0.046928713					
282	0.3205	0.039996307					
283	0.3065	0.034051383					
284	0.2932	0.028963434					
285	0.2805	0.024616351					
286	0.2684	0.020907667					
287	0.2569	0.017747565					
288	0.2459	0.015057753					
289	0.2354	0.012770307					
290	0.2254	0.010826531					
291	0.2159	0.009175869					
292	0.2069	0.007774895					
293	0.1983	0.006586401					
294	0.1901	0.005578562					
295	0.1822	0.004724208					
296	0.1748	0.004000171					
297	0.1677	0.003386723					
298	0.1609	0.00286708					
299	0.1544	0.002426974					
300	0.1482	0.002054287					
301	0.1424	0.00173873					
302	0.1368	0.001471574					

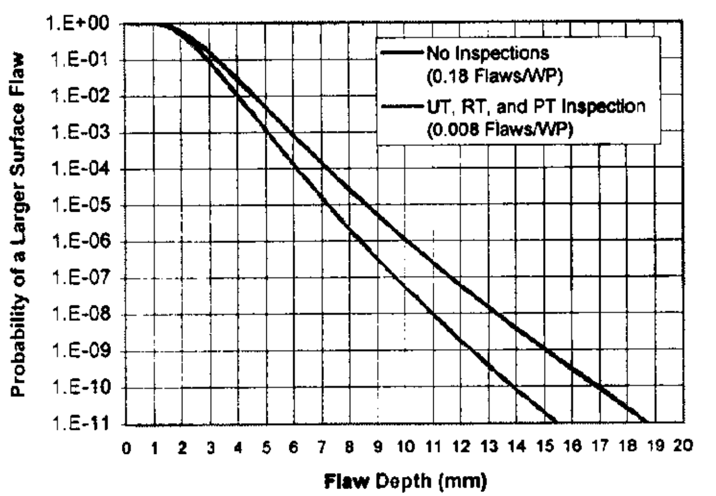


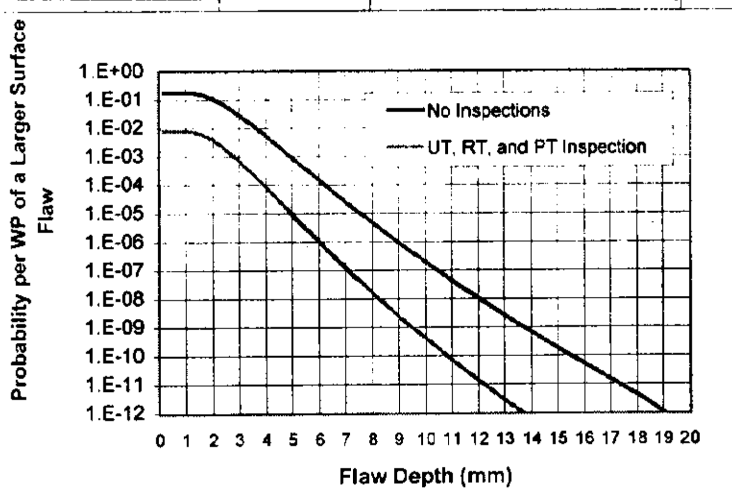
	E	F	G	H	I	J	K
303	0.1314	0.001245415					
304	0.1263	0.001053977					
305	0.1214	0.000891939					
306	0.1167	0.000754794					
307	0.1123	0.000638723					
308	0.1081	0.000540492					
309	0.104	0.000457361					
310	0.1001	0.000387011					
311	0.0964	0.000327479					
312	0.09286	0.000277101					
313	0.08947	0.000234472					
314	0.08623	0.000198399					
315	0.08313	0.000167876					
316	0.08016	0.000142047					
317	0.07732	0.000120192					
318	0.0746	0.000101699					
319	0.072	8.60514E-05					
320	0.06951	7.28111E-05					
321	0.06712	6.16078E-05					
322	0.06483	5.21283E-05					
323	0.06264	4.41074E-05					
324	0.06054	3.73205E-05					
325	0.05852	3.15779E-05					
326	0.05659	2.6719E-05					
327	0.05474	2.26076E-05					
328	0.05296	1.91289E-05					
329	0.05126	1.61855E-05					
330	0.04962	1.36949E-05					
331	0.04805	1.15876E-05					
332	0.04655	9.80459E-06					
333	0.0451	8.29591E-06					
334	0.04371	7.01937E-06					
335	0.04237	5.93926E-06					
336	0.04109	5.02535E-06					
337	0.03986	4.25207E-06					
338	0.03867	3.59778E-06					
339	0.03753	3.04417E-06					
340	0.03643	2.57574E-06					

	E	F	G	H	I	J	K
341	0.03538	2.1794E-06					
342	0.03437	1.84404E-06					
343	0.03339	1.56029E-06					
344	0.03245	1.32019E-06					
345	0.03155	1.11705E-06					
346	0.03068	9.45161E-07					
347	0.02984	7.99723E-07					
348	0.02298	1.5041E-07					
349	0.0182	2.82888E-08					
350	0.01481	5.32049E-09					
351	0.01238	1.00067E-09					
352	0.01061	1.88203E-10					
353	0.009308	3.53968E-11					
354	0.008338	6.65734E-12					
355	0.007608	1.25211E-12					
356	0.007054	2.35589E-13					
357	0.006629	4.41869E-14					
358	0.006301	8.43769E-15					
359	0.006045	0					
360	0.005845	0					
361	0.005687	0					
362	0.005561	0					
363	0.005219	0					
364	0.005094	0					
365	0.005044	0					
366	0.005022	0					
367	0.005011	0					

	E	F	G	H	I	J	K
341	0.03538	2.1794E-06					
342	0.03437	1.84404E-06					
343	0.03339	1.56029E-06					
344	0.03245	1.32019E-06					
345	0.03155	1.11705E-06					
346	0.03068	9.45161E-07					
347	0.02984	7.99723E-07					
348	0.02298	1.5041E-07					
349	0.0182	2.82888E-08					
350	0.01481	5.32049E-09					
351	0.01238	1.00067E-09					
352	0.01061	1.88203E-10					
353	0.009308	3.53968E-11					
354	0.008338	6.65734E-12					
355	0.007608	1.25211E-12					
356	0.007054	2.35589E-13					
357	0.006629	4.41869E-14					
358	0.006301	8.43769E-15					
359	0.006045	0					
360	0.005845	0					
361	0.005687	0					
362	0.005561	0					
363	0.005219	0					
364	0.005094	0					
365	0.005044	0					
366	0.005022	0					
367	0.005011	0					

Barrier Thickness (mm)	20
Barrier Inner Radius (m)	0.76
Seam Weld Length (m)	4.558
Circumferential Weld Length	4.775
Total Weld Length	9.333
Total Flaws per WP - no inspection	52.360
Total Flaws per WP - w/ RT & PT inpsection	4.057





	A	B	C	D	E	F	G	H	I	J
51	Probability of various size flaws in WP shell assuming no inspections									
52	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
53	1%	0.2	3.05E-12	2.53E-14	3.19E-13	1.62E-12	1.08E-12	1.04E-14	1.00E+00	1.78E-01
54	1.500%	0.3	1.89E-08	1.57E-10	1.98E-09	1.00E-08	6.70E-09	6.45E-11	1.00E+00	1.78E-01
55	2.000%	0.4	3.60E-06	2.99E-08	3.77E-07	1.91E-06	1.28E-06	1.23E-08	1.00E+00	1.78E-01
56	2.500%	0.5	1.22E-04	1.01E-06	1.27E-05	6.44E-05	4.30E-05	4.14E-07	1.00E+00	1.78E-01
57	3.000%	0.6	1.48E-03	1.23E-05	1.55E-04	7.83E-04	5.24E-04	5.04E-06	1.00E+00	1.78E-01
58	3.500%	0.7	9.32E-03	7.74E-05	9.74E-04	4.94E-03	3.30E-03	3.18E-05	1.00E+00	1.78E-01
59	4.000%	0.8	3.74E-02	3.10E-04	3.91E-03	1.98E-02	1.32E-02	1.27E-04	9.99E-01	1.78E-01
60	4.500%	0.9	1.09E-01	9.02E-04	1.14E-02	5.75E-02	3.85E-02	3.70E-04	9.97E-01	1.78E-01
61	5.000%	1.0	2.49E-01	2.06E-03	2.60E-02	1.32E-01	8.81E-02	8.47E-04	9.92E-01	1.77E-01
62	5.500%	1.1	4.75E-01	3.94E-03	4.96E-02	2.51E-01	1.68E-01	1.62E-03	9.83E-01	1.75E-01
63	6.000%	1.2	7.88E-01	6.54E-03	8.23E-02	4.17E-01	2.79E-01	2.68E-03	9.68E-01	1.73E-01
64	6.500%	1.3	1.17E+00	9.71E-03	1.22E-01	6.19E-01	4.14E-01	3.99E-03	9.46E-01	1.69E-01
65	7.000%	1.4	1.59E+00	1.32E-02	1.66E-01	8.41E-01	5.63E-01	5.41E-03	9.15E-01	1.63E-01
66	7.500%	1.5	2.01E+00	1.67E-02	2.10E-01	1.06E+00	7.11E-01	6.84E-03	8.77E-01	1.57E-01
67	8.000%	1.6	2.39E+00	1.98E-02	2.49E-01	1.26E+00	8.46E-01	8.14E-03	8.32E-01	1.48E-01
68	8.500%	1.7	2.70E+00	2.24E-02	2.82E-01	1.43E+00	9.58E-01	9.21E-03	7.80E-01	1.39E-01
69	9.000%	1.8	2.94E+00	2.44E-02	3.07E-01	1.55E+00	1.04E+00	1.00E-02	7.24E-01	1.29E-01
70	9.500%	1.9	3.08E+00	2.55E-02	3.22E-01	1.63E+00	1.09E+00	1.05E-02	6.65E-01	1.19E-01
71	10.000%	2.0	3.13E+00	2.60E-02	3.27E-01	1.66E+00	1.11E+00	1.07E-02	6.05E-01	1.08E-01
72	10.500%	2.1	3.11E+00	2.58E-02	3.25E-01	1.65E+00	1.10E+00	1.06E-02	5.46E-01	9.74E-02
73	11.000%	2.2	3.01E+00	2.50E-02	3.15E-01	1.60E+00	1.07E+00	1.03E-02	4.88E-01	8.71E-02
74	11.500%	2.3	2.87E+00	2.38E-02	3.00E-01	1.52E+00	1.02E+00	9.78E-03	4.34E-01	7.74E-02
75	12.000%	2.4	2.69E+00	2.23E-02	2.81E-01	1.42E+00	9.52E-01	9.15E-03	3.82E-01	6.82E-02

	A	B	C	D	E	F	G	H	I	J
76	12.500%	2.5	2.48E+00	2.06E-02	2.59E-01	1.31E+00	8.78E-01	8.45E-03	3.35E-01	5.98E-02
77	13.000%	2.6	2.26E+00	1.88E-02	2.36E-01	1.20E+00	8.00E-01	7.70E-03	2.92E-01	5.21E-02
78	13.500%	2.7	2.04E+00	1.69E-02	2.13E-01	1.08E+00	7.22E-01	6.94E-03	2.53E-01	4.51E-02
79	14.000%	2.8	1.82E+00	1.51E-02	1.90E-01	9.63E-01	6.44E-01	6.20E-03	2.18E-01	3.89E-02
80	14.500%	2.9	1.61E+00	1.34E-02	1.68E-01	8.52E-01	5.70E-01	5.48E-03	1.87E-01	3.34E-02
81	15.000%	3.0	1.41E+00	1.17E-02	1.48E-01	7.49E-01	5.01E-01	4.82E-03	1.60E-01	2.86E-02
82	15.500%	3.1	1.23E+00	1.02E-02	1.29E-01	6.54E-01	4.37E-01	4.21E-03	1.37E-01	2.44E-02
83	16.000%	3.2	1.07E+00	8.89E-03	1.12E-01	5.67E-01	3.79E-01	3.65E-03	1.16E-01	2.08E-02
84	16.500%	3.3	9.25E-01	7.67E-03	9.66E-02	4.90E-01	3.28E-01	3.15E-03	9.87E-02	1.76E-02
85	17.000%	3.4	7.94E-01	6.59E-03	8.30E-02	4.21E-01	2.81E-01	2.71E-03	8.35E-02	1.49E-02
86	17.500%	3.5	6.80E-01	5.64E-03	7.11E-02	3.60E-01	2.41E-01	2.32E-03	7.05E-02	1.26E-02
87	18.000%	3.6	5.80E-01	4.81E-03	6.06E-02	3.07E-01	2.05E-01	1.98E-03	5.94E-02	1.06E-02
88	18.500%	3.7	4.93E-01	4.09E-03	5.15E-02	2.61E-01	1.75E-01	1.68E-03	5.00E-02	8.93E-03
89	19.000%	3.8	4.18E-01	3.47E-03	4.37E-02	2.21E-01	1.48E-01	1.42E-03	4.20E-02	7.50E-03
90	19.500%	3.9	3.54E-01	2.93E-03	3.69E-02	1.87E-01	1.25E-01	1.20E-03	3.53E-02	6.30E-03
91	20.000%	4.0	2.98E-01	2.48E-03	3.12E-02	1.58E-01	1.06E-01	1.02E-03	2.96E-02	5.28E-03
92	20.500%	4.1	2.51E-01	2.09E-03	2.63E-02	1.33E-01	8.90E-02	8.56E-04	2.48E-02	4.42E-03
93	21.000%	4.2	2.11E-01	1.75E-03	2.21E-02	1.12E-01	7.49E-02	7.20E-04	2.08E-02	3.70E-03
94	21.500%	4.3	1.78E-01	1.47E-03	1.85E-02	9.40E-02	6.29E-02	6.05E-04	1.74E-02	3.10E-03
95	22.000%	4.4	1.49E-01	1.24E-03	1.56E-02	7.88E-02	5.27E-02	5.07E-04	1.45E-02	2.59E-03
96	22.500%	4.5	1.25E-01	1.04E-03	1.30E-02	6.61E-02	4.42E-02	4.25E-04	1.21E-02	2.16E-03
97	23.000%	4.6	1.04E-01	8.67E-04	1.09E-02	5.53E-02	3.70E-02	3.56E-04	1.01E-02	1.81E-03
98	23.500%	4.7	8.74E-02	7.25E-04	9.13E-03	4.63E-02	3.09E-02	2.98E-04	8.47E-03	1.51E-03
99	24.000%	4.8	7.30E-02	6.06E-04	7.63E-03	3.87E-02	2.59E-02	2.49E-04	7.08E-03	1.26E-03
100	24.500%	4.9	6.10E-02	5.07E-04	6.38E-03	3.23E-02	2.16E-02	2.08E-04	5.91E-03	1.05E-03
101	25.000%	5.0	5.10E-02	4.23E-04	5.33E-03	2.70E-02	1.81E-02	1.74E-04	4.94E-03	8.81E-04
102	25.500%	5.1	4.26E-02	3.53E-04	4.45E-03	2.25E-02	1.51E-02	1.45E-04	4.12E-03	7.36E-04
103	26.000%	5.2	3.55E-02	2.95E-04	3.71E-03	1.88E-02	1.26E-02	1.21E-04	3.44E-03	6.15E-04
104	26.500%	5.3	2.97E-02	2.46E-04	3.10E-03	1.57E-02	1.05E-02	1.01E-04	2.88E-03	5.14E-04
105	27.000%	5.4	2.48E-02	2.05E-04	2.59E-03	1.31E-02	8.77E-03	8.44E-05	2.41E-03	4.29E-04
106	27.500%	5.5	2.07E-02	1.71E-04	2.16E-03	1.09E-02	7.32E-03	7.04E-05	2.01E-03	3.59E-04
107	28.000%	5.6	1.72E-02	1.43E-04	1.80E-03	9.13E-03	6.11E-03	5.88E-05	1.68E-03	3.00E-04
108	28.500%	5.7	1.44E-02	1.19E-04	1.50E-03	7.62E-03	5.10E-03	4.91E-05	1.41E-03	2.51E-04
109	29.000%	5.8	1.20E-02	9.98E-05	1.26E-03	6.37E-03	4.26E-03	4.10E-05	1.18E-03	2.10E-04
110	29.500%	5.9	1.00E-02	8.33E-05	1.05E-03	5.32E-03	3.56E-03	3.42E-05	9.86E-04	1.76E-04
111	30.000%	6.0	8.39E-03	6.96E-05	8.76E-04	4.44E-03	2.97E-03	2.86E-05	8.25E-04	1.47E-04
112	30.500%	6.1	7.01E-03	5.82E-05	7.32E-04	3.71E-03	2.48E-03	2.39E-05	6.92E-04	1.23E-04
113	31.000%	6.2	5.86E-03	4.86E-05	6.12E-04	3.10E-03	2.07E-03	2.00E-05	5.80E-04	1.03E-04
114	31.500%	6.3	4.90E-03	4.06E-05	5.12E-04	2.59E-03	1.73E-03	1.67E-05	4.86E-04	8.68E-05
115	32.000%	6.4	4.10E-03	3.40E-05	4.28E-04	2.17E-03	1.45E-03	1.40E-05	4.08E-04	7.28E-05
116	32.500%	6.5	3.43E-03	2.85E-05	3.58E-04	1.82E-03	1.21E-03	1.17E-05	3.43E-04	6.11E-05
117	33.000%	6.6	2.87E-03	2.38E-05	3.00E-04	1.52E-03	1.02E-03	9.78E-06	2.88E-04	5.13E-05
118	33.500%	6.7	2.40E-03	2.00E-05	2.51E-04	1.27E-03	8.52E-04	8.19E-06	2.42E-04	4.32E-05
119	34.000%	6.8	2.01E-03	1.67E-05	2.10E-04	1.07E-03	7.14E-04	6.86E-06	2.03E-04	3.63E-05
120	34.500%	6.9	1.69E-03	1.40E-05	1.76E-04	8.94E-04	5.98E-04	5.75E-06	1.71E-04	3.05E-05
121	35.000%	7.0	1.42E-03	1.18E-05	1.48E-04	7.50E-04	5.02E-04	4.83E-06	1.44E-04	2.57E-05
122	35.500%	7.1	1.19E-03	9.87E-06	1.24E-04	6.30E-04	4.21E-04	4.05E-06	1.21E-04	2.17E-05
123	36.000%	7.2	9.98E-04	8.29E-06	1.04E-04	5.29E-04	3.54E-04	3.40E-06	1.02E-04	1.83E-05
124	36.500%	7.3	8.39E-04	6.96E-06	8.76E-05	4.44E-04	2.97E-04	2.86E-06	8.63E-05	1.54E-05
125	37.000%	7.4	7.05E-04	5.85E-06	7.37E-05	3.73E-04	2.50E-04	2.40E-06	7.28E-05	1.30E-05
126	37.500%	7.5	5.93E-04	4.92E-06	6.20E-05	3.14E-04	2.10E-04	2.02E-06	6.15E-05	1.10E-05

	A	B	C	D	E	F	G	H	I	J
127	38.000%	7.6	4.99E-04	4.14E-06	5.22E-05	2.64E-04	1.77E-04	1.70E-06	5.20E-05	9.27E-06
128	38.500%	7.7	4.20E-04	3.49E-06	4.39E-05	2.23E-04	1.49E-04	1.43E-06	4.39E-05	7.84E-06
129	39.000%	7.8	3.54E-04	2.94E-06	3.70E-05	1.88E-04	1.25E-04	1.21E-06	3.72E-05	6.63E-06
130	39.500%	7.9	2.99E-04	2.48E-06	3.12E-05	1.58E-04	1.06E-04	1.02E-06	3.15E-05	5.62E-06
131	40.000%	8.0	2.52E-04	2.09E-06	2.63E-05	1.33E-04	8.93E-05	8.59E-07	2.67E-05	4.76E-06
132	40.500%	8.1	2.13E-04	1.77E-06	2.22E-05	1.13E-04	7.53E-05	7.25E-07	2.26E-05	4.03E-06
133	41.000%	8.2	1.80E-04	1.49E-06	1.88E-05	9.51E-05	6.36E-05	6.12E-07	1.92E-05	3.42E-06
134	41.500%	8.3	1.52E-04	1.26E-06	1.59E-05	8.04E-05	5.38E-05	5.17E-07	1.63E-05	2.90E-06
135	42.000%	8.4	1.28E-04	1.07E-06	1.34E-05	6.80E-05	4.55E-05	4.38E-07	1.38E-05	2.47E-06
136	42.500%	8.5	1.09E-04	9.02E-07	1.14E-05	5.75E-05	3.85E-05	3.70E-07	1.17E-05	2.10E-06
137	43.000%	8.6	9.20E-05	7.64E-07	9.61E-06	4.87E-05	3.26E-05	3.14E-07	9.98E-06	1.78E-06
138	43.500%	8.7	7.80E-05	6.47E-07	8.15E-06	4.13E-05	2.76E-05	2.66E-07	8.50E-06	1.52E-06
139	44.000%	8.8	6.61E-05	5.49E-07	6.91E-06	3.50E-05	2.34E-05	2.25E-07	7.23E-06	1.29E-06
140	44.500%	8.9	5.61E-05	4.65E-07	5.86E-06	2.97E-05	1.99E-05	1.91E-07	6.16E-06	1.10E-06
141	45.000%	9.0	4.76E-05	3.95E-07	4.97E-06	2.52E-05	1.69E-05	1.62E-07	5.25E-06	9.37E-07
142	45.500%	9.1	4.04E-05	3.36E-07	4.22E-06	2.14E-05	1.43E-05	1.38E-07	4.48E-06	8.00E-07
143	46.000%	9.2	3.44E-05	2.85E-07	3.59E-06	1.82E-05	1.22E-05	1.17E-07	3.83E-06	6.82E-07
144	46.500%	9.3	2.92E-05	2.43E-07	3.05E-06	1.55E-05	1.04E-05	9.96E-08	3.27E-06	5.83E-07
145	47.000%	9.4	2.49E-05	2.06E-07	2.60E-06	1.32E-05	8.81E-06	8.47E-08	2.79E-06	4.98E-07
146	47.500%	9.5	2.12E-05	1.76E-07	2.21E-06	1.12E-05	7.50E-06	7.22E-08	2.39E-06	4.26E-07
147	48.000%	9.6	1.80E-05	1.50E-07	1.89E-06	9.55E-06	6.39E-06	6.15E-08	2.04E-06	3.65E-07
148	48.500%	9.7	1.54E-05	1.28E-07	1.61E-06	8.15E-06	5.45E-06	5.24E-08	1.75E-06	3.12E-07
149	49.000%	9.8	1.31E-05	1.09E-07	1.37E-06	6.95E-06	4.65E-06	4.47E-08	1.50E-06	2.67E-07
150	49.500%	9.9	1.12E-05	9.30E-08	1.17E-06	5.93E-06	3.97E-06	3.82E-08	1.28E-06	2.29E-07
151	50.000%	10.0	9.57E-06	7.94E-08	1.00E-06	5.07E-06	3.39E-06	3.26E-08	1.10E-06	1.97E-07
152	50.500%	10.1	8.18E-06	6.79E-08	8.54E-07	4.33E-06	2.90E-06	2.79E-08	9.46E-07	1.69E-07
153	51.000%	10.2	6.99E-06	5.80E-08	7.31E-07	3.70E-06	2.48E-06	2.38E-08	8.12E-07	1.45E-07
154	51.500%	10.3	5.98E-06	4.97E-08	6.25E-07	3.17E-06	2.12E-06	2.04E-08	6.98E-07	1.25E-07
155	52.000%	10.4	5.12E-06	4.25E-08	5.35E-07	2.71E-06	1.81E-06	1.75E-08	6.00E-07	1.07E-07
156	52.500%	10.5	4.39E-06	3.64E-08	4.59E-07	2.32E-06	1.55E-06	1.50E-08	5.16E-07	9.21E-08
157	53.000%	10.6	3.76E-06	3.12E-08	3.93E-07	1.99E-06	1.33E-06	1.28E-08	4.44E-07	7.93E-08
158	53.500%	10.7	3.23E-06	2.68E-08	3.37E-07	1.71E-06	1.14E-06	1.10E-08	3.83E-07	6.83E-08
159	54.000%	10.8	2.77E-06	2.30E-08	2.89E-07	1.47E-06	9.81E-07	9.44E-09	3.30E-07	5.89E-08
160	54.500%	10.9	2.38E-06	1.97E-08	2.48E-07	1.26E-06	8.42E-07	8.10E-09	2.84E-07	5.08E-08
161	55.000%	11.0	2.04E-06	1.70E-08	2.14E-07	1.08E-06	7.24E-07	6.96E-09	2.45E-07	4.38E-08
162	55.500%	11.1	1.76E-06	1.46E-08	1.84E-07	9.30E-07	6.22E-07	5.99E-09	2.12E-07	3.78E-08
163	56.000%	11.2	1.51E-06	1.25E-08	1.58E-07	8.00E-07	5.35E-07	5.15E-09	1.83E-07	3.27E-08
164	56.500%	11.3	1.30E-06	1.08E-08	1.36E-07	6.89E-07	4.61E-07	4.43E-09	1.58E-07	2.82E-08
165	57.000%	11.4	1.12E-06	9.30E-09	1.17E-07	5.93E-07	3.97E-07	3.82E-09	1.37E-07	2.44E-08
166	57.500%	11.5	9.65E-07	8.01E-09	1.01E-07	5.11E-07	3.42E-07	3.29E-09	1.18E-07	2.11E-08
167	58.000%	11.6	8.32E-07	6.91E-09	8.70E-08	4.41E-07	2.95E-07	2.84E-09	1.02E-07	1.83E-08
168	58.500%	11.7	7.18E-07	5.96E-09	7.50E-08	3.80E-07	2.54E-07	2.45E-09	8.87E-08	1.58E-08
169	59.000%	11.8	6.20E-07	5.14E-09	6.47E-08	3.28E-07	2.19E-07	2.11E-09	7.69E-08	1.37E-08
170	59.500%	11.9	5.35E-07	4.44E-09	5.59E-08	2.83E-07	1.90E-07	1.82E-09	6.67E-08	1.19E-08
171	60.000%	12.0	4.62E-07	3.84E-09	4.83E-08	2.45E-07	1.64E-07	1.58E-09	5.78E-08	1.03E-08
172	60.500%	12.1	4.00E-07	3.32E-09	4.18E-08	2.12E-07	1.42E-07	1.36E-09	5.02E-08	8.96E-09
173	61.000%	12.2	3.46E-07	2.87E-09	3.61E-08	1.83E-07	1.22E-07	1.18E-09	4.36E-08	7.78E-09
174	61.500%	12.3	2.99E-07	2.48E-09	3.13E-08	1.58E-07	1.06E-07	1.02E-09	3.79E-08	6.76E-09
175	62.000%	12.4	2.59E-07	2.15E-09	2.71E-08	1.37E-07	9.18E-08	8.83E-10	3.29E-08	5.88E-09
176	62.500%	12.5	2.25E-07	1.86E-09	2.35E-08	1.19E-07	7.95E-08	7.65E-10	2.87E-08	5.11E-09
177	63.000%	12.6	1.95E-07	1.62E-09	2.03E-08	1.03E-07	6.89E-08	6.63E-10	2.49E-08	4.45E-09

	A	B	C	D	E	F	G	H	I	J
178	63.500%	12.7	1.69E-07	1.40E-09	1.76E-08	8.94E-08	5.98E-08	5.75E-10	2.17E-08	3.87E-09
179	64.000%	12.8	1.46E-07	1.22E-09	1.53E-08	7.76E-08	5.19E-08	4.99E-10	1.89E-08	3.38E-09
180	64.500%	12.9	1.27E-07	1.06E-09	1.33E-08	6.73E-08	4.51E-08	4.33E-10	1.65E-08	2.94E-09
181	65.000%	13.0	1.10E-07	9.17E-10	1.15E-08	5.85E-08	3.91E-08	3.76E-10	1.44E-08	2.57E-09
182	65.500%	13.1	9.60E-08	7.97E-10	1.00E-08	5.08E-08	3.40E-08	3.27E-10	1.25E-08	2.24E-09
183	66.000%	13.2	8.35E-08	6.93E-10	8.72E-09	4.42E-08	2.96E-08	2.85E-10	1.10E-08	1.95E-09
184	66.500%	13.3	7.26E-08	6.03E-10	7.59E-09	3.85E-08	2.57E-08	2.48E-10	9.56E-09	1.71E-09
185	67.000%	13.4	6.32E-08	5.25E-10	6.61E-09	3.35E-08	2.24E-08	2.15E-10	8.36E-09	1.49E-09
186	67.500%	13.5	5.51E-08	4.57E-10	5.75E-09	2.92E-08	1.95E-08	1.88E-10	7.30E-09	1.30E-09
187	68.000%	13.6	4.80E-08	3.98E-10	5.01E-09	2.54E-08	1.70E-08	1.63E-10	6.39E-09	1.14E-09
188	68.500%	13.7	4.18E-08	3.47E-10	4.37E-09	2.21E-08	1.48E-08	1.43E-10	5.59E-09	9.97E-10
189	69.000%	13.8	3.65E-08	3.03E-10	3.81E-09	1.93E-08	1.29E-08	1.24E-10	4.89E-09	8.73E-10
190	69.500%	13.9	3.18E-08	2.64E-10	3.33E-09	1.69E-08	1.13E-08	1.08E-10	4.28E-09	7.65E-10
191	70.000%	14.0	2.78E-08	2.31E-10	2.90E-09	1.47E-08	9.84E-09	9.47E-11	3.75E-09	6.70E-10
192	70.500%	14.1	2.43E-08	2.01E-10	2.54E-09	1.28E-08	8.60E-09	8.27E-11	3.29E-09	5.87E-10
193	71.000%	14.2	2.12E-08	1.76E-10	2.22E-09	1.12E-08	7.51E-09	7.22E-11	2.89E-09	5.15E-10
194	71.500%	14.3	1.85E-08	1.54E-10	1.94E-09	9.81E-09	6.57E-09	6.32E-11	2.53E-09	4.52E-10
195	72.000%	14.4	1.62E-08	1.35E-10	1.69E-09	8.58E-09	5.74E-09	5.52E-11	2.22E-09	3.97E-10
196	72.500%	14.5	1.42E-08	1.18E-10	1.48E-09	7.51E-09	5.02E-09	4.83E-11	1.95E-09	3.48E-10
197	73.000%	14.6	1.24E-08	1.03E-10	1.30E-09	6.58E-09	4.40E-09	4.23E-11	1.71E-09	3.06E-10
198	73.500%	14.7	1.09E-08	9.03E-11	1.14E-09	5.76E-09	3.85E-09	3.71E-11	1.51E-09	2.69E-10
199	74.000%	14.8	9.53E-09	7.91E-11	9.96E-10	5.05E-09	3.38E-09	3.25E-11	1.32E-09	2.36E-10
200	74.500%	14.9	8.35E-09	6.93E-11	8.73E-10	4.42E-09	2.96E-09	2.85E-11	1.17E-09	2.08E-10
201	75.000%	15.0	7.33E-09	6.08E-11	7.66E-10	3.88E-09	2.60E-09	2.50E-11	1.03E-09	1.83E-10
202	75.500%	15.1	6.43E-09	5.34E-11	6.72E-10	3.40E-09	2.28E-09	2.19E-11	9.02E-10	1.61E-10
203	76.000%	15.2	5.64E-09	4.68E-11	5.90E-10	2.99E-09	2.00E-09	1.92E-11	7.95E-10	1.42E-10
204	76.500%	15.3	4.96E-09	4.11E-11	5.18E-10	2.62E-09	1.76E-09	1.69E-11	7.00E-10	1.25E-10
205	77.000%	15.4	4.35E-09	3.61E-11	4.55E-10	2.31E-09	1.54E-09	1.48E-11	6.17E-10	1.10E-10
206	77.500%	15.5	3.83E-09	3.18E-11	4.00E-10	2.03E-09	1.36E-09	1.30E-11	5.44E-10	9.70E-11
207	78.000%	15.6	3.36E-09	2.79E-11	3.52E-10	1.78E-09	1.19E-09	1.15E-11	4.79E-10	8.56E-11
208	78.500%	15.7	2.96E-09	2.46E-11	3.09E-10	1.57E-09	1.05E-09	1.01E-11	4.23E-10	7.55E-11
209	79.000%	15.8	2.60E-09	2.16E-11	2.72E-10	1.38E-09	9.23E-10	8.88E-12	3.73E-10	6.66E-11
210	79.500%	15.9	2.29E-09	1.90E-11	2.40E-10	1.21E-09	8.12E-10	7.82E-12	3.29E-10	5.88E-11
211	80.000%	16.0	2.02E-09	1.68E-11	2.11E-10	1.07E-09	7.16E-10	6.88E-12	2.91E-10	5.19E-11
212	80.500%	16.1	1.78E-09	1.48E-11	1.86E-10	9.43E-10	6.31E-10	6.07E-12	2.57E-10	4.58E-11
213	81.000%	16.2	1.57E-09	1.30E-11	1.64E-10	8.31E-10	5.56E-10	5.35E-12	2.27E-10	4.05E-11
214	81.500%	16.3	1.38E-09	1.15E-11	1.45E-10	7.33E-10	4.90E-10	4.72E-12	2.00E-10	3.58E-11
215	82.000%	16.4	1.22E-09	1.01E-11	1.28E-10	6.47E-10	4.33E-10	4.16E-12	1.77E-10	3.16E-11
216	82.500%	16.5	1.08E-09	8.94E-12	1.13E-10	5.71E-10	3.82E-10	3.67E-12	1.57E-10	2.79E-11
217	83.000%	16.6	9.51E-10	7.90E-12	9.94E-11	5.04E-10	3.37E-10	3.24E-12	1.38E-10	2.47E-11
218	83.500%	16.7	8.40E-10	6.98E-12	8.78E-11	4.45E-10	2.98E-10	2.86E-12	1.22E-10	2.18E-11
219	84.000%	16.8	7.43E-10	6.16E-12	7.76E-11	3.93E-10	2.63E-10	2.53E-12	1.08E-10	1.93E-11
220	84.500%	16.9	6.57E-10	5.45E-12	6.86E-11	3.48E-10	2.33E-10	2.24E-12	9.56E-11	1.71E-11
221	85.000%	17.0	5.81E-10	4.82E-12	6.07E-11	3.07E-10	2.06E-10	1.98E-12	8.45E-11	1.51E-11
222	85.500%	17.1	5.14E-10	4.26E-12	5.37E-11	2.72E-10	1.82E-10	1.75E-12	7.47E-11	1.33E-11
223	86.000%	17.2	4.55E-10	3.77E-12	4.75E-11	2.41E-10	1.61E-10	1.55E-12	6.60E-11	1.18E-11
224	86.500%	17.3	4.03E-10	3.34E-12	4.21E-11	2.13E-10	1.43E-10	1.37E-12	5.83E-11	1.04E-11
225	87.000%	17.4	3.57E-10	2.96E-12	3.73E-11	1.89E-10	1.26E-10	1.21E-12	5.15E-11	9.19E-12
226	87.500%	17.5	3.16E-10	2.62E-12	3.30E-11	1.67E-10	1.12E-10	1.08E-12	4.55E-11	8.11E-12
227	88.000%	17.6	2.80E-10	2.32E-12	2.93E-11	1.48E-10	9.92E-11	9.54E-13	4.01E-11	7.16E-12
228	88.500%	17.7	2.48E-10	2.06E-12	2.59E-11	1.31E-10	8.80E-11	8.46E-13	3.54E-11	6.31E-12

	A	B	C	D	E	F	G	H	I	J
229	89.000%	17.8	2.20E-10	1.83E-12	2.30E-11	1.17E-10	7.80E-11	7.51E-13	3.12E-11	5.56E-12
230	89.500%	17.9	1.95E-10	1.62E-12	2.04E-11	1.03E-10	6.92E-11	6.66E-13	2.74E-11	4.89E-12
231	90.000%	18.0	1.73E-10	1.44E-12	1.81E-11	9.19E-11	6.15E-11	5.91E-13	2.41E-11	4.30E-12
232	90.500%	18.1	1.54E-10	1.28E-12	1.61E-11	8.16E-11	5.46E-11	5.25E-13	2.12E-11	3.78E-12
233	91.000%	18.2	1.37E-10	1.14E-12	1.43E-11	7.25E-11	4.85E-11	4.66E-13	1.86E-11	3.31E-12
234	91.500%	18.3	1.22E-10	1.01E-12	1.27E-11	6.44E-11	4.31E-11	4.14E-13	1.62E-11	2.90E-12
235	92.000%	18.4	1.08E-10	8.97E-13	1.13E-11	5.73E-11	3.83E-11	3.68E-13	1.42E-11	2.53E-12
236	92.500%	18.5	9.62E-11	7.98E-13	1.00E-11	5.09E-11	3.41E-11	3.28E-13	1.23E-11	2.20E-12
237	93.000%	18.6	8.55E-11	7.10E-13	8.94E-12	4.53E-11	3.03E-11	2.91E-13	1.07E-11	1.91E-12
238	93.500%	18.7	7.61E-11	6.32E-13	7.95E-12	4.03E-11	2.70E-11	2.59E-13	9.25E-12	1.65E-12
239	94.000%	18.8	6.78E-11	5.62E-13	7.08E-12	3.59E-11	2.40E-11	2.31E-13	7.95E-12	1.42E-12
240	94.500%	18.9	6.03E-11	5.01E-13	6.31E-12	3.20E-11	2.14E-11	2.06E-13	6.80E-12	1.21E-12
241	95.000%	19.0	5.38E-11	4.46E-13	5.62E-12	2.85E-11	1.90E-11	1.83E-13	5.77E-12	1.03E-12
242	95.500%	19.1	4.79E-11	3.98E-13	5.01E-12	2.54E-11	1.70E-11	1.63E-13	4.86E-12	8.67E-13
243	96.000%	19.2	4.27E-11	3.54E-13	4.46E-12	2.26E-11	1.51E-11	1.46E-13	4.04E-12	7.21E-13
244	96.500%	19.3	3.81E-11	3.16E-13	3.98E-12	2.02E-11	1.35E-11	1.30E-13	3.32E-12	5.92E-13
245	97.000%	19.4	3.40E-11	2.82E-13	3.55E-12	1.80E-11	1.20E-11	1.16E-13	2.67E-12	4.76E-13
246	97.500%	19.5	3.03E-11	2.52E-13	3.17E-12	1.61E-11	1.07E-11	1.03E-13	2.09E-12	3.73E-13
247	98.000%	19.6	2.71E-11	2.25E-13	2.83E-12	1.43E-11	9.59E-12	9.22E-14	1.57E-12	2.80E-13
248	98.500%	19.7	2.42E-11	2.01E-13	2.52E-12	1.28E-11	8.56E-12	8.23E-14	1.11E-12	1.98E-13
249	99.000%	19.8	2.16E-11	1.79E-13	2.26E-12	1.14E-11	7.65E-12	7.36E-14	6.97E-13	1.24E-13
250	99.500%	19.9	1.93E-11	1.60E-13	2.01E-12	1.02E-11	6.83E-12	6.57E-14	3.29E-13	5.87E-14
251	100%	20.0	1.72E-11	1.43E-13	1.80E-12	9.13E-12	6.11E-12	5.87E-14	0.00E+00	0.00E+00
252			52.36	0.43	5.47	27.73	18.55	0.18		
253										
254										
255	Frequency of various size flaws in WP shell assuming RT, PT, and UT exams									
256	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
257	1%	0.2	2.36E-13	1.96E-15	2.47E-14	1.25E-13	8.37E-14	8.06E-16	1.00E+00	7.77E-03
258	1.500%	0.3	1.46E-09	1.21E-11	1.53E-10	7.75E-10	5.18E-10	4.99E-12	1.00E+00	7.77E-03
259	2.000%	0.4	2.78E-07	2.31E-09	2.90E-08	1.47E-07	9.84E-08	9.47E-10	1.00E+00	7.77E-03
260	2.500%	0.5	9.31E-06	7.73E-08	9.73E-07	4.93E-06	3.30E-06	3.17E-08	1.00E+00	7.77E-03
261	3.000%	0.6	1.12E-04	9.31E-07	1.17E-05	5.94E-05	3.97E-05	3.82E-07	1.00E+00	7.77E-03
262	3.500%	0.7	6.96E-04	5.78E-06	7.28E-05	3.69E-04	2.47E-04	2.37E-06	1.00E+00	7.77E-03
263	4.000%	0.8	2.74E-03	2.28E-05	2.87E-04	1.45E-03	9.72E-04	9.35E-06	9.98E-01	7.76E-03
264	4.500%	0.9	7.97E-03	6.61E-05	8.33E-04	4.22E-03	2.82E-03	2.72E-05	9.95E-01	7.73E-03
265	5.000%	1.0	1.78E-02	1.48E-04	1.86E-03	9.45E-03	6.32E-03	6.08E-05	9.87E-01	7.67E-03
266	5.500%	1.1	3.32E-02	2.76E-04	3.47E-03	1.76E-02	1.18E-02	1.13E-04	9.73E-01	7.56E-03
267	6.000%	1.2	5.36E-02	4.45E-04	5.60E-03	2.84E-02	1.90E-02	1.83E-04	9.49E-01	7.37E-03
268	6.500%	1.3	7.71E-02	6.40E-04	8.06E-03	4.08E-02	2.73E-02	2.63E-04	9.15E-01	7.11E-03
269	7.000%	1.4	9.78E-02	8.12E-04	1.02E-02	5.18E-02	3.47E-02	3.33E-04	8.72E-01	6.78E-03
270	7.500%	1.5	1.19E-01	9.89E-04	1.24E-02	6.31E-02	4.22E-02	4.06E-04	8.20E-01	6.37E-03
271	8.000%	1.6	1.36E-01	1.13E-03	1.43E-02	7.22E-02	4.83E-02	4.65E-04	7.60E-01	5.91E-03
272	8.500%	1.7	1.48E-01	1.23E-03	1.55E-02	7.86E-02	5.26E-02	5.06E-04	6.95E-01	5.40E-03
273	9.000%	1.8	1.55E-01	1.28E-03	1.62E-02	8.20E-02	5.48E-02	5.27E-04	6.27E-01	4.87E-03
274	9.500%	1.9	1.56E-01	1.29E-03	1.63E-02	8.24E-02	5.52E-02	5.31E-04	5.59E-01	4.34E-03
275	10.000%	2.0	1.52E-01	1.26E-03	1.59E-02	8.04E-02	5.38E-02	5.17E-04	4.92E-01	3.82E-03
276	10.500%	2.1	1.44E-01	1.20E-03	1.51E-02	7.64E-02	5.11E-02	4.92E-04	4.29E-01	3.33E-03
277	11.000%	2.2	1.34E-01	1.11E-03	1.40E-02	7.10E-02	4.75E-02	4.57E-04	3.70E-01	2.88E-03
278	11.500%	2.3	1.22E-01	1.01E-03	1.28E-02	6.46E-02	4.32E-02	4.16E-04	3.17E-01	2.46E-03
279	12.000%	2.4	1.09E-01	9.08E-04	1.14E-02	5.79E-02	3.87E-02	3.73E-04	2.69E-01	2.09E-03

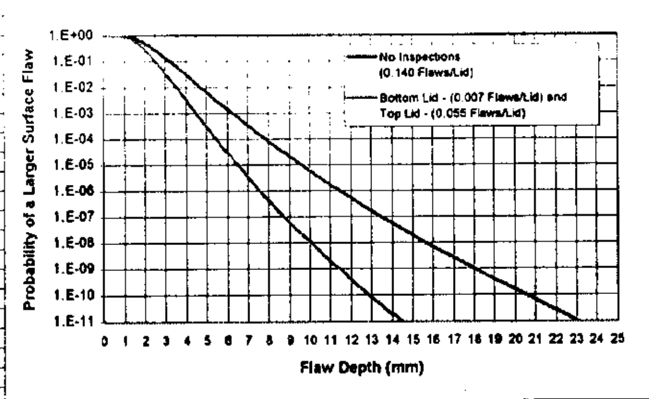
	A	B	C	D	E	F	G	H	I	J
280	12.500%	2.5	9.65E-02	8.01E-04	1.01E-02	5.11E-02	3.42E-02	3.29E-04	2.26E-01	1.76E-03
281	13.000%	2.6	8.41E-02	6.98E-04	8.79E-03	4.45E-02	2.98E-02	2.87E-04	1.90E-01	1.47E-03
282	13.500%	2.7	7.25E-02	6.02E-04	7.57E-03	3.84E-02	2.57E-02	2.47E-04	1.58E-01	1.23E-03
283	14.000%	2.8	6.19E-02	5.14E-04	6.46E-03	3.28E-02	2.19E-02	2.11E-04	1.31E-01	1.01E-03
284	14.500%	2.9	5.23E-02	4.34E-04	5.47E-03	2.77E-02	1.85E-02	1.78E-04	1.08E-01	8.36E-04
285	15.000%	3.0	4.40E-02	3.65E-04	4.59E-03	2.33E-02	1.56E-02	1.50E-04	8.83E-02	6.86E-04
286	15.500%	3.1	3.67E-02	3.04E-04	3.83E-03	1.94E-02	1.30E-02	1.25E-04	7.23E-02	5.61E-04
287	16.000%	3.2	3.04E-02	2.53E-04	3.18E-03	1.61E-02	1.08E-02	1.04E-04	5.89E-02	4.58E-04
288	16.500%	3.3	2.51E-02	2.08E-04	2.62E-03	1.33E-02	8.90E-03	8.56E-05	4.79E-02	3.72E-04
289	17.000%	3.4	2.06E-02	1.71E-04	2.16E-03	1.09E-02	7.31E-03	7.03E-05	3.88E-02	3.02E-04
290	17.500%	3.5	1.69E-02	1.40E-04	1.76E-03	8.94E-03	5.98E-03	5.75E-05	3.14E-02	2.44E-04
291	18.000%	3.6	1.38E-02	1.14E-04	1.44E-03	7.29E-03	4.88E-03	4.69E-05	2.54E-02	1.97E-04
292	18.500%	3.7	1.12E-02	9.30E-05	1.17E-03	5.93E-03	3.97E-03	3.82E-05	2.05E-02	1.59E-04
293	19.000%	3.8	9.08E-03	7.54E-05	9.49E-04	4.81E-03	3.22E-03	3.10E-05	1.65E-02	1.28E-04
294	19.500%	3.9	7.35E-03	6.10E-05	7.68E-04	3.89E-03	2.60E-03	2.51E-05	1.33E-02	1.03E-04
295	20.000%	4.0	5.94E-03	4.93E-05	6.21E-04	3.14E-03	2.10E-03	2.02E-05	1.07E-02	8.29E-05
296	20.500%	4.1	4.79E-03	3.97E-05	5.00E-04	2.54E-03	1.70E-03	1.63E-05	8.57E-03	6.66E-05
297	21.000%	4.2	3.86E-03	3.20E-05	4.03E-04	2.04E-03	1.37E-03	1.31E-05	6.88E-03	5.35E-05
298	21.500%	4.3	3.10E-03	2.57E-05	3.24E-04	1.64E-03	1.10E-03	1.06E-05	5.52E-03	4.29E-05
299	22.000%	4.4	2.49E-03	2.07E-05	2.60E-04	1.32E-03	8.82E-04	8.49E-06	4.43E-03	3.44E-05
300	22.500%	4.5	2.00E-03	1.66E-05	2.09E-04	1.06E-03	7.08E-04	6.81E-06	3.55E-03	2.76E-05
301	23.000%	4.6	1.60E-03	1.33E-05	1.68E-04	8.50E-04	5.68E-04	5.47E-06	2.85E-03	2.21E-05
302	23.500%	4.7	1.29E-03	1.07E-05	1.34E-04	6.81E-04	4.56E-04	4.38E-06	2.28E-03	1.77E-05
303	24.000%	4.8	1.03E-03	8.56E-06	1.08E-04	5.46E-04	3.65E-04	3.51E-06	1.83E-03	1.42E-05
304	24.500%	4.9	8.26E-04	6.86E-06	8.64E-05	4.38E-04	2.93E-04	2.82E-06	1.47E-03	1.14E-05
305	25.000%	5.0	6.62E-04	5.50E-06	6.92E-05	3.51E-04	2.35E-04	2.26E-06	1.18E-03	9.15E-06
306	25.500%	5.1	5.31E-04	4.40E-06	5.54E-05	2.81E-04	1.88E-04	1.81E-06	9.45E-04	7.34E-06
307	26.000%	5.2	4.25E-04	3.53E-06	4.44E-05	2.25E-04	1.51E-04	1.45E-06	7.59E-04	5.89E-06
308	26.500%	5.3	3.41E-04	2.83E-06	3.56E-05	1.80E-04	1.21E-04	1.16E-06	6.09E-04	4.73E-06
309	27.000%	5.4	2.73E-04	2.27E-06	2.85E-05	1.45E-04	9.67E-05	9.31E-07	4.90E-04	3.80E-06
310	27.500%	5.5	2.19E-04	1.82E-06	2.29E-05	1.16E-04	7.76E-05	7.46E-07	3.93E-04	3.06E-06
311	28.000%	5.6	1.76E-04	1.46E-06	1.83E-05	9.30E-05	6.22E-05	5.98E-07	3.16E-04	2.46E-06
312	28.500%	5.7	1.41E-04	1.17E-06	1.47E-05	7.46E-05	4.99E-05	4.80E-07	2.55E-04	1.98E-06
313	29.000%	5.8	1.13E-04	9.38E-07	1.18E-05	5.99E-05	4.01E-05	3.85E-07	2.05E-04	1.59E-06
314	29.500%	5.9	9.08E-05	7.53E-07	9.48E-06	4.81E-05	3.22E-05	3.09E-07	1.65E-04	1.28E-06
315	30.000%	6.0	7.30E-05	6.06E-07	7.62E-06	3.86E-05	2.58E-05	2.49E-07	1.33E-04	1.04E-06
316	30.500%	6.1	5.87E-05	4.87E-07	6.13E-06	3.11E-05	2.08E-05	2.00E-07	1.08E-04	8.36E-07
317	31.000%	6.2	4.72E-05	3.92E-07	4.93E-06	2.50E-05	1.67E-05	1.61E-07	8.68E-05	6.75E-07
318	31.500%	6.3	3.80E-05	3.15E-07	3.97E-06	2.01E-05	1.35E-05	1.29E-07	7.02E-05	5.45E-07
319	32.000%	6.4	3.06E-05	2.54E-07	3.20E-06	1.62E-05	1.08E-05	1.04E-07	5.68E-05	4.41E-07
320	32.500%	6.5	2.47E-05	2.05E-07	2.58E-06	1.31E-05	8.74E-06	8.40E-08	4.60E-05	3.57E-07
321	33.000%	6.6	1.99E-05	1.65E-07	2.08E-06	1.05E-05	7.05E-06	6.78E-08	3.72E-05	2.89E-07
322	33.500%	6.7	1.61E-05	1.33E-07	1.68E-06	8.50E-06	5.69E-06	5.47E-08	3.02E-05	2.35E-07
323	34.000%	6.8	1.30E-05	1.08E-07	1.36E-06	6.87E-06	4.60E-06	4.42E-08	2.45E-05	1.90E-07
324	34.500%	6.9	1.05E-05	8.71E-08	1.10E-06	5.55E-06	3.72E-06	3.57E-08	1.99E-05	1.55E-07
325	35.000%	7.0	8.49E-06	7.04E-08	8.87E-07	4.49E-06	3.01E-06	2.89E-08	1.62E-05	1.26E-07
326	35.500%	7.1	6.87E-06	5.70E-08	7.18E-07	3.64E-06	2.43E-06	2.34E-08	1.32E-05	1.02E-07
327	36.000%	7.2	5.57E-06	4.62E-08	5.82E-07	2.95E-06	1.97E-06	1.90E-08	1.07E-05	8.32E-08
328	36.500%	7.3	4.52E-06	3.75E-08	4.72E-07	2.39E-06	1.60E-06	1.54E-08	8.73E-06	6.79E-08
329	37.000%	7.4	3.67E-06	3.04E-08	3.83E-07	1.94E-06	1.30E-06	1.25E-08	7.12E-06	5.54E-08
330	37.500%	7.5	2.98E-06	2.47E-08	3.11E-07	1.58E-06	1.06E-06	1.02E-08	5.82E-06	4.52E-08

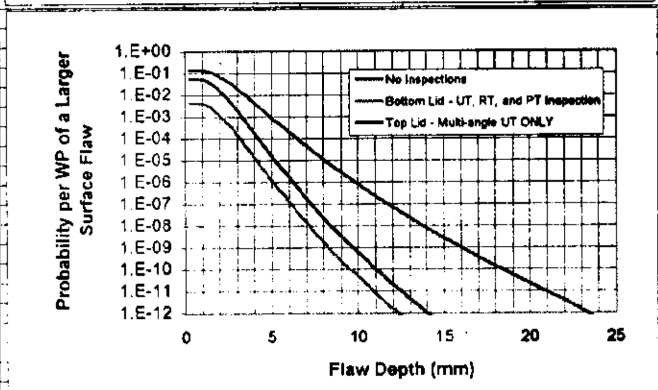
	A	B	C	D	E	F	G	H	I	J
331	38.000%	7.6	2.42E-06	2.01E-08	2.53E-07	1.28E-06	8.58E-07	8.26E-09	4.76E-06	3.69E-08
332	38.500%	7.7	1.97E-06	1.64E-08	2.06E-07	1.04E-06	6.99E-07	6.72E-09	3.89E-06	3.02E-08
333	39.000%	7.8	1.61E-06	1.33E-08	1.68E-07	8.50E-07	5.69E-07	5.47E-09	3.19E-06	2.48E-08
334	39.500%	7.9	1.31E-06	1.09E-08	1.37E-07	6.93E-07	4.64E-07	4.46E-09	2.61E-06	2.03E-08
335	40.000%	8.0	1.07E-06	8.87E-09	1.12E-07	5.66E-07	3.79E-07	3.64E-09	2.14E-06	1.67E-08
336	40.500%	8.1	8.73E-07	7.24E-09	9.12E-08	4.62E-07	3.09E-07	2.97E-09	1.76E-06	1.37E-08
337	41.000%	8.2	7.13E-07	5.92E-09	7.46E-08	3.78E-07	2.53E-07	2.43E-09	1.45E-06	1.12E-08
338	41.500%	8.3	5.84E-07	4.84E-09	6.10E-08	3.09E-07	2.07E-07	1.99E-09	1.19E-06	9.26E-09
339	42.000%	8.4	4.78E-07	3.97E-09	5.00E-08	2.53E-07	1.69E-07	1.63E-09	9.82E-07	7.63E-09
340	42.500%	8.5	3.92E-07	3.25E-09	4.10E-08	2.08E-07	1.39E-07	1.34E-09	8.10E-07	6.29E-09
341	43.000%	8.6	3.22E-07	2.67E-09	3.36E-08	1.70E-07	1.14E-07	1.10E-09	6.69E-07	5.20E-09
342	43.500%	8.7	2.64E-07	2.19E-09	2.76E-08	1.40E-07	9.35E-08	9.00E-10	5.53E-07	4.30E-09
343	44.000%	8.8	2.17E-07	1.80E-09	2.27E-08	1.15E-07	7.69E-08	7.39E-10	4.58E-07	3.56E-09
344	44.500%	8.9	1.79E-07	1.48E-09	1.87E-08	9.45E-08	6.32E-08	6.08E-10	3.79E-07	2.95E-09
345	45.000%	9.0	1.47E-07	1.22E-09	1.54E-08	7.78E-08	5.21E-08	5.01E-10	3.15E-07	2.45E-09
346	45.500%	9.1	1.21E-07	1.01E-09	1.27E-08	6.41E-08	4.29E-08	4.13E-10	2.62E-07	2.03E-09
347	46.000%	9.2	9.99E-08	8.29E-10	1.04E-08	5.29E-08	3.54E-08	3.40E-10	2.18E-07	1.69E-09
348	46.500%	9.3	8.25E-08	6.85E-10	8.62E-09	4.37E-08	2.92E-08	2.81E-10	1.82E-07	1.41E-09
349	47.000%	9.4	6.82E-08	5.66E-10	7.12E-09	3.61E-08	2.41E-08	2.32E-10	1.52E-07	1.18E-09
350	47.500%	9.5	5.64E-08	4.68E-10	5.89E-09	2.99E-08	2.00E-08	1.92E-10	1.27E-07	9.88E-10
351	48.000%	9.6	4.67E-08	3.87E-10	4.88E-09	2.47E-08	1.65E-08	1.59E-10	1.07E-07	8.29E-10
352	48.500%	9.7	3.87E-08	3.21E-10	4.04E-09	2.05E-08	1.37E-08	1.32E-10	8.98E-08	6.98E-10
353	49.000%	9.8	3.21E-08	2.66E-10	3.35E-09	1.70E-08	1.14E-08	1.09E-10	7.57E-08	5.88E-10
354	49.500%	9.9	2.66E-08	2.21E-10	2.78E-09	1.41E-08	9.43E-09	9.07E-11	6.40E-08	4.98E-10
355	50.000%	10.0	2.21E-08	1.84E-10	2.31E-09	1.17E-08	7.84E-09	7.54E-11	5.43E-08	4.22E-10
356	50.500%	10.1	1.89E-08	1.57E-10	1.98E-09	1.00E-08	6.70E-09	6.44E-11	4.61E-08	3.58E-10
357	51.000%	10.2	1.62E-08	1.34E-10	1.69E-09	8.56E-09	5.73E-09	5.51E-11	3.90E-08	3.03E-10
358	51.500%	10.3	1.38E-08	1.15E-10	1.45E-09	7.33E-09	4.90E-09	4.71E-11	3.29E-08	2.56E-10
359	52.000%	10.4	1.18E-08	9.83E-11	1.24E-09	6.27E-09	4.20E-09	4.04E-11	2.77E-08	2.15E-10
360	52.500%	10.5	1.01E-08	8.42E-11	1.06E-09	5.37E-09	3.59E-09	3.46E-11	2.32E-08	1.81E-10
361	53.000%	10.6	8.70E-09	7.22E-11	9.09E-10	4.61E-09	3.08E-09	2.96E-11	1.94E-08	1.51E-10
362	53.500%	10.7	7.46E-09	6.19E-11	7.80E-10	3.95E-09	2.64E-09	2.54E-11	1.62E-08	1.26E-10
363	54.000%	10.8	6.40E-09	5.31E-11	6.69E-10	3.39E-09	2.27E-09	2.18E-11	1.34E-08	1.04E-10
364	54.500%	10.9	5.50E-09	4.56E-11	5.74E-10	2.91E-09	1.95E-09	1.87E-11	1.09E-08	8.50E-11
365	55.000%	11.0	3.64E-09	3.02E-11	3.80E-10	1.93E-09	1.29E-09	1.24E-11	9.35E-09	7.26E-11
366	55.500%	11.1	3.13E-09	2.60E-11	3.27E-10	1.66E-09	1.11E-09	1.07E-11	7.97E-09	6.19E-11
367	56.000%	11.2	2.69E-09	2.23E-11	2.81E-10	1.42E-09	9.53E-10	9.17E-12	6.79E-09	5.28E-11
368	56.500%	11.3	2.32E-09	1.92E-11	2.42E-10	1.23E-09	8.20E-10	7.89E-12	5.78E-09	4.49E-11
369	57.000%	11.4	1.99E-09	1.66E-11	2.08E-10	1.06E-09	7.06E-10	6.80E-12	4.90E-09	3.81E-11
370	57.500%	11.5	1.72E-09	1.43E-11	1.80E-10	9.10E-10	6.09E-10	5.86E-12	4.15E-09	3.22E-11
371	58.000%	11.6	1.48E-09	1.23E-11	1.55E-10	7.85E-10	5.25E-10	5.05E-12	3.50E-09	2.72E-11
372	58.500%	11.7	1.28E-09	1.06E-11	1.34E-10	6.77E-10	4.53E-10	4.36E-12	2.94E-09	2.28E-11
373	59.000%	11.8	1.10E-09	9.16E-12	1.15E-10	5.84E-10	3.91E-10	3.76E-12	2.45E-09	1.91E-11
374	59.500%	11.9	9.53E-10	7.91E-12	9.95E-11	5.04E-10	3.37E-10	3.25E-12	2.04E-09	1.58E-11
375	60.000%	12.0	6.52E-10	5.41E-12	6.81E-11	3.45E-10	2.31E-10	2.22E-12	1.75E-09	1.36E-11
376	60.500%	12.1	5.64E-10	4.68E-12	5.89E-11	2.98E-10	2.00E-10	1.92E-12	1.50E-09	1.17E-11
377	61.000%	12.2	4.88E-10	4.05E-12	5.09E-11	2.58E-10	1.73E-10	1.66E-12	1.29E-09	1.00E-11
378	61.500%	12.3	4.22E-10	3.50E-12	4.41E-11	2.23E-10	1.49E-10	1.44E-12	1.10E-09	8.58E-12
379	62.000%	12.4	3.65E-10	3.03E-12	3.82E-11	1.94E-10	1.29E-10	1.25E-12	9.44E-10	7.34E-12
380	62.500%	12.5	3.17E-10	2.63E-12	3.31E-11	1.68E-10	1.12E-10	1.08E-12	8.05E-10	6.26E-12
381	63.000%	12.6	2.74E-10	2.28E-12	2.87E-11	1.45E-10	9.72E-11	9.35E-13	6.85E-10	5.32E-12

	A	B	C	D	E	F	G	H	I	J
382	63.500%	12.7	2.38E-10	1.98E-12	2.49E-11	1.26E-10	8.43E-11	8.11E-13	5.81E-10	4.51E-12
383	64.000%	12.8	2.07E-10	1.71E-12	2.16E-11	1.09E-10	7.32E-11	7.04E-13	4.90E-10	3.81E-12
384	64.500%	12.9	1.79E-10	1.49E-12	1.87E-11	9.50E-11	6.35E-11	6.11E-13	4.11E-10	3.20E-12
385	65.000%	13.0	1.27E-10	1.05E-12	1.32E-11	6.71E-11	4.49E-11	4.32E-13	3.56E-10	2.76E-12
386	65.500%	13.1	1.10E-10	9.14E-13	1.15E-11	5.83E-11	3.90E-11	3.75E-13	3.07E-10	2.39E-12
387	66.000%	13.2	9.58E-11	7.95E-13	1.00E-11	5.07E-11	3.39E-11	3.26E-13	2.65E-10	2.06E-12
388	66.500%	13.3	8.33E-11	6.92E-13	8.71E-12	4.41E-11	2.95E-11	2.84E-13	2.29E-10	1.78E-12
389	67.000%	13.4	7.25E-11	6.02E-13	7.58E-12	3.84E-11	2.57E-11	2.47E-13	1.97E-10	1.53E-12
390	67.500%	13.5	6.32E-11	5.24E-13	6.60E-12	3.35E-11	2.24E-11	2.15E-13	1.69E-10	1.32E-12
391	68.000%	13.6	5.50E-11	4.57E-13	5.75E-12	2.91E-11	1.95E-11	1.88E-13	1.45E-10	1.13E-12
392	68.500%	13.7	4.80E-11	3.98E-13	5.01E-12	2.54E-11	1.70E-11	1.64E-13	1.24E-10	9.64E-13
393	69.000%	13.8	4.18E-11	3.47E-13	4.37E-12	2.22E-11	1.48E-11	1.43E-13	1.06E-10	8.22E-13
394	69.500%	13.9	3.65E-11	3.03E-13	3.82E-12	1.93E-11	1.29E-11	1.24E-13	8.97E-11	6.97E-13
395	70.000%	14.0	2.66E-11	2.21E-13	2.78E-12	1.41E-11	9.44E-12	9.08E-14	7.81E-11	6.06E-13
396	70.500%	14.1	2.33E-11	1.93E-13	2.43E-12	1.23E-11	8.24E-12	7.93E-14	6.79E-11	5.27E-13
397	71.000%	14.2	2.03E-11	1.69E-13	2.12E-12	1.08E-11	7.20E-12	6.93E-14	5.89E-11	4.58E-13
398	71.500%	14.3	1.78E-11	1.48E-13	1.86E-12	9.41E-12	6.30E-12	6.06E-14	5.11E-11	3.97E-13
399	72.000%	14.4	1.55E-11	1.29E-13	1.62E-12	8.23E-12	5.51E-12	5.30E-14	4.43E-11	3.44E-13
400	72.500%	14.5	1.36E-11	1.13E-13	1.42E-12	7.20E-12	4.82E-12	4.64E-14	3.83E-11	2.98E-13
401	73.000%	14.6	1.19E-11	9.89E-14	1.24E-12	6.31E-12	4.22E-12	4.06E-14	3.31E-11	2.57E-13
402	73.500%	14.7	1.04E-11	8.66E-14	1.09E-12	5.52E-12	3.70E-12	3.55E-14	2.85E-11	2.22E-13
403	74.000%	14.8	9.14E-12	7.59E-14	9.55E-13	4.84E-12	3.24E-12	3.11E-14	2.45E-11	1.91E-13
404	74.500%	14.9	8.01E-12	6.65E-14	8.37E-13	4.24E-12	2.84E-12	2.73E-14	2.10E-11	1.63E-13
405	75.000%	15.0	6.02E-12	5.00E-14	6.29E-13	3.19E-12	2.13E-12	2.05E-14	1.84E-11	1.43E-13
406	75.500%	15.1	5.28E-12	4.39E-14	5.52E-13	2.80E-12	1.87E-12	1.80E-14	1.61E-11	1.25E-13
407	76.000%	15.2	4.64E-12	3.85E-14	4.85E-13	2.46E-12	1.64E-12	1.58E-14	1.40E-11	1.09E-13
408	76.500%	15.3	4.07E-12	3.38E-14	4.26E-13	2.16E-12	1.44E-12	1.39E-14	1.22E-11	9.51E-14
409	77.000%	15.4	3.58E-12	2.97E-14	3.74E-13	1.90E-12	1.27E-12	1.22E-14	1.07E-11	8.29E-14
410	77.500%	15.5	3.15E-12	2.61E-14	3.29E-13	1.67E-12	1.11E-12	1.07E-14	9.29E-12	7.22E-14
411	78.000%	15.6	2.77E-12	2.30E-14	2.89E-13	1.46E-12	9.80E-13	9.43E-15	8.08E-12	6.28E-14
412	78.500%	15.7	2.43E-12	2.02E-14	2.54E-13	1.29E-12	8.62E-13	8.29E-15	7.01E-12	5.45E-14
413	79.000%	15.8	2.14E-12	1.78E-14	2.24E-13	1.13E-12	7.59E-13	7.30E-15	6.08E-12	4.72E-14
414	79.500%	15.9	1.89E-12	1.56E-14	1.97E-13	9.98E-13	6.68E-13	6.42E-15	5.25E-12	4.08E-14
415	80.000%	16.0	1.46E-12	1.21E-14	1.52E-13	7.71E-13	5.16E-13	4.96E-15	4.61E-12	3.58E-14
416	80.500%	16.1	1.28E-12	1.07E-14	1.34E-13	6.80E-13	4.55E-13	4.37E-15	4.05E-12	3.14E-14
417	81.000%	16.2	1.13E-12	9.39E-15	1.18E-13	5.99E-13	4.01E-13	3.86E-15	3.55E-12	2.76E-14
418	81.500%	16.3	9.98E-13	8.28E-15	1.04E-13	5.28E-13	3.54E-13	3.40E-15	3.11E-12	2.42E-14
419	82.000%	16.4	8.80E-13	7.31E-15	9.20E-14	4.66E-13	3.12E-13	3.00E-15	2.73E-12	2.12E-14
420	82.500%	16.5	7.77E-13	6.45E-15	8.12E-14	4.12E-13	2.75E-13	2.65E-15	2.38E-12	1.85E-14
421	83.000%	16.6	6.86E-13	5.69E-15	7.17E-14	3.63E-13	2.43E-13	2.34E-15	2.08E-12	1.62E-14
422	83.500%	16.7	6.06E-13	5.03E-15	6.33E-14	3.21E-13	2.15E-13	2.07E-15	1.82E-12	1.41E-14
423	84.000%	16.8	5.36E-13	4.45E-15	5.60E-14	2.84E-13	1.90E-13	1.83E-15	1.58E-12	1.23E-14
424	84.500%	16.9	4.73E-13	3.93E-15	4.95E-14	2.51E-13	1.68E-13	1.61E-15	1.38E-12	1.07E-14
425	85.000%	17.0	3.75E-13	3.11E-15	3.92E-14	1.99E-13	1.33E-13	1.28E-15	1.21E-12	9.41E-15
426	85.500%	17.1	3.32E-13	2.75E-15	3.47E-14	1.76E-13	1.18E-13	1.13E-15	1.07E-12	8.28E-15
427	86.000%	17.2	2.94E-13	2.44E-15	3.07E-14	1.56E-13	1.04E-13	1.00E-15	9.37E-13	7.28E-15
428	86.500%	17.3	2.60E-13	2.16E-15	2.72E-14	1.38E-13	9.21E-14	8.86E-16	8.22E-13	6.39E-15
429	87.000%	17.4	2.30E-13	1.91E-15	2.41E-14	1.22E-13	8.16E-14	7.85E-16	7.21E-13	5.60E-15
430	87.500%	17.5	2.04E-13	1.69E-15	2.13E-14	1.08E-13	7.23E-14	6.95E-16	6.32E-13	4.91E-15
431	88.000%	17.6	1.81E-13	1.50E-15	1.89E-14	9.58E-14	6.41E-14	6.16E-16	5.53E-13	4.29E-15
432	88.500%	17.7	1.60E-13	1.33E-15	1.68E-14	8.49E-14	5.68E-14	5.47E-16	4.82E-13	3.75E-15

	A	B	C	D	E	F	G	H	I	J
433	89.000%	17.8	1.42E-13	1.18E-15	1.49E-14	7.53E-14	5.04E-14	4.85E-16	4.20E-13	3.26E-15
434	89.500%	17.9	1.26E-13	1.05E-15	1.32E-14	6.69E-14	4.47E-14	4.30E-16	3.64E-13	2.83E-15
435	90.000%	18.0	1.02E-13	8.49E-16	1.07E-14	5.42E-14	3.62E-14	3.48E-16	3.20E-13	2.48E-15
436	90.500%	18.1	9.08E-14	7.54E-16	9.49E-15	4.81E-14	3.22E-14	3.09E-16	2.80E-13	2.17E-15
437	91.000%	18.2	8.07E-14	6.70E-16	8.43E-15	4.27E-14	2.86E-14	2.75E-16	2.44E-13	1.90E-15
438	91.500%	18.3	7.17E-14	5.95E-16	7.49E-15	3.80E-14	2.54E-14	2.44E-16	2.13E-13	1.65E-15
439	92.000%	18.4	6.37E-14	5.29E-16	6.66E-15	3.37E-14	2.26E-14	2.17E-16	1.85E-13	1.44E-15
440	92.500%	18.5	5.67E-14	4.70E-16	5.92E-15	3.00E-14	2.01E-14	1.93E-16	1.60E-13	1.24E-15
441	93.000%	18.6	5.04E-14	4.18E-16	5.27E-15	2.67E-14	1.79E-14	1.72E-16	1.38E-13	1.07E-15
442	93.500%	18.7	4.49E-14	3.72E-16	4.69E-15	2.38E-14	1.59E-14	1.53E-16	1.18E-13	9.19E-16
443	94.000%	18.8	3.99E-14	3.32E-16	4.17E-15	2.12E-14	1.41E-14	1.36E-16	1.01E-13	7.82E-16
444	94.500%	18.9	3.56E-14	2.95E-16	3.72E-15	1.88E-14	1.26E-14	1.21E-16	8.50E-14	6.61E-16
445	95.000%	19.0	2.94E-14	2.44E-16	3.07E-15	1.56E-14	1.04E-14	1.00E-16	7.23E-14	5.62E-16
446	95.500%	19.1	2.62E-14	2.17E-16	2.74E-15	1.39E-14	9.27E-15	8.92E-17	6.07E-14	4.72E-16
447	96.000%	19.2	2.33E-14	1.94E-16	2.44E-15	1.24E-14	8.27E-15	7.95E-17	5.05E-14	3.92E-16
448	96.500%	19.3	2.08E-14	1.73E-16	2.17E-15	1.10E-14	7.37E-15	7.09E-17	4.13E-14	3.21E-16
449	97.000%	19.4	1.86E-14	1.54E-16	1.94E-15	9.83E-15	6.58E-15	6.33E-17	3.32E-14	2.58E-16
450	97.500%	19.5	1.66E-14	1.38E-16	1.73E-15	8.77E-15	5.87E-15	5.65E-17	2.59E-14	2.01E-16
451	98.000%	19.6	1.48E-14	1.23E-16	1.55E-15	7.83E-15	5.24E-15	5.04E-17	1.94E-14	1.51E-16
452	98.500%	19.7	1.32E-14	1.10E-16	1.38E-15	6.99E-15	4.68E-15	4.50E-17	1.37E-14	1.06E-16
453	99.000%	19.8	1.18E-14	9.79E-17	1.23E-15	6.25E-15	4.18E-15	4.02E-17	8.44E-15	6.56E-17
454	99.500%	19.9	1.05E-14	8.75E-17	1.10E-15	5.58E-15	3.73E-15	3.59E-17	3.89E-15	3.02E-17
455	100.000%	20.0	8.85E-15	7.35E-17	9.25E-16	4.69E-15	3.14E-15	3.02E-17	0.00E+00	0.00E+00
456			2.28	1.89E-02	2.38E-01	1.21E+00	8.08E-01	7.77E-03		

	A	B	C	D	E	F
1	Lid Thickness (mm)		25			
2	Lid Radius (m)		0.76		UT Benefit	2.54E+00
3	Weld Circumference (m)		4.775220833			
4	Total Flaws per WP - no inspection		41.01340489			
5	Total Flaws per Lid - w/ RT & PT inpsection		3.177608683			





Frequency of various size flaws in WP shell assuming no inspection

	A	B	C	D	E	F	G	H	I	J
48										Cumulative Prob.
50	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Per WP
51	1%	0.3	1.80E-07	1.50E-09	1.89E-08	9.56E-08	6.39E-08	6.15E-10	1.00E+00	1.40E-01
52	1.500%	0.4	7.19E-05	5.97E-07	7.51E-06	3.81E-05	2.55E-05	2.45E-07	1.00E+00	1.40E-01
53	2.000%	0.5	2.37E-03	1.97E-05	2.48E-04	1.26E-03	8.41E-04	8.09E-06	1.00E+00	1.40E-01
54	2.500%	0.6	2.26E-02	1.87E-04	2.36E-03	1.19E-02	7.99E-03	7.69E-05	9.99E-01	1.40E-01
55	3.000%	0.8	1.04E-01	8.60E-04	1.08E-02	5.49E-02	3.67E-02	3.53E-04	9.97E-01	1.39E-01
56	3.500%	0.9	3.00E-01	2.49E-03	3.14E-02	1.59E-01	1.06E-01	1.02E-03	9.90E-01	1.38E-01
57	4.000%	1.0	6.39E-01	5.30E-03	6.58E-02	3.38E-01	2.26E-01	2.18E-03	9.74E-01	1.36E-01
58	4.500%	1.1	1.10E+00	9.09E-03	1.14E-01	5.80E-01	3.88E-01	3.73E-03	9.47E-01	1.32E-01
59	5.000%	1.3	1.61E+00	1.33E-02	1.66E-01	8.50E-01	5.69E-01	5.47E-03	9.08E-01	1.27E-01
60	5.500%	1.4	2.09E+00	1.74E-02	2.19E-01	1.11E+00	7.41E-01	7.13E-03	8.57E-01	1.20E-01
61	6.000%	1.5	2.50E+00	2.07E-02	2.61E-01	1.32E+00	8.84E-01	8.51E-03	7.96E-01	1.11E-01
62	6.500%	1.6	2.78E+00	2.31E-02	2.90E-01	1.47E+00	9.84E-01	9.47E-03	7.28E-01	1.02E-01
63	7.000%	1.8	2.93E+00	2.43E-02	3.06E-01	1.55E+00	1.04E+00	9.98E-03	6.57E-01	9.18E-02
64	7.500%	1.9	2.95E+00	2.45E-02	3.09E-01	1.56E+00	1.05E+00	1.01E-02	5.85E-01	8.18E-02

	A	B	C	D	E	F	G	H	I	J
65	8.000%	2.0	2.88E+00	2.39E-02	3.00E-01	1.52E+00	1.02E+00	9.80E-03	5.15E-01	7.20E-02
66	8.500%	2.1	2.72E+00	2.26E-02	2.84E-01	1.44E+00	9.64E-01	9.27E-03	4.49E-01	6.27E-02
67	9.000%	2.3	2.51E+00	2.09E-02	2.63E-01	1.33E+00	8.90E-01	8.56E-03	3.87E-01	5.41E-02
68	9.500%	2.4	2.28E+00	1.89E-02	2.38E-01	1.21E+00	8.07E-01	7.76E-03	3.32E-01	4.64E-02
69	10.000%	2.5	2.03E+00	1.68E-02	2.12E-01	1.07E+00	7.19E-01	6.91E-03	2.82E-01	3.95E-02
70	10.500%	2.6	1.78E+00	1.48E-02	1.86E-01	9.45E-01	6.32E-01	6.08E-03	2.39E-01	3.34E-02
71	11.000%	2.8	1.55E+00	1.29E-02	1.62E-01	8.21E-01	5.49E-01	5.28E-03	2.01E-01	2.81E-02
72	11.500%	2.9	1.33E+00	1.11E-02	1.39E-01	7.07E-01	4.73E-01	4.55E-03	1.69E-01	2.36E-02
73	12.000%	3.0	1.14E+00	9.46E-03	1.19E-01	6.03E-01	4.04E-01	3.88E-03	1.41E-01	1.97E-02
74	12.500%	3.1	9.56E-01	8.02E-03	1.01E-01	5.12E-01	3.42E-01	3.29E-03	1.17E-01	1.64E-02
75	13.000%	3.3	8.15E-01	6.76E-03	8.51E-02	4.31E-01	2.89E-01	2.78E-03	9.73E-02	1.36E-02
76	13.500%	3.4	6.84E-01	5.67E-03	7.14E-02	3.62E-01	2.42E-01	2.33E-03	8.07E-02	1.13E-02
77	14.000%	3.5	5.71E-01	4.74E-03	5.97E-02	3.03E-01	2.02E-01	1.95E-03	6.67E-02	9.33E-03
78	14.500%	3.6	4.76E-01	3.95E-03	4.97E-02	2.52E-01	1.69E-01	1.62E-03	5.51E-02	7.70E-03
79	15.000%	3.8	3.95E-01	3.28E-03	4.13E-02	2.09E-01	1.40E-01	1.35E-03	4.55E-02	6.36E-03
80	15.500%	3.9	3.27E-01	2.72E-03	3.42E-02	1.73E-01	1.16E-01	1.12E-03	3.75E-02	5.24E-03
81	16.000%	4.0	2.71E-01	2.25E-03	2.83E-02	1.43E-01	9.59E-02	9.23E-04	3.09E-02	4.32E-03
82	16.500%	4.1	2.24E-01	1.86E-03	2.34E-02	1.18E-01	7.92E-02	7.62E-04	2.55E-02	3.56E-03
83	17.000%	4.3	1.84E-01	1.53E-03	1.93E-02	9.76E-02	6.53E-02	6.28E-04	2.10E-02	2.93E-03
84	17.500%	4.4	1.52E-01	1.26E-03	1.59E-02	8.04E-02	5.38E-02	5.17E-04	1.73E-02	2.41E-03
85	18.000%	4.5	1.25E-01	1.04E-03	1.31E-02	6.62E-02	4.43E-02	4.26E-04	1.42E-02	1.99E-03
86	18.500%	4.6	1.03E-01	8.54E-04	1.07E-02	5.45E-02	3.64E-02	3.50E-04	1.17E-02	1.64E-03
87	19.000%	4.8	8.46E-02	7.02E-04	8.84E-03	4.48E-02	3.00E-02	2.88E-04	9.64E-03	1.35E-03
88	19.500%	4.9	6.96E-02	5.77E-04	7.27E-03	3.68E-02	2.46E-02	2.37E-04	7.95E-03	1.11E-03
89	20.000%	5.0	5.72E-02	4.75E-04	5.98E-03	3.03E-02	2.03E-02	1.95E-04	6.55E-03	9.16E-04
90	20.500%	5.1	4.71E-02	3.91E-04	4.92E-03	2.49E-02	1.67E-02	1.60E-04	5.40E-03	7.55E-04
91	21.000%	5.3	3.87E-02	3.21E-04	4.04E-03	2.05E-02	1.37E-02	1.32E-04	4.46E-03	6.23E-04
92	21.500%	5.4	3.19E-02	2.64E-04	3.33E-03	1.69E-02	1.13E-02	1.09E-04	3.68E-03	5.15E-04
93	22.000%	5.5	2.62E-02	2.18E-04	2.74E-03	1.39E-02	9.29E-03	8.94E-05	3.05E-03	4.26E-04
94	22.500%	5.6	2.16E-02	1.79E-04	2.26E-03	1.14E-02	7.65E-03	7.36E-05	2.52E-03	3.52E-04
95	23.000%	5.8	1.78E-02	1.48E-04	1.86E-03	9.42E-03	6.30E-03	6.06E-05	2.08E-03	2.91E-04
96	23.500%	5.9	1.47E-02	1.22E-04	1.53E-03	7.77E-03	5.20E-03	5.00E-05	1.73E-03	2.41E-04
97	24.000%	6.0	1.21E-02	1.00E-04	1.26E-03	6.41E-03	4.29E-03	4.13E-05	1.43E-03	2.00E-04
98	24.500%	6.1	1.00E-02	8.30E-05	1.04E-03	5.29E-03	3.54E-03	3.41E-05	1.19E-03	1.66E-04
99	25.000%	6.3	8.26E-03	6.85E-05	8.63E-04	4.37E-03	2.93E-03	2.81E-05	9.87E-04	1.38E-04
100	25.500%	6.4	6.83E-03	5.67E-05	7.14E-04	3.62E-03	2.42E-03	2.33E-05	8.20E-04	1.15E-04
101	26.000%	6.5	5.65E-03	4.69E-05	5.90E-04	2.99E-03	2.00E-03	1.93E-05	6.82E-04	9.54E-05
102	26.500%	6.6	4.68E-03	3.88E-05	4.89E-04	2.48E-03	1.66E-03	1.59E-05	5.68E-04	7.94E-05
103	27.000%	6.8	3.88E-03	3.22E-05	4.05E-04	2.05E-03	1.37E-03	1.32E-05	4.74E-04	6.62E-05
104	27.500%	6.9	3.22E-03	2.67E-05	3.36E-04	1.70E-03	1.14E-03	1.10E-05	3.95E-04	5.52E-05
105	28.000%	7.0	2.67E-03	2.22E-05	2.79E-04	1.42E-03	9.47E-04	9.11E-06	3.30E-04	4.61E-05
106	28.500%	7.1	2.22E-03	1.84E-05	2.32E-04	1.18E-03	7.87E-04	7.57E-06	2.76E-04	3.86E-05
107	29.000%	7.3	1.85E-03	1.53E-05	1.93E-04	9.78E-04	6.55E-04	6.30E-06	2.31E-04	3.23E-05
108	29.500%	7.4	1.54E-03	1.28E-05	1.61E-04	8.15E-04	5.45E-04	5.24E-06	1.93E-04	2.70E-05
109	30.000%	7.5	1.28E-03	1.06E-05	1.34E-04	6.79E-04	4.54E-04	4.37E-06	1.62E-04	2.26E-05
110	30.500%	7.6	1.07E-03	8.88E-06	1.12E-04	5.66E-04	3.79E-04	3.64E-06	1.36E-04	1.90E-05
111	31.000%	7.8	8.93E-04	7.41E-06	9.33E-05	4.73E-04	3.16E-04	3.04E-06	1.14E-04	1.60E-05
112	31.500%	7.9	7.46E-04	6.19E-06	7.80E-05	3.95E-04	2.64E-04	2.54E-06	9.60E-05	1.34E-05
113	32.000%	8.0	6.24E-04	5.18E-06	6.52E-05	3.30E-04	2.21E-04	2.13E-06	8.08E-05	1.13E-05
114	32.500%	8.1	5.23E-04	4.34E-06	5.46E-05	2.77E-04	1.85E-04	1.78E-06	6.80E-05	9.51E-06
115	33.000%	8.3	4.38E-04	3.63E-06	4.58E-05	2.32E-04	1.55E-04	1.49E-06	5.73E-05	8.01E-06
116	33.500%	8.4	3.67E-04	3.05E-06	3.84E-05	1.95E-04	1.30E-04	1.25E-06	4.84E-05	6.76E-06
117	34.000%	8.5	3.08E-04	2.56E-06	3.22E-05	1.63E-04	1.09E-04	1.05E-06	4.09E-05	5.71E-06
118	34.500%	8.6	2.59E-04	2.15E-06	2.71E-05	1.37E-04	9.18E-05	8.83E-07	3.45E-05	4.83E-06
119	35.000%	8.8	2.18E-04	1.81E-06	2.28E-05	1.15E-04	7.72E-05	7.43E-07	2.92E-05	4.09E-06
120	35.500%	8.9	1.84E-04	1.52E-06	1.92E-05	9.72E-05	6.50E-05	6.25E-07	2.48E-05	3.46E-06
121	36.000%	9.0	1.55E-04	1.28E-06	1.62E-05	8.19E-05	5.48E-05	5.27E-07	2.10E-05	2.93E-06
122	36.500%	9.1	1.30E-04	1.08E-06	1.36E-05	6.91E-05	4.62E-05	4.45E-07	1.78E-05	2.49E-06
123	37.000%	9.3	1.10E-04	9.14E-07	1.15E-05	5.83E-05	3.90E-05	3.75E-07	1.51E-05	2.11E-06
124	37.500%	9.4	9.30E-05	7.72E-07	9.72E-06	4.93E-05	3.30E-05	3.17E-07	1.29E-05	1.80E-06
125	38.000%	9.5	7.87E-05	6.53E-07	8.22E-06	4.17E-05	2.79E-05	2.68E-07	1.09E-05	1.53E-06
126	38.500%	9.6	6.66E-05	5.53E-07	6.96E-06	3.53E-05	2.36E-05	2.27E-07	9.31E-06	1.30E-06
127	39.000%	9.8	5.64E-05	4.68E-07	5.90E-06	2.99E-05	2.00E-05	1.92E-07	7.93E-06	1.11E-06
128	39.500%	9.9	4.79E-05	3.97E-07	5.00E-06	2.53E-05	1.70E-05	1.63E-07	6.77E-06	9.46E-07

	A	B	C	D	E	F	G	H	I	J
129	40.000%	10.0	4.06E-05	3.37E-07	4.24E-06	2.15E-05	1.44E-05	1.38E-07	5.78E-06	8.07E-07
130	40.500%	10.1	3.45E-05	2.86E-07	3.61E-06	1.83E-05	1.22E-05	1.18E-07	4.93E-06	6.90E-07
131	41.000%	10.3	2.93E-05	2.43E-07	3.06E-06	1.55E-05	1.04E-05	1.00E-07	4.22E-06	5.90E-07
132	41.500%	10.4	2.50E-05	2.07E-07	2.61E-06	1.32E-05	8.84E-06	8.51E-08	3.61E-06	5.05E-07
133	42.000%	10.5	2.13E-05	1.76E-07	2.22E-06	1.13E-05	7.53E-06	7.24E-08	3.09E-06	4.32E-07
134	42.500%	10.6	1.81E-05	1.50E-07	1.89E-06	9.59E-06	6.42E-06	6.17E-08	2.65E-06	3.70E-07
135	43.000%	10.8	1.55E-05	1.28E-07	1.61E-06	8.18E-06	5.47E-06	5.27E-08	2.27E-06	3.18E-07
136	43.500%	10.9	1.32E-05	1.10E-07	1.38E-06	6.99E-06	4.67E-06	4.50E-08	1.95E-06	2.73E-07
137	44.000%	11.0	1.13E-05	9.36E-08	1.18E-06	5.97E-06	3.99E-06	3.84E-08	1.68E-06	2.34E-07
138	44.500%	11.1	9.64E-06	8.00E-08	1.01E-06	5.10E-06	3.41E-06	3.28E-08	1.44E-06	2.02E-07
139	45.000%	11.3	8.25E-06	6.85E-08	8.62E-07	4.37E-06	2.92E-06	2.81E-08	1.24E-06	1.73E-07
140	45.500%	11.4	7.07E-06	5.86E-08	7.38E-07	3.74E-06	2.50E-06	2.41E-08	1.07E-06	1.49E-07
141	46.000%	11.5	6.06E-06	5.03E-08	6.33E-07	3.21E-06	2.15E-06	2.06E-08	9.21E-07	1.29E-07
142	46.500%	11.6	5.20E-06	4.31E-08	5.43E-07	2.75E-06	1.84E-06	1.77E-08	7.95E-07	1.11E-07
143	47.000%	11.8	4.46E-06	3.70E-08	4.66E-07	2.36E-06	1.58E-06	1.52E-08	6.86E-07	9.59E-08
144	47.500%	11.9	3.83E-06	3.18E-08	4.00E-07	2.03E-06	1.36E-06	1.31E-08	5.93E-07	8.28E-08
145	48.000%	12.0	3.29E-06	2.73E-08	3.44E-07	1.74E-06	1.17E-06	1.12E-08	5.12E-07	7.16E-08
146	48.500%	12.1	2.83E-06	2.35E-08	2.96E-07	1.50E-06	1.00E-06	9.66E-09	4.43E-07	6.19E-08
147	49.000%	12.3	2.44E-06	2.03E-08	2.55E-07	1.29E-06	8.65E-07	8.32E-09	3.84E-07	5.36E-08
148	49.500%	12.4	2.10E-06	1.75E-08	2.20E-07	1.11E-06	7.45E-07	7.17E-09	3.32E-07	4.64E-08
149	50.000%	12.5	1.81E-06	1.51E-08	1.90E-07	9.61E-07	6.43E-07	6.18E-09	2.88E-07	4.03E-08
150	50.500%	12.6	1.57E-06	1.30E-08	1.64E-07	8.29E-07	5.55E-07	5.33E-09	2.50E-07	3.49E-08
151	51.000%	12.8	1.35E-06	1.12E-08	1.41E-07	7.16E-07	4.79E-07	4.61E-09	2.17E-07	3.03E-08
152	51.500%	12.9	1.17E-06	9.70E-09	1.22E-07	6.19E-07	4.14E-07	3.98E-09	1.88E-07	2.53E-08
153	52.000%	13.0	1.01E-06	8.39E-09	1.06E-07	5.35E-07	3.58E-07	3.44E-09	1.64E-07	2.29E-08
154	52.500%	13.1	8.74E-07	7.26E-09	9.14E-08	4.63E-07	3.10E-07	2.98E-09	1.42E-07	1.99E-08
155	53.000%	13.3	7.57E-07	6.28E-09	7.91E-08	4.01E-07	2.68E-07	2.58E-09	1.24E-07	1.73E-08
156	53.500%	13.4	6.56E-07	5.45E-09	6.86E-08	3.47E-07	2.32E-07	2.24E-09	1.08E-07	1.51E-08
157	54.000%	13.5	5.69E-07	4.72E-09	5.95E-08	3.01E-07	2.02E-07	1.94E-09	9.41E-08	1.32E-08
158	54.500%	13.6	4.94E-07	4.10E-09	5.16E-08	2.61E-07	1.75E-07	1.68E-09	8.21E-08	1.15E-08
159	55.000%	13.8	4.29E-07	3.56E-09	4.48E-08	2.27E-07	1.52E-07	1.46E-09	7.17E-08	1.00E-08
160	55.500%	13.9	3.73E-07	3.09E-09	3.89E-08	1.97E-07	1.32E-07	1.27E-09	6.26E-08	8.74E-09
161	56.000%	14.0	3.24E-07	2.69E-09	3.38E-08	1.72E-07	1.15E-07	1.10E-09	5.47E-08	7.64E-09
162	56.500%	14.1	2.82E-07	2.34E-09	2.94E-08	1.49E-07	9.98E-08	9.60E-10	4.78E-08	6.68E-09
163	57.000%	14.3	2.45E-07	2.04E-09	2.56E-08	1.30E-07	8.69E-08	8.36E-10	4.18E-08	5.84E-09
164	57.500%	14.4	2.14E-07	1.77E-09	2.23E-08	1.13E-07	7.57E-08	7.28E-10	3.66E-08	5.12E-09
165	58.000%	14.5	1.86E-07	1.55E-09	1.95E-08	9.87E-08	6.60E-08	6.35E-10	3.21E-08	4.48E-09
166	58.500%	14.6	1.63E-07	1.35E-09	1.70E-08	8.61E-08	5.76E-08	5.54E-10	2.81E-08	3.93E-09
167	59.000%	14.8	1.42E-07	1.18E-09	1.48E-08	7.51E-08	5.02E-08	4.83E-10	2.46E-08	3.44E-09
168	59.500%	14.9	1.24E-07	1.03E-09	1.29E-08	6.56E-08	4.39E-08	4.22E-10	2.16E-08	3.02E-09
169	60.000%	15.0	1.08E-07	8.98E-10	1.13E-08	5.73E-08	3.83E-08	3.69E-10	1.90E-08	2.65E-09
170	60.500%	15.1	9.46E-08	7.85E-10	9.89E-09	5.01E-08	3.35E-08	3.22E-10	1.67E-08	2.33E-09
171	61.000%	15.3	8.28E-08	6.87E-10	8.65E-09	4.38E-08	2.93E-08	2.82E-10	1.47E-08	2.05E-09
172	61.500%	15.4	7.25E-08	6.01E-10	7.57E-09	3.84E-08	2.57E-08	2.47E-10	1.29E-08	1.80E-09
173	62.000%	15.5	6.35E-08	5.27E-10	6.63E-09	3.36E-08	2.25E-08	2.16E-10	1.13E-08	1.59E-09
174	62.500%	15.6	5.56E-08	4.62E-10	5.81E-09	2.95E-08	1.97E-08	1.90E-10	9.99E-09	1.40E-09
175	63.000%	15.8	4.88E-08	4.05E-10	5.10E-09	2.58E-08	1.73E-08	1.66E-10	8.80E-09	1.23E-09
176	63.500%	15.9	4.28E-08	3.55E-10	4.47E-09	2.27E-08	1.52E-08	1.46E-10	7.75E-09	1.08E-09
177	64.000%	16.0	3.76E-08	3.12E-10	3.93E-09	1.99E-08	1.33E-08	1.28E-10	6.84E-09	9.55E-10
178	64.500%	16.1	3.30E-08	2.74E-10	3.45E-09	1.75E-08	1.17E-08	1.12E-10	6.03E-09	8.43E-10
179	65.000%	16.3	2.90E-08	2.41E-10	3.03E-09	1.54E-08	1.03E-08	9.88E-11	5.32E-09	7.44E-10
180	65.500%	16.4	2.55E-08	2.12E-10	2.66E-09	1.35E-08	9.03E-09	8.69E-11	4.70E-09	6.57E-10
181	66.000%	16.5	2.24E-08	1.86E-10	2.34E-09	1.19E-08	7.95E-09	7.65E-11	4.16E-09	5.81E-10
182	66.500%	16.6	1.98E-08	1.64E-10	2.06E-09	1.05E-08	7.00E-09	6.73E-11	3.67E-09	5.13E-10
183	67.000%	16.8	1.74E-08	1.44E-10	1.82E-09	9.21E-09	6.16E-09	5.93E-11	3.25E-09	4.54E-10
184	67.500%	16.9	1.53E-08	1.27E-10	1.60E-09	8.12E-09	5.43E-09	5.22E-11	2.88E-09	4.02E-10
185	68.000%	17.0	1.35E-08	1.12E-10	1.41E-09	7.16E-09	4.79E-09	4.61E-11	2.55E-09	3.56E-10
186	68.500%	17.1	1.19E-08	9.90E-11	1.25E-09	6.31E-09	4.22E-09	4.06E-11	2.26E-09	3.15E-10
187	69.000%	17.3	1.05E-08	8.73E-11	1.10E-09	5.57E-09	3.73E-09	3.59E-11	2.00E-09	2.79E-10
188	69.500%	17.4	9.29E-09	7.71E-11	9.71E-10	4.92E-09	3.29E-09	3.17E-11	1.77E-09	2.48E-10
189	70.000%	17.5	8.21E-09	6.81E-11	8.58E-10	4.35E-09	2.91E-09	2.80E-11	1.57E-09	2.20E-10
190	70.500%	17.6	7.26E-09	6.02E-11	7.58E-10	3.84E-09	2.57E-09	2.47E-11	1.40E-09	1.95E-10
191	71.000%	17.8	6.42E-09	5.33E-11	6.70E-10	3.40E-09	2.27E-09	2.19E-11	1.24E-09	1.73E-10
192	71.500%	17.9	5.68E-09	4.71E-11	5.93E-10	3.01E-09	2.01E-09	1.93E-11	1.10E-09	1.54E-10

	A	B	C	D	E	F	G	H	I	J
193	72.000%	18.0	5.03E-09	4.17E-11	5.25E-10	2.66E-09	1.78E-09	1.71E-11	9.78E-10	1.37E-10
194	72.500%	18.1	4.45E-09	3.69E-11	4.65E-10	2.36E-09	1.58E-09	1.52E-11	8.69E-10	1.22E-10
195	73.000%	18.3	3.94E-09	3.27E-11	4.12E-10	2.09E-09	1.40E-09	1.34E-11	7.73E-10	1.08E-10
196	73.500%	18.4	3.50E-09	2.90E-11	3.65E-10	1.85E-09	1.24E-09	1.19E-11	6.88E-10	9.62E-11
197	74.000%	18.5	3.10E-09	2.57E-11	3.24E-10	1.64E-09	1.10E-09	1.06E-11	6.12E-10	8.56E-11
198	74.500%	18.6	2.75E-09	2.28E-11	2.87E-10	1.46E-09	9.75E-10	9.37E-12	5.45E-10	7.62E-11
199	75.000%	18.8	2.44E-09	2.03E-11	2.55E-10	1.29E-09	8.65E-10	8.32E-12	4.86E-10	6.79E-11
200	75.500%	18.9	2.17E-09	1.80E-11	2.27E-10	1.15E-09	7.68E-10	7.39E-12	4.33E-10	6.05E-11
201	76.000%	19.0	1.93E-09	1.60E-11	2.01E-10	1.02E-09	6.83E-10	6.57E-12	3.86E-10	5.39E-11
202	76.500%	19.1	1.71E-09	1.42E-11	1.79E-10	9.07E-10	6.07E-10	5.84E-12	3.44E-10	4.81E-11
203	77.000%	19.3	1.52E-09	1.26E-11	1.59E-10	8.07E-10	5.40E-10	5.19E-12	3.07E-10	4.29E-11
204	77.500%	19.4	1.36E-09	1.12E-11	1.42E-10	7.18E-10	4.80E-10	4.62E-12	2.74E-10	3.83E-11
205	78.000%	19.5	1.21E-09	1.00E-11	1.26E-10	6.39E-10	4.27E-10	4.11E-12	2.45E-10	3.42E-11
206	78.500%	19.6	1.07E-09	8.92E-12	1.12E-10	5.69E-10	3.81E-10	3.66E-12	2.18E-10	3.05E-11
207	79.000%	19.8	9.57E-10	7.94E-12	1.00E-10	5.07E-10	3.39E-10	3.26E-12	1.95E-10	2.73E-11
208	79.500%	19.9	8.53E-10	7.08E-12	8.91E-11	4.52E-10	3.02E-10	2.91E-12	1.74E-10	2.44E-11
209	80.000%	20.0	7.61E-10	6.31E-12	7.95E-11	4.03E-10	2.69E-10	2.59E-12	1.56E-10	2.18E-11
210	80.500%	20.1	6.78E-10	5.63E-12	7.09E-11	3.59E-10	2.40E-10	2.31E-12	1.39E-10	1.94E-11
211	81.000%	20.3	6.05E-10	5.02E-12	6.33E-11	3.21E-10	2.14E-10	2.06E-12	1.24E-10	1.74E-11
212	81.500%	20.4	5.40E-10	4.49E-12	5.65E-11	2.86E-10	1.91E-10	1.84E-12	1.11E-10	1.55E-11
213	82.000%	20.5	4.83E-10	4.01E-12	5.04E-11	2.56E-10	1.71E-10	1.64E-12	9.94E-11	1.39E-11
214	82.500%	20.6	4.31E-10	3.58E-12	4.51E-11	2.28E-10	1.53E-10	1.47E-12	8.89E-11	1.24E-11
215	83.000%	20.8	3.86E-10	3.20E-12	4.03E-11	2.04E-10	1.37E-10	1.31E-12	7.95E-11	1.11E-11
216	83.500%	20.9	3.45E-10	2.86E-12	3.60E-11	1.83E-10	1.22E-10	1.17E-12	7.11E-11	9.94E-12
217	84.000%	21.0	3.08E-10	2.56E-12	3.22E-11	1.63E-10	1.09E-10	1.05E-12	6.36E-11	8.89E-12
218	84.500%	21.1	2.76E-10	2.29E-12	2.88E-11	1.46E-10	9.78E-11	9.40E-13	5.69E-11	7.95E-12
219	85.000%	21.3	2.47E-10	2.05E-12	2.58E-11	1.31E-10	8.75E-11	8.42E-13	5.08E-11	7.11E-12
220	85.500%	21.4	2.21E-10	1.84E-12	2.31E-11	1.17E-10	7.84E-11	7.54E-13	4.54E-11	6.35E-12
221	86.000%	21.5	1.98E-10	1.65E-12	2.07E-11	1.05E-10	7.02E-11	6.76E-13	4.06E-11	5.68E-12
222	86.500%	21.6	1.78E-10	1.47E-12	1.86E-11	9.41E-11	6.29E-11	6.06E-13	3.63E-11	5.07E-12
223	87.000%	21.8	1.59E-10	1.32E-12	1.66E-11	8.44E-11	5.64E-11	5.43E-13	3.24E-11	4.53E-12
224	87.500%	21.9	1.43E-10	1.19E-12	1.49E-11	7.57E-11	5.06E-11	4.87E-13	2.89E-11	4.04E-12
225	88.000%	22.0	1.28E-10	1.06E-12	1.34E-11	6.79E-11	4.54E-11	4.37E-13	2.58E-11	3.60E-12
226	88.500%	22.1	1.15E-10	9.55E-13	1.20E-11	6.10E-11	4.08E-11	3.92E-13	2.30E-11	3.21E-12
227	89.000%	22.3	1.03E-10	8.58E-13	1.08E-11	5.47E-11	3.66E-11	3.52E-13	2.05E-11	2.86E-12
228	89.500%	22.4	9.29E-11	7.71E-13	9.70E-12	4.92E-11	3.29E-11	3.16E-13	1.82E-11	2.54E-12
229	90.000%	22.5	8.34E-11	6.93E-13	8.72E-12	4.42E-11	2.96E-11	2.84E-13	1.62E-11	2.26E-12
230	90.500%	22.6	7.50E-11	6.23E-13	7.84E-12	3.97E-11	2.66E-11	2.56E-13	1.43E-11	2.00E-12
231	91.000%	22.8	6.75E-11	5.60E-13	7.05E-12	3.57E-11	2.39E-11	2.30E-13	1.27E-11	1.77E-12
232	91.500%	22.9	6.07E-11	5.04E-13	6.34E-12	3.21E-11	2.15E-11	2.07E-13	1.12E-11	1.57E-12
233	92.000%	23.0	5.46E-11	4.53E-13	5.71E-12	2.89E-11	1.93E-11	1.86E-13	9.87E-12	1.38E-12
234	92.500%	23.1	4.92E-11	4.08E-13	5.14E-12	2.60E-11	1.74E-11	1.68E-13	8.67E-12	1.21E-12
235	93.000%	23.3	4.43E-11	3.67E-13	4.63E-12	2.34E-11	1.57E-11	1.51E-13	7.59E-12	1.06E-12
235	93.500%	23.4	3.99E-11	3.31E-13	4.17E-12	2.11E-11	1.41E-11	1.36E-13	6.62E-12	9.25E-13
237	94.000%	23.5	3.59E-11	2.98E-13	3.76E-12	1.90E-11	1.27E-11	1.22E-13	5.74E-12	8.02E-13
238	94.500%	23.6	3.24E-11	2.69E-13	3.39E-12	1.72E-11	1.15E-11	1.10E-13	4.95E-12	6.92E-13
239	95.000%	23.8	2.92E-11	2.43E-13	3.05E-12	1.55E-11	1.04E-11	9.96E-14	4.24E-12	5.92E-13
240	95.500%	23.9	2.64E-11	2.19E-13	2.75E-12	1.40E-11	9.34E-12	8.98E-14	3.60E-12	5.03E-13
241	96.000%	24.0	2.38E-11	1.97E-13	2.49E-12	1.26E-11	8.42E-12	8.10E-14	3.02E-12	4.22E-13
242	96.500%	24.1	2.15E-11	1.78E-13	2.24E-12	1.14E-11	7.61E-12	7.32E-14	2.49E-12	3.48E-13
243	97.000%	24.3	1.94E-11	1.61E-13	2.03E-12	1.03E-11	6.87E-12	6.61E-14	2.02E-12	2.82E-13
244	97.500%	24.4	1.75E-11	1.45E-13	1.83E-12	9.27E-12	6.20E-12	5.97E-14	1.59E-12	2.23E-13
245	98.000%	24.5	1.58E-11	1.31E-13	1.65E-12	8.38E-12	5.61E-12	5.39E-14	1.21E-12	1.69E-13
246	98.500%	24.6	1.43E-11	1.19E-13	1.49E-12	7.57E-12	5.06E-12	4.87E-14	8.59E-13	1.20E-13
247	99.000%	24.8	1.29E-11	1.07E-13	1.35E-12	6.85E-12	4.58E-12	4.41E-14	5.43E-13	7.59E-14
248	99.500%	24.9	1.17E-11	9.71E-14	1.22E-12	6.19E-12	4.14E-12	3.98E-14	2.58E-13	3.61E-14
249	100%	25.0	1.06E-11	8.78E-14	1.11E-12	5.60E-12	3.75E-12	3.60E-14	0.00E+00	0.00E+00
250		Flaws/Lid	4.10E+01	3.40E-01	4.29E+00	2.17E+01	1.45E+01	1.40E-01		
251										
252										Cumulative
253	Frequency of various size flaws in WP shell assuming RT, PT, and UT exams (Bottom Lid)									Prob.
254	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Per WP
255	1%	0.3	1.40E-06	1.16E-10	1.46E-09	7.40E-09	4.95E-09	4.76E-11	1.00E+00	4.26E-03
256	1.500%	0.4	5.56E-06	4.61E-08	5.80E-07	2.94E-06	1.97E-06	1.89E-08	1.00E+00	4.26E-03

	A	B	C	D	E	F	G	H	I	J
257	2.000%	0.5	1.80E-04	1.49E-06	1.88E-05	9.52E-05	6.37E-05	6.12E-07	1.00E+00	4.26E-03
258	2.500%	0.6	1.67E-03	1.39E-05	1.75E-04	8.86E-04	5.92E-04	5.70E-06	9.99E-01	4.26E-03
259	3.000%	0.8	7.46E-03	6.19E-05	7.80E-04	3.95E-03	2.64E-03	2.54E-05	9.93E-01	4.23E-03
260	3.500%	0.9	2.08E-02	1.73E-04	2.18E-03	1.10E-02	7.38E-03	7.10E-05	9.76E-01	4.16E-03
261	4.000%	1.0	4.04E-02	3.35E-04	4.22E-03	2.14E-02	1.43E-02	1.38E-04	9.44E-01	4.02E-03
262	4.500%	1.1	6.54E-02	5.43E-04	6.83E-03	3.46E-02	2.32E-02	2.23E-04	8.91E-01	3.80E-03
263	5.000%	1.3	9.01E-02	7.48E-04	9.41E-03	4.77E-02	3.19E-02	3.07E-04	8.19E-01	3.49E-03
264	5.500%	1.4	1.10E-01	9.13E-04	1.15E-02	5.82E-02	3.89E-02	3.75E-04	7.31E-01	3.12E-03
265	6.000%	1.5	1.22E-01	1.01E-03	1.28E-02	6.47E-02	4.33E-02	4.16E-04	6.34E-01	2.70E-03
266	6.500%	1.6	1.17E-01	9.71E-04	1.22E-02	6.20E-02	4.15E-02	3.99E-04	5.40E-01	2.30E-03
267	7.000%	1.8	1.14E-01	9.46E-04	1.19E-02	6.03E-02	4.04E-02	3.88E-04	4.49E-01	1.91E-03
268	7.500%	1.9	1.06E-01	8.79E-04	1.11E-02	5.61E-02	3.75E-02	3.61E-04	3.64E-01	1.55E-03
269	8.000%	2.0	8.72E-02	7.24E-04	9.11E-03	4.62E-02	3.09E-02	2.97E-04	2.94E-01	1.26E-03
270	8.500%	2.1	7.57E-02	6.28E-04	7.91E-03	4.01E-02	2.68E-02	2.58E-04	2.34E-01	9.97E-04
271	9.000%	2.3	6.41E-02	5.32E-04	6.70E-03	3.40E-02	2.27E-02	2.19E-04	1.83E-01	7.78E-04
272	9.500%	2.4	5.32E-02	4.42E-04	5.56E-03	2.82E-02	1.88E-02	1.81E-04	1.40E-01	5.97E-04
273	10.000%	2.5	3.97E-02	3.29E-04	4.15E-03	2.10E-02	1.41E-02	1.35E-04	1.08E-01	4.62E-04
274	10.500%	2.6	3.19E-02	2.65E-04	3.33E-03	1.69E-02	1.13E-02	1.09E-04	8.2[illegible]	3.53E-04
275	11.000%	2.8	2.53E-02	2.10E-04	2.65E-03	1.34E-02	8.98E-03	8.64E-05	6.[illegible]	2.67E-04
276	11.500%	2.9	1.99E-02	1.66E-04	2.08E-03	1.06E-02	7.07E-03	6.80E-05	4.[illegible]	1.99E-04
277	12.000%	3.0	1.42E-02	1.18E-04	1.49E-03	7.53E-03	5.04E-03	4.84E-05	3.53E-02	1.50E-04
278	12.500%	3.1	1.10E-02	9.14E-05	1.15E-03	5.83E-03	3.90E-03	3.75E-05	2.65E-02	1.13E-04
279	13.000%	3.3	8.49E-03	7.05E-05	8.87E-04	4.50E-03	3.01E-03	2.89E-05	1.97E-02	8.39E-05
280	13.500%	3.4	6.51E-03	5.40E-05	6.80E-04	3.45E-03	2.31E-03	2.22E-05	1.45E-02	6.17E-05
281	14.000%	3.5	4.55E-03	3.77E-05	4.75E-04	2.41E-03	1.61E-03	1.55E-05	1.08E-02	4.62E-05
282	14.500%	3.6	3.46E-03	2.87E-05	3.62E-04	1.83E-03	1.23E-03	1.18E-05	8.07E-03	3.44E-05
283	15.000%	3.8	2.63E-03	2.18E-05	2.75E-04	1.39E-03	9.32E-04	8.97E-06	5.96E-03	2.54E-05
284	15.500%	3.9	2.00E-03	1.66E-05	2.09E-04	1.06E-03	7.07E-04	6.80E-06	4.37E-03	1.86E-05
285	15.000%	4.0	1.38E-03	1.15E-05	1.45E-04	7.33E-04	4.90E-04	4.72E-06	3.26E-03	1.39E-05
286	15.500%	4.1	1.05E-03	8.69E-06	1.09E-04	5.55E-04	3.71E-04	3.57E-06	2.42E-03	1.03E-05
287	17.000%	4.3	7.91E-04	6.57E-06	8.27E-05	4.19E-04	2.80E-04	2.70E-06	1.79E-03	7.64E-06
288	17.500%	4.4	5.98E-04	4.96E-06	6.25E-05	3.17E-04	2.12E-04	2.04E-06	1.31E-03	5.60E-06
289	18.000%	4.5	4.15E-04	3.44E-06	4.33E-05	2.20E-04	1.47E-04	1.41E-06	9.82E-04	4.19E-06
290	18.500%	4.6	3.13E-04	2.60E-06	3.27E-05	1.66E-04	1.11E-04	1.07E-06	7.32E-04	3.12E-06
291	19.000%	4.8	2.37E-04	1.97E-06	2.47E-05	1.25E-04	8.39E-05	8.07E-07	5.42E-04	2.31E-06
292	19.500%	4.9	1.79E-04	1.49E-06	1.87E-05	9.48E-05	6.34E-05	6.10E-07	3.99E-04	1.70E-06
293	20.000%	5.0	1.25E-04	1.03E-06	1.30E-05	6.60E-05	4.42E-05	4.25E-07	3.00E-04	1.28E-06
294	20.500%	5.1	9.44E-05	7.83E-07	9.86E-06	5.00E-05	3.34E-05	3.22E-07	2.24E-04	9.56E-07
295	21.000%	5.3	7.15E-05	5.93E-07	7.47E-06	3.79E-05	2.53E-05	2.44E-07	1.67E-04	7.12E-07
296	21.500%	5.4	5.42E-05	4.50E-07	5.66E-06	2.87E-05	1.92E-05	1.85E-07	1.24E-04	5.27E-07
297	22.000%	5.5	3.80E-05	3.16E-07	3.97E-06	2.01E-05	1.35E-05	1.30E-07	9.33E-05	3.98E-07
298	22.500%	5.6	2.89E-05	2.40E-07	3.02E-06	1.53E-05	1.02E-05	9.84E-08	7.02E-05	2.99E-07
299	23.000%	5.8	2.20E-05	1.83E-07	2.30E-06	1.16E-05	7.79E-06	7.49E-08	5.27E-05	2.24E-07
300	23.500%	5.9	1.68E-05	1.39E-07	1.75E-06	8.87E-06	5.94E-06	5.71E-08	3.93E-05	1.67E-07
301	24.000%	6.0	1.18E-05	9.82E-08	1.24E-06	6.26E-06	4.19E-06	4.03E-08	2.98E-05	1.27E-07
302	24.500%	6.1	9.05E-06	7.51E-08	9.48E-07	4.79E-06	3.21E-06	3.08E-08	2.26E-05	9.62E-08
303	25.000%	6.3	6.92E-06	5.74E-08	7.23E-07	3.66E-06	2.45E-06	2.36E-08	1.70E-05	7.26E-08
304	25.500%	6.4	5.30E-06	4.40E-08	5.54E-07	2.81E-06	1.88E-06	1.81E-08	1.28E-05	5.45E-08
305	26.000%	6.5	3.78E-06	3.13E-08	3.94E-07	2.00E-06	1.34E-06	1.29E-08	9.78E-06	4.17E-08
306	26.500%	6.6	2.90E-06	2.41E-08	3.03E-07	1.54E-06	1.03E-06	9.89E-09	7.46E-06	3.18E-08
307	27.000%	6.8	2.24E-06	1.86E-08	2.34E-07	1.18E-06	7.92E-07	7.62E-09	5.67E-06	2.42E-08
308	27.500%	6.9	1.72E-06	1.43E-08	1.80E-07	9.13E-07	6.10E-07	5.87E-09	4.29E-06	1.83E-08
309	28.000%	7.0	1.24E-06	1.03E-08	1.29E-07	6.56E-07	4.39E-07	4.22E-09	3.30E-06	1.41E-08
310	28.500%	7.1	9.58E-07	7.95E-09	1.00E-07	5.07E-07	3.39E-07	3.26E-09	2.54E-06	1.08E-08
311	29.000%	7.3	7.42E-07	6.16E-09	7.75E-08	3.93E-07	2.63E-07	2.53E-09	1.94E-06	8.29E-09
312	29.500%	7.4	5.76E-07	4.78E-09	6.02E-08	3.05E-07	2.04E-07	1.96E-09	1.48E-06	6.32E-09
313	30.000%	7.5	4.17E-07	3.46E-09	4.36E-08	2.21E-07	1.48E-07	1.42E-09	1.15E-06	4.90E-09
314	30.500%	7.6	3.25E-07	2.70E-09	3.40E-08	1.72E-07	1.15E-07	1.11E-09	8.90E-07	3.79E-09
315	31.000%	7.8	2.54E-07	2.10E-09	2.65E-08	1.34E-07	8.98E-08	8.64E-10	6.87E-07	2.93E-09
316	31.500%	7.9	1.98E-07	1.64E-09	2.07E-08	1.05E-07	7.01E-08	6.75E-10	5.29E-07	2.25E-09
317	32.000%	8.0	1.45E-07	1.20E-09	1.51E-08	7.67E-08	5.13E-08	4.94E-10	4.13E-07	1.76E-09

	A	B	C	D	E	F	G	H	I	J
318	32.500%	8.1	1.14E-07	9.42E-10	1.19E-08	6.01E-08	4.02E-08	3.87E-10	3.22E-07	1.37E-09
319	33.000%	8.3	8.91E-08	7.40E-10	9.31E-09	4.72E-08	3.16E-08	3.04E-10	2.51E-07	1.07E-09
320	33.500%	8.4	7.01E-08	5.82E-10	7.32E-09	3.71E-08	2.48E-08	2.39E-10	1.95E-07	8.31E-10
321	34.000%	8.5	5.18E-08	4.30E-10	5.41E-09	2.74E-08	1.83E-08	1.76E-10	1.54E-07	6.54E-10
322	34.500%	8.6	4.08E-08	3.39E-10	4.27E-09	2.16E-08	1.45E-08	1.39E-10	1.21E-07	5.15E-10
323	35.000%	8.8	3.23E-08	2.68E-10	3.37E-09	1.71E-08	1.14E-08	1.10E-10	9.51E-08	4.05E-10
324	35.500%	8.9	2.55E-08	2.12E-10	2.67E-09	1.35E-08	9.04E-09	8.70E-11	7.47E-08	3.18E-10
325	36.000%	9.0	1.90E-08	1.58E-10	1.99E-09	1.01E-08	6.74E-09	6.49E-11	5.95E-08	2.54E-10
326	36.500%	9.1	1.51E-08	1.25E-10	1.58E-09	8.00E-09	5.35E-09	5.15E-11	4.74E-08	2.02E-10
327	37.000%	9.3	1.20E-08	9.97E-11	1.26E-09	6.36E-09	4.26E-09	4.10E-11	3.78E-08	1.61E-10
328	37.500%	9.4	9.57E-09	7.94E-11	1.00E-09	5.07E-09	3.39E-09	3.26E-11	3.01E-08	1.28E-10
329	38.000%	9.5	7.20E-09	5.98E-11	7.53E-10	3.81E-09	2.55E-09	2.45E-11	2.44E-08	1.04E-10
330	38.500%	9.6	5.75E-09	4.78E-11	6.01E-10	3.05E-09	2.04E-09	1.96E-11	1.98E-08	8.43E-11
331	39.000%	9.8	4.60E-09	3.82E-11	4.81E-10	2.44E-09	1.63E-09	1.57E-11	1.61E-08	6.86E-11
332	39.500%	9.9	3.69E-09	3.06E-11	3.86E-10	1.95E-09	1.31E-09	1.26E-11	1.31E-08	5.60E-11
333	40.000%	10.0	2.80E-09	2.33E-11	2.93E-10	1.48E-09	9.93E-10	9.55E-12	1.09E-08	4.65E-11
334	40.500%	10.1	2.38E-09	1.98E-11	2.49E-10	1.26E-09	8.43E-10	8.11E-12	9.00E-09	3.84E-11
335	41.000%	10.3	2.02E-09	1.68E-11	2.11E-10	1.07E-09	7.17E-10	6.90E-12	7.39E-09	3.15E-11
336	41.500%	10.4	1.72E-09	1.43E-11	1.80E-10	9.12E-10	6.10E-10	5.87E-12	6.01E-09	2.56E-11
337	42.000%	10.5	1.47E-09	1.22E-11	1.53E-10	7.77E-10	5.19E-10	5.00E-12	4.84E-09	2.06E-11
338	42.500%	10.6	1.25E-09	1.04E-11	1.31E-10	6.62E-10	4.43E-10	4.26E-12	3.84E-09	1.64E-11
339	43.000%	10.8	1.07E-09	8.85E-12	1.11E-10	5.65E-10	3.78E-10	3.63E-12	2.98E-09	1.27E-11
340	43.500%	10.9	9.10E-10	7.55E-12	9.51E-11	4.82E-10	3.22E-10	3.10E-12	2.26E-09	9.62E-12
341	44.000%	11.0	4.61E-10	3.83E-12	4.82E-11	2.44E-10	1.63E-10	1.57E-12	1.89E-09	8.04E-12
342	44.500%	11.1	3.94E-10	3.27E-12	4.12E-11	2.09E-10	1.40E-10	1.34E-12	1.57E-09	6.70E-12
343	45.000%	11.3	3.38E-10	2.80E-12	3.53E-11	1.79E-10	1.20E-10	1.15E-12	1.30E-09	5.55E-12
344	45.500%	11.4	2.89E-10	2.40E-12	3.02E-11	1.53E-10	1.02E-10	9.85E-13	1.07E-09	4.56E-12
345	46.000%	11.5	2.48E-10	2.06E-12	2.59E-11	1.31E-10	8.78E-11	8.44E-13	8.73E-10	3.72E-12
346	46.500%	11.6	2.13E-10	1.76E-12	2.22E-11	1.13E-10	7.53E-11	7.24E-13	7.03E-10	3.00E-12
347	47.000%	11.8	1.82E-10	1.51E-12	1.91E-11	9.66E-11	6.46E-11	6.22E-13	5.57E-10	2.37E-12
348	47.500%	11.9	1.57E-10	1.30E-12	1.64E-11	8.30E-11	5.55E-11	5.34E-13	4.32E-10	1.84E-12
349	48.000%	12.0	8.46E-11	7.02E-13	8.84E-12	4.48E-11	3.00E-11	2.88E-13	3.64E-10	1.55E-12
350	48.500%	12.1	7.28E-11	6.04E-13	7.60E-12	3.85E-11	2.58E-11	2.48E-13	3.06E-10	1.30E-12
351	49.000%	12.3	6.26E-11	5.20E-13	6.55E-12	3.32E-11	2.22E-11	2.13E-13	2.56E-10	1.09E-12
352	49.500%	12.4	5.40E-11	4.48E-13	5.64E-12	2.86E-11	1.91E-11	1.84E-13	2.13E-10	9.08E-13
353	50.000%	12.5	4.66E-11	3.86E-13	4.86E-12	2.47E-11	1.65E-11	1.59E-13	1.75E-10	7.48E-13
354	50.500%	12.6	4.02E-11	3.33E-13	4.20E-12	2.13E-11	1.42E-11	1.37E-13	1.43E-10	6.11E-13
355	51.000%	12.8	3.47E-11	2.88E-13	3.63E-12	1.84E-11	1.23E-11	1.18E-13	1.16E-10	4.93E-13
356	51.500%	12.9	3.00E-11	2.49E-13	3.13E-12	1.59E-11	1.06E-11	1.02E-13	9.16E-11	3.90E-13
357	52.000%	13.0	1.72E-11	1.42E-13	1.79E-12	9.09E-12	6.08E-12	5.85E-14	7.79E-11	3.32E-13
358	52.500%	13.1	1.49E-11	1.23E-13	1.55E-12	7.87E-12	5.26E-12	5.06E-14	6.60E-11	2.81E-13
359	53.000%	13.3	1.29E-11	1.07E-13	1.34E-12	6.81E-12	4.56E-12	4.38E-14	5.57E-11	2.37E-13
360	53.500%	13.4	1.12E-11	9.25E-14	1.17E-12	5.90E-12	3.95E-12	3.80E-14	4.68E-11	1.99E-13
361	54.000%	13.5	9.67E-12	8.03E-14	1.01E-12	5.12E-12	3.43E-12	3.30E-14	3.90E-11	1.66E-13
362	54.500%	13.6	8.39E-12	6.96E-14	8.77E-13	4.44E-12	2.97E-12	2.86E-14	3.23E-11	1.38E-13
363	55.000%	13.8	7.29E-12	6.05E-14	7.61E-13	3.86E-12	2.58E-12	2.48E-14	2.65E-11	1.13E-13
364	55.500%	13.9	6.33E-12	5.25E-14	6.62E-13	3.35E-12	2.24E-12	2.16E-14	2.14E-11	9.14E-14
365	56.000%	14.0	3.85E-12	3.19E-14	4.02E-13	2.04E-12	1.36E-12	1.31E-14	1.84E-11	7.83E-14
366	56.500%	14.1	3.35E-12	2.78E-14	3.50E-13	1.77E-12	1.19E-12	1.14E-14	1.57E-11	6.69E-14
367	57.000%	14.3	2.91E-12	2.42E-14	3.04E-13	1.54E-12	1.03E-12	9.93E-15	1.34E-11	5.70E-14
368	57.500%	14.4	2.54E-12	2.11E-14	2.65E-13	1.34E-12	8.99E-13	8.65E-15	1.13E-11	4.83E-14
369	58.000%	14.5	2.21E-12	1.84E-14	2.31E-13	1.17E-12	7.84E-13	7.54E-15	9.57E-12	4.08E-14
370	58.500%	14.6	1.93E-12	1.60E-14	2.02E-13	1.02E-12	6.84E-13	6.58E-15	8.03E-12	3.42E-14
371	59.000%	14.8	1.68E-12	1.40E-14	1.76E-13	8.92E-13	5.97E-13	5.74E-15	6.88E-12	2.85E-14
372	59.500%	14.9	1.47E-12	1.22E-14	1.54E-13	7.79E-13	5.21E-13	5.01E-15	5.50E-12	2.35E-14
373	60.000%	15.0	9.44E-13	7.83E-15	9.86E-14	5.00E-13	3.34E-13	3.22E-15	4.75E-12	2.02E-14
374	60.500%	15.1	8.25E-13	6.85E-15	8.62E-14	4.37E-13	2.92E-13	2.81E-15	4.09E-12	1.74E-14
375	61.000%	15.3	7.22E-13	5.99E-15	7.54E-14	3.82E-13	2.56E-13	2.46E-15	3.51E-12	1.50E-14
376	61.500%	15.4	6.32E-13	5.25E-15	6.60E-14	3.35E-13	2.24E-13	2.15E-15	3.01E-12	1.28E-14
377	62.000%	15.5	5.54E-13	4.59E-15	5.78E-14	2.93E-13	1.96E-13	1.89E-15	2.58E-12	1.09E-14
378	62.500%	15.6	4.85E-13	4.03E-15	5.07E-14	2.57E-13	1.72E-13	1.65E-15	2.17E-12	9.27E-15

	A	B	C	D	E	F	G	H	I	J
379	63.000%	15.8	4.25E-13	3.53E-15	4.45E-14	2.25E-13	1.51E-13	1.45E-15	1.83E-12	7.82E-15
380	63.500%	15.9	3.73E-13	3.10E-15	3.90E-14	1.98E-13	1.32E-13	1.27E-15	1.54E-12	6.55E-15
381	64.000%	16.0	2.52E-13	2.09E-15	2.64E-14	1.34E-13	8.93E-14	8.59E-16	1.33E-12	5.69E-15
382	64.500%	16.1	2.22E-13	1.84E-15	2.31E-14	1.17E-13	7.85E-14	7.55E-16	1.16E-12	4.93E-15
383	65.000%	16.3	1.95E-13	1.62E-15	2.03E-14	1.03E-13	6.90E-14	6.63E-16	1.00E-12	4.27E-15
384	65.500%	16.4	1.71E-13	1.42E-15	1.79E-14	9.07E-14	6.06E-14	5.83E-16	8.64E-13	3.68E-15
385	66.000%	16.5	1.51E-13	1.25E-15	1.57E-14	7.98E-14	5.34E-14	5.13E-16	7.44E-13	3.17E-15
386	66.500%	16.6	1.33E-13	1.10E-15	1.39E-14	7.02E-14	4.70E-14	4.52E-16	6.38E-13	2.72E-15
387	67.000%	16.8	1.17E-13	9.69E-16	1.22E-14	6.18E-14	4.14E-14	3.98E-16	5.44E-13	2.32E-15
388	67.500%	16.9	1.03E-13	8.54E-16	1.08E-14	5.45E-14	3.65E-14	3.51E-16	4.62E-13	1.97E-15
389	68.000%	17.0	7.28E-14	6.04E-16	7.61E-15	3.86E-14	2.58E-14	2.48E-16	4.04E-13	1.72E-15
390	68.500%	17.1	6.42E-14	5.33E-16	6.71E-15	3.40E-14	2.27E-14	2.19E-16	3.53E-13	1.50E-15
391	69.000%	17.3	5.67E-14	4.70E-16	5.92E-15	3.00E-14	2.01E-14	1.93E-16	3.07E-13	1.31E-15
392	69.500%	17.4	5.00E-14	4.15E-16	5.23E-15	2.65E-14	1.77E-14	1.71E-16	2.67E-13	1.14E-15
393	70.000%	17.5	4.42E-14	3.67E-16	4.62E-15	2.34E-14	1.57E-14	1.51E-16	2.32E-13	9.88E-16
394	70.500%	17.6	3.91E-14	3.24E-16	4.08E-15	2.07E-14	1.38E-14	1.33E-16	2.01E-13	8.55E-16
395	71.000%	17.8	3.46E-14	2.87E-16	3.61E-15	1.83E-14	1.22E-14	1.18E-16	1.73E-13	7.36E-16
396	71.500%	17.9	3.06E-14	2.54E-16	3.20E-15	1.62E-14	1.08E-14	1.04E-16	1.48E-13	6.32E-16
397	72.000%	18.0	2.25E-14	1.87E-16	2.35E-15	1.19E-14	7.98E-15	7.68E-17	1.30E-13	5.55E-16
398	72.500%	18.1	2.00E-14	1.66E-16	2.09E-15	1.06E-14	7.07E-15	6.80E-17	1.14E-13	4.87E-16
399	73.000%	18.3	1.77E-14	1.47E-16	1.85E-15	9.36E-15	6.26E-15	6.03E-17	1.00E-13	4.28E-16
400	73.500%	18.4	1.57E-14	1.30E-16	1.64E-15	8.30E-15	5.55E-15	5.34E-17	8.77E-14	3.74E-16
401	74.000%	18.5	1.39E-14	1.15E-16	1.45E-15	7.36E-15	4.93E-15	4.74E-17	7.65E-14	3.26E-16
402	74.500%	18.6	1.23E-14	1.02E-16	1.29E-15	6.53E-15	4.37E-15	4.20E-17	6.67E-14	2.84E-16
403	75.000%	18.8	1.10E-14	9.09E-17	1.14E-15	5.80E-15	3.88E-15	3.73E-17	5.80E-14	2.47E-16
404	75.500%	18.9	9.73E-15	8.07E-17	1.02E-15	5.15E-15	3.45E-15	3.31E-17	5.03E-14	2.14E-16
405	76.000%	19.0	7.43E-15	6.17E-17	7.76E-16	3.93E-15	2.63E-15	2.53E-17	4.44E-14	1.89E-16
406	76.500%	19.1	6.60E-15	5.48E-17	6.90E-16	3.50E-15	2.34E-15	2.25E-17	3.91E-14	1.67E-16
407	77.000%	19.3	5.87E-15	4.87E-17	6.14E-16	3.11E-15	2.08E-15	2.00E-17	3.44E-14	1.47E-16
408	77.500%	19.4	5.23E-15	4.34E-17	5.46E-16	2.77E-15	1.85E-15	1.78E-17	3.01E-14	1.28E-16
409	78.000%	19.5	4.65E-15	3.86E-17	4.86E-16	2.46E-15	1.65E-15	1.58E-17	2.64E-14	1.13E-16
410	78.500%	19.6	4.14E-15	3.44E-17	4.33E-16	2.19E-15	1.47E-15	1.41E-17	2.32E-14	9.89E-17
411	79.000%	19.8	3.69E-15	3.06E-17	3.86E-16	1.95E-15	1.31E-15	1.26E-17	2.03E-14	8.66E-17
412	79.500%	19.9	3.29E-15	2.73E-17	3.44E-16	1.74E-15	1.16E-15	1.12E-17	1.77E-14	7.52E-17
413	80.000%	20.0	2.59E-15	2.15E-17	2.71E-16	1.37E-15	9.17E-16	8.82E-18	1.57E-14	6.67E-17
414	80.500%	20.1	2.31E-15	1.92E-17	2.41E-16	1.22E-15	8.18E-16	7.87E-18	1.39E-14	5.91E-17
415	81.000%	20.3	2.06E-15	1.71E-17	2.15E-16	1.09E-15	7.30E-16	7.02E-18	1.22E-14	5.20E-17
416	81.500%	20.4	1.84E-15	1.53E-17	1.92E-16	9.74E-16	6.52E-16	6.27E-18	1.08E-14	4.59E-17
417	82.000%	20.5	1.64E-15	1.36E-17	1.72E-16	8.70E-16	5.82E-16	5.60E-18	9.55E-15	4.07E-17
418	82.500%	20.6	1.47E-15	1.22E-17	1.53E-16	7.78E-16	5.20E-16	5.00E-18	8.33E-15	3.55E-17
419	83.000%	20.8	1.31E-15	1.09E-17	1.37E-16	6.95E-16	4.65E-16	4.47E-18	7.33E-15	3.12E-17
420	83.500%	20.9	1.17E-15	9.74E-18	1.23E-16	6.22E-16	4.16E-16	4.00E-18	6.33E-15	2.70E-17
421	84.000%	21.0	9.49E-16	7.87E-18	9.91E-17	5.02E-16	3.36E-16	3.23E-18	5.44E-15	2.32E-17
422	84.500%	21.1	8.49E-16	7.05E-18	8.87E-17	4.50E-16	3.01E-16	2.89E-18	4.88E-15	2.08E-17
423	85.000%	21.3	7.60E-16	6.31E-18	7.94E-17	4.02E-16	2.69E-16	2.59E-18	4.22E-15	1.80E-17
424	85.500%	21.4	6.81E-16	5.65E-18	7.11E-17	3.60E-16	2.41E-16	2.32E-18	3.66E-15	1.56E-17
425	86.000%	21.5	6.10E-16	5.06E-18	6.37E-17	3.23E-16	2.16E-16	2.08E-18	3.22E-15	1.37E-17
426	86.500%	21.6	5.47E-16	4.54E-18	5.71E-17	2.89E-16	1.94E-16	1.86E-18	2.89E-15	1.23E-17
427	87.000%	21.8	4.90E-16	4.07E-18	5.12E-17	2.60E-16	1.74E-16	1.67E-18	2.44E-15	1.04E-17
428	87.500%	21.9	4.40E-16	3.65E-18	4.59E-17	2.33E-16	1.56E-16	1.50E-18	2.00E-15	8.52E-18
429	88.000%	22.0	3.63E-16	3.01E-18	3.79E-17	1.92E-16	1.29E-16	1.24E-18	1.78E-15	7.57E-18
430	88.500%	22.1	3.26E-16	2.70E-18	3.41E-17	1.73E-16	1.15E-16	1.11E-18	0.00E+00	0.00E+00
431	89.000%	22.3	2.93E-16	2.43E-18	3.06E-17	1.55E-16	1.04E-16	9.97E-19	0.00E+00	0.00E+00
432	89.500%	22.4	2.63E-16	2.18E-18	2.75E-17	1.39E-16	9.31E-17	8.96E-19	0.00E+00	0.00E+00
433	90.000%	22.5	2.36E-16	1.96E-18	2.47E-17	1.25E-16	8.37E-17	8.05E-19	0.00E+00	0.00E+00
434	90.500%	22.6	2.12E-16	1.76E-18	2.22E-17	1.12E-16	7.52E-17	7.24E-19	0.00E+00	0.00E+00
435	91.000%	22.8	1.91E-16	1.59E-18	2.00E-17	1.01E-16	6.77E-17	6.51E-19	0.00E+00	0.00E+00
436	91.500%	22.9	1.72E-16	1.43E-18	1.80E-17	9.10E-17	6.09E-17	5.85E-19	0.00E+00	0.00E+00
437	92.000%	23.0	1.45E-16	1.20E-18	1.51E-17	7.66E-17	5.12E-17	4.93E-19	0.00E+00	0.00E+00
438	92.500%	23.1	1.30E-16	1.08E-18	1.36E-17	6.89E-17	4.61E-17	4.43E-19	0.00E+00	0.00E+00
439	93.000%	23.3	1.17E-16	9.73E-19	1.22E-17	6.21E-17	4.15E-17	3.99E-19	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
440	93.500%	23.4	1.06E-16	8.76E-19	1.10E-17	5.59E-17	3.74E-17	3.60E-19	0.00E+00	0.00E+00
441	94.000%	23.5	9.51E-17	7.90E-19	9.94E-18	5.04E-17	3.37E-17	3.24E-19	0.00E+00	0.00E+00
442	94.500%	23.6	8.58E-17	7.12E-19	8.96E-18	4.54E-17	3.04E-17	2.92E-19	0.00E+00	0.00E+00
443	95.000%	23.8	7.73E-17	6.42E-19	8.08E-18	4.10E-17	2.74E-17	2.64E-19	0.00E+00	0.00E+00
444	95.500%	23.9	6.98E-17	5.79E-19	7.29E-18	3.69E-17	2.47E-17	2.38E-19	0.00E+00	0.00E+00
445	96.000%	24.0	5.96E-17	4.95E-19	6.23E-18	3.16E-17	2.11E-17	2.03E-19	0.00E+00	0.00E+00
446	96.500%	24.1	5.38E-17	4.47E-19	5.62E-18	2.85E-17	1.91E-17	1.83E-19	0.00E+00	0.00E+00
447	97.000%	24.3	4.86E-17	4.03E-19	5.08E-18	2.57E-17	1.72E-17	1.66E-19	0.00E+00	0.00E+00
448	97.500%	24.4	4.39E-17	3.64E-19	4.58E-18	2.32E-17	1.55E-17	1.49E-19	0.00E+00	0.00E+00
449	98.000%	24.5	3.96E-17	3.29E-19	4.14E-18	2.10E-17	1.40E-17	1.35E-19	0.00E+00	0.00E+00
450	98.500%	24.6	3.58E-17	2.97E-19	3.74E-18	1.90E-17	1.27E-17	1.22E-19	0.00E+00	0.00E+00
451	99.000%	24.8	3.24E-17	2.69E-19	3.39E-18	1.72E-17	1.15E-17	1.10E-19	0.00E+00	0.00E+00
452	99.500%	24.9	2.93E-17	2.43E-19	3.06E-18	1.55E-17	1.04E-17	9.98E-20	0.00E+00	0.00E+00
453	100.000%	25.0	2.53E-17	2.10E-19	2.65E-18	1.34E-17	8.98E-18	8.64E-20	0.00E+00	0.00E+00
454		Flaws/Lid	1.25E+00	1.04E-02	1.31E-01	6.62E-01	4.43E-01	4.26E-03		
455										

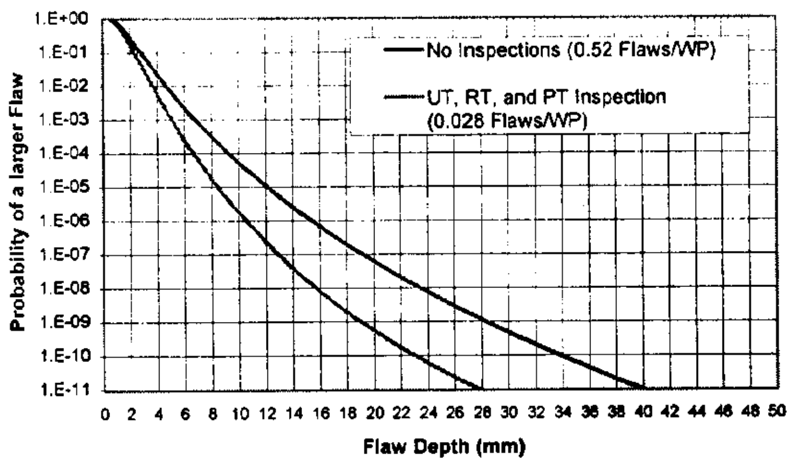
	A	B	C	D	E	F	G	H	I	J
456										Cumulative
457	Frequency of various size flaws in WP shell assuming multi-angle UT exam (Top Lid)									Prob.
458	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Per WP
459	1%	0.3	1.80E-07	1.50E-09	1.89E-08	9.55E-08	6.39E-08	6.15E-10	1.00E+00	5.50E-02
460	1.5000%	0.4	7.17E-05	5.95E-07	7.49E-06	3.80E-05	2.54E-05	2.44E-07	1.00E+00	5.50E-02
461	2.0000%	0.5	2.32E-03	1.93E-05	2.42E-04	1.23E-03	8.22E-04	7.90E-06	1.00E+00	5.50E-02
462	2.5000%	0.6	2.16E-02	1.79E-04	2.26E-03	1.14E-02	7.65E-03	7.36E-05	9.99E-01	5.49E-02
463	3.0000%	0.8	9.63E-02	7.99E-04	1.01E-02	5.10E-02	3.41E-02	3.28E-04	9.93E-01	5.46E-02
464	3.5000%	0.9	2.69E-01	2.23E-03	2.81E-02	1.42E-01	9.53E-02	9.17E-04	9.76E-01	5.37E-02
465	4.0000%	1.0	5.21E-01	4.32E-03	5.44E-02	2.76E-01	1.85E-01	1.78E-03	9.44E-01	5.19E-02
466	4.5000%	1.1	8.44E-01	7.00E-03	8.82E-02	4.47E-01	2.99E-01	2.88E-03	8.91E-01	4.90E-02
467	5.0000%	1.3	1.16E+00	9.65E-03	1.21E-01	6.16E-01	4.12E-01	3.96E-03	8.19E-01	4.51E-02
468	5.5000%	1.4	1.42E+00	1.18E-02	1.48E-01	7.51E-01	5.03E-01	4.84E-03	7.31E-01	4.02E-02
469	6.0000%	1.5	1.58E+00	1.31E-02	1.65E-01	8.35E-01	5.59E-01	5.38E-03	6.34E-01	3.49E-02
470	6.5000%	1.6	1.51E+00	1.25E-02	1.58E-01	8.00E-01	5.35E-01	5.15E-03	5.40E-01	2.97E-02
471	7.0000%	1.8	1.47E+00	1.22E-02	1.54E-01	7.79E-01	5.21E-01	5.01E-03	4.49E-01	2.47E-02
472	7.5000%	1.9	1.37E+00	1.14E-02	1.43E-01	7.24E-01	4.84E-01	4.66E-03	3.64E-01	2.00E-02
473	8.0000%	2.0	1.13E+00	9.34E-03	1.18E-01	5.96E-01	3.99E-01	3.84E-03	2.94E-01	1.62E-02
474	8.5000%	2.1	9.77E-01	8.11E-03	1.02E-01	5.18E-01	3.46E-01	3.33E-03	2.34E-01	1.29E-02
475	9.0000%	2.3	8.28E-01	6.87E-03	8.65E-02	4.38E-01	2.93E-01	2.82E-03	1.83E-01	1.00E-02
476	9.5000%	2.4	6.87E-01	5.70E-03	7.18E-02	3.64E-01	2.43E-01	2.34E-03	1.40E-01	7.71E-03
477	10.0000%	2.5	5.12E-01	4.25E-03	5.35E-02	2.71E-01	1.81E-01	1.75E-03	1.08E-01	5.96E-03
478	10.5000%	2.6	4.12E-01	3.42E-03	4.30E-02	2.18E-01	1.46E-01	1.40E-03	8.29E-02	4.56E-03
479	11.0000%	2.8	3.27E-01	2.72E-03	3.42E-02	1.73E-01	1.16E-01	1.11E-03	6.26E-02	3.44E-03
480	11.5000%	2.9	2.57E-01	2.14E-03	2.69E-02	1.36E-01	9.12E-02	8.77E-04	4.66E-02	2.57E-03
481	12.0000%	3.0	1.84E-01	1.52E-03	1.92E-02	9.72E-02	6.50E-02	6.25E-04	3.53E-02	1.94E-03
482	12.5000%	3.1	1.42E-01	1.18E-03	1.49E-02	7.53E-02	5.04E-02	4.85E-04	2.65E-02	1.46E-03
483	13.0000%	3.3	1.10E-01	9.09E-04	1.14E-02	5.80E-02	3.88E-02	3.73E-04	1.97E-02	1.08E-03
484	13.5000%	3.4	8.40E-02	6.98E-04	8.78E-03	4.45E-02	2.98E-02	2.86E-04	1.45E-02	7.96E-04
485	14.0000%	3.5	5.87E-02	4.87E-04	6.13E-03	3.11E-02	2.08E-02	2.00E-04	1.08E-02	5.96E-04
486	14.5000%	3.6	4.47E-02	3.71E-04	4.67E-03	2.37E-02	1.58E-02	1.52E-04	8.07E-03	4.44E-04
487	15.0000%	3.8	3.40E-02	2.82E-04	3.55E-03	1.80E-02	1.20E-02	1.16E-04	5.96E-03	3.28E-04
488	15.5000%	3.9	2.58E-02	2.14E-04	2.69E-03	1.36E-02	9.13E-03	8.78E-05	4.37E-03	2.40E-04
489	16.0000%	4.0	1.79E-02	1.48E-04	1.87E-03	9.46E-03	6.33E-03	6.09E-05	3.26E-03	1.79E-04
490	16.5000%	4.1	1.35E-02	1.12E-04	1.41E-03	7.16E-03	4.79E-03	4.61E-05	2.42E-03	1.33E-04
491	17.0000%	4.3	1.02E-02	8.48E-05	1.07E-03	5.41E-03	3.62E-03	3.48E-05	1.79E-03	9.86E-05
492	17.5000%	4.4	7.71E-03	6.40E-05	8.06E-04	4.09E-03	2.73E-03	2.63E-05	1.31E-03	7.23E-05
493	18.0000%	4.5	5.35E-03	4.44E-05	5.59E-04	2.83E-03	1.90E-03	1.82E-05	9.82E-04	5.40E-05
494	18.5000%	4.6	4.04E-03	3.36E-05	4.23E-04	2.14E-03	1.43E-03	1.38E-05	7.32E-04	4.03E-05
495	19.0000%	4.8	3.06E-03	2.54E-05	3.19E-04	1.62E-03	1.09E-03	1.04E-05	5.42E-04	2.98E-05
496	19.5000%	4.9	2.31E-03	1.92E-05	2.41E-04	1.22E-03	8.18E-04	7.87E-06	3.99E-04	2.20E-05
497	20.0000%	5.0	1.61E-03	1.34E-05	1.68E-04	8.52E-04	5.70E-04	5.48E-06	3.00E-04	1.65E-05
498	20.5000%	5.1	1.22E-03	1.01E-05	1.27E-04	6.45E-04	4.32E-04	4.15E-06	2.24E-04	1.23E-05
499	21.0000%	5.3	9.23E-04	7.66E-06	9.64E-05	4.89E-04	3.27E-04	3.14E-06	1.67E-04	9.19E-06
500	21.5000%	5.4	7.00E-04	5.81E-06	7.31E-05	3.70E-04	2.48E-04	2.38E-06	1.24E-04	6.81E-06
501	22.0000%	5.5	4.91E-04	4.07E-06	5.13E-05	2.60E-04	1.74E-04	1.67E-06	9.33E-05	5.13E-06
502	22.5000%	5.6	3.73E-04	3.09E-06	3.90E-05	1.97E-04	1.32E-04	1.27E-06	7.02E-05	3.86E-06
503	23.0000%	5.8	2.84E-04	2.36E-06	2.97E-05	1.50E-04	1.01E-04	9.67E-07	5.27E-05	2.90E-06
504	23.5000%	5.9	2.16E-04	1.79E-06	2.26E-05	1.15E-04	7.68E-05	7.37E-07	3.93E-05	2.16E-06
505	24.0000%	6.0	1.53E-04	1.27E-06	1.60E-05	8.08E-05	5.41E-05	5.20E-07	2.98E-05	1.64E-06
506	24.5000%	6.1	1.17E-04	9.69E-07	1.22E-05	6.19E-05	4.14E-05	3.98E-07	2.26E-05	1.24E-06
507	25.0000%	6.3	8.93E-05	7.41E-07	9.33E-06	4.73E-05	3.15E-05	3.04E-07	1.70E-05	9.37E-07
508	25.5000%	6.4	6.84E-05	5.68E-07	7.15E-06	3.62E-05	2.42E-05	2.33E-07	1.28E-05	7.04E-07
509	26.0000%	6.5	4.87E-05	4.04E-07	5.09E-06	2.58E-05	1.73E-05	1.66E-07	9.78E-06	5.38E-07
510	26.5000%	6.6	3.75E-05	3.11E-07	3.91E-06	1.98E-05	1.33E-05	1.28E-07	7.46E-06	4.10E-07
511	27.0000%	6.8	2.88E-05	2.39E-07	3.01E-06	1.53E-05	1.02E-05	9.83E-08	5.67E-06	3.12E-07
512	27.5000%	6.9	2.22E-05	1.85E-07	2.32E-06	1.18E-05	7.88E-06	7.58E-08	4.29E-06	2.36E-07
513	28.0000%	7.0	1.60E-05	1.33E-07	1.67E-06	8.46E-06	5.88E-06	5.44E-08	3.30E-06	1.82E-07
514	28.5000%	7.1	1.24E-05	1.03E-07	1.29E-06	6.55E-06	4.38E-06	4.21E-08	2.54E-06	1.40E-07
515	29.0000%	7.3	9.58E-06	7.95E-08	1.00E-06	5.07E-06	3.35E-06	3.26E-08	1.94E-06	1.07E-07
516	29.5000%	7.4	7.43E-06	6.17E-08	7.77E-07	3.94E-06	2.63E-06	2.53E-08	1.48E-06	8.16E-08
517	30.0000%	7.5	5.39E-06	4.47E-08	5.63E-07	2.85E-06	1.91E-06	1.84E-08	1.15E-06	6.33E-08
518	30.5000%	7.6	4.20E-06	3.48E-08	4.38E-07	2.22E-06	1.49E-06	1.43E-08	8.90E-07	4.90E-08
519	31.0000%	7.8	3.27E-06	2.72E-08	3.42E-07	1.73E-06	1.16E-06	1.12E-08	6.87E-07	3.78E-08

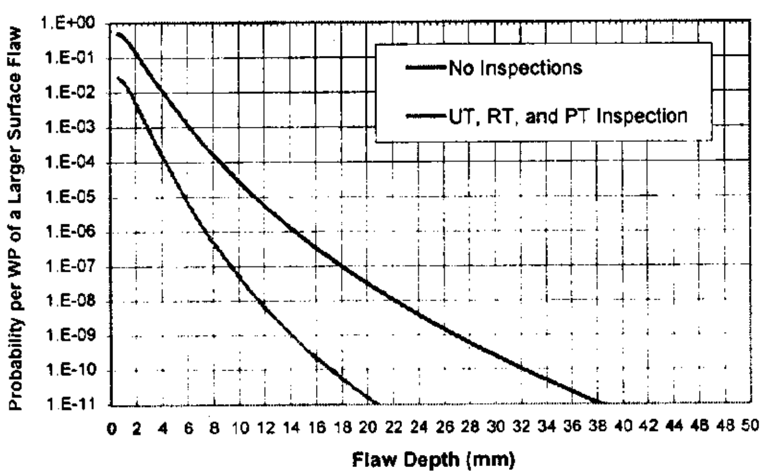
	A	B	C	D	E	F	G	H	I	J
520	31.5000%	7.9	2.56E-06	2.12E-08	2.67E-07	1.35E-06	9.05E-07	8.71E-09	5.29E-07	2.91E-08
521	32.0000%	8.0	1.87E-06	1.55E-08	1.95E-07	9.90E-07	6.62E-07	6.37E-09	4.13E-07	2.27E-08
522	32.5000%	8.1	1.47E-06	1.22E-08	1.53E-07	7.76E-07	5.19E-07	4.99E-09	3.22E-07	1.77E-08
523	33.0000%	8.3	1.15E-06	9.55E-09	1.20E-07	6.09E-07	4.08E-07	3.92E-09	2.51E-07	1.38E-08
524	33.5000%	8.4	9.04E-07	7.51E-09	9.45E-08	4.79E-07	3.20E-07	3.08E-09	1.95E-07	1.07E-08
525	34.0000%	8.5	6.68E-07	5.55E-09	6.98E-08	3.54E-07	2.37E-07	2.28E-09	1.54E-07	8.45E-09
526	34.5000%	8.6	5.27E-07	4.37E-09	5.51E-08	2.79E-07	1.87E-07	1.80E-09	1.21E-07	6.65E-09
527	35.0000%	8.8	4.16E-07	3.46E-09	4.35E-08	2.21E-07	1.48E-07	1.42E-09	9.51E-08	5.23E-09
528	35.5000%	8.9	3.29E-07	2.73E-09	3.44E-08	1.74E-07	1.17E-07	1.12E-09	7.47E-08	4.11E-09
529	36.0000%	9.0	2.46E-07	2.04E-09	2.57E-08	1.30E-07	8.70E-08	8.37E-10	5.95E-08	3.27E-09
530	36.5000%	9.1	1.95E-07	1.62E-09	2.04E-08	1.03E-07	6.91E-08	6.65E-10	4.74E-08	2.61E-09
531	37.0000%	9.3	1.55E-07	1.29E-09	1.62E-08	8.21E-08	5.49E-08	5.29E-10	3.78E-08	2.08E-09
532	37.5000%	9.4	1.23E-07	1.02E-09	1.29E-08	6.54E-08	4.37E-08	4.21E-10	3.01E-08	1.66E-09
533	38.0000%	9.5	9.30E-08	7.72E-10	9.71E-09	4.92E-08	3.29E-08	3.17E-10	2.44E-08	1.34E-09
534	38.5000%	9.6	7.43E-08	6.16E-10	7.76E-09	3.93E-08	2.63E-08	2.53E-10	1.98E-08	1.09E-09
535	39.0000%	9.8	5.94E-08	4.93E-10	6.21E-09	3.15E-08	2.11E-08	2.03E-10	1.61E-08	8.86E-10
536	39.5000%	9.9	4.76E-08	3.95E-10	4.98E-09	2.52E-08	1.69E-08	1.62E-10	1.31E-08	7.23E-10
537	40.0000%	10.0	3.62E-08	3.00E-10	3.78E-09	1.92E-08	1.28E-08	1.23E-10	1.09E-08	6.00E-10
538	40.5000%	10.1	3.07E-08	2.55E-10	3.21E-09	1.63E-08	1.09E-08	1.05E-10	9.00E-09	4.95E-10
539	41.0000%	10.3	2.61E-08	2.17E-10	2.73E-09	1.38E-08	9.25E-09	8.90E-11	7.39E-09	4.06E-10
540	41.5000%	10.4	2.22E-08	1.84E-10	2.32E-09	1.18E-08	7.87E-09	7.57E-11	6.01E-09	3.31E-10
541	42.0000%	10.5	1.89E-08	1.57E-10	1.98E-09	1.00E-08	6.70E-09	6.45E-11	4.84E-09	2.66E-10
542	42.5000%	10.6	1.61E-08	1.34E-10	1.69E-09	8.54E-09	5.71E-09	5.50E-11	3.84E-09	2.11E-10
543	43.0000%	10.8	1.38E-08	1.14E-10	1.44E-09	7.29E-09	4.87E-09	4.69E-11	2.98E-09	1.64E-10
544	43.5000%	10.9	1.17E-08	9.75E-11	1.23E-09	6.22E-09	4.16E-09	4.00E-11	2.26E-09	1.24E-10
545	44.0000%	11.0	5.95E-09	4.94E-11	6.22E-10	3.15E-09	2.11E-09	2.03E-11	1.89E-09	1.04E-10
546	44.5000%	11.1	5.09E-09	4.23E-11	5.32E-10	2.70E-09	1.80E-09	1.73E-11	1.57E-09	8.65E-11
547	45.0000%	11.3	4.36E-09	3.62E-11	4.55E-10	2.31E-09	1.54E-09	1.48E-11	1.30E-09	7.16E-11
548	45.5000%	11.4	3.73E-09	3.10E-11	3.90E-10	1.98E-09	1.32E-09	1.27E-11	1.07E-09	5.89E-11
549	46.0000%	11.5	3.20E-09	2.65E-11	3.34E-10	1.69E-09	1.13E-09	1.09E-11	8.73E-10	4.80E-11
550	46.5000%	11.6	2.74E-09	2.28E-11	2.87E-10	1.45E-09	9.72E-10	9.35E-12	7.03E-10	3.87E-11
551	47.0000%	11.8	2.36E-09	1.95E-11	2.46E-10	1.25E-09	8.34E-10	8.03E-12	5.57E-10	3.06E-11
552	47.5000%	11.9	2.02E-09	1.68E-11	2.11E-10	1.07E-09	7.17E-10	6.90E-12	4.32E-10	2.37E-11
553	48.0000%	12.0	1.09E-09	9.06E-12	1.14E-10	5.78E-10	3.87E-10	3.72E-12	3.64E-10	2.00E-11
554	48.5000%	12.1	9.39E-10	7.79E-12	9.81E-11	4.97E-10	3.33E-10	3.20E-12	3.06E-10	1.68E-11
555	49.0000%	12.3	8.09E-10	6.71E-12	8.45E-11	4.28E-10	2.86E-10	2.76E-12	2.56E-10	1.41E-11
556	49.5000%	12.4	6.97E-10	5.78E-12	7.28E-11	3.69E-10	2.47E-10	2.37E-12	2.13E-10	1.17E-11
557	50.0000%	12.5	6.01E-10	4.99E-12	6.28E-11	3.18E-10	2.13E-10	2.05E-12	1.75E-10	9.65E-12
558	50.5000%	12.6	5.19E-10	4.30E-12	5.42E-11	2.75E-10	1.84E-10	1.77E-12	1.43E-10	7.88E-12
559	51.0000%	12.8	4.48E-10	3.72E-12	4.68E-11	2.37E-10	1.59E-10	1.53E-12	1.16E-10	6.36E-12
560	51.5000%	12.9	3.87E-10	3.21E-12	4.04E-11	2.05E-10	1.37E-10	1.32E-12	9.16E-11	5.04E-12
561	52.0000%	13.0	2.22E-10	1.84E-12	2.32E-11	1.17E-10	7.85E-11	7.55E-13	7.79E-11	4.28E-12
562	52.5000%	13.1	1.92E-10	1.59E-12	2.00E-11	1.02E-10	6.79E-11	6.54E-13	6.60E-11	3.63E-12
563	53.0000%	13.3	1.66E-10	1.38E-12	1.74E-11	8.79E-11	5.88E-11	5.66E-13	5.57E-11	3.06E-12
564	53.5000%	13.4	1.44E-10	1.19E-12	1.50E-11	7.62E-11	5.10E-11	4.90E-13	4.68E-11	2.57E-12
565	54.0000%	13.5	1.25E-10	1.04E-12	1.30E-11	6.61E-11	4.42E-11	4.25E-13	3.90E-11	2.15E-12
566	54.5000%	13.6	1.08E-10	8.99E-13	1.13E-11	5.74E-11	3.84E-11	3.69E-13	3.23E-11	1.78E-12
567	55.0000%	13.8	9.40E-11	7.81E-13	9.83E-12	4.98E-11	3.33E-11	3.20E-13	2.65E-11	1.46E-12
568	55.5000%	13.9	8.17E-11	6.78E-13	8.54E-12	4.33E-11	2.89E-11	2.78E-13	2.14E-11	1.18E-12
569	56.0000%	14.0	4.96E-11	4.12E-13	5.19E-12	2.63E-11	1.76E-11	1.69E-13	1.84E-11	1.01E-12
570	56.5000%	14.1	4.32E-11	3.58E-13	4.51E-12	2.29E-11	1.53E-11	1.47E-13	1.57E-11	8.63E-13
571	57.0000%	14.3	3.76E-11	3.12E-13	3.93E-12	1.99E-11	1.33E-11	1.28E-13	1.34E-11	7.35E-13
572	57.5000%	14.4	3.28E-11	2.72E-13	3.42E-12	1.73E-11	1.16E-11	1.12E-13	1.13E-11	6.24E-13
573	58.0000%	14.5	2.86E-11	2.37E-13	2.98E-12	1.51E-11	1.01E-11	9.73E-14	9.57E-12	5.26E-13
574	58.5000%	14.6	2.49E-11	2.07E-13	2.60E-12	1.32E-11	8.82E-12	8.49E-14	8.02E-12	4.41E-13
575	59.0000%	14.8	2.17E-11	1.80E-13	2.27E-12	1.15E-11	7.70E-12	7.41E-14	6.68E-12	3.67E-13
576	59.5000%	14.9	1.90E-11	1.58E-13	1.98E-12	1.01E-11	6.72E-12	6.47E-14	5.50E-12	3.03E-13
577	60.0000%	15.0	1.22E-11	1.01E-13	1.27E-12	6.45E-12	4.32E-12	4.15E-14	4.75E-12	2.61E-13
578	60.5000%	15.1	1.07E-11	8.84E-14	1.11E-12	5.64E-12	3.77E-12	3.63E-14	4.09E-12	2.25E-13
579	61.0000%	15.3	9.32E-12	7.74E-14	9.74E-13	4.94E-12	3.30E-12	3.18E-14	3.51E-12	1.93E-13
580	61.5000%	15.4	8.16E-12	6.77E-14	8.52E-13	4.32E-12	2.89E-12	2.78E-14	3.00E-12	1.65E-13
581	62.0000%	15.5	7.15E-12	5.93E-14	7.47E-13	3.78E-12	2.53E-12	2.44E-14	2.56E-12	1.41E-13
582	62.5000%	15.6	6.26E-12	5.20E-14	6.54E-13	3.32E-12	2.22E-12	2.13E-14	2.17E-12	1.20E-13
583	63.0000%	15.8	5.49E-12	4.56E-14	5.74E-13	2.91E-12	1.95E-12	1.87E-14	1.83E-12	1.01E-13

	A	B	C	D	E	F	G	H	I	J
584	63.5000%	15.9	4.82E-12	4.00E-14	5.03E-13	2.55E-12	1.71E-12	1.64E-14	1.54E-12	8.45E-14
585	64.0000%	16.0	3.26E-12	2.70E-14	3.40E-13	1.72E-12	1.15E-12	1.11E-14	1.33E-12	7.34E-14
586	64.5000%	16.1	2.86E-12	2.37E-14	2.99E-13	1.51E-12	1.01E-12	9.74E-15	1.16E-12	6.36E-14
587	65.0000%	16.3	2.51E-12	2.09E-14	2.63E-13	1.33E-12	8.90E-13	8.56E-15	1.00E-12	5.51E-14
588	65.5000%	16.4	2.21E-12	1.83E-14	2.31E-13	1.17E-12	7.83E-13	7.53E-15	8.64E-13	4.75E-14
589	66.0000%	16.5	1.94E-12	1.61E-14	2.03E-13	1.03E-12	6.89E-13	6.82E-15	7.44E-13	4.09E-14
590	66.5000%	16.6	1.71E-12	1.42E-14	1.79E-13	9.06E-13	6.06E-13	5.83E-15	6.38E-13	3.51E-14
591	67.0000%	16.8	1.51E-12	1.25E-14	1.57E-13	7.98E-13	5.34E-13	5.14E-15	5.44E-13	2.99E-14
592	67.5000%	16.9	1.33E-12	1.10E-14	1.39E-13	7.03E-13	4.71E-13	4.53E-15	4.62E-13	2.54E-14
593	68.0000%	17.0	9.40E-13	7.80E-15	9.82E-14	4.98E-13	3.33E-13	3.20E-15	4.04E-13	2.22E-14
594	68.5000%	17.1	8.29E-13	6.88E-15	8.66E-14	4.39E-13	2.94E-13	2.82E-15	3.52E-13	1.94E-14
595	69.0000%	17.3	7.32E-13	6.07E-15	7.64E-14	3.87E-13	2.59E-13	2.49E-15	3.07E-13	1.69E-14
596	69.5000%	17.4	6.46E-13	5.36E-15	6.75E-14	3.42E-13	2.29E-13	2.20E-15	2.67E-13	1.47E-14
597	70.0000%	17.5	5.71E-13	4.74E-15	5.96E-14	3.02E-13	2.02E-13	1.94E-15	2.32E-13	1.28E-14
598	70.5000%	17.6	5.04E-13	4.19E-15	5.27E-14	2.67E-13	1.79E-13	1.72E-15	2.01E-13	1.10E-14
599	71.0000%	17.8	4.46E-13	3.70E-15	4.66E-14	2.36E-13	1.58E-13	1.52E-15	1.73E-13	9.51E-15
600	71.5000%	17.9	3.95E-13	3.28E-15	4.12E-14	2.09E-13	1.40E-13	1.34E-15	1.48E-13	8.16E-15
601	72.0000%	18.0	2.91E-13	2.41E-15	3.04E-14	1.54E-13	1.03E-13	9.91E-16	1.30E-13	7.18E-15
602	72.5000%	18.1	2.58E-13	2.14E-15	2.69E-14	1.36E-13	9.13E-14	8.78E-16	1.14E-13	6.30E-15
603	73.0000%	18.3	2.28E-13	1.89E-15	2.39E-14	1.21E-13	8.09E-14	7.78E-16	1.00E-13	5.51E-15
604	73.5000%	18.4	2.02E-13	1.68E-15	2.11E-14	1.07E-13	7.17E-14	6.90E-16	8.78E-14	4.83E-15
605	74.0000%	18.5	1.79E-13	1.49E-15	1.88E-14	9.50E-14	6.36E-14	6.12E-16	7.67E-14	4.22E-15
606	74.5000%	18.6	1.59E-13	1.32E-15	1.66E-14	8.43E-14	5.64E-14	5.43E-16	6.68E-14	3.68E-15
607	75.0000%	18.8	1.41E-13	1.17E-15	1.48E-14	7.49E-14	5.01E-14	4.82E-16	5.82E-14	3.20E-15
608	75.5000%	18.9	1.26E-13	1.04E-15	1.31E-14	6.65E-14	4.45E-14	4.28E-16	5.03E-14	2.77E-15
609	76.0000%	19.0	9.59E-14	7.96E-16	1.00E-14	5.08E-14	3.40E-14	3.27E-16	4.44E-14	2.44E-15
610	76.5000%	19.1	8.52E-14	7.07E-16	8.91E-15	4.51E-14	3.02E-14	2.90E-16	3.91E-14	2.15E-15
611	77.0000%	19.3	7.58E-14	6.29E-16	7.92E-15	4.01E-14	2.69E-14	2.58E-16	3.44E-14	1.89E-15
612	77.5000%	19.4	6.74E-14	5.60E-16	7.05E-15	3.57E-14	2.39E-14	2.30E-16	3.03E-14	1.67E-15
613	78.0000%	19.5	6.00E-14	4.98E-16	6.27E-15	3.18E-14	2.13E-14	2.05E-16	2.66E-14	1.47E-15
614	78.5000%	19.6	5.35E-14	4.44E-16	5.59E-15	2.83E-14	1.89E-14	1.82E-16	2.33E-14	1.28E-15
615	79.0000%	19.8	4.76E-14	3.95E-16	4.98E-15	2.52E-14	1.69E-14	1.62E-16	2.04E-14	1.12E-15
616	79.5000%	19.9	4.24E-14	3.52E-16	4.44E-15	2.25E-14	1.50E-14	1.45E-16	1.78E-14	9.77E-16
617	80.0000%	20.0	3.34E-14	2.77E-16	3.49E-15	1.77E-14	1.18E-14	1.14E-16	1.58E-14	8.67E-16
618	80.5000%	20.1	2.98E-14	2.47E-16	3.12E-15	1.58E-14	1.06E-14	1.02E-16	1.39E-14	7.63E-16
619	81.0000%	20.3	2.66E-14	2.21E-16	2.78E-15	1.41E-14	9.42E-15	9.07E-17	1.22E-14	6.72E-16
620	81.5000%	20.4	2.38E-14	1.97E-16	2.48E-15	1.26E-14	8.41E-15	8.09E-17	1.08E-14	5.92E-16
621	82.0000%	20.5	2.12E-14	1.76E-16	2.22E-15	1.12E-14	7.51E-15	7.23E-17	9.44E-15	5.19E-16
622	82.5000%	20.6	1.90E-14	1.57E-16	1.98E-15	1.00E-14	6.71E-15	6.46E-17	8.33E-15	4.58E-16
623	83.0000%	20.8	1.69E-14	1.41E-16	1.77E-15	8.97E-15	6.00E-15	5.77E-17	7.33E-15	4.03E-16
624	83.5000%	20.9	1.51E-14	1.26E-16	1.58E-15	8.02E-15	5.37E-15	5.16E-17	6.44E-15	3.54E-16
625	84.0000%	21.0	1.22E-14	1.02E-16	1.28E-15	6.48E-15	4.34E-15	4.17E-17	5.66E-15	3.11E-16
626	84.5000%	21.1	1.10E-14	9.09E-17	1.14E-15	5.80E-15	3.88E-15	3.73E-17	5.00E-15	2.75E-16
627	85.0000%	21.3	9.81E-15	8.14E-17	1.02E-15	5.19E-15	3.48E-15	3.34E-17	4.44E-15	2.44E-16
628	85.5000%	21.4	8.79E-15	7.29E-17	9.18E-16	4.65E-15	3.11E-15	2.99E-17	3.89E-15	2.14E-16
629	86.0000%	21.5	7.87E-15	6.53E-17	8.22E-16	4.17E-15	2.79E-15	2.68E-17	3.44E-15	1.89E-16
630	86.5000%	21.6	7.06E-15	5.86E-17	7.37E-16	3.74E-15	2.50E-15	2.40E-17	3.00E-15	1.65E-16
631	87.0000%	21.8	6.33E-15	5.25E-17	6.61E-16	3.35E-15	2.24E-15	2.16E-17	2.66E-15	1.47E-16
632	87.5000%	21.9	5.67E-15	4.71E-17	5.93E-16	3.00E-15	2.01E-15	1.93E-17	2.22E-15	1.22E-16
633	88.0000%	22.0	4.69E-15	3.89E-17	4.90E-16	2.48E-15	1.66E-15	1.60E-17	2.00E-15	1.10E-16
634	88.5000%	22.1	4.21E-15	3.49E-17	4.40E-16	2.23E-15	1.49E-15	1.43E-17	1.78E-15	9.77E-17
635	89.0000%	22.3	3.78E-15	3.14E-17	3.95E-16	2.00E-15	1.34E-15	1.29E-17	0.00E+00	0.00E+00
636	89.5000%	22.4	3.39E-15	2.82E-17	3.55E-16	1.80E-15	1.20E-15	1.16E-17	0.00E+00	0.00E+00
637	90.0000%	22.5	3.05E-15	2.53E-17	3.19E-16	1.61E-15	1.08E-15	1.04E-17	0.00E+00	0.00E+00
638	90.5000%	22.6	2.74E-15	2.28E-17	2.86E-16	1.45E-15	9.71E-16	9.34E-18	0.00E+00	0.00E+00
639	91.0000%	22.8	2.47E-15	2.05E-17	2.58E-16	1.31E-15	8.73E-16	8.40E-18	0.00E+00	0.00E+00
640	91.5000%	22.9	2.22E-15	1.84E-17	2.32E-16	1.17E-15	7.86E-16	7.56E-18	0.00E+00	0.00E+00
641	92.0000%	23.0	1.87E-15	1.55E-17	1.95E-16	9.88E-16	6.61E-16	6.36E-18	0.00E+00	0.00E+00
642	92.5000%	23.1	1.68E-15	1.39E-17	1.76E-16	8.89E-16	5.95E-16	5.72E-18	0.00E+00	0.00E+00
643	93.0000%	23.3	1.51E-15	1.26E-17	1.58E-16	8.01E-16	5.36E-16	5.15E-18	0.00E+00	0.00E+00
644	93.5000%	23.4	1.36E-15	1.13E-17	1.42E-16	7.22E-16	4.83E-16	4.64E-18	0.00E+00	0.00E+00
645	94.0000%	23.5	1.23E-15	1.02E-17	1.28E-16	6.50E-16	4.35E-16	4.18E-18	0.00E+00	0.00E+00
646	94.5000%	23.6	1.11E-15	9.19E-18	1.16E-16	5.86E-16	3.92E-16	3.77E-18	0.00E+00	0.00E+00
647	95.0000%	23.8	9.98E-16	8.29E-18	1.04E-16	5.29E-16	3.54E-16	3.40E-18	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
648	95.5000%	23.9	9.00E-16	7.47E-18	9.41E-17	4.77E-16	3.19E-16	3.07E-18	0.00E+00	0.00E+00
649	96.0000%	24.0	7.69E-16	6.38E-18	8.04E-17	4.07E-16	2.72E-16	2.62E-18	0.00E+00	0.00E+00
650	96.5000%	24.1	6.94E-16	5.76E-18	7.26E-17	3.68E-16	2.46E-16	2.37E-18	0.00E+00	0.00E+00
651	97.0000%	24.3	6.27E-16	5.20E-18	6.55E-17	3.32E-16	2.22E-16	2.14E-18	0.00E+00	0.00E+00
652	97.5000%	24.4	5.66E-16	4.70E-18	5.92E-17	3.00E-16	2.01E-16	1.93E-18	0.00E+00	0.00E+00
653	98.0000%	24.5	5.12E-16	4.25E-18	5.35E-17	2.71E-16	1.81E-16	1.74E-18	0.00E+00	0.00E+00
654	98.5000%	24.6	4.62E-16	3.84E-18	4.83E-17	2.45E-16	1.64E-16	1.58E-18	0.00E+00	0.00E+00
655	99.0000%	24.8	4.18E-16	3.47E-18	4.37E-17	2.21E-16	1.48E-16	1.43E-18	0.00E+00	0.00E+00
656	99.5000%	24.9	3.78E-16	3.14E-18	3.95E-17	2.00E-16	1.34E-16	1.29E-18	0.00E+00	0.00E+00
657	100.0000%	25.0	3.27E-16	2.71E-18	3.42E-17	1.73E-16	1.16E-16	1.11E-18	0.00E+00	0.00E+00
658		Flaws/Lid	1.61E+01	1.34E-01	1.69E+00	8.55E+00	5.72E+00	5.50E-02		

	A	B	C
1	Barrier Thickness (mm)		50
2	Barrier Inner Radius (m)		0.71
3	Seam Weld Length (m)		4.558
4	Circumferential Weld Length		4.461
5	Total Weld Length		9.019
6	Total Flaws per WP - no inspection		152.400
7	Total Flaws per WP - w/ RT & PT inpsection		11.808





	A	B	C	D	E	F	G	H	I	J
49										
50										
51	Frequency of various size flaws in WP shell assuming no inspections									Cumulative
52	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
53	1%	0.5	1.86E+00	1.54E-02	1.94E-01	9.85E-01	6.59E-01	6.34E-03	9.88E-01	5.13E-01
54	1.500%	0.8	9.96E+00	8.27E-02	1.04E+00	5.28E+00	3.53E+00	3.39E-02	9.22E-01	4.79E-01
55	2.000%	1.0	1.90E+01	1.58E-01	1.99E+00	1.01E+01	6.73E+00	6.48E-02	7.98E-01	4.14E-01
56	2.500%	1.3	2.30E+01	1.91E-01	2.40E+00	1.22E+01	8.14E+00	7.83E-02	6.47E-01	3.36E-01
57	3.000%	1.5	2.21E+01	1.84E-01	2.31E+00	1.17E+01	7.84E+00	7.54E-02	5.02E-01	2.61E-01
58	3.500%	1.8	1.89E+01	1.57E-01	1.97E+00	9.99E+00	6.68E+00	6.43E-02	3.78E-01	1.96E-01
59	4.000%	2.0	1.50E+01	1.24E-01	1.57E+00	7.93E+00	5.31E+00	5.11E-02	2.80E-01	1.45E-01
60	4.500%	2.3	1.14E+01	9.47E-02	1.19E+00	6.04E+00	4.04E+00	3.89E-02	2.05E-01	1.06E-01
61	5.000%	2.5	8.48E+00	7.04E-02	8.86E-01	4.49E+00	3.00E+00	2.89E-02	1.49E-01	7.75E-02
62	5.500%	2.8	6.21E+00	5.15E-02	6.49E-01	3.29E+00	2.20E+00	2.12E-02	1.08E-01	5.63E-02
63	6.000%	3.0	4.51E+00	3.74E-02	4.71E-01	2.39E+00	1.60E+00	1.54E-02	7.89E-02	4.10E-02
64	6.500%	3.3	3.26E+00	2.71E-02	3.41E-01	1.73E+00	1.16E+00	1.11E-02	5.75E-02	2.99E-02
65	7.000%	3.5	2.36E+00	1.96E-02	2.46E-01	1.25E+00	8.35E-01	8.03E-03	4.20E-02	2.18E-02
66	7.500%	3.8	1.71E+00	1.42E-02	1.78E-01	9.03E-01	6.04E-01	5.81E-03	3.08E-02	1.60E-02
67	8.000%	4.0	1.24E+00	1.03E-02	1.29E-01	6.55E-01	4.38E-01	4.21E-03	2.27E-02	1.18E-02
68	8.500%	4.3	9.00E-01	7.47E-03	9.40E-02	4.76E-01	3.19E-01	3.07E-03	1.68E-02	8.73E-03
69	9.000%	4.5	6.57E-01	5.45E-03	6.86E-02	3.48E-01	2.33E-01	2.24E-03	1.25E-02	6.49E-03
70	9.500%	4.8	4.82E-01	4.00E-03	5.03E-02	2.55E-01	1.71E-01	1.64E-03	9.33E-03	4.85E-03
71	10.000%	5.0	3.55E-01	2.94E-03	3.71E-02	1.88E-01	1.26E-01	1.21E-03	7.01E-03	3.64E-03
72	10.500%	5.3	2.63E-01	2.18E-03	2.74E-02	1.39E-01	9.30E-02	8.95E-04	5.28E-03	2.74E-03
73	11.000%	5.5	1.95E-01	1.62E-03	2.04E-02	1.03E-01	6.91E-02	6.65E-04	4.00E-03	2.08E-03
74	11.500%	5.8	1.46E-01	1.21E-03	1.52E-02	7.72E-02	5.16E-02	4.97E-04	3.05E-03	1.58E-03
75	12.000%	6.0	1.09E-01	9.07E-04	1.14E-02	5.79E-02	3.87E-02	3.73E-04	2.33E-03	1.21E-03
76	12.500%	6.3	8.24E-02	6.84E-04	8.61E-03	4.36E-02	2.92E-02	2.81E-04	1.79E-03	9.29E-04

	A	B	C	D	E	F	G	H	I	J
77	13.000%	6.5	6.24E-02	5.18E-04	6.52E-03	3.30E-02	2.21E-02	2.13E-04	1.38E-03	7.17E-04
78	13.500%	6.8	4.74E-02	3.94E-04	4.96E-03	2.51E-02	1.68E-02	1.62E-04	1.07E-03	5.55E-04
79	14.000%	7.0	3.62E-02	3.01E-04	3.78E-03	1.92E-02	1.28E-02	1.23E-04	8.31E-04	4.32E-04
80	14.500%	7.3	2.78E-02	2.31E-04	2.90E-03	1.47E-02	9.84E-03	9.47E-05	6.49E-04	3.37E-04
81	15.000%	7.5	2.14E-02	1.78E-04	2.23E-03	1.13E-02	7.58E-03	7.29E-05	5.08E-04	2.64E-04
82	15.500%	7.8	1.65E-02	1.37E-04	1.73E-03	8.76E-03	5.86E-03	5.63E-05	4.00E-04	2.08E-04
83	16.000%	8.0	1.28E-02	1.07E-04	1.34E-03	6.80E-03	4.55E-03	4.37E-05	3.16E-04	1.64E-04
84	16.500%	8.3	1.00E-02	8.30E-05	1.04E-03	5.29E-03	3.54E-03	3.41E-05	2.50E-04	1.30E-04
85	17.000%	8.5	7.82E-03	6.49E-05	8.17E-04	4.14E-03	2.77E-03	2.66E-05	1.99E-04	1.03E-04
86	17.500%	8.8	6.13E-03	5.09E-05	6.41E-04	3.25E-03	2.17E-03	2.09E-05	1.59E-04	8.23E-05
87	18.000%	9.0	4.83E-03	4.01E-05	5.05E-04	2.56E-03	1.71E-03	1.65E-05	1.27E-04	6.59E-05
88	18.500%	9.3	3.82E-03	3.17E-05	3.99E-04	2.02E-03	1.35E-03	1.30E-05	1.02E-04	5.29E-05
89	19.000%	9.5	3.03E-03	2.51E-05	3.16E-04	1.60E-03	1.07E-03	1.03E-05	8.19E-05	4.25E-05
90	19.500%	9.8	2.41E-03	2.00E-05	2.51E-04	1.27E-03	8.52E-04	8.20E-06	6.61E-05	3.43E-05
91	20.000%	10.0	1.92E-03	1.59E-05	2.01E-04	1.02E-03	6.80E-04	6.54E-06	5.35E-05	2.78E-05
92	20.500%	10.3	1.54E-03	1.27E-05	1.60E-04	8.13E-04	5.44E-04	5.23E-06	4.35E-05	2.26E-05
93	21.000%	10.5	1.23E-03	1.02E-05	1.29E-04	6.52E-04	4.36E-04	4.20E-06	3.54E-05	1.84E-05
94	21.500%	10.8	9.91E-04	8.23E-06	1.04E-04	5.25E-04	3.51E-04	3.38E-06	2.89E-05	1.50E-05
95	22.000%	11.0	8.00E-04	6.64E-06	8.36E-05	4.24E-04	2.83E-04	2.73E-06	2.36E-05	1.23E-05
96	22.500%	11.3	6.47E-04	5.37E-06	6.76E-05	3.43E-04	2.29E-04	2.21E-06	1.94E-05	1.01E-05
97	23.000%	11.5	5.25E-04	4.36E-06	5.49E-05	2.78E-04	1.86E-04	1.79E-06	1.59E-05	8.28E-06
98	23.500%	11.8	4.27E-04	3.54E-06	4.46E-05	2.26E-04	1.51E-04	1.46E-06	1.31E-05	6.82E-06
99	24.000%	12.0	3.48E-04	2.89E-06	3.64E-05	1.84E-04	1.23E-04	1.19E-06	1.09E-05	5.63E-06
100	24.500%	12.3	2.85E-04	2.36E-06	2.97E-05	1.51E-04	1.01E-04	9.70E-07	8.98E-06	4.67E-06
101	25.000%	12.5	2.33E-04	1.94E-06	2.44E-05	1.23E-04	8.26E-05	7.95E-07	7.45E-06	3.87E-06
102	25.500%	12.8	1.91E-04	1.59E-06	2.00E-05	1.01E-04	6.78E-05	6.52E-07	6.20E-06	3.22E-06
103	26.000%	13.0	1.58E-04	1.31E-06	1.65E-05	8.34E-05	5.58E-05	5.37E-07	5.16E-06	2.68E-06
104	26.500%	13.3	1.30E-04	1.08E-06	1.36E-05	6.88E-05	4.60E-05	4.43E-07	4.31E-06	2.24E-06
105	27.000%	13.5	1.07E-04	8.92E-07	1.12E-05	5.69E-05	3.81E-05	3.66E-07	3.61E-06	1.87E-06
106	27.500%	13.8	8.90E-05	7.38E-07	9.30E-06	4.71E-05	3.15E-05	3.03E-07	3.02E-06	1.57E-06
107	28.000%	14.0	7.38E-05	6.13E-07	7.72E-06	3.91E-05	2.62E-05	2.52E-07	2.54E-06	1.32E-06
108	28.500%	14.3	6.14E-05	5.10E-07	6.42E-06	3.25E-05	2.18E-05	2.09E-07	2.13E-06	1.11E-06
109	29.000%	14.5	5.12E-05	4.25E-07	5.35E-06	2.71E-05	1.81E-05	1.74E-07	1.80E-06	9.34E-07
110	29.500%	14.8	4.27E-05	3.55E-07	4.46E-06	2.26E-05	1.51E-05	1.46E-07	1.52E-06	7.88E-07
111	30.000%	15.0	3.57E-05	2.96E-07	3.73E-06	1.89E-05	1.27E-05	1.22E-07	1.28E-06	6.67E-07
112	30.500%	15.3	2.99E-05	2.48E-07	3.13E-06	1.58E-05	1.06E-05	1.02E-07	1.09E-06	5.65E-07
113	31.000%	15.5	2.51E-05	2.09E-07	2.62E-06	1.33E-05	8.90E-06	8.56E-08	9.22E-07	4.79E-07
114	31.500%	15.8	2.11E-05	1.75E-07	2.21E-06	1.12E-05	7.48E-06	7.20E-08	7.84E-07	4.07E-07
115	32.000%	16.0	1.78E-05	1.48E-07	1.86E-06	9.42E-06	6.30E-06	6.06E-08	6.67E-07	3.46E-07
116	32.500%	16.3	1.50E-05	1.25E-07	1.57E-06	7.95E-06	5.32E-06	5.11E-08	5.68E-07	2.95E-07
117	33.000%	16.5	1.27E-05	1.05E-07	1.33E-06	6.72E-06	4.49E-06	4.32E-08	4.85E-07	2.52E-07
118	33.500%	16.8	1.07E-05	8.91E-08	1.12E-06	5.68E-06	3.80E-06	3.66E-08	4.15E-07	2.15E-07
119	34.000%	17.0	9.10E-06	7.55E-08	9.51E-07	4.82E-06	3.22E-06	3.10E-08	3.55E-07	1.84E-07
120	34.500%	17.3	7.72E-06	6.41E-08	8.07E-07	4.09E-06	2.74E-06	2.63E-08	3.04E-07	1.58E-07
121	35.000%	17.5	6.57E-06	5.45E-08	6.86E-07	3.48E-06	2.33E-06	2.24E-08	2.61E-07	1.36E-07
122	35.500%	17.8	5.59E-06	4.64E-08	5.84E-07	2.96E-06	1.98E-06	1.91E-08	2.25E-07	1.17E-07
123	36.000%	18.0	4.77E-06	3.96E-08	4.98E-07	2.52E-06	1.69E-06	1.62E-08	1.93E-07	1.00E-07
124	36.500%	18.3	4.07E-06	3.38E-08	4.25E-07	2.16E-06	1.44E-06	1.39E-08	1.67E-07	8.65E-08
125	37.000%	18.5	3.48E-06	2.89E-08	3.64E-07	1.84E-06	1.23E-06	1.19E-08	1.44E-07	7.47E-08

	A	B	C	D	E	F	G	H	I	J
126	37.500%	18.8	2.98E-06	2.47E-08	3.11E-07	1.58E-06	1.06E-06	1.02E-08	1.24E-07	6.45E-08
127	38.000%	19.0	2.55E-06	2.12E-08	2.67E-07	1.35E-06	9.05E-07	8.71E-09	1.07E-07	5.58E-08
128	38.500%	19.3	2.19E-06	1.82E-08	2.29E-07	1.16E-06	7.77E-07	7.47E-09	9.31E-08	4.83E-08
129	39.000%	19.5	1.88E-06	1.56E-08	1.97E-07	9.98E-07	6.68E-07	6.42E-09	8.07E-08	4.19E-08
130	39.500%	19.8	1.62E-06	1.35E-08	1.69E-07	8.59E-07	5.75E-07	5.53E-09	7.01E-08	3.64E-08
131	40.000%	20.0	1.40E-06	1.16E-08	1.46E-07	7.40E-07	4.95E-07	4.76E-09	6.09E-08	3.16E-08
132	40.500%	20.3	1.21E-06	1.00E-08	1.26E-07	6.39E-07	4.27E-07	4.11E-09	5.30E-08	2.75E-08
133	41.000%	20.5	1.04E-06	8.64E-09	1.09E-07	5.52E-07	3.69E-07	3.55E-09	4.62E-08	2.40E-08
134	41.500%	20.8	9.01E-07	7.47E-09	9.41E-08	4.77E-07	3.19E-07	3.07E-09	4.03E-08	2.09E-08
135	42.000%	21.0	7.80E-07	6.47E-09	8.15E-08	4.13E-07	2.76E-07	2.66E-09	3.51E-08	1.82E-08
136	42.500%	21.3	6.76E-07	5.61E-09	7.06E-08	3.58E-07	2.39E-07	2.30E-09	3.07E-08	1.59E-08
137	43.000%	21.5	5.86E-07	4.87E-09	6.13E-08	3.10E-07	2.08E-07	2.00E-09	2.69E-08	1.39E-08
138	43.500%	21.8	5.09E-07	4.23E-09	5.32E-08	2.70E-07	1.80E-07	1.74E-09	2.35E-08	1.22E-08
139	44.000%	22.0	4.43E-07	3.67E-09	4.63E-08	2.34E-07	1.57E-07	1.51E-09	2.06E-08	1.07E-08
140	44.500%	22.3	3.85E-07	3.20E-09	4.03E-08	2.04E-07	1.37E-07	1.31E-09	1.81E-08	9.39E-09
141	45.000%	22.5	3.36E-07	2.79E-09	3.51E-08	1.78E-07	1.19E-07	1.14E-09	1.59E-08	8.24E-09
142	45.500%	22.8	2.93E-07	2.43E-09	3.06E-08	1.55E-07	1.04E-07	9.98E-10	1.40E-08	7.25E-09
143	46.000%	23.0	2.56E-07	2.12E-09	2.67E-08	1.35E-07	9.06E-08	8.71E-10	1.23E-08	6.38E-09
144	46.500%	23.3	2.23E-07	1.85E-09	2.33E-08	1.18E-07	7.92E-08	7.61E-10	1.08E-08	5.61E-09
145	47.000%	23.5	1.95E-07	1.62E-09	2.04E-08	1.04E-07	6.92E-08	6.66E-10	9.53E-09	4.95E-09
146	47.500%	23.8	1.71E-07	1.42E-09	1.79E-08	9.06E-08	6.06E-08	5.83E-10	8.40E-09	4.36E-09
147	48.000%	24.0	1.50E-07	1.24E-09	1.57E-08	7.94E-08	5.31E-08	5.11E-10	7.42E-09	3.85E-09
148	48.500%	24.3	1.32E-07	1.09E-09	1.37E-08	6.97E-08	4.66E-08	4.48E-10	6.56E-09	3.40E-09
149	49.000%	24.5	1.16E-07	9.59E-10	1.21E-08	6.12E-08	4.09E-08	3.94E-10	5.80E-09	3.01E-09
150	49.500%	24.8	1.02E-07	8.43E-10	1.06E-08	5.38E-08	3.60E-08	3.46E-10	5.13E-09	2.67E-09
151	50.000%	25.0	8.93E-08	7.41E-10	9.33E-09	4.73E-08	3.16E-08	3.04E-10	4.55E-09	2.36E-09
152	50.500%	25.3	7.86E-08	6.52E-10	8.21E-09	4.16E-08	2.78E-08	2.68E-10	4.03E-09	2.09E-09
153	51.000%	25.5	6.93E-08	5.75E-10	7.24E-09	3.67E-08	2.45E-08	2.36E-10	3.58E-09	1.86E-09
154	51.500%	25.8	6.11E-08	5.07E-10	6.38E-09	3.23E-08	2.16E-08	2.08E-10	3.18E-09	1.65E-09
155	52.000%	26.0	5.39E-08	4.47E-10	5.63E-09	2.85E-08	1.91E-08	1.84E-10	2.82E-09	1.47E-09
156	52.500%	26.3	4.76E-08	3.95E-10	4.97E-09	2.52E-08	1.69E-08	1.62E-10	2.51E-09	1.30E-09
157	53.000%	26.5	4.21E-08	3.49E-10	4.40E-09	2.23E-08	1.49E-08	1.43E-10	2.23E-09	1.16E-09
158	53.500%	26.8	3.72E-08	3.09E-10	3.89E-09	1.97E-08	1.32E-08	1.27E-10	1.99E-09	1.03E-09
159	54.000%	27.0	3.30E-08	2.74E-10	3.44E-09	1.75E-08	1.17E-08	1.12E-10	1.77E-09	9.20E-10
160	54.500%	27.3	2.92E-08	2.42E-10	3.05E-09	1.55E-08	1.03E-08	9.95E-11	1.58E-09	8.21E-10
161	55.000%	27.5	2.59E-08	2.15E-10	2.71E-09	1.37E-08	9.17E-09	8.83E-11	1.41E-09	7.33E-10
162	55.500%	27.8	2.30E-08	1.91E-10	2.40E-09	1.22E-08	8.14E-09	7.83E-11	1.26E-09	6.54E-10
163	56.000%	28.0	2.04E-08	1.69E-10	2.13E-09	1.08E-08	7.23E-09	6.95E-11	1.13E-09	5.85E-10
164	56.500%	28.3	1.81E-08	1.51E-10	1.89E-09	9.60E-09	6.42E-09	6.18E-11	1.01E-09	5.23E-10
165	57.000%	28.5	1.61E-08	1.34E-10	1.69E-09	8.54E-09	5.71E-09	5.50E-11	9.01E-10	4.68E-10
166	57.500%	28.8	1.44E-08	1.19E-10	1.50E-09	7.60E-09	5.08E-09	4.89E-11	8.07E-10	4.19E-10
167	58.000%	29.0	1.28E-08	1.06E-10	1.34E-09	6.77E-09	4.53E-09	4.36E-11	7.23E-10	3.76E-10
168	58.500%	29.3	1.14E-08	9.45E-11	1.19E-09	6.03E-09	4.04E-09	3.88E-11	6.48E-10	3.37E-10
169	59.000%	29.5	1.02E-08	8.43E-11	1.06E-09	5.38E-09	3.60E-09	3.46E-11	5.82E-10	3.02E-10
170	59.500%	29.8	9.06E-09	7.52E-11	9.47E-10	4.80E-09	3.21E-09	3.09E-11	5.22E-10	2.71E-10
171	60.000%	30.0	8.09E-09	6.72E-11	8.46E-10	4.29E-09	2.87E-09	2.76E-11	4.69E-10	2.44E-10
172	60.500%	30.3	7.23E-09	6.00E-11	7.56E-10	3.83E-09	2.56E-09	2.46E-11	4.22E-10	2.19E-10
173	61.000%	30.5	6.47E-09	5.37E-11	6.76E-10	3.42E-09	2.29E-09	2.20E-11	3.79E-10	1.97E-10
174	61.500%	30.8	5.79E-09	4.80E-11	6.05E-10	3.06E-09	2.05E-09	1.97E-11	3.41E-10	1.77E-10

	A	B	C	D	E	F	G	H	I	J
175	62.000%	31.0	5.18E-09	4.30E-11	5.41E-10	2.74E-09	1.83E-09	1.77E-11	3.07E-10	1.60E-10
176	62.500%	31.3	4.64E-09	3.85E-11	4.85E-10	2.46E-09	1.64E-09	1.58E-11	2.77E-10	1.44E-10
177	63.000%	31.5	4.16E-09	3.45E-11	4.35E-10	2.20E-09	1.47E-09	1.42E-11	2.49E-10	1.30E-10
178	63.500%	31.8	3.73E-09	3.10E-11	3.90E-10	1.98E-09	1.32E-09	1.27E-11	2.25E-10	1.17E-10
179	64.000%	32.0	3.35E-09	2.78E-11	3.50E-10	1.77E-09	1.19E-09	1.14E-11	2.03E-10	1.05E-10
180	64.500%	32.3	3.01E-09	2.49E-11	3.14E-10	1.59E-09	1.06E-09	1.02E-11	1.83E-10	9.52E-11
181	65.000%	32.5	2.70E-09	2.24E-11	2.82E-10	1.43E-09	9.57E-10	9.20E-12	1.66E-10	8.60E-11
182	65.500%	32.8	2.43E-09	2.02E-11	2.54E-10	1.29E-09	8.60E-10	8.27E-12	1.50E-10	7.77E-11
183	66.000%	33.0	2.18E-09	1.81E-11	2.28E-10	1.16E-09	7.74E-10	7.44E-12	1.35E-10	7.03E-11
184	66.500%	33.3	1.97E-09	1.63E-11	2.05E-10	1.04E-09	6.96E-10	6.70E-12	1.22E-10	6.36E-11
185	67.000%	33.5	1.77E-09	1.47E-11	1.85E-10	9.37E-10	6.27E-10	6.03E-12	1.11E-10	5.76E-11
186	67.500%	33.8	1.59E-09	1.32E-11	1.67E-10	8.45E-10	5.65E-10	5.43E-12	1.00E-10	5.21E-11
187	68.000%	34.0	1.44E-09	1.19E-11	1.50E-10	7.61E-10	5.09E-10	4.90E-12	9.09E-11	4.72E-11
188	68.500%	34.3	1.30E-09	1.08E-11	1.35E-10	6.87E-10	4.59E-10	4.42E-12	8.24E-11	4.28E-11
189	69.000%	34.5	1.17E-09	9.71E-12	1.22E-10	6.20E-10	4.15E-10	3.99E-12	7.47E-11	3.88E-11
190	69.500%	34.8	1.06E-09	8.77E-12	1.10E-10	5.60E-10	3.74E-10	3.60E-12	6.78E-11	3.52E-11
191	70.000%	35.0	9.55E-10	7.92E-12	9.97E-11	5.06E-10	3.38E-10	3.25E-12	6.15E-11	3.20E-11
192	70.500%	35.3	8.63E-10	7.16E-12	9.02E-11	4.57E-10	3.06E-10	2.94E-12	5.59E-11	2.90E-11
193	71.000%	35.5	7.80E-10	6.48E-12	8.15E-11	4.13E-10	2.76E-10	2.66E-12	5.08E-11	2.64E-11
194	71.500%	35.8	7.06E-10	5.86E-12	7.38E-11	3.74E-10	2.50E-10	2.41E-12	4.61E-11	2.40E-11
195	72.000%	36.0	6.39E-10	5.30E-12	6.68E-11	3.38E-10	2.26E-10	2.18E-12	4.19E-11	2.18E-11
196	72.500%	36.3	5.79E-10	4.80E-12	6.05E-11	3.06E-10	2.05E-10	1.97E-12	3.81E-11	1.98E-11
197	73.000%	36.5	5.24E-10	4.35E-12	5.48E-11	2.78E-10	1.86E-10	1.79E-12	3.47E-11	1.80E-11
198	73.500%	36.8	4.75E-10	3.95E-12	4.97E-11	2.52E-10	1.68E-10	1.62E-12	3.16E-11	1.64E-11
199	74.000%	37.0	4.31E-10	3.58E-12	4.51E-11	2.28E-10	1.53E-10	1.47E-12	2.87E-11	1.49E-11
200	74.500%	37.3	3.91E-10	3.25E-12	4.09E-11	2.07E-10	1.39E-10	1.33E-12	2.62E-11	1.36E-11
201	75.000%	37.5	3.55E-10	2.95E-12	3.71E-11	1.88E-10	1.26E-10	1.21E-12	2.38E-11	1.24E-11
202	75.500%	37.8	3.23E-10	2.68E-12	3.37E-11	1.71E-10	1.14E-10	1.10E-12	2.17E-11	1.13E-11
203	76.000%	38.0	2.93E-10	2.43E-12	3.06E-11	1.55E-10	1.04E-10	9.99E-13	1.98E-11	1.03E-11
204	76.500%	38.3	2.66E-10	2.21E-12	2.78E-11	1.41E-10	9.44E-11	9.08E-13	1.81E-11	9.38E-12
205	77.000%	38.5	2.42E-10	2.01E-12	2.53E-11	1.28E-10	8.58E-11	8.26E-13	1.65E-11	8.55E-12
206	77.500%	38.8	2.20E-10	1.83E-12	2.30E-11	1.17E-10	7.81E-11	7.51E-13	1.50E-11	7.80E-12
207	78.000%	39.0	2.01E-10	1.67E-12	2.10E-11	1.06E-10	7.11E-11	6.84E-13	1.37E-11	7.12E-12
208	78.500%	39.3	1.83E-10	1.52E-12	1.91E-11	9.68E-11	6.47E-11	6.23E-13	1.25E-11	6.50E-12
209	79.000%	39.5	1.66E-10	1.38E-12	1.74E-11	8.82E-11	5.90E-11	5.67E-13	1.14E-11	5.93E-12
210	79.500%	39.8	1.52E-10	1.26E-12	1.59E-11	8.04E-11	5.38E-11	5.17E-13	1.04E-11	5.41E-12
211	80.000%	40.0	1.38E-10	1.15E-12	1.45E-11	7.33E-11	4.90E-11	4.71E-13	9.51E-12	4.94E-12
212	80.500%	40.3	1.26E-10	1.05E-12	1.32E-11	6.68E-11	4.47E-11	4.30E-13	8.68E-12	4.51E-12
213	81.000%	40.5	1.15E-10	9.56E-13	1.20E-11	6.10E-11	4.08E-11	3.92E-13	7.93E-12	4.12E-12
214	81.500%	40.8	1.05E-10	8.73E-13	1.10E-11	5.57E-11	3.72E-11	3.58E-13	7.24E-12	3.76E-12
215	82.000%	41.0	9.60E-11	7.97E-13	1.00E-11	5.08E-11	3.40E-11	3.27E-13	6.61E-12	3.43E-12
216	82.500%	41.3	8.77E-11	7.28E-13	9.17E-12	4.65E-11	3.11E-11	2.99E-13	6.03E-12	3.13E-12
217	83.000%	41.5	8.02E-11	6.66E-13	8.38E-12	4.25E-11	2.84E-11	2.73E-13	5.51E-12	2.86E-12
218	83.500%	41.8	7.33E-11	6.08E-13	7.66E-12	3.88E-11	2.60E-11	2.50E-13	5.02E-12	2.61E-12
219	84.000%	42.0	6.71E-11	5.57E-13	7.01E-12	3.55E-11	2.38E-11	2.29E-13	4.58E-12	2.38E-12
220	84.500%	42.3	6.14E-11	5.09E-13	6.41E-12	3.25E-11	2.17E-11	2.09E-13	4.18E-12	2.17E-12
221	85.000%	42.5	5.62E-11	4.66E-13	5.87E-12	2.97E-11	1.99E-11	1.91E-13	3.81E-12	1.98E-12
222	85.500%	42.8	5.15E-11	4.27E-13	5.38E-12	2.72E-11	1.82E-11	1.75E-13	3.48E-12	1.81E-12
223	86.000%	43.0	4.71E-11	3.91E-13	4.92E-12	2.50E-11	1.67E-11	1.61E-13	3.17E-12	1.64E-12

	A	B	C	D	E	F	G	H	I	J
224	86.500%	43.3	4.32E-11	3.58E-13	4.51E-12	2.29E-11	1.53E-11	1.47E-13	2.88E-12	1.50E-12
225	87.000%	43.5	3.96E-11	3.29E-13	4.14E-12	2.10E-11	1.40E-11	1.35E-13	2.62E-12	1.36E-12
226	87.500%	43.8	3.63E-11	3.01E-13	3.79E-12	1.92E-11	1.29E-11	1.24E-13	2.39E-12	1.24E-12
227	88.000%	44.0	3.33E-11	2.77E-13	3.48E-12	1.76E-11	1.18E-11	1.14E-13	2.17E-12	1.13E-12
228	88.500%	44.3	3.06E-11	2.54E-13	3.19E-12	1.62E-11	1.08E-11	1.04E-13	1.97E-12	1.02E-12
229	89.000%	44.5	2.81E-11	2.33E-13	2.93E-12	1.49E-11	9.94E-12	9.57E-14	1.78E-12	9.25E-13
230	89.500%	44.8	2.58E-11	2.14E-13	2.69E-12	1.36E-11	9.13E-12	8.78E-14	1.61E-12	8.38E-13
231	90.000%	45.0	2.37E-11	1.97E-13	2.48E-12	1.25E-11	8.39E-12	8.07E-14	1.46E-12	7.57E-13
232	90.500%	45.3	2.18E-11	1.81E-13	2.27E-12	1.15E-11	7.71E-12	7.41E-14	1.31E-12	6.83E-13
233	91.000%	45.5	2.00E-11	1.66E-13	2.09E-12	1.06E-11	7.09E-12	6.82E-14	1.18E-12	6.15E-13
234	91.500%	45.8	1.84E-11	1.53E-13	1.92E-12	9.74E-12	6.52E-12	6.27E-14	1.06E-12	5.52E-13
235	92.000%	46.0	1.69E-11	1.40E-13	1.77E-12	8.96E-12	5.99E-12	5.77E-14	9.51E-13	4.94E-13
236	92.500%	46.3	1.56E-11	1.29E-13	1.63E-12	8.25E-12	5.52E-12	5.31E-14	8.49E-13	4.41E-13
237	93.000%	46.5	1.43E-11	1.19E-13	1.50E-12	7.60E-12	5.08E-12	4.89E-14	7.55E-13	3.92E-13
238	93.500%	46.8	1.32E-11	1.10E-13	1.38E-12	6.99E-12	4.68E-12	4.50E-14	6.69E-13	3.47E-13
239	94.000%	47.0	1.22E-11	1.01E-13	1.27E-12	6.44E-12	4.31E-12	4.15E-14	5.89E-13	3.06E-13
240	94.500%	47.3	1.12E-11	9.30E-14	1.17E-12	5.93E-12	3.97E-12	3.82E-14	5.15E-13	2.68E-13
241	95.000%	47.5	1.03E-11	8.58E-14	1.08E-12	5.47E-12	3.66E-12	3.52E-14	4.48E-13	2.32E-13
242	95.500%	47.8	9.53E-12	7.91E-14	9.95E-13	5.04E-12	3.37E-12	3.25E-14	3.85E-13	2.00E-13
243	96.000%	48.0	8.78E-12	7.29E-14	9.18E-13	4.65E-12	3.11E-12	2.99E-14	3.28E-13	1.70E-13
244	96.500%	48.3	8.10E-12	6.73E-14	8.47E-13	4.29E-12	2.87E-12	2.76E-14	2.74E-13	1.42E-13
245	97.000%	48.5	7.48E-12	6.21E-14	7.81E-13	3.96E-12	2.65E-12	2.55E-14	2.25E-13	1.17E-13
246	97.500%	48.8	6.90E-12	5.73E-14	7.21E-13	3.66E-12	2.45E-12	2.35E-14	1.80E-13	9.33E-14
247	98.000%	49.0	6.38E-12	5.29E-14	6.67E-13	3.38E-12	2.26E-12	2.17E-14	1.38E-13	7.16E-14
248	98.500%	49.3	5.89E-12	4.89E-14	6.15E-13	3.12E-12	2.09E-12	2.01E-14	9.91E-14	5.15E-14
249	99.000%	49.5	5.43E-12	4.51E-14	5.68E-13	2.88E-12	1.92E-12	1.85E-14	6.35E-14	3.30E-14
250	99.500%	49.8	5.04E-12	4.18E-14	5.27E-13	2.67E-12	1.79E-12	1.72E-14	3.03E-14	1.57E-14
251	100.000%	50.0	4.64E-12	3.85E-14	4.84E-13	2.46E-12	1.64E-12	1.58E-14	0.00E+00	0.00E+00
252		Flaws/WP	152.40	1.26	15.92	80.70	53.99	0.52		
253										
254										
255	Frequency of various size flaws in WP shell assuming RT, PT, and UT exams									Cumulative
256	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
257	1%	0.5	1.42E-01	1.18E-03	1.49E-02	7.55E-02	5.05E-02	4.86E-04	9.83E-01	2.77E-02
258	1.500%	0.8	7.44E-01	6.18E-03	7.78E-02	3.94E-01	2.64E-01	2.54E-03	8.93E-01	2.52E-02
259	2.000%	1.0	1.33E+00	1.10E-02	1.39E-01	7.04E-01	4.71E-01	4.53E-03	7.32E-01	2.07E-02
260	2.500%	1.3	1.51E+00	1.26E-02	1.58E-01	8.02E-01	5.36E-01	5.16E-03	5.49E-01	1.55E-02
261	3.000%	1.5	1.31E+00	1.09E-02	1.37E-01	6.96E-01	4.65E-01	4.48E-03	3.91E-01	1.10E-02
262	3.500%	1.8	1.04E+00	8.60E-03	1.08E-01	5.48E-01	3.67E-01	3.53E-03	2.65E-01	7.49E-03
263	4.000%	2.0	7.26E-01	6.03E-03	7.59E-02	3.85E-01	2.57E-01	2.47E-03	1.78E-01	5.01E-03
264	4.500%	2.3	5.07E-01	4.21E-03	5.30E-02	2.69E-01	1.80E-01	1.73E-03	1.16E-01	3.28E-03
265	5.000%	2.5	3.30E-01	2.74E-03	3.45E-02	1.75E-01	1.17E-01	1.12E-03	7.65E-02	2.16E-03
266	5.500%	2.8	2.21E-01	1.83E-03	2.31E-02	1.17E-01	7.83E-02	7.53E-04	4.98E-02	1.41E-03
267	6.000%	3.0	1.47E-01	1.22E-03	1.53E-02	7.77E-02	5.19E-02	5.00E-04	3.21E-02	9.05E-04
268	6.500%	3.3	9.27E-02	7.69E-04	9.68E-03	4.91E-02	3.28E-02	3.16E-04	2.09E-02	5.90E-04
269	7.000%	3.5	6.12E-02	5.08E-04	6.40E-03	3.24E-02	2.17E-02	2.09E-04	1.35E-02	3.81E-04
270	7.500%	3.8	3.87E-02	3.22E-04	4.05E-03	2.05E-02	1.37E-02	1.32E-04	8.82E-03	2.49E-04
271	8.000%	4.0	2.46E-02	2.04E-04	2.57E-03	1.30E-02	8.72E-03	8.39E-05	5.85E-03	1.65E-04
272	8.500%	4.3	1.64E-02	1.36E-04	1.71E-03	8.69E-03	5.81E-03	5.59E-05	3.87E-03	1.09E-04

	A	B	C	D	E	F	G	H	I	J
273	9.000%	4.5	1.05E-02	8.74E-05	1.10E-03	5.58E-03	3.73E-03	3.59E-05	2.60E-03	7.32E-05
274	9.500%	4.8	7.10E-03	5.89E-05	7.41E-04	3.76E-03	2.51E-03	2.42E-05	1.74E-03	4.90E-05
275	10.000%	5.0	4.61E-03	3.83E-05	4.82E-04	2.44E-03	1.63E-03	1.57E-05	1.18E-03	3.33E-05
276	10.500%	5.3	3.14E-03	2.61E-05	3.28E-04	1.66E-03	1.11E-03	1.07E-05	8.02E-04	2.26E-05
277	11.000%	5.5	2.07E-03	1.72E-05	2.16E-04	1.10E-03	7.33E-04	7.05E-06	5.52E-04	1.56E-05
278	11.500%	5.8	1.43E-03	1.18E-05	1.49E-04	7.55E-04	5.05E-04	4.86E-06	3.79E-04	1.07E-05
279	12.000%	6.0	9.51E-04	7.89E-06	9.94E-05	5.04E-04	3.37E-04	3.24E-06	2.65E-04	7.46E-06
280	12.500%	6.3	6.64E-04	5.51E-06	6.94E-05	3.52E-04	2.35E-04	2.26E-06	1.84E-04	5.20E-06
281	13.000%	6.5	4.49E-04	3.72E-06	4.69E-05	2.38E-04	1.59E-04	1.53E-06	1.30E-04	3.67E-06
282	13.500%	6.8	3.17E-04	2.63E-06	3.31E-05	1.68E-04	1.12E-04	1.08E-06	9.18E-05	2.59E-06
283	14.000%	7.0	2.17E-04	1.80E-06	2.27E-05	1.15E-04	7.69E-05	7.39E-07	6.56E-05	1.85E-06
284	14.500%	7.3	1.55E-04	1.29E-06	1.62E-05	8.21E-05	5.49E-05	5.28E-07	4.69E-05	1.32E-06
285	15.000%	7.5	1.07E-04	8.92E-07	1.12E-05	5.69E-05	3.81E-05	3.66E-07	3.39E-05	9.56E-07
286	15.500%	7.8	7.76E-05	6.44E-07	8.10E-06	4.11E-05	2.75E-05	2.64E-07	2.45E-05	6.92E-07
287	16.000%	8.0	5.44E-05	4.52E-07	5.69E-06	2.88E-05	1.93E-05	1.85E-07	1.80E-05	5.06E-07
288	16.500%	8.3	3.97E-05	3.30E-07	4.15E-06	2.10E-05	1.41E-05	1.35E-07	1.32E-05	3.71E-07
289	17.000%	8.5	2.82E-05	2.34E-07	2.95E-06	1.49E-05	9.99E-06	9.61E-08	9.75E-06	2.75E-07
290	17.500%	8.8	2.08E-05	1.72E-07	2.17E-06	1.10E-05	7.36E-06	7.08E-08	7.24E-06	2.04E-07
291	18.000%	9.0	1.49E-05	1.24E-07	1.56E-06	7.90E-06	5.28E-06	5.08E-08	5.44E-06	1.53E-07
292	18.500%	9.3	1.11E-05	9.21E-08	1.16E-06	5.88E-06	3.93E-06	3.78E-08	4.10E-06	1.16E-07
293	19.000%	9.5	8.06E-06	6.69E-08	8.42E-07	4.27E-06	2.85E-06	2.75E-08	3.13E-06	8.82E-08
294	19.500%	9.8	6.05E-06	5.02E-08	6.32E-07	3.20E-06	2.14E-06	2.06E-08	2.40E-06	6.76E-08
295	20.000%	10.0	4.44E-06	3.68E-08	4.64E-07	2.35E-06	1.57E-06	1.51E-08	1.86E-06	5.25E-08
296	20.500%	10.3	3.55E-06	2.95E-08	3.71E-07	1.88E-06	1.26E-06	1.21E-08	1.43E-06	4.04E-08
297	21.000%	10.5	2.85E-06	2.36E-08	2.98E-07	1.51E-06	1.01E-06	9.71E-09	1.09E-06	3.07E-08
298	21.500%	10.8	2.29E-06	1.90E-08	2.39E-07	1.21E-06	8.12E-07	7.81E-09	8.10E-07	2.29E-08
299	22.000%	11.0	1.42E-06	1.18E-08	1.49E-07	7.54E-07	5.05E-07	4.85E-09	6.38E-07	1.80E-08
300	22.500%	11.3	1.15E-06	9.57E-09	1.20E-07	6.10E-07	4.08E-07	3.93E-09	4.99E-07	1.41E-08
301	23.000%	11.5	9.35E-07	7.76E-09	9.77E-08	4.95E-07	3.31E-07	3.19E-09	3.86E-07	1.09E-08
302	23.500%	11.8	7.60E-07	6.31E-09	7.95E-08	4.03E-07	2.69E-07	2.59E-09	2.94E-07	8.30E-09
303	24.000%	12.0	4.91E-07	4.08E-09	5.13E-08	2.60E-07	1.74E-07	1.67E-09	2.35E-07	6.63E-09
304	24.500%	12.3	4.01E-07	3.33E-09	4.19E-08	2.13E-07	1.42E-07	1.37E-09	1.87E-07	5.26E-09
305	25.000%	12.5	3.29E-07	2.73E-09	3.44E-08	1.74E-07	1.16E-07	1.12E-09	1.47E-07	4.14E-09
306	25.500%	12.8	2.70E-07	2.24E-09	2.82E-08	1.43E-07	9.56E-08	9.20E-10	1.14E-07	3.22E-09
307	26.000%	13.0	1.81E-07	1.50E-09	1.89E-08	9.57E-08	6.40E-08	6.16E-10	9.23E-08	2.60E-09
308	26.500%	13.3	1.49E-07	1.24E-09	1.56E-08	7.90E-08	5.28E-08	5.08E-10	7.43E-08	2.10E-09
309	27.000%	13.5	1.23E-07	1.02E-09	1.29E-08	6.53E-08	4.37E-08	4.20E-10	5.94E-08	1.68E-09
310	27.500%	13.8	1.02E-07	8.47E-10	1.07E-08	5.41E-08	3.62E-08	3.48E-10	4.71E-08	1.33E-09
311	28.000%	14.0	7.08E-08	5.88E-10	7.40E-09	3.75E-08	2.51E-08	2.41E-10	3.85E-08	1.09E-09
312	28.500%	14.3	5.89E-08	4.89E-10	6.15E-09	3.12E-08	2.09E-08	2.01E-10	3.14E-08	8.86E-10
313	29.000%	14.5	4.91E-08	4.07E-10	5.13E-09	2.60E-08	1.74E-08	1.67E-10	2.55E-08	7.19E-10
314	29.500%	14.8	4.10E-08	3.40E-10	4.28E-09	2.17E-08	1.45E-08	1.40E-10	2.05E-08	5.79E-10
315	30.000%	15.0	2.94E-08	2.44E-10	3.07E-09	1.56E-08	1.04E-08	1.00E-10	1.70E-08	4.79E-10
316	30.500%	15.3	2.46E-08	2.04E-10	2.57E-09	1.30E-08	8.72E-09	8.38E-11	1.40E-08	3.95E-10
317	31.000%	15.5	2.07E-08	1.71E-10	2.16E-09	1.09E-08	7.32E-09	7.04E-11	1.15E-08	3.25E-10
318	31.500%	15.8	1.74E-08	1.44E-10	1.81E-09	9.19E-09	6.15E-09	5.92E-11	9.42E-09	2.66E-10
319	32.000%	16.0	1.28E-08	1.06E-10	1.34E-09	6.79E-09	4.54E-09	4.37E-11	7.87E-09	2.22E-10
320	32.500%	16.3	1.08E-08	8.98E-11	1.13E-09	5.73E-09	3.83E-09	3.69E-11	6.56E-09	1.85E-10
321	33.000%	16.5	9.15E-09	7.59E-11	9.56E-10	4.84E-09	3.24E-09	3.12E-11	5.46E-09	1.54E-10

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322	33.500%	16.8	7.74E-09	6.42E-11	8.09E-10	4.10E-09	2.74E-09	2.64E-11	4.52E-09	1.28E-10
323	34.000%	17.0	5.88E-09	4.88E-11	6.14E-10	3.11E-09	2.08E-09	2.00E-11	3.81E-09	1.08E-10
324	34.500%	17.3	4.99E-09	4.14E-11	5.21E-10	2.64E-09	1.77E-09	1.70E-11	3.21E-09	9.06E-11
325	35.000%	17.5	4.24E-09	3.52E-11	4.43E-10	2.25E-09	1.50E-09	1.45E-11	2.70E-09	7.61E-11
326	35.500%	17.8	3.61E-09	3.00E-11	3.77E-10	1.91E-09	1.28E-09	1.23E-11	2.26E-09	6.38E-11
327	36.000%	18.0	2.81E-09	2.33E-11	2.94E-10	1.49E-09	9.95E-10	9.57E-12	1.92E-09	5.42E-11
328	36.500%	18.3	2.40E-09	1.99E-11	2.51E-10	1.27E-09	8.50E-10	8.18E-12	1.63E-09	4.61E-11
329	37.000%	18.5	2.05E-09	1.70E-11	2.14E-10	1.09E-09	7.27E-10	6.99E-12	1.39E-09	3.91E-11
330	37.500%	18.8	1.76E-09	1.46E-11	1.84E-10	9.30E-10	6.22E-10	5.99E-12	1.17E-09	3.31E-11
331	38.000%	19.0	1.40E-09	1.16E-11	1.46E-10	7.39E-10	4.95E-10	4.76E-12	1.00E-09	2.83E-11
332	38.500%	19.3	1.20E-09	9.95E-12	1.25E-10	6.35E-10	4.25E-10	4.08E-12	8.60E-10	2.43E-11
333	39.000%	19.5	1.03E-09	8.55E-12	1.08E-10	5.45E-10	3.65E-10	3.51E-12	7.35E-10	2.07E-11
334	39.500%	19.8	8.87E-10	7.36E-12	9.26E-11	4.69E-10	3.14E-10	3.02E-12	6.28E-10	1.77E-11
335	40.000%	20.0	7.18E-10	5.96E-12	7.50E-11	3.80E-10	2.54E-10	2.45E-12	5.41E-10	1.53E-11
336	40.500%	20.3	6.19E-10	5.14E-12	6.47E-11	3.28E-10	2.19E-10	2.11E-12	4.67E-10	1.32E-11
337	41.000%	20.5	5.35E-10	4.44E-12	5.59E-11	2.83E-10	1.89E-10	1.82E-12	4.02E-10	1.13E-11
338	41.500%	20.8	4.63E-10	3.84E-12	4.83E-11	2.45E-10	1.64E-10	1.58E-12	3.46E-10	9.76E-12
339	42.000%	21.0	3.81E-10	3.16E-12	3.98E-11	2.02E-10	1.35E-10	1.30E-12	3.00E-10	8.47E-12
340	42.500%	21.3	3.30E-10	2.74E-12	3.45E-11	1.75E-10	1.17E-10	1.12E-12	2.60E-10	7.34E-12
341	43.000%	21.5	2.86E-10	2.38E-12	2.99E-11	1.52E-10	1.01E-10	9.75E-13	2.26E-10	6.37E-12
342	43.500%	21.8	2.49E-10	2.06E-12	2.60E-11	1.32E-10	8.81E-11	8.47E-13	1.96E-10	5.52E-12
343	44.000%	22.0	2.07E-10	1.72E-12	2.17E-11	1.10E-10	7.35E-11	7.07E-13	1.71E-10	4.81E-12
344	44.500%	22.3	1.80E-10	1.50E-12	1.89E-11	9.56E-11	6.39E-11	6.15E-13	1.49E-10	4.20E-12
345	45.000%	22.5	1.57E-10	1.31E-12	1.64E-11	8.33E-11	5.57E-11	5.36E-13	1.30E-10	3.66E-12
346	45.500%	22.8	1.37E-10	1.14E-12	1.43E-11	7.26E-11	4.86E-11	4.67E-13	1.13E-10	3.19E-12
347	46.000%	23.0	1.16E-10	9.61E-13	1.21E-11	6.13E-11	4.10E-11	3.95E-13	9.93E-11	2.80E-12
348	46.500%	23.3	1.01E-10	8.40E-13	1.06E-11	5.36E-11	3.58E-11	3.45E-13	8.70E-11	2.46E-12
349	47.000%	23.5	8.85E-11	7.35E-13	9.25E-12	4.69E-11	3.14E-11	3.02E-13	7.63E-11	2.15E-12
350	47.500%	23.8	7.75E-11	6.43E-13	8.10E-12	4.10E-11	2.75E-11	2.64E-13	6.70E-11	1.89E-12
351	48.000%	24.0	6.61E-11	5.49E-13	6.91E-12	3.50E-11	2.34E-11	2.25E-13	5.90E-11	1.66E-12
352	48.500%	24.3	5.80E-11	4.81E-13	6.06E-12	3.07E-11	2.05E-11	1.98E-13	5.20E-11	1.47E-12
353	49.000%	24.5	5.09E-11	4.22E-13	5.32E-12	2.70E-11	1.80E-11	1.73E-13	4.58E-11	1.29E-12
354	49.500%	24.8	4.47E-11	3.71E-13	4.67E-12	2.37E-11	1.58E-11	1.52E-13	4.04E-11	1.14E-12
355	50.000%	25.0	3.85E-11	3.19E-13	4.02E-12	2.04E-11	1.36E-11	1.31E-13	3.58E-11	1.01E-12
356	50.500%	25.3	3.39E-11	2.81E-13	3.54E-12	1.79E-11	1.20E-11	1.15E-13	3.17E-11	8.94E-13
357	51.000%	25.5	2.98E-11	2.48E-13	3.12E-12	1.58E-11	1.06E-11	1.02E-13	2.81E-11	7.93E-13
358	51.500%	25.8	2.63E-11	2.18E-13	2.75E-12	1.39E-11	9.32E-12	8.97E-14	2.49E-11	7.03E-13
359	52.000%	26.0	2.32E-11	1.93E-13	2.43E-12	1.23E-11	8.23E-12	7.91E-14	2.21E-11	6.24E-13
360	52.500%	26.3	2.05E-11	1.70E-13	2.14E-12	1.09E-11	7.27E-12	6.99E-14	1.96E-11	5.54E-13
361	53.000%	26.5	1.81E-11	1.50E-13	1.89E-12	9.60E-12	6.42E-12	6.18E-14	1.74E-11	4.92E-13
362	53.500%	26.8	1.60E-11	1.33E-13	1.68E-12	8.49E-12	5.68E-12	5.47E-14	1.55E-11	4.37E-13
363	54.000%	27.0	1.42E-11	1.18E-13	1.48E-12	7.52E-12	5.03E-12	4.84E-14	1.38E-11	3.89E-13
364	54.500%	27.3	1.26E-11	1.04E-13	1.31E-12	6.66E-12	4.46E-12	4.29E-14	1.23E-11	3.46E-13
365	55.000%	27.5	1.12E-11	9.26E-14	1.17E-12	5.91E-12	3.95E-12	3.80E-14	1.09E-11	3.08E-13
366	55.500%	27.8	9.90E-12	8.22E-14	1.03E-12	5.24E-12	3.51E-12	3.37E-14	9.73E-12	2.74E-13
367	56.000%	28.0	8.79E-12	7.30E-14	9.19E-13	4.66E-12	3.11E-12	3.00E-14	8.66E-12	2.44E-13
368	56.500%	28.3	7.81E-12	6.49E-14	8.16E-13	4.14E-12	2.77E-12	2.66E-14	7.72E-12	2.18E-13
369	57.000%	28.5	6.95E-12	5.77E-14	7.26E-13	3.68E-12	2.46E-12	2.37E-14	6.88E-12	1.94E-13
370	57.500%	28.8	6.18E-12	5.13E-14	6.46E-13	3.27E-12	2.19E-12	2.11E-14	6.13E-12	1.73E-13

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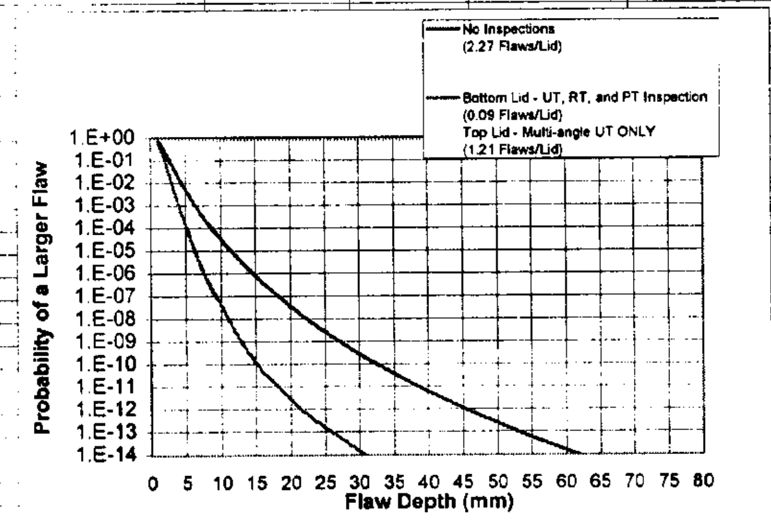
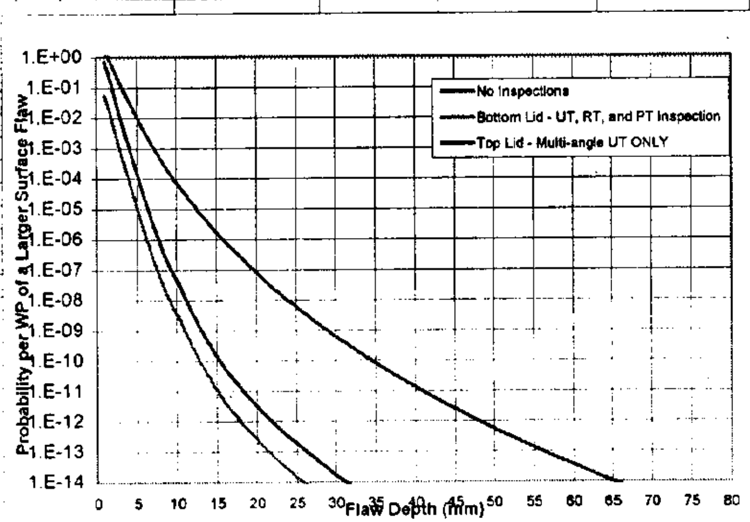
371	58.000%	29.0	5.51E-12	4.57E-14	5.75E-13	2.92E-12	1.95E-12	1.88E-14	5.47E-12	1.54E-13
372	58.500%	29.3	4.91E-12	4.07E-14	5.13E-13	2.60E-12	1.74E-12	1.67E-14	4.88E-12	1.38E-13
373	59.000%	29.5	4.38E-12	3.63E-14	4.57E-13	2.32E-12	1.55E-12	1.49E-14	4.35E-12	1.23E-13
374	59.500%	29.8	3.91E-12	3.24E-14	4.08E-13	2.07E-12	1.38E-12	1.33E-14	3.87E-12	1.09E-13
375	60.000%	30.0	3.27E-12	2.72E-14	3.42E-13	1.73E-12	1.16E-12	1.12E-14	3.48E-12	9.81E-14
376	60.500%	30.3	2.92E-12	2.43E-14	3.06E-13	1.55E-12	1.04E-12	9.97E-15	3.13E-12	8.82E-14
377	61.000%	30.5	2.61E-12	2.17E-14	2.73E-13	1.38E-12	9.26E-13	8.91E-15	2.81E-12	7.93E-14
378	61.500%	30.8	2.34E-12	1.94E-14	2.44E-13	1.24E-12	8.29E-13	7.97E-15	2.53E-12	7.13E-14
379	62.000%	31.0	2.09E-12	1.74E-14	2.19E-13	1.11E-12	7.42E-13	7.14E-15	2.27E-12	6.42E-14
380	62.500%	31.3	1.88E-12	1.56E-14	1.96E-13	9.94E-13	6.65E-13	6.39E-15	2.05E-12	5.78E-14
381	63.000%	31.5	1.68E-12	1.40E-14	1.76E-13	8.91E-13	5.96E-13	5.73E-15	1.84E-12	5.20E-14
382	63.500%	31.8	1.51E-12	1.25E-14	1.58E-13	7.99E-13	5.34E-13	5.14E-15	1.66E-12	4.69E-14
383	64.000%	32.0	1.35E-12	1.12E-14	1.41E-13	7.17E-13	4.80E-13	4.61E-15	1.50E-12	4.23E-14
384	64.500%	32.3	1.22E-12	1.01E-14	1.27E-13	6.44E-13	4.31E-13	4.14E-15	1.35E-12	3.81E-14
385	65.000%	32.5	1.09E-12	9.06E-15	1.14E-13	5.78E-13	3.87E-13	3.72E-15	1.22E-12	3.44E-14
386	65.500%	32.8	9.82E-13	8.15E-15	1.03E-13	5.20E-13	3.48E-13	3.35E-15	1.10E-12	3.11E-14
387	66.000%	33.0	8.83E-13	7.33E-15	9.23E-14	4.68E-13	3.13E-13	3.01E-15	9.95E-13	2.81E-14
388	66.500%	33.3	7.95E-13	6.60E-15	8.30E-14	4.21E-13	2.82E-13	2.71E-15	8.99E-13	2.54E-14
389	67.000%	33.5	7.16E-13	5.94E-15	7.48E-14	3.79E-13	2.54E-13	2.44E-15	8.12E-13	2.29E-14
390	67.500%	33.8	6.45E-13	5.35E-15	6.74E-14	3.41E-13	2.28E-13	2.20E-15	7.34E-13	2.07E-14
391	68.000%	34.0	5.81E-13	4.83E-15	6.07E-14	3.08E-13	2.06E-13	1.98E-15	6.64E-13	1.87E-14
392	68.500%	34.3	5.24E-13	4.35E-15	5.48E-14	2.78E-13	1.86E-13	1.79E-15	6.01E-13	1.69E-14
393	69.000%	34.5	4.73E-13	3.93E-15	4.94E-14	2.51E-13	1.68E-13	1.61E-15	5.44E-13	1.53E-14
394	69.500%	34.8	4.27E-13	3.55E-15	4.46E-14	2.26E-13	1.51E-13	1.46E-15	4.92E-13	1.39E-14
395	70.000%	35.0	3.77E-13	3.13E-15	3.94E-14	2.00E-13	1.33E-13	1.28E-15	4.47E-13	1.26E-14
396	70.500%	35.3	3.41E-13	2.83E-15	3.56E-14	1.80E-13	1.21E-13	1.16E-15	4.05E-13	1.14E-14
397	71.000%	35.5	3.08E-13	2.56E-15	3.22E-14	1.63E-13	1.09E-13	1.05E-15	3.68E-13	1.04E-14
398	71.500%	35.8	2.79E-13	2.31E-15	2.91E-14	1.48E-13	9.87E-14	9.49E-16	3.35E-13	9.44E-15
399	72.000%	36.0	2.52E-13	2.09E-15	2.64E-14	1.34E-13	8.93E-14	8.59E-16	3.04E-13	8.58E-15
400	72.500%	36.3	2.28E-13	1.90E-15	2.39E-14	1.21E-13	8.09E-14	7.78E-16	2.76E-13	7.80E-15
401	73.000%	36.5	2.07E-13	1.72E-15	2.16E-14	1.10E-13	7.33E-14	7.05E-16	2.52E-13	7.10E-15
402	73.500%	36.8	1.88E-13	1.56E-15	1.96E-14	9.94E-14	6.65E-14	6.39E-16	2.29E-13	6.46E-15
403	74.000%	37.0	1.70E-13	1.41E-15	1.78E-14	9.01E-14	6.03E-14	5.80E-16	2.08E-13	5.88E-15
404	74.500%	37.3	1.54E-13	1.28E-15	1.61E-14	8.18E-14	5.47E-14	5.26E-16	1.90E-13	5.35E-15
405	75.000%	37.5	1.40E-13	1.16E-15	1.46E-14	7.42E-14	4.97E-14	4.78E-16	1.73E-13	4.87E-15
406	75.500%	37.8	1.27E-13	1.06E-15	1.33E-14	6.74E-14	4.51E-14	4.34E-16	1.57E-13	4.44E-15
407	76.000%	38.0	1.16E-13	9.60E-16	1.21E-14	6.13E-14	4.10E-14	3.94E-16	1.43E-13	4.04E-15
408	76.500%	38.3	1.05E-13	8.73E-16	1.10E-14	5.57E-14	3.73E-14	3.58E-16	1.31E-13	3.69E-15
409	77.000%	38.5	9.56E-14	7.94E-16	9.99E-15	5.06E-14	3.39E-14	3.26E-16	1.19E-13	3.36E-15
410	77.500%	38.8	8.70E-14	7.22E-16	9.09E-15	4.61E-14	3.08E-14	2.97E-16	1.09E-13	3.06E-15
411	78.000%	39.0	7.92E-14	6.57E-16	8.28E-15	4.19E-14	2.81E-14	2.70E-16	9.90E-14	2.79E-15
412	78.500%	39.3	7.21E-14	5.99E-16	7.54E-15	3.82E-14	2.56E-14	2.46E-16	9.03E-14	2.55E-15
413	79.000%	39.5	6.57E-14	5.45E-16	6.87E-15	3.48E-14	2.33E-14	2.24E-16	8.23E-14	2.32E-15
414	79.500%	39.8	5.99E-14	4.97E-16	6.26E-15	3.17E-14	2.12E-14	2.04E-16	7.51E-14	2.12E-15
415	80.000%	40.0	5.41E-14	4.49E-16	5.65E-15	2.86E-14	1.92E-14	1.84E-16	6.85E-14	1.93E-15
416	80.500%	40.3	4.93E-14	4.09E-16	5.15E-15	2.61E-14	1.75E-14	1.68E-16	6.26E-14	1.77E-15
417	81.000%	40.5	4.50E-14	3.74E-16	4.70E-15	2.38E-14	1.59E-14	1.53E-16	5.72E-14	1.61E-15
418	81.500%	40.8	4.11E-14	3.41E-16	4.29E-15	2.18E-14	1.46E-14	1.40E-16	5.23E-14	1.48E-15
419	82.000%	41.0	3.75E-14	3.11E-16	3.92E-15	1.99E-14	1.33E-14	1.28E-16	4.77E-14	1.35E-15

	A	B	C	D	E	F	G	H	I	J
420	82.500%	41.3	3.43E-14	2.85E-16	3.58E-15	1.82E-14	1.21E-14	1.17E-16	4.35E-14	1.23E-15
421	83.000%	41.5	3.13E-14	2.60E-16	3.27E-15	1.66E-14	1.11E-14	1.07E-16	3.97E-14	1.12E-15
422	83.500%	41.8	2.87E-14	2.38E-16	2.99E-15	1.52E-14	1.01E-14	9.76E-17	3.63E-14	1.02E-15
423	84.000%	42.0	2.62E-14	2.17E-16	2.74E-15	1.39E-14	9.28E-15	8.93E-17	3.31E-14	9.33E-16
424	84.500%	42.3	2.40E-14	1.99E-16	2.51E-15	1.27E-14	8.50E-15	8.17E-17	3.01E-14	8.49E-16
425	85.000%	42.5	2.20E-14	1.82E-16	2.29E-15	1.16E-14	7.78E-15	7.48E-17	2.74E-14	7.74E-16
426	85.500%	42.8	2.01E-14	1.67E-16	2.10E-15	1.06E-14	7.12E-15	6.85E-17	2.50E-14	7.05E-16
427	86.000%	43.0	1.84E-14	1.53E-16	1.92E-15	9.75E-15	6.52E-15	6.28E-17	2.28E-14	6.42E-16
428	86.500%	43.3	1.69E-14	1.40E-16	1.76E-15	8.94E-15	5.98E-15	5.75E-17	2.07E-14	5.82E-16
429	87.000%	43.5	1.55E-14	1.28E-16	1.62E-15	8.19E-15	5.48E-15	5.27E-17	1.89E-14	5.32E-16
430	87.500%	43.8	1.42E-14	1.18E-16	1.48E-15	7.51E-15	5.03E-15	4.84E-17	1.71E-14	4.82E-16
431	88.000%	44.0	1.30E-14	1.08E-16	1.36E-15	6.89E-15	4.61E-15	4.44E-17	1.55E-14	4.38E-16
432	88.500%	44.3	1.19E-14	9.92E-17	1.25E-15	6.33E-15	4.23E-15	4.07E-17	1.40E-14	3.95E-16
433	89.000%	44.5	1.10E-14	9.10E-17	1.15E-15	5.81E-15	3.89E-15	3.74E-17	1.27E-14	3.57E-16
434	89.500%	44.8	1.01E-14	8.36E-17	1.05E-15	5.33E-15	3.57E-15	3.43E-17	1.14E-14	3.23E-16
435	90.000%	45.0	9.22E-15	7.65E-17	9.63E-16	4.88E-15	3.27E-15	3.14E-17	1.03E-14	2.91E-16
436	90.500%	45.3	8.47E-15	7.03E-17	8.85E-16	4.48E-15	3.00E-15	2.89E-17	9.33E-15	2.63E-16
437	91.000%	45.5	7.79E-15	6.46E-17	8.14E-16	4.12E-15	2.76E-15	2.65E-17	8.33E-15	2.35E-16
438	91.500%	45.8	7.16E-15	5.94E-17	7.48E-16	3.79E-15	2.54E-15	2.44E-17	7.55E-15	2.13E-16
439	92.000%	46.0	6.58E-15	5.46E-17	6.88E-16	3.49E-15	2.33E-15	2.24E-17	6.77E-15	1.91E-16
440	92.500%	46.3	6.06E-15	5.03E-17	6.34E-16	3.21E-15	2.15E-15	2.07E-17	6.00E-15	1.69E-16
441	93.000%	46.5	5.58E-15	4.63E-17	5.83E-16	2.96E-15	1.98E-15	1.90E-17	5.44E-15	1.53E-16
442	93.500%	46.8	5.14E-15	4.26E-17	5.37E-16	2.72E-15	1.82E-15	1.75E-17	4.77E-15	1.35E-16
443	94.000%	47.0	4.73E-15	3.93E-17	4.95E-16	2.51E-15	1.68E-15	1.61E-17	4.22E-15	1.19E-16
444	94.500%	47.3	4.36E-15	3.62E-17	4.55E-16	2.31E-15	1.54E-15	1.49E-17	3.66E-15	1.03E-16
445	95.000%	47.5	4.02E-15	3.34E-17	4.20E-16	2.13E-15	1.42E-15	1.37E-17	3.22E-15	9.08E-17
446	95.500%	47.8	3.71E-15	3.08E-17	3.87E-16	1.96E-15	1.31E-15	1.26E-17	2.66E-15	7.52E-17
447	96.000%	48.0	3.42E-15	2.84E-17	3.57E-16	1.81E-15	1.21E-15	1.16E-17	2.33E-15	6.58E-17
448	96.500%	48.3	3.15E-15	2.62E-17	3.30E-16	1.67E-15	1.12E-15	1.07E-17	2.00E-15	5.64E-17
449	97.000%	48.5	2.91E-15	2.42E-17	3.04E-16	1.54E-15	1.03E-15	9.92E-18	0.00E+00	0.00E+00
450	97.500%	48.8	2.69E-15	2.23E-17	2.81E-16	1.42E-15	9.52E-16	9.15E-18	0.00E+00	0.00E+00
451	98.000%	49.0	2.48E-15	2.06E-17	2.59E-16	1.31E-15	8.79E-16	8.46E-18	0.00E+00	0.00E+00
452	98.500%	49.3	2.29E-15	1.90E-17	2.39E-16	1.21E-15	8.12E-16	7.81E-18	0.00E+00	0.00E+00
453	99.000%	49.5	2.11E-15	1.75E-17	2.21E-16	1.12E-15	7.49E-16	7.20E-18	0.00E+00	0.00E+00
454	99.500%	49.8	1.96E-15	1.63E-17	2.05E-16	1.04E-15	6.95E-16	6.69E-18	0.00E+00	0.00E+00
455	100.000%	50.0	1.80E-15	1.49E-17	1.88E-16	9.53E-16	6.38E-16	6.13E-18	0.00E+00	0.00E+00
456			8.28	6.87E-02	8.65E-01	4.38E+00	2.93E+00	2.82E-02		

	A	B	C
1	Lid Thickness (mm)		95
2	Lid Radius (m)		0.71
3	Weld Circumference (m)		4.461061568
4	Total Flaws per WP - no inspection		667.5430121
5	Total Flaws per Lid - w/ RT & PT inpsection		51.71944304





	A	B	C	D	E	F	G	H	I	J
57	Frequency of various size flaws in WP shell assuming no inspection									Cumulative
58	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
59	1%	1.0	1.52E+02	1.26E+00	1.59E+01	8.04E+01	5.38E+01	5.17E-01	7.73E-01	1.76E+00
60	1.500%	1.4	2.00E+02	1.66E+00	2.09E+01	1.06E+02	7.10E+01	6.83E-01	4.73E-01	1.07E+00
61	2.000%	1.9	1.43E+02	1.19E+00	1.49E+01	7.57E+01	5.06E+01	4.87E-01	2.58E-01	5.88E-01
62	2.500%	2.4	8.16E+01	6.77E-01	8.53E+00	4.32E+01	2.89E+01	2.78E-01	1.36E-01	3.10E-01
63	3.000%	2.9	4.32E+01	3.58E-01	4.51E+00	2.29E+01	1.53E+01	1.47E-01	7.15E-02	1.63E-01
64	3.500%	3.3	2.24E+01	1.86E-01	2.34E+00	1.19E+01	7.94E+00	7.63E-02	3.79E-02	8.63E-02
65	4.000%	3.8	1.17E+01	9.67E-02	1.22E+00	6.17E+00	4.13E+00	3.97E-02	2.05E-02	4.66E-02
66	4.500%	4.3	6.14E+00	5.10E-02	6.42E-01	3.25E+00	2.18E+00	2.09E-02	1.13E-02	2.56E-02
67	5.000%	4.8	3.30E+00	2.74E-02	3.44E-01	1.75E+00	1.17E+00	1.12E-02	6.32E-03	1.44E-02
68	5.500%	5.2	1.80E+00	1.50E-02	1.88E-01	9.55E-01	6.39E-01	6.15E-03	3.62E-03	8.23E-03
69	6.000%	5.7	1.01E+00	8.35E-03	1.05E-01	5.33E-01	3.56E-01	3.43E-03	2.11E-03	4.81E-03
70	6.500%	6.2	5.72E-01	4.75E-03	5.98E-02	3.03E-01	2.03E-01	1.95E-03	1.26E-03	2.86E-03
71	7.000%	6.7	3.31E-01	2.75E-03	3.46E-02	1.76E-01	1.17E-01	1.13E-03	7.59E-04	1.73E-03
72	7.500%	7.1	1.95E-01	1.62E-03	2.04E-02	1.03E-01	6.92E-02	6.66E-04	4.66E-04	1.06E-03
73	8.000%	7.6	1.17E-01	9.72E-04	1.22E-02	6.20E-02	4.15E-02	3.99E-04	2.91E-04	6.61E-04
74	8.500%	8.1	7.13E-02	5.92E-04	7.45E-03	3.78E-02	2.53E-02	2.43E-04	1.84E-04	4.18E-04
75	9.000%	8.6	4.41E-02	3.66E-04	4.60E-03	2.33E-02	1.56E-02	1.50E-04	1.18E-04	2.68E-04
76	9.500%	9.0	2.76E-02	2.29E-04	2.88E-03	1.46E-02	9.78E-03	9.41E-05	7.65E-05	1.74E-04
77	10.000%	9.5	1.75E-02	1.45E-04	1.83E-03	9.28E-03	6.21E-03	5.97E-05	5.02E-05	1.14E-04
78	10.500%	10.0	1.13E-02	9.35E-05	1.18E-03	5.96E-03	3.99E-03	3.84E-05	3.33E-05	7.59E-05
79	11.000%	10.5	7.32E-03	6.08E-05	7.65E-04	3.88E-03	2.59E-03	2.50E-05	2.24E-05	5.09E-05
80	11.500%	10.9	4.81E-03	4.00E-05	5.03E-04	2.55E-03	1.71E-03	1.64E-05	1.52E-05	3.45E-05
81	12.000%	11.4	3.20E-03	2.65E-05	3.34E-04	1.69E-03	1.13E-03	1.09E-05	1.04E-05	2.36E-05
82	12.500%	11.9	2.15E-03	1.78E-05	2.24E-04	1.14E-03	7.60E-04	7.31E-06	7.16E-06	1.63E-05
83	13.000%	12.4	1.45E-03	1.21E-05	1.52E-04	7.69E-04	5.15E-04	4.95E-06	4.98E-06	1.13E-05
84	13.500%	12.8	9.93E-04	8.24E-06	1.04E-04	5.26E-04	3.52E-04	3.38E-06	3.50E-06	7.96E-06
85	14.000%	13.3	6.84E-04	5.68E-06	7.15E-05	3.62E-04	2.42E-04	2.33E-06	2.47E-06	5.63E-06
86	14.500%	13.8	4.75E-04	3.94E-06	4.96E-05	2.52E-04	1.68E-04	1.62E-06	1.76E-06	4.01E-06
87	15.000%	14.3	3.33E-04	2.76E-06	3.47E-05	1.76E-04	1.18E-04	1.13E-06	1.26E-06	2.87E-06
88	15.500%	14.7	2.34E-04	1.95E-06	2.45E-05	1.24E-04	8.31E-05	7.99E-07	9.12E-07	2.07E-06
89	16.000%	15.2	1.66E-04	1.38E-06	1.74E-05	8.82E-05	5.90E-05	5.67E-07	6.63E-07	1.51E-06
90	16.500%	15.7	1.19E-04	9.88E-07	1.24E-05	6.30E-05	4.22E-05	4.06E-07	4.84E-07	1.10E-06
91	17.000%	16.2	8.56E-05	7.11E-07	8.94E-06	4.53E-05	3.03E-05	2.92E-07	3.56E-07	8.10E-07
92	17.500%	16.6	6.20E-05	5.14E-07	6.47E-06	3.28E-05	2.20E-05	2.11E-07	2.63E-07	5.99E-07
93	18.000%	17.1	4.51E-05	3.74E-07	4.71E-06	2.39E-05	1.60E-05	1.54E-07	1.96E-07	4.45E-07
94	18.500%	17.6	3.30E-05	2.74E-07	3.45E-06	1.75E-05	1.17E-05	1.13E-07	1.46E-07	3.33E-07
95	19.000%	18.1	2.43E-05	2.02E-07	2.54E-06	1.29E-05	8.62E-06	8.29E-08	1.10E-07	2.50E-07
96	19.500%	18.5	1.80E-05	1.49E-07	1.88E-06	9.53E-06	6.38E-06	6.13E-08	8.28E-08	1.88E-07
97	20.000%	19.0	1.34E-05	1.11E-07	1.40E-06	7.09E-06	4.74E-06	4.56E-08	6.28E-08	1.43E-07
98	20.500%	19.5	1.00E-05	8.30E-08	1.05E-06	5.30E-06	3.54E-06	3.41E-08	4.78E-08	1.09E-07
99	21.000%	20.0	7.51E-06	6.24E-08	7.85E-07	3.98E-06	2.66E-06	2.56E-08	3.65E-08	8.31E-08
100	21.500%	20.4	5.67E-06	4.70E-08	5.92E-07	3.00E-06	2.01E-06	1.93E-08	2.80E-08	6.38E-08
101	22.000%	20.9	4.29E-06	3.56E-08	4.49E-07	2.27E-06	1.52E-06	1.46E-08	2.16E-08	4.92E-08
102	22.500%	21.4	3.27E-06	2.71E-08	3.41E-07	1.73E-06	1.16E-06	1.11E-08	1.67E-08	3.80E-08
103	23.000%	21.9	2.49E-06	2.07E-08	2.61E-07	1.32E-06	8.84E-07	8.50E-09	1.30E-08	2.95E-08
104	23.500%	22.3	1.91E-06	1.59E-08	2.00E-07	1.01E-06	6.78E-07	6.52E-09	1.01E-08	2.30E-08
105	24.000%	22.8	1.47E-06	1.22E-08	1.54E-07	7.80E-07	5.22E-07	5.02E-09	7.91E-09	1.80E-08
106	24.500%	23.3	1.14E-06	9.44E-09	1.19E-07	6.02E-07	4.03E-07	3.88E-09	6.21E-09	1.41E-08
107	25.000%	23.8	8.82E-07	7.32E-09	9.22E-08	4.67E-07	3.12E-07	3.01E-09	4.89E-09	1.11E-08
108	25.500%	24.2	6.86E-07	5.70E-09	7.17E-08	3.63E-07	2.43E-07	2.34E-09	3.86E-09	8.79E-09
109	26.000%	24.7	5.36E-07	4.45E-09	5.60E-08	2.84E-07	1.90E-07	1.83E-09	3.06E-09	6.96E-09
110	26.500%	25.2	4.20E-07	3.48E-09	4.38E-08	2.22E-07	1.49E-07	1.43E-09	2.43E-09	5.53E-09
111	27.000%	25.7	3.30E-07	2.74E-09	3.44E-08	1.75E-07	1.17E-07	1.12E-09	1.94E-09	4.41E-09
112	27.500%	26.1	2.60E-07	2.16E-09	2.71E-08	1.38E-07	9.20E-08	8.85E-10	1.55E-09	3.52E-09

	A	B	C	D	E	F	G	H	I	J
113	28.000%	26.6	2.05E-07	1.70E-09	2.15E-08	1.09E-07	7.27E-08	7.00E-10	1.24E-09	2.82E-09
114	28.500%	27.1	1.63E-07	1.35E-09	1.70E-08	8.62E-08	5.77E-08	5.55E-10	9.97E-10	2.27E-09
115	29.000%	27.6	1.29E-07	1.07E-09	1.35E-08	6.85E-08	4.58E-08	4.41E-10	8.03E-10	1.83E-09
116	29.500%	28.0	1.03E-07	8.56E-10	1.08E-08	5.46E-08	3.65E-08	3.51E-10	6.49E-10	1.48E-09
117	30.000%	28.5	8.24E-08	6.84E-10	8.61E-09	4.36E-08	2.92E-08	2.81E-10	5.25E-10	1.19E-09
118	30.500%	29.0	6.61E-08	5.48E-10	6.90E-09	3.50E-08	2.34E-08	2.25E-10	4.26E-10	9.69E-10
119	31.000%	29.5	5.31E-08	4.40E-10	5.54E-09	2.81E-08	1.88E-08	1.81E-10	3.47E-10	7.89E-10
120	31.500%	29.9	4.27E-08	3.55E-10	4.47E-09	2.26E-08	1.51E-08	1.46E-10	2.83E-10	6.43E-10
121	32.000%	30.4	3.45E-08	2.86E-10	3.61E-09	1.83E-08	1.22E-08	1.18E-10	2.31E-10	5.25E-10
122	32.500%	30.9	2.79E-08	2.32E-10	2.92E-09	1.48E-08	9.89E-09	9.51E-11	1.89E-10	4.30E-10
123	33.000%	31.4	2.26E-08	1.88E-10	2.37E-09	1.20E-08	8.02E-09	7.72E-11	1.55E-10	3.53E-10
124	33.500%	31.8	1.84E-08	1.53E-10	1.92E-09	9.75E-09	6.52E-09	6.27E-11	1.28E-10	2.90E-10
125	34.000%	32.3	1.50E-08	1.24E-10	1.57E-09	7.94E-09	5.31E-09	5.11E-11	1.05E-10	2.39E-10
126	34.500%	32.8	1.22E-08	1.02E-10	1.28E-09	6.48E-09	4.34E-09	4.17E-11	8.68E-11	1.98E-10
127	35.000%	33.3	1.00E-08	8.31E-11	1.05E-09	5.30E-09	3.55E-09	3.41E-11	7.18E-11	1.63E-10
128	35.500%	33.7	8.21E-09	6.81E-11	8.58E-10	4.35E-09	2.91E-09	2.80E-11	5.95E-11	1.35E-10
129	36.000%	34.2	6.74E-09	5.60E-11	7.05E-10	3.57E-09	2.39E-09	2.30E-11	4.94E-11	1.12E-10
130	36.500%	34.7	5.55E-09	4.61E-11	5.80E-10	2.94E-09	1.97E-09	1.89E-11	4.11E-11	9.36E-11
131	37.000%	35.2	4.58E-09	3.80E-11	4.78E-10	2.42E-09	1.62E-09	1.56E-11	3.43E-11	7.80E-11
132	37.500%	35.6	3.78E-09	3.14E-11	3.95E-10	2.00E-09	1.34E-09	1.29E-11	2.86E-11	6.51E-11
133	38.000%	36.1	3.13E-09	2.60E-11	3.27E-10	1.66E-09	1.11E-09	1.07E-11	2.39E-11	5.44E-11
134	38.500%	36.6	2.59E-09	2.15E-11	2.71E-10	1.37E-09	9.19E-10	8.84E-12	2.00E-11	4.56E-11
135	39.000%	37.1	2.15E-09	1.79E-11	2.25E-10	1.14E-09	7.63E-10	7.34E-12	1.68E-11	3.82E-11
136	39.500%	37.5	1.79E-09	1.49E-11	1.87E-10	9.49E-10	6.35E-10	6.11E-12	1.41E-11	3.21E-11
137	40.000%	38.0	1.49E-09	1.24E-11	1.56E-10	7.91E-10	5.29E-10	5.09E-12	1.19E-11	2.70E-11
138	40.500%	38.5	1.25E-09	1.03E-11	1.30E-10	6.60E-10	4.42E-10	4.25E-12	1.00E-11	2.28E-11
139	41.000%	39.0	1.04E-09	8.65E-12	1.09E-10	5.52E-10	3.69E-10	3.55E-12	8.45E-12	1.92E-11
140	41.500%	39.4	8.73E-10	7.24E-12	9.12E-11	4.62E-10	3.09E-10	2.97E-12	7.15E-12	1.63E-11
141	42.000%	39.9	7.32E-10	6.08E-12	7.65E-11	3.88E-10	2.59E-10	2.49E-12	6.05E-12	1.38E-11
142	42.500%	40.4	6.15E-10	5.10E-12	6.43E-11	3.26E-10	2.18E-10	2.10E-12	5.13E-12	1.17E-11
143	43.000%	40.9	5.17E-10	4.29E-12	5.41E-11	2.74E-10	1.83E-10	1.76E-12	4.35E-12	9.90E-12
144	43.500%	41.3	4.36E-10	3.62E-12	4.55E-11	2.31E-10	1.54E-10	1.48E-12	3.70E-12	8.42E-12
145	44.000%	41.8	3.68E-10	3.05E-12	3.84E-11	1.95E-10	1.30E-10	1.25E-12	3.15E-12	7.17E-12
146	44.500%	42.3	3.11E-10	2.58E-12	3.24E-11	1.64E-10	1.10E-10	1.06E-12	2.69E-12	6.11E-12
147	45.000%	42.8	2.63E-10	2.18E-12	2.75E-11	1.39E-10	9.31E-11	8.96E-13	2.29E-12	5.21E-12
148	45.500%	43.2	2.23E-10	1.85E-12	2.33E-11	1.18E-10	7.88E-11	7.58E-13	1.96E-12	4.45E-12
149	46.000%	43.7	1.89E-10	1.57E-12	1.97E-11	1.00E-10	6.69E-11	6.44E-13	1.68E-12	3.81E-12
150	46.500%	44.2	1.60E-10	1.33E-12	1.68E-11	8.49E-11	5.68E-11	5.47E-13	1.44E-12	3.26E-12
151	47.000%	44.7	1.36E-10	1.13E-12	1.42E-11	7.22E-11	4.83E-11	4.65E-13	1.23E-12	2.80E-12
152	47.500%	45.1	1.16E-10	9.64E-13	1.21E-11	6.15E-11	4.11E-11	3.96E-13	1.06E-12	2.40E-12
153	48.000%	45.6	9.91E-11	8.22E-13	1.04E-11	5.25E-11	3.51E-11	3.38E-13	9.09E-13	2.07E-12
154	48.500%	46.1	8.45E-11	7.01E-13	8.83E-12	4.47E-11	2.99E-11	2.88E-13	7.82E-13	1.78E-12
155	49.000%	46.6	7.23E-11	6.00E-13	7.55E-12	3.83E-11	2.56E-11	2.46E-13	6.74E-13	1.53E-12
156	49.500%	47.0	6.18E-11	5.13E-13	6.46E-12	3.27E-11	2.19E-11	2.11E-13	5.81E-13	1.32E-12
157	50.000%	47.5	5.30E-11	4.40E-13	5.54E-12	2.81E-11	1.88E-11	1.81E-13	5.02E-13	1.14E-12
158	50.500%	48.0	4.54E-11	3.77E-13	4.75E-12	2.41E-11	1.61E-11	1.55E-13	4.34E-13	9.87E-13
159	51.000%	48.5	3.90E-11	3.24E-13	4.07E-12	2.06E-11	1.38E-11	1.33E-13	3.75E-13	8.54E-13
160	51.500%	48.9	3.35E-11	2.78E-13	3.50E-12	1.77E-11	1.19E-11	1.14E-13	3.25E-13	7.40E-13
161	52.000%	49.4	2.88E-11	2.39E-13	3.01E-12	1.53E-11	1.02E-11	9.82E-14	2.82E-13	6.42E-13
162	52.500%	49.9	2.49E-11	2.07E-13	2.60E-12	1.32E-11	8.82E-12	8.49E-14	2.45E-13	5.57E-13
163	53.000%	50.4	2.14E-11	1.78E-13	2.24E-12	1.13E-11	7.59E-12	7.30E-14	2.13E-13	4.84E-13
164	53.500%	50.8	1.85E-11	1.53E-13	1.93E-12	9.77E-12	6.54E-12	6.29E-14	1.85E-13	4.21E-13
165	54.000%	51.3	1.60E-11	1.33E-13	1.67E-12	8.48E-12	5.67E-12	5.46E-14	1.61E-13	3.66E-13
166	54.500%	51.8	1.39E-11	1.15E-13	1.45E-12	7.34E-12	4.91E-12	4.72E-14	1.40E-13	3.19E-13
167	55.000%	52.3	1.19E-11	9.90E-14	1.25E-12	6.32E-12	4.23E-12	4.07E-14	1.22E-13	2.79E-13
168	55.500%	52.7	1.04E-11	8.61E-14	1.08E-12	5.49E-12	3.68E-12	3.54E-14	1.07E-13	2.43E-13

	A	B	C	D	E	F	G	H	I	J
169	56.000%	53.2	8.97E-12	7.44E-14	9.37E-13	4.75E-12	3.18E-12	3.06E-14	9.34E-14	2.12E-13
170	56.500%	53.7	7.86E-12	6.52E-14	8.21E-13	4.16E-12	2.78E-12	2.68E-14	8.16E-14	1.86E-13
171	57.000%	54.2	6.82E-12	5.66E-14	7.12E-13	3.61E-12	2.42E-12	2.32E-14	7.15E-14	1.63E-13
172	57.500%	54.6	5.85E-12	4.86E-14	6.12E-13	3.10E-12	2.07E-12	2.00E-14	6.26E-14	1.42E-13
173	58.000%	55.1	5.19E-12	4.31E-14	5.42E-13	2.75E-12	1.84E-12	1.77E-14	5.48E-14	1.25E-13
174	58.500%	55.6	4.45E-12	3.69E-14	4.65E-13	2.35E-12	1.58E-12	1.52E-14	4.82E-14	1.10E-13
175	59.000%	56.1	3.93E-12	3.26E-14	4.10E-13	2.08E-12	1.39E-12	1.34E-14	4.24E-14	9.65E-14
176	59.500%	56.5	3.41E-12	2.83E-14	3.56E-13	1.81E-12	1.21E-12	1.16E-14	3.73E-14	8.49E-14
177	60.000%	57.0	2.96E-12	2.46E-14	3.10E-13	1.57E-12	1.05E-12	1.01E-14	3.28E-14	7.45E-14
178	60.500%	57.5	2.59E-12	2.15E-14	2.71E-13	1.37E-12	9.19E-13	8.84E-15	2.89E-14	6.57E-14
179	61.000%	58.0	2.30E-12	1.91E-14	2.40E-13	1.22E-12	8.14E-13	7.83E-15	2.54E-14	5.78E-14
180	61.500%	58.4	2.00E-12	1.66E-14	2.09E-13	1.06E-12	7.09E-13	6.82E-15	2.24E-14	5.10E-14
181	62.000%	58.9	1.78E-12	1.48E-14	1.86E-13	9.42E-13	6.30E-13	6.06E-15	1.98E-14	4.50E-14
182	62.500%	59.4	1.56E-12	1.29E-14	1.63E-13	8.24E-13	5.51E-13	5.30E-15	1.73E-14	3.94E-14
183	63.000%	59.9	1.33E-12	1.11E-14	1.39E-13	7.06E-13	4.73E-13	4.55E-15	1.54E-14	3.51E-14
184	63.500%	60.3	1.19E-12	9.84E-15	1.24E-13	6.28E-13	4.20E-13	4.04E-15	1.37E-14	3.11E-14
185	64.000%	60.8	1.04E-12	8.61E-15	1.08E-13	5.49E-13	3.68E-13	3.54E-15	1.21E-14	2.75E-14
186	64.500%	61.3	8.89E-13	7.38E-15	9.29E-14	4.71E-13	3.15E-13	3.03E-15	1.08E-14	2.45E-14
187	65.000%	61.8	8.15E-13	6.77E-15	8.52E-14	4.32E-13	2.89E-13	2.78E-15	9.55E-15	2.17E-14
188	65.500%	62.2	7.41E-13	6.15E-15	7.74E-14	3.92E-13	2.63E-13	2.53E-15	8.44E-15	1.92E-14
189	66.000%	62.7	5.93E-13	4.92E-15	6.20E-14	3.14E-13	2.10E-13	2.02E-15	7.44E-15	1.69E-14
190	66.500%	63.2	5.93E-13	4.92E-15	6.20E-14	3.14E-13	2.10E-13	2.02E-15	6.44E-15	1.46E-14
191	67.000%	63.7	4.45E-13	3.69E-15	4.65E-14	2.35E-13	1.58E-13	1.52E-15	5.88E-15	1.34E-14
192	67.500%	64.1	4.45E-13	3.69E-15	4.65E-14	2.35E-13	1.58E-13	1.52E-15	5.22E-15	1.19E-14
193	68.000%	64.6	3.71E-13	3.08E-15	3.87E-14	1.96E-13	1.31E-13	1.26E-15	4.66E-15	1.06E-14
194	68.500%	65.1	3.71E-13	3.08E-15	3.87E-14	1.96E-13	1.31E-13	1.26E-15	4.11E-15	9.34E-15
195	69.000%	65.6	2.96E-13	2.46E-15	3.10E-14	1.57E-13	1.05E-13	1.01E-15	3.66E-15	8.33E-15
196	69.500%	66.0	2.96E-13	2.46E-15	3.10E-14	1.57E-13	1.05E-13	1.01E-15	3.33E-15	7.58E-15
197	70.000%	66.5	2.22E-13	1.85E-15	2.32E-14	1.18E-13	7.88E-14	7.58E-16	2.89E-15	6.57E-15
198	70.500%	67.0	2.22E-13	1.85E-15	2.32E-14	1.18E-13	7.88E-14	7.58E-16	2.55E-15	5.81E-15
199	71.000%	67.5	1.48E-13	1.23E-15	1.55E-14	7.85E-14	5.25E-14	5.05E-16	2.33E-15	5.30E-15
200	71.500%	67.9	1.48E-13	1.23E-15	1.55E-14	7.85E-14	5.25E-14	5.05E-16	2.11E-15	4.80E-15
201	72.000%	68.4	1.48E-13	1.23E-15	1.55E-14	7.85E-14	5.25E-14	5.05E-16	2.00E-15	4.55E-15
202	72.500%	68.9	1.26E-12	1.05E-14	1.32E-13	6.67E-13	4.46E-13	4.29E-15	0.00E+00	0.00E+00
203	73.000%	69.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
204	73.500%	69.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
205	74.000%	70.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
206	74.500%	70.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
207	75.000%	71.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
208	75.500%	71.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
209	76.000%	72.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
210	76.500%	72.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
211	77.000%	73.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
212	77.500%	73.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
213	78.000%	74.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
214	78.500%	74.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
215	79.000%	75.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
216	79.500%	75.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
217	80.000%	76.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
218	80.500%	76.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
219	81.000%	77.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
220	81.500%	77.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
221	82.000%	77.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
222	82.500%	78.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
223	83.000%	78.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
224	83.500%	79.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
225	84.000%	79.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
226	84.500%	80.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
227	85.000%	80.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
228	85.500%	81.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
229	86.000%	81.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
230	86.500%	82.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
231	87.000%	82.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
232	87.500%	83.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
233	88.000%	83.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
234	88.500%	84.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
235	89.000%	84.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
236	89.500%	85.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
237	90.000%	85.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
238	90.500%	86.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
239	91.000%	86.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
240	91.500%	86.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
241	92.000%	87.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
242	92.500%	87.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
243	93.000%	88.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
244	93.500%	88.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
245	94.000%	89.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
246	94.500%	89.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
247	95.000%	90.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
248	95.500%	90.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
249	96.000%	91.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
250	96.500%	91.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
251	97.000%	92.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
252	97.500%	92.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
253	98.000%	93.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
254	98.500%	93.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
255	99.000%	94.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
256	99.500%	94.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
257	100.000%	95.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
258		Flaws/Lid	6.68E+02	5.54E+00	6.98E+01	3.53E+02	2.36E+02	2.27E+00		
259										
260										
261	Frequency of various size flaws in WP shell assuming RT, PT, and UT exams (Bottom Lid)									Cumulative
262	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
263	1%	1.0	1.01E+01	8.37E-02	1.05E+00	5.34E+00	3.57E+00	3.44E-02	6.33E-01	5.93E-02
264	1.500%	1.4	9.81E+00	8.14E-02	1.02E+00	5.19E+00	3.47E+00	3.34E-02	2.76E-01	2.59E-02
265	2.000%	1.9	4.72E+00	3.92E-02	4.93E-01	2.50E+00	1.67E+00	1.61E-02	1.05E-01	9.81E-03
266	2.500%	2.4	1.91E+00	1.58E-02	1.99E-01	1.01E+00	6.75E-01	6.50E-03	3.53E-02	3.31E-03
267	3.000%	2.9	6.45E-01	5.36E-03	6.74E-02	3.42E-01	2.29E-01	2.20E-03	1.18E-02	1.11E-03
268	3.500%	3.3	2.13E-01	1.77E-03	2.23E-02	1.13E-01	7.56E-02	7.27E-04	4.08E-03	3.82E-04
269	4.000%	3.8	7.10E-02	5.90E-04	7.42E-03	3.76E-02	2.52E-02	2.42E-04	1.50E-03	1.40E-04
270	4.500%	4.3	2.64E-02	2.19E-04	2.76E-03	1.40E-02	9.34E-03	8.99E-05	5.38E-04	5.04E-05
271	5.000%	4.8	9.23E-03	7.66E-05	9.65E-04	4.89E-03	3.27E-03	3.15E-05	2.02E-04	1.89E-05
272	5.500%	5.2	3.33E-03	2.76E-05	3.48E-04	1.76E-03	1.18E-03	1.14E-05	8.08E-05	7.57E-06
273	6.000%	5.7	1.35E-03	1.12E-05	1.41E-04	7.13E-04	4.77E-04	4.59E-06	3.18E-05	2.98E-06
274	6.500%	6.2	5.18E-04	4.30E-06	5.41E-05	2.74E-04	1.84E-04	1.77E-06	1.30E-05	1.21E-06
275	7.000%	6.7	2.06E-04	1.71E-06	2.15E-05	1.09E-04	7.28E-05	7.01E-07	5.49E-06	5.14E-07
276	7.500%	7.1	8.43E-05	6.99E-07	8.80E-06	4.46E-05	2.98E-05	2.87E-07	2.42E-06	2.27E-07
277	8.000%	7.6	3.56E-05	2.96E-07	3.72E-06	1.89E-05	1.26E-05	1.21E-07	1.13E-06	1.05E-07
278	8.500%	8.1	1.66E-05	1.37E-07	1.73E-06	8.77E-06	5.86E-06	5.64E-08	5.23E-07	4.90E-08
279	9.000%	8.6	7.40E-06	6.14E-08	7.73E-07	3.92E-06	2.62E-06	2.52E-08	2.54E-07	2.38E-08
280	9.500%	9.0	3.40E-06	2.82E-08	3.55E-07	1.80E-06	1.20E-06	1.16E-08	1.30E-07	1.22E-08

	A	B	C	D	E	F	G	H	I	J
281	10.000%	9.5	1.60E-06	1.33E-08	1.68E-07	8.49E-07	5.68E-07	5.47E-09	7.17E-08	6.72E-09
282	10.500%	10.0	8.21E-07	6.82E-09	8.58E-08	4.35E-07	2.91E-07	2.80E-09	4.18E-08	3.92E-09
283	11.000%	10.5	5.05E-07	4.19E-09	5.28E-08	2.68E-07	1.79E-07	1.72E-09	2.34E-08	2.20E-09
284	11.500%	10.9	3.32E-07	2.76E-09	3.47E-08	1.76E-07	1.18E-07	1.13E-09	1.14E-08	1.06E-09
285	12.000%	11.4	1.31E-07	1.09E-09	1.37E-08	6.93E-08	4.64E-08	4.46E-10	6.59E-09	6.18E-10
286	12.500%	11.9	8.78E-08	7.29E-10	9.17E-09	4.65E-08	3.11E-08	2.99E-10	3.40E-09	3.19E-10
287	13.000%	12.4	3.73E-08	3.09E-10	3.90E-09	1.97E-08	1.32E-08	1.27E-10	2.04E-09	1.91E-10
288	13.500%	12.8	2.55E-08	2.11E-10	2.66E-09	1.35E-08	9.02E-09	8.68E-11	1.12E-09	1.05E-10
289	14.000%	13.3	1.16E-08	9.65E-11	1.21E-09	6.15E-09	4.12E-09	3.96E-11	6.94E-10	6.51E-11
290	14.500%	13.8	8.07E-09	6.70E-11	8.44E-10	4.28E-09	2.86E-09	2.75E-11	4.01E-10	3.75E-11
291	15.000%	14.3	3.95E-09	3.28E-11	4.13E-10	2.09E-09	1.40E-09	1.35E-11	2.57E-10	2.41E-11
292	15.500%	14.7	2.78E-09	2.31E-11	2.91E-10	1.47E-09	9.86E-10	9.49E-12	1.56E-10	1.46E-11
293	16.000%	15.2	1.45E-09	1.21E-11	1.52E-10	7.69E-10	5.14E-10	4.95E-12	1.03E-10	9.65E-12
294	16.500%	15.7	1.04E-09	8.61E-12	1.08E-10	5.50E-10	3.68E-10	3.54E-12	6.53E-11	6.12E-12
295	17.000%	16.2	5.75E-10	4.77E-12	6.00E-11	3.04E-10	2.04E-10	1.96E-12	4.44E-11	4.16E-12
296	17.500%	16.6	4.16E-10	3.45E-12	4.35E-11	2.20E-10	1.47E-10	1.42E-12	2.93E-11	2.74E-12
297	18.000%	17.1	2.43E-10	2.02E-12	2.54E-11	1.29E-10	8.61E-11	8.28E-13	2.04E-11	1.91E-12
298	18.500%	17.6	1.78E-10	1.48E-12	1.86E-11	9.42E-11	6.30E-11	6.06E-13	1.39E-11	1.31E-12
299	19.000%	18.1	1.09E-10	9.05E-13	1.14E-11	5.78E-11	3.86E-11	3.72E-13	9.98E-12	9.35E-13
300	19.500%	18.5	8.07E-11	6.70E-13	8.43E-12	4.27E-11	2.86E-11	2.75E-13	7.04E-12	6.60E-13
301	20.000%	19.0	5.16E-11	4.28E-13	5.39E-12	2.73E-11	1.83E-11	1.76E-13	5.16E-12	4.84E-13
302	20.500%	19.5	3.86E-11	3.20E-13	4.03E-12	2.04E-11	1.37E-11	1.31E-13	3.76E-12	3.52E-13
303	21.000%	20.0	2.90E-11	2.40E-13	3.03E-12	1.53E-11	1.03E-11	9.87E-14	2.71E-12	2.54E-13
304	21.500%	20.4	1.93E-11	1.60E-13	2.02E-12	1.02E-11	6.83E-12	6.57E-14	2.01E-12	1.88E-13
305	22.000%	20.9	1.46E-11	1.21E-13	1.53E-12	7.74E-12	5.18E-12	4.98E-14	1.47E-12	1.38E-13
306	22.500%	21.4	1.00E-11	8.34E-14	1.05E-12	5.32E-12	3.56E-12	3.42E-14	1.11E-12	1.04E-13
307	23.000%	21.9	7.67E-12	6.37E-14	8.02E-13	4.06E-12	2.72E-12	2.61E-14	8.30E-13	7.78E-14
308	23.500%	22.3	5.42E-12	4.49E-14	5.66E-13	2.87E-12	1.92E-12	1.85E-14	6.33E-13	5.93E-14
309	24.000%	22.8	4.17E-12	3.46E-14	4.36E-13	2.21E-12	1.48E-12	1.42E-14	4.82E-13	4.51E-14
310	24.500%	23.3	3.01E-12	2.50E-14	3.15E-13	1.59E-12	1.07E-12	1.03E-14	3.72E-13	3.49E-14
311	25.000%	23.8	2.33E-12	1.94E-14	2.44E-13	1.24E-12	8.27E-13	7.96E-15	2.87E-13	2.69E-14
312	25.500%	24.2	1.72E-12	1.43E-14	1.80E-13	9.11E-13	6.09E-13	5.86E-15	2.25E-13	2.10E-14
313	26.000%	24.7	1.34E-12	1.11E-14	1.40E-13	7.11E-13	4.75E-13	4.57E-15	1.76E-13	1.65E-14
314	26.500%	25.2	1.01E-12	8.34E-15	1.05E-13	5.32E-13	3.56E-13	3.43E-15	1.39E-13	1.30E-14
315	27.000%	25.7	7.90E-13	6.55E-15	8.25E-14	4.18E-13	2.80E-13	2.69E-15	1.10E-13	1.03E-14
316	27.500%	26.1	6.22E-13	5.17E-15	6.50E-14	3.30E-13	2.20E-13	2.12E-15	8.77E-14	8.22E-15
317	28.000%	26.6	4.92E-13	4.08E-15	5.14E-14	2.60E-13	1.74E-13	1.68E-15	6.97E-14	6.53E-15
318	28.500%	27.1	3.90E-13	3.24E-15	4.07E-14	2.06E-13	1.38E-13	1.33E-15	5.55E-14	5.20E-15
319	29.000%	27.6	3.10E-13	2.57E-15	3.24E-14	1.64E-13	1.10E-13	1.06E-15	4.43E-14	4.15E-15
320	29.500%	28.0	2.47E-13	2.05E-15	2.58E-14	1.31E-13	8.75E-14	8.42E-16	3.53E-14	3.31E-15
321	30.000%	28.5	1.97E-13	1.64E-15	2.06E-14	1.05E-13	7.00E-14	6.73E-16	2.82E-14	2.64E-15
322	30.500%	29.0	1.58E-13	1.31E-15	1.65E-14	8.38E-14	5.61E-14	5.39E-16	2.23E-14	2.09E-15
323	31.000%	29.5	1.27E-13	1.06E-15	1.33E-14	6.73E-14	4.50E-14	4.33E-16	1.78E-14	1.66E-15
324	31.500%	29.9	1.02E-13	8.50E-16	1.07E-14	5.42E-14	3.63E-14	3.49E-16	1.41E-14	1.32E-15
325	32.000%	30.4	7.28E-14	6.04E-16	7.61E-15	3.86E-14	2.58E-14	2.48E-16	1.14E-14	1.07E-15
326	32.500%	30.9	5.89E-14	4.89E-16	6.16E-15	3.12E-14	2.09E-14	2.01E-16	9.33E-15	8.74E-16
327	33.000%	31.4	4.78E-14	3.97E-16	4.99E-15	2.53E-14	1.69E-14	1.63E-16	7.55E-15	7.07E-16
328	33.500%	31.8	3.88E-14	3.22E-16	4.06E-15	2.06E-14	1.38E-14	1.32E-16	6.11E-15	5.72E-16
329	34.000%	32.3	3.16E-14	2.63E-16	3.31E-15	1.68E-14	1.12E-14	1.08E-16	4.88E-15	4.58E-16
330	34.500%	32.8	2.58E-14	2.14E-16	2.70E-15	1.37E-14	9.15E-15	8.80E-17	4.00E-15	3.74E-16
331	35.000%	33.3	2.11E-14	1.75E-16	2.21E-15	1.12E-14	7.49E-15	7.20E-17	3.22E-15	3.02E-16
332	35.500%	33.7	1.73E-14	1.44E-16	1.81E-15	9.17E-15	6.14E-15	5.90E-17	2.66E-15	2.50E-16
333	36.000%	34.2	1.42E-14	1.18E-16	1.49E-15	7.54E-15	5.04E-15	4.85E-17	2.22E-15	2.08E-16
334	36.500%	34.7	1.17E-14	9.72E-17	1.22E-15	6.20E-15	4.15E-15	3.99E-17	1.78E-15	1.66E-16
335	37.000%	35.2	9.20E-15	7.64E-17	9.61E-16	4.87E-15	3.26E-15	3.14E-17	0.00E+00	0.00E+00
336	37.500%	35.6	7.60E-15	6.31E-17	7.94E-16	4.02E-15	2.69E-15	2.59E-17	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
337	38.000%	36.1	6.29E-15	5.22E-17	6.57E-16	3.33E-15	2.23E-15	2.14E-17	0.00E+00	0.00E+00
338	38.500%	36.6	5.22E-15	4.33E-17	5.45E-16	2.76E-15	1.85E-15	1.78E-17	0.00E+00	0.00E+00
339	39.000%	37.1	4.33E-15	3.59E-17	4.53E-16	2.29E-15	1.53E-15	1.48E-17	0.00E+00	0.00E+00
340	39.500%	37.5	3.60E-15	2.99E-17	3.77E-16	1.91E-15	1.28E-15	1.23E-17	0.00E+00	0.00E+00
341	40.000%	38.0	3.00E-15	2.49E-17	3.14E-16	1.59E-15	1.06E-15	1.02E-17	0.00E+00	0.00E+00
342	40.500%	38.5	2.51E-15	2.08E-17	2.62E-16	1.33E-15	8.88E-16	8.54E-18	0.00E+00	0.00E+00
343	41.000%	39.0	2.10E-15	1.74E-17	2.19E-16	1.11E-15	7.42E-16	7.14E-18	0.00E+00	0.00E+00
344	41.500%	39.4	1.75E-15	1.46E-17	1.83E-16	9.29E-16	6.22E-16	5.98E-18	0.00E+00	0.00E+00
345	42.000%	39.9	1.47E-15	1.22E-17	1.54E-16	7.79E-16	5.21E-16	5.02E-18	0.00E+00	0.00E+00
346	42.500%	40.4	1.21E-15	1.01E-17	1.27E-16	6.42E-16	4.29E-16	4.13E-18	0.00E+00	0.00E+00
347	43.000%	40.9	1.02E-15	8.46E-18	1.07E-16	5.40E-16	3.61E-16	3.47E-18	0.00E+00	0.00E+00
348	43.500%	41.3	8.59E-16	7.13E-18	8.97E-17	4.55E-16	3.04E-16	2.93E-18	0.00E+00	0.00E+00
349	44.000%	41.8	7.25E-16	6.02E-18	7.57E-17	3.84E-16	2.57E-16	2.47E-18	0.00E+00	0.00E+00
350	44.500%	42.3	6.12E-16	5.08E-18	6.40E-17	3.24E-16	2.17E-16	2.09E-18	0.00E+00	0.00E+00
351	45.000%	42.8	5.18E-16	4.30E-18	5.41E-17	2.74E-16	1.84E-16	1.77E-18	0.00E+00	0.00E+00
352	45.500%	43.2	4.39E-16	3.64E-18	4.58E-17	2.32E-16	1.55E-16	1.49E-18	0.00E+00	0.00E+00
353	46.000%	43.7	3.72E-16	3.09E-18	3.89E-17	1.97E-16	1.32E-16	1.27E-18	0.00E+00	0.00E+00
354	46.500%	44.2	3.16E-16	2.62E-18	3.30E-17	1.67E-16	1.12E-16	1.08E-18	0.00E+00	0.00E+00
355	47.000%	44.7	2.69E-16	2.23E-18	2.81E-17	1.42E-16	9.52E-17	9.16E-19	0.00E+00	0.00E+00
356	47.500%	45.1	2.27E-16	1.88E-18	2.37E-17	1.20E-16	8.04E-17	7.73E-19	0.00E+00	0.00E+00
357	48.000%	45.6	1.94E-16	1.61E-18	2.02E-17	1.03E-16	6.86E-17	6.60E-19	0.00E+00	0.00E+00
358	48.500%	46.1	1.65E-16	1.37E-18	1.73E-17	8.74E-17	5.85E-17	5.63E-19	0.00E+00	0.00E+00
359	49.000%	46.6	1.41E-16	1.17E-18	1.48E-17	7.48E-17	5.00E-17	4.81E-19	0.00E+00	0.00E+00
360	49.500%	47.0	1.21E-16	1.00E-18	1.26E-17	6.40E-17	4.28E-17	4.12E-19	0.00E+00	0.00E+00
361	50.000%	47.5	1.04E-16	8.59E-19	1.08E-17	5.48E-17	3.67E-17	3.53E-19	0.00E+00	0.00E+00
362	50.500%	48.0	8.88E-17	7.37E-19	9.28E-18	4.70E-17	3.14E-17	3.03E-19	0.00E+00	0.00E+00
363	51.000%	48.5	7.62E-17	6.32E-19	7.96E-18	4.03E-17	2.70E-17	2.60E-19	0.00E+00	0.00E+00
364	51.500%	48.9	6.55E-17	5.43E-19	6.84E-18	3.47E-17	2.32E-17	2.23E-19	0.00E+00	0.00E+00
365	52.000%	49.4	5.63E-17	4.68E-19	5.89E-18	2.98E-17	2.00E-17	1.92E-19	0.00E+00	0.00E+00
366	52.500%	49.9	4.87E-17	4.04E-19	5.08E-18	2.58E-17	1.72E-17	1.66E-19	0.00E+00	0.00E+00
367	53.000%	50.4	4.17E-17	3.46E-19	4.35E-18	2.21E-17	1.48E-17	1.42E-19	0.00E+00	0.00E+00
368	53.500%	50.8	3.59E-17	2.98E-19	3.75E-18	1.90E-17	1.27E-17	1.22E-19	0.00E+00	0.00E+00
369	54.000%	51.3	3.11E-17	2.58E-19	3.25E-18	1.65E-17	1.10E-17	1.06E-19	0.00E+00	0.00E+00
370	54.500%	51.8	2.70E-17	2.24E-19	2.82E-18	1.43E-17	9.55E-18	9.19E-20	0.00E+00	0.00E+00
371	55.000%	52.3	2.32E-17	1.93E-19	2.43E-18	1.23E-17	8.22E-18	7.91E-20	0.00E+00	0.00E+00
372	55.500%	52.7	2.02E-17	1.68E-19	2.11E-18	1.07E-17	7.15E-18	6.88E-20	0.00E+00	0.00E+00
373	56.000%	53.2	1.74E-17	1.45E-19	1.82E-18	9.24E-18	6.18E-18	5.95E-20	0.00E+00	0.00E+00
374	56.500%	53.7	1.53E-17	1.27E-19	1.60E-18	8.09E-18	5.41E-18	5.21E-20	0.00E+00	0.00E+00
375	57.000%	54.2	1.33E-17	1.10E-19	1.39E-18	7.02E-18	4.70E-18	4.52E-20	0.00E+00	0.00E+00
376	57.500%	54.6	1.14E-17	9.45E-20	1.19E-18	6.03E-18	4.04E-18	3.88E-20	0.00E+00	0.00E+00
377	58.000%	55.1	1.01E-17	8.38E-20	1.05E-18	5.34E-18	3.58E-18	3.44E-20	0.00E+00	0.00E+00
378	58.500%	55.6	8.65E-18	7.18E-20	9.04E-19	4.58E-18	3.06E-18	2.95E-20	0.00E+00	0.00E+00
379	59.000%	56.1	7.64E-18	6.34E-20	7.98E-19	4.05E-18	2.71E-18	2.60E-20	0.00E+00	0.00E+00
380	59.500%	56.5	6.63E-18	5.50E-20	6.93E-19	3.51E-18	2.35E-18	2.26E-20	0.00E+00	0.00E+00
381	60.000%	57.0	5.77E-18	4.79E-20	6.03E-19	3.05E-18	2.04E-18	1.97E-20	0.00E+00	0.00E+00
382	60.500%	57.5	5.05E-18	4.19E-20	5.27E-19	2.67E-18	1.79E-18	1.72E-20	0.00E+00	0.00E+00
383	61.000%	58.0	4.47E-18	3.71E-20	4.67E-19	2.37E-18	1.58E-18	1.52E-20	0.00E+00	0.00E+00
384	61.500%	58.4	3.89E-18	3.23E-20	4.07E-19	2.06E-18	1.38E-18	1.33E-20	0.00E+00	0.00E+00
385	62.000%	58.9	3.46E-18	2.87E-20	3.62E-19	1.83E-18	1.23E-18	1.18E-20	0.00E+00	0.00E+00
386	62.500%	59.4	3.03E-18	2.51E-20	3.16E-19	1.60E-18	1.07E-18	1.03E-20	0.00E+00	0.00E+00
387	63.000%	59.9	2.60E-18	2.15E-20	2.71E-19	1.37E-18	9.19E-19	8.84E-21	0.00E+00	0.00E+00
388	63.500%	60.3	2.31E-18	1.91E-20	2.41E-19	1.22E-18	8.17E-19	7.86E-21	0.00E+00	0.00E+00
389	64.000%	60.8	2.02E-18	1.68E-20	2.11E-19	1.07E-18	7.15E-19	6.88E-21	0.00E+00	0.00E+00
390	64.500%	61.3	1.73E-18	1.44E-20	1.81E-19	9.16E-19	6.13E-19	5.90E-21	0.00E+00	0.00E+00
391	65.000%	61.8	1.59E-18	1.32E-20	1.66E-19	8.40E-19	5.62E-19	5.40E-21	0.00E+00	0.00E+00
392	65.500%	62.2	1.44E-18	1.20E-20	1.51E-19	7.64E-19	5.11E-19	4.91E-21	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
393	66.000%	62.7	1.15E-18	9.57E-21	1.21E-19	6.11E-19	4.09E-19	3.93E-21	0.00E+00	0.00E+00
394	66.500%	63.2	1.15E-18	9.57E-21	1.21E-19	6.11E-19	4.09E-19	3.93E-21	0.00E+00	0.00E+00
395	67.000%	63.7	8.65E-19	7.18E-21	9.04E-20	4.58E-19	3.06E-19	2.95E-21	0.00E+00	0.00E+00
396	67.500%	64.1	8.65E-19	7.18E-21	9.04E-20	4.58E-19	3.06E-19	2.95E-21	0.00E+00	0.00E+00
397	68.000%	64.6	7.21E-19	5.98E-21	7.53E-20	3.82E-19	2.55E-19	2.46E-21	0.00E+00	0.00E+00
398	68.500%	65.1	7.21E-19	5.98E-21	7.53E-20	3.82E-19	2.55E-19	2.46E-21	0.00E+00	0.00E+00
399	69.000%	65.6	5.77E-19	4.79E-21	6.03E-20	3.05E-19	2.04E-19	1.97E-21	0.00E+00	0.00E+00
400	69.500%	66.0	5.77E-19	4.79E-21	6.03E-20	3.05E-19	2.04E-19	1.97E-21	0.00E+00	0.00E+00
401	70.000%	66.5	4.33E-19	3.59E-21	4.52E-20	2.29E-19	1.53E-19	1.47E-21	0.00E+00	0.00E+00
402	70.500%	67.0	4.33E-19	3.59E-21	4.52E-20	2.29E-19	1.53E-19	1.47E-21	0.00E+00	0.00E+00
403	71.000%	67.5	2.88E-19	2.39E-21	3.01E-20	1.53E-19	1.02E-19	9.83E-22	0.00E+00	0.00E+00
404	71.500%	67.9	2.88E-19	2.39E-21	3.01E-20	1.53E-19	1.02E-19	9.83E-22	0.00E+00	0.00E+00
405	72.000%	68.4	2.88E-19	2.39E-21	3.01E-20	1.53E-19	1.02E-19	9.83E-22	0.00E+00	0.00E+00
406	72.500%	68.9	2.45E-18	2.03E-20	2.56E-19	1.30E-18	8.68E-19	8.35E-21	0.00E+00	0.00E+00
407	73.000%	69.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
408	73.500%	69.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
409	74.000%	70.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
410	74.500%	70.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
411	75.000%	71.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
412	75.500%	71.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
413	76.000%	72.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
414	76.500%	72.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
415	77.000%	73.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
416	77.500%	73.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
417	78.000%	74.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
418	78.500%	74.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
419	79.000%	75.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
420	79.500%	75.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
421	80.000%	76.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
422	80.500%	76.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
423	81.000%	77.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
424	81.500%	77.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
425	82.000%	77.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
426	82.500%	78.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
427	83.000%	78.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
428	83.500%	79.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
429	84.000%	79.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
430	84.500%	80.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
431	85.000%	80.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
432	85.500%	81.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
433	86.000%	81.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
434	86.500%	82.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
435	87.000%	82.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
436	87.500%	83.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
437	88.000%	83.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
438	88.500%	84.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
439	89.000%	84.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
440	89.500%	85.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
441	90.000%	85.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
442	90.500%	86.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
443	91.000%	86.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
444	91.500%	86.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
445	92.000%	87.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
446	92.500%	87.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
447	93.000%	88.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
448	93.500%	88.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

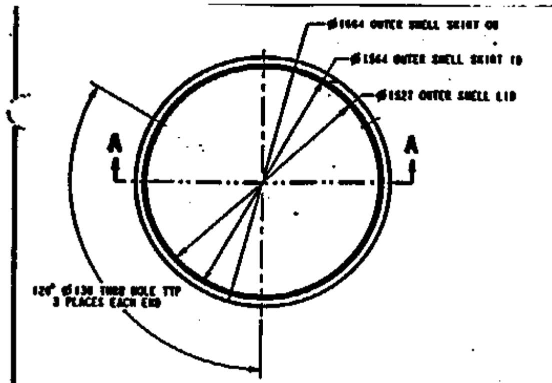
	A	B	C	D	E	F	G	H	I	J
449	94.000%	89.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
450	94.500%	89.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
451	95.000%	90.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
452	95.500%	90.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
453	96.000%	91.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
454	96.500%	91.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
455	97.000%	92.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
456	97.500%	92.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
457	98.000%	93.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
458	98.500%	93.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
459	99.000%	94.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
460	99.500%	94.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
461	100.000%	95.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
462		Flaws/Lid	2.75E+01	2.28E-01	2.87E+00	1.46E+01	9.74E+00	9.37E-02		
463										
464										
465	Frequency of various size flaws in WP shell assuming multi-angle UT exam (Top Lid)									Cumulative
466	Flaw Size (% throughwall)	Depth (mm)	Total per WP	Inner Surface	Embeded Inner 1/4	Embedded Center	Embeded Outer 1/4	Outer Surface	OS CCDF	Prob. Per WP
467	1%	1.0	1.30E+02	1.08E+00	1.36E+01	6.89E+01	4.61E+01	4.44E-01	6.33E-01	7.66E-01
468	1.500%	1.4	1.27E+02	1.06E+00	1.32E+01	6.70E+01	4.48E+01	4.31E-01	2.76E-01	3.34E-01
469	2.000%	1.9	6.09E+01	5.06E-01	6.37E+00	3.23E+01	2.16E+01	2.08E-01	1.05E-01	1.27E-01
470	2.500%	2.4	2.46E+01	2.04E-01	2.57E+00	1.30E+01	8.72E+00	8.39E-02	3.53E-02	4.27E-02
471	3.000%	2.9	8.33E+00	6.91E-02	8.70E-01	4.41E+00	2.95E+00	2.84E-02	1.18E-02	1.43E-02
472	3.500%	3.3	2.75E+00	2.29E-02	2.88E-01	1.46E+00	9.75E-01	9.38E-03	4.08E-03	4.94E-03
473	4.000%	3.8	9.17E-01	7.61E-03	9.58E-02	4.86E-01	3.25E-01	3.12E-03	1.50E-03	1.81E-03
474	4.500%	4.3	3.40E-01	2.83E-03	3.56E-02	1.80E-01	1.21E-01	1.16E-03	5.38E-04	6.50E-04
475	5.000%	4.8	1.19E-01	9.89E-04	1.24E-02	6.31E-02	4.22E-02	4.06E-04	2.02E-04	2.44E-04
476	5.500%	5.2	4.30E-02	3.57E-04	4.49E-03	2.28E-02	1.52E-02	1.47E-04	8.08E-05	9.77E-05
477	6.000%	5.7	1.74E-02	1.44E-04	1.82E-03	9.20E-03	6.15E-03	5.92E-05	3.18E-05	3.85E-05
478	6.500%	6.2	6.69E-03	5.55E-05	6.99E-04	3.54E-03	2.37E-03	2.28E-05	1.30E-05	1.57E-05
479	7.000%	6.7	2.65E-03	2.20E-05	2.77E-04	1.41E-03	9.40E-04	9.04E-06	5.49E-06	6.63E-06
480	7.500%	7.1	1.09E-03	9.03E-06	1.14E-04	5.76E-04	3.85E-04	3.71E-06	2.42E-06	2.93E-06
481	8.000%	7.6	4.60E-04	3.81E-06	4.80E-05	2.43E-04	1.63E-04	1.57E-06	1.13E-06	1.36E-06
482	8.500%	8.1	2.14E-04	1.77E-06	2.23E-05	1.13E-04	7.57E-05	7.28E-07	5.23E-07	6.32E-07
483	9.000%	8.6	9.55E-05	7.92E-07	9.98E-06	5.06E-05	3.38E-05	3.25E-07	2.54E-07	3.07E-07
484	9.500%	9.0	4.39E-05	3.64E-07	4.58E-06	2.32E-05	1.55E-05	1.49E-07	1.30E-07	1.57E-07
485	10.000%	9.5	2.07E-05	1.72E-07	2.16E-06	1.10E-05	7.33E-06	7.05E-08	7.17E-08	8.67E-08
486	10.500%	10.0	1.06E-05	8.80E-08	1.11E-06	5.61E-06	3.76E-06	3.61E-08	4.18E-08	5.06E-08
487	11.000%	10.5	6.52E-06	5.41E-08	6.81E-07	3.45E-06	2.31E-06	2.22E-08	2.34E-08	2.83E-08
488	11.500%	10.9	4.29E-06	3.56E-08	4.48E-07	2.27E-06	1.52E-06	1.46E-08	1.14E-08	1.37E-08
489	12.000%	11.4	1.69E-06	1.40E-08	1.76E-07	8.94E-07	5.98E-07	5.75E-09	6.59E-09	7.97E-09
490	12.500%	11.9	1.13E-06	9.40E-09	1.18E-07	6.00E-07	4.01E-07	3.86E-09	3.40E-09	4.11E-09
491	13.000%	12.4	4.81E-07	3.99E-09	5.03E-08	2.55E-07	1.70E-07	1.64E-09	2.04E-09	2.47E-09
492	13.500%	12.8	3.29E-07	2.73E-09	3.44E-08	1.74E-07	1.16E-07	1.12E-09	1.12E-09	1.35E-09
493	14.000%	13.3	1.50E-07	1.25E-09	1.57E-08	7.94E-08	5.31E-08	5.11E-10	6.94E-10	8.40E-10
494	14.500%	13.8	1.04E-07	8.65E-10	1.09E-08	5.52E-08	3.69E-08	3.55E-10	4.01E-10	4.85E-10
495	15.000%	14.3	5.10E-08	4.23E-10	5.33E-09	2.70E-08	1.81E-08	1.74E-10	2.57E-10	3.11E-10
496	15.500%	14.7	3.59E-08	2.98E-10	3.75E-09	1.90E-08	1.27E-08	1.22E-10	1.56E-10	1.88E-10
497	16.000%	15.2	1.87E-08	1.56E-10	1.96E-09	9.92E-09	6.64E-09	6.39E-11	1.03E-10	1.25E-10
498	16.500%	15.7	1.34E-08	1.11E-10	1.40E-09	7.09E-09	4.75E-09	4.56E-11	6.53E-11	7.89E-11
499	17.000%	16.2	7.42E-09	6.16E-11	7.75E-10	3.93E-09	2.63E-09	2.53E-11	4.44E-11	5.37E-11
500	17.500%	16.6	5.37E-09	4.46E-11	5.61E-10	2.84E-09	1.90E-09	1.83E-11	2.93E-11	3.54E-11
501	18.000%	17.1	3.14E-09	2.60E-11	3.28E-10	1.66E-09	1.11E-09	1.07E-11	2.04E-11	2.47E-11
502	18.500%	17.6	2.30E-09	1.91E-11	2.40E-10	1.22E-09	8.14E-10	7.83E-12	1.39E-11	1.69E-11
503	19.000%	18.1	1.41E-09	1.17E-11	1.47E-10	7.45E-10	4.99E-10	4.80E-12	9.98E-12	1.21E-11
504	19.500%	18.5	1.04E-09	8.65E-12	1.09E-10	5.52E-10	3.69E-10	3.55E-12	7.04E-12	8.51E-12

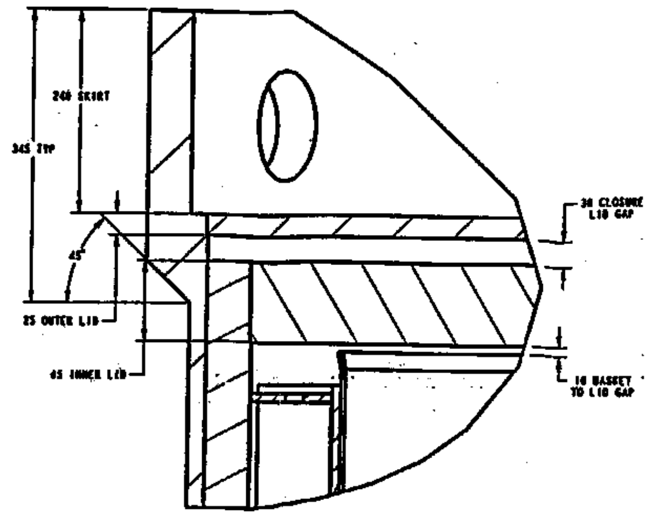
	A	B	C	D	E	F	G	H	I	J
505	20.000%	19.0	6.66E-10	5.53E-12	6.96E-11	3.53E-10	2.36E-10	2.27E-12	5.16E-12	6.24E-12
506	20.500%	19.5	4.98E-10	4.13E-12	5.20E-11	2.64E-10	1.76E-10	1.70E-12	3.76E-12	4.55E-12
507	21.000%	20.0	3.74E-10	3.10E-12	3.91E-11	1.98E-10	1.32E-10	1.27E-12	2.71E-12	3.27E-12
508	21.500%	20.4	2.49E-10	2.07E-12	2.60E-11	1.32E-10	8.82E-11	8.49E-13	2.01E-12	2.42E-12
509	22.000%	20.9	1.89E-10	1.57E-12	1.97E-11	9.99E-11	6.68E-11	6.43E-13	1.47E-12	1.78E-12
510	22.500%	21.4	1.30E-10	1.08E-12	1.35E-11	6.87E-11	4.59E-11	4.42E-13	1.11E-12	1.34E-12
511	23.000%	21.9	9.90E-11	8.22E-13	1.03E-11	5.24E-11	3.51E-11	3.37E-13	8.29E-13	1.00E-12
512	23.500%	22.3	6.99E-11	5.80E-13	7.30E-12	3.70E-11	2.48E-11	2.38E-13	6.32E-13	7.64E-13
513	24.000%	22.8	5.38E-11	4.47E-13	5.62E-12	2.85E-11	1.91E-11	1.83E-13	4.81E-13	5.81E-13
514	24.500%	23.3	3.89E-11	3.23E-13	4.06E-12	2.06E-11	1.38E-11	1.32E-13	3.71E-13	4.49E-13
515	25.000%	23.8	3.01E-11	2.50E-13	3.15E-12	1.60E-11	1.07E-11	1.03E-13	2.86E-13	3.46E-13
516	25.500%	24.2	2.22E-11	1.84E-13	2.32E-12	1.18E-11	7.86E-12	7.56E-14	2.24E-13	2.70E-13
517	26.000%	24.7	1.73E-11	1.44E-13	1.81E-12	9.17E-12	6.14E-12	5.90E-14	1.75E-13	2.11E-13
518	26.500%	25.2	1.30E-11	1.08E-13	1.36E-12	6.87E-12	4.60E-12	4.42E-14	1.38E-13	1.67E-13
519	27.000%	25.7	1.02E-11	8.46E-14	1.07E-12	5.40E-12	3.61E-12	3.47E-14	1.10E-13	1.33E-13
520	27.500%	26.1	8.03E-12	6.67E-14	8.39E-13	4.25E-12	2.85E-12	2.74E-14	8.70E-14	1.05E-13
521	28.000%	26.6	6.35E-12	5.27E-14	6.63E-13	3.36E-12	2.25E-12	2.16E-14	6.93E-14	8.38E-14
522	28.500%	27.1	5.03E-12	4.18E-14	5.26E-13	2.67E-12	1.78E-12	1.72E-14	5.51E-14	6.66E-14
523	29.000%	27.6	4.00E-12	3.32E-14	4.18E-13	2.12E-12	1.42E-12	1.36E-14	4.39E-14	5.30E-14
524	29.500%	28.0	3.19E-12	2.65E-14	3.33E-13	1.69E-12	1.13E-12	1.09E-14	3.49E-14	4.21E-14
525	30.000%	28.5	2.55E-12	2.12E-14	2.66E-13	1.35E-12	9.03E-13	8.69E-15	2.78E-14	3.36E-14
526	30.500%	29.0	2.04E-12	1.70E-14	2.13E-13	1.08E-12	7.24E-13	6.96E-15	2.20E-14	2.66E-14
527	31.000%	29.5	1.64E-12	1.36E-14	1.71E-13	8.69E-13	5.81E-13	5.59E-15	1.74E-14	2.11E-14
528	31.500%	29.9	1.32E-12	1.10E-14	1.38E-13	7.00E-13	4.68E-13	4.50E-15	1.38E-14	1.66E-14
529	32.000%	30.4	9.40E-13	7.80E-15	9.82E-14	4.98E-13	3.33E-13	3.20E-15	1.12E-14	1.36E-14
530	32.500%	30.9	7.60E-13	6.31E-15	7.95E-14	4.03E-13	2.69E-13	2.59E-15	8.99E-15	1.09E-14
531	33.000%	31.4	6.17E-13	5.12E-15	6.44E-14	3.27E-13	2.18E-13	2.10E-15	7.33E-15	8.86E-15
532	33.500%	31.8	5.01E-13	4.16E-15	5.24E-14	2.65E-13	1.78E-13	1.71E-15	5.88E-15	7.11E-15
533	34.000%	32.3	4.08E-13	3.39E-15	4.27E-14	2.16E-13	1.45E-13	1.39E-15	4.77E-15	5.77E-15
534	34.500%	32.8	3.33E-13	2.77E-15	3.48E-14	1.77E-13	1.18E-13	1.14E-15	3.89E-15	4.70E-15
535	35.000%	33.3	2.73E-13	2.26E-15	2.85E-14	1.44E-13	9.66E-14	9.30E-16	3.11E-15	3.76E-15
536	35.500%	33.7	2.24E-13	1.86E-15	2.34E-14	1.18E-13	7.92E-14	7.62E-16	2.55E-15	3.09E-15
537	36.000%	34.2	1.84E-13	1.52E-15	1.92E-14	9.73E-14	6.51E-14	6.26E-16	2.00E-15	2.42E-15
538	36.500%	34.7	1.51E-13	1.25E-15	1.58E-14	8.00E-14	5.36E-14	5.15E-16	0.00E+00	0.00E+00
539	37.000%	35.2	1.19E-13	9.86E-16	1.24E-14	6.29E-14	4.21E-14	4.05E-16	0.00E+00	0.00E+00
540	37.500%	35.6	9.81E-14	8.14E-16	1.03E-14	5.19E-14	3.48E-14	3.34E-16	0.00E+00	0.00E+00
541	38.000%	36.1	8.12E-14	6.74E-16	8.48E-15	4.30E-14	2.88E-14	2.77E-16	0.00E+00	0.00E+00
542	38.500%	36.6	6.73E-14	5.59E-16	7.03E-15	3.56E-14	2.38E-14	2.29E-16	0.00E+00	0.00E+00
543	39.000%	37.1	5.59E-14	4.64E-16	5.84E-15	2.96E-14	1.98E-14	1.91E-16	0.00E+00	0.00E+00
544	39.500%	37.5	4.65E-14	3.86E-16	4.86E-15	2.46E-14	1.65E-14	1.58E-16	0.00E+00	0.00E+00
545	40.000%	38.0	3.88E-14	3.22E-16	4.05E-15	2.05E-14	1.37E-14	1.32E-16	0.00E+00	0.00E+00
546	40.500%	38.5	3.24E-14	2.69E-16	3.38E-15	1.71E-14	1.15E-14	1.10E-16	0.00E+00	0.00E+00
547	41.000%	39.0	2.70E-14	2.24E-16	2.83E-15	1.43E-14	9.58E-15	9.22E-17	0.00E+00	0.00E+00
548	41.500%	39.4	2.26E-14	1.88E-16	2.37E-15	1.20E-14	8.02E-15	7.72E-17	0.00E+00	0.00E+00
549	42.000%	39.9	1.90E-14	1.58E-16	1.98E-15	1.01E-14	6.73E-15	6.47E-17	0.00E+00	0.00E+00
550	42.500%	40.4	1.56E-14	1.30E-16	1.63E-15	8.28E-15	5.54E-15	5.33E-17	0.00E+00	0.00E+00
551	43.000%	40.9	1.32E-14	1.09E-16	1.38E-15	6.97E-15	4.66E-15	4.48E-17	0.00E+00	0.00E+00
552	43.500%	41.3	1.11E-14	9.20E-17	1.16E-15	5.87E-15	3.93E-15	3.78E-17	0.00E+00	0.00E+00
553	44.000%	41.8	9.35E-15	7.76E-17	9.77E-16	4.95E-15	3.31E-15	3.19E-17	0.00E+00	0.00E+00
554	44.500%	42.3	7.90E-15	6.56E-17	8.26E-16	4.18E-15	2.80E-15	2.69E-17	0.00E+00	0.00E+00
555	45.000%	42.8	6.69E-15	5.55E-17	6.99E-16	3.54E-15	2.37E-15	2.28E-17	0.00E+00	0.00E+00
556	45.500%	43.2	5.66E-15	4.70E-17	5.92E-16	3.00E-15	2.01E-15	1.93E-17	0.00E+00	0.00E+00
557	46.000%	43.7	4.80E-15	3.99E-17	5.02E-16	2.54E-15	1.70E-15	1.64E-17	0.00E+00	0.00E+00
558	46.500%	44.2	4.08E-15	3.39E-17	4.26E-16	2.16E-15	1.45E-15	1.39E-17	0.00E+00	0.00E+00
559	47.000%	44.7	3.47E-15	2.88E-17	3.63E-16	1.84E-15	1.23E-15	1.18E-17	0.00E+00	0.00E+00
560	47.500%	45.1	2.93E-15	2.43E-17	3.06E-16	1.55E-15	1.04E-15	9.98E-18	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
561	48.000%	45.6	2.50E-15	2.07E-17	2.61E-16	1.32E-15	8.85E-16	8.52E-18	0.00E+00	0.00E+00
562	48.500%	46.1	2.13E-15	1.77E-17	2.23E-16	1.13E-15	7.55E-16	7.26E-18	0.00E+00	0.00E+00
563	49.000%	46.6	1.82E-15	1.51E-17	1.90E-16	9.65E-16	6.46E-16	6.21E-18	0.00E+00	0.00E+00
564	49.500%	47.0	1.56E-15	1.29E-17	1.63E-16	8.25E-16	5.52E-16	5.31E-18	0.00E+00	0.00E+00
565	50.000%	47.5	1.34E-15	1.11E-17	1.40E-16	7.08E-16	4.73E-16	4.55E-18	0.00E+00	0.00E+00
566	50.500%	48.0	1.15E-15	9.51E-18	1.20E-16	6.07E-16	4.06E-16	3.90E-18	0.00E+00	0.00E+00
567	51.000%	48.5	9.83E-16	8.16E-18	1.03E-16	5.21E-16	3.48E-16	3.35E-18	0.00E+00	0.00E+00
568	51.500%	48.9	8.45E-16	7.01E-18	8.83E-17	4.47E-16	2.99E-16	2.88E-18	0.00E+00	0.00E+00
569	52.000%	49.4	7.27E-16	6.03E-18	7.60E-17	3.85E-16	2.58E-16	2.48E-18	0.00E+00	0.00E+00
570	52.500%	49.9	6.28E-16	5.21E-18	6.56E-17	3.33E-16	2.22E-16	2.14E-18	0.00E+00	0.00E+00
571	53.000%	50.4	5.38E-16	4.46E-18	5.62E-17	2.85E-16	1.91E-16	1.83E-18	0.00E+00	0.00E+00
572	53.500%	50.8	4.63E-16	3.85E-18	4.84E-17	2.45E-16	1.64E-16	1.58E-18	0.00E+00	0.00E+00
573	54.000%	51.3	4.02E-16	3.34E-18	4.20E-17	2.13E-16	1.42E-16	1.37E-18	0.00E+00	0.00E+00
574	54.500%	51.8	3.48E-16	2.89E-18	3.64E-17	1.84E-16	1.23E-16	1.19E-18	0.00E+00	0.00E+00
575	55.000%	52.3	3.00E-16	2.49E-18	3.13E-17	1.59E-16	1.06E-16	1.02E-18	0.00E+00	0.00E+00
576	55.500%	52.7	2.61E-16	2.16E-18	2.72E-17	1.38E-16	9.23E-17	8.88E-19	0.00E+00	0.00E+00
577	56.000%	53.2	2.25E-16	1.87E-18	2.35E-17	1.19E-16	7.98E-17	7.67E-19	0.00E+00	0.00E+00
578	56.500%	53.7	1.97E-16	1.64E-18	2.06E-17	1.04E-16	6.99E-17	6.72E-19	0.00E+00	0.00E+00
579	57.000%	54.2	1.71E-16	1.42E-18	1.79E-17	9.07E-17	6.07E-17	5.83E-19	0.00E+00	0.00E+00
580	57.500%	54.6	1.47E-16	1.22E-18	1.54E-17	7.79E-17	5.21E-17	5.01E-19	0.00E+00	0.00E+00
581	58.000%	55.1	1.30E-16	1.08E-18	1.36E-17	6.90E-17	4.61E-17	4.44E-19	0.00E+00	0.00E+00
582	58.500%	55.6	1.12E-16	9.27E-19	1.17E-17	5.91E-17	3.96E-17	3.81E-19	0.00E+00	0.00E+00
583	59.000%	56.1	9.86E-17	8.19E-19	1.03E-17	5.22E-17	3.49E-17	3.36E-19	0.00E+00	0.00E+00
584	59.500%	56.5	8.56E-17	7.10E-19	8.94E-18	4.53E-17	3.03E-17	2.92E-19	0.00E+00	0.00E+00
585	60.000%	57.0	7.44E-17	6.18E-19	7.78E-18	3.94E-17	2.64E-17	2.54E-19	0.00E+00	0.00E+00
586	60.500%	57.5	6.51E-17	5.41E-19	6.81E-18	3.45E-17	2.31E-17	2.22E-19	0.00E+00	0.00E+00
587	61.000%	58.0	5.77E-17	4.79E-19	6.03E-18	3.05E-17	2.04E-17	1.97E-19	0.00E+00	0.00E+00
588	61.500%	58.4	5.02E-17	4.17E-19	5.25E-18	2.66E-17	1.78E-17	1.71E-19	0.00E+00	0.00E+00
589	62.000%	58.9	4.47E-17	3.71E-19	4.67E-18	2.37E-17	1.58E-17	1.52E-19	0.00E+00	0.00E+00
590	62.500%	59.4	3.91E-17	3.24E-19	4.08E-18	2.07E-17	1.38E-17	1.33E-19	0.00E+00	0.00E+00
591	63.000%	59.9	3.35E-17	2.78E-19	3.50E-18	1.77E-17	1.19E-17	1.14E-19	0.00E+00	0.00E+00
592	63.500%	60.3	2.98E-17	2.47E-19	3.11E-18	1.58E-17	1.05E-17	1.01E-19	0.00E+00	0.00E+00
593	64.000%	60.8	2.61E-17	2.16E-19	2.72E-18	1.38E-17	9.23E-18	8.88E-20	0.00E+00	0.00E+00
594	64.500%	61.3	2.23E-17	1.85E-19	2.33E-18	1.18E-17	7.91E-18	7.61E-20	0.00E+00	0.00E+00
595	65.000%	61.8	2.05E-17	1.70E-19	2.14E-18	1.08E-17	7.25E-18	6.98E-20	0.00E+00	0.00E+00
596	65.500%	62.2	1.86E-17	1.54E-19	1.94E-18	9.85E-18	6.59E-18	6.34E-20	0.00E+00	0.00E+00
597	66.000%	62.7	1.49E-17	1.24E-19	1.56E-18	7.88E-18	5.27E-18	5.07E-20	0.00E+00	0.00E+00
598	66.500%	63.2	1.49E-17	1.24E-19	1.56E-18	7.88E-18	5.27E-18	5.07E-20	0.00E+00	0.00E+00
599	67.000%	63.7	1.12E-17	9.27E-20	1.17E-18	5.91E-18	3.96E-18	3.81E-20	0.00E+00	0.00E+00
600	67.500%	64.1	1.12E-17	9.27E-20	1.17E-18	5.91E-18	3.96E-18	3.81E-20	0.00E+00	0.00E+00
601	68.000%	64.6	9.30E-18	7.72E-20	9.72E-19	4.93E-18	3.30E-18	3.17E-20	0.00E+00	0.00E+00
602	68.500%	65.1	9.30E-18	7.72E-20	9.72E-19	4.93E-18	3.30E-18	3.17E-20	0.00E+00	0.00E+00
603	69.000%	65.6	7.44E-18	6.18E-20	7.78E-19	3.94E-18	2.64E-18	2.54E-20	0.00E+00	0.00E+00
604	69.500%	66.0	7.44E-18	6.18E-20	7.78E-19	3.94E-18	2.64E-18	2.54E-20	0.00E+00	0.00E+00
605	70.000%	66.5	5.58E-18	4.63E-20	5.83E-19	2.96E-18	1.98E-18	1.90E-20	0.00E+00	0.00E+00
606	70.500%	67.0	5.58E-18	4.63E-20	5.83E-19	2.96E-18	1.98E-18	1.90E-20	0.00E+00	0.00E+00
607	71.000%	67.5	3.72E-18	3.09E-20	3.89E-19	1.97E-18	1.32E-18	1.27E-20	0.00E+00	0.00E+00
608	71.500%	67.9	3.72E-18	3.09E-20	3.89E-19	1.97E-18	1.32E-18	1.27E-20	0.00E+00	0.00E+00
609	72.000%	68.4	3.72E-18	3.09E-20	3.89E-19	1.97E-18	1.32E-18	1.27E-20	0.00E+00	0.00E+00
610	72.500%	68.9	3.16E-17	2.63E-19	3.31E-18	1.68E-17	1.12E-17	1.08E-19	0.00E+00	0.00E+00
611	73.000%	69.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
612	73.500%	69.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
613	74.000%	70.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
614	74.500%	70.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
615	75.000%	71.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
616	75.500%	71.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

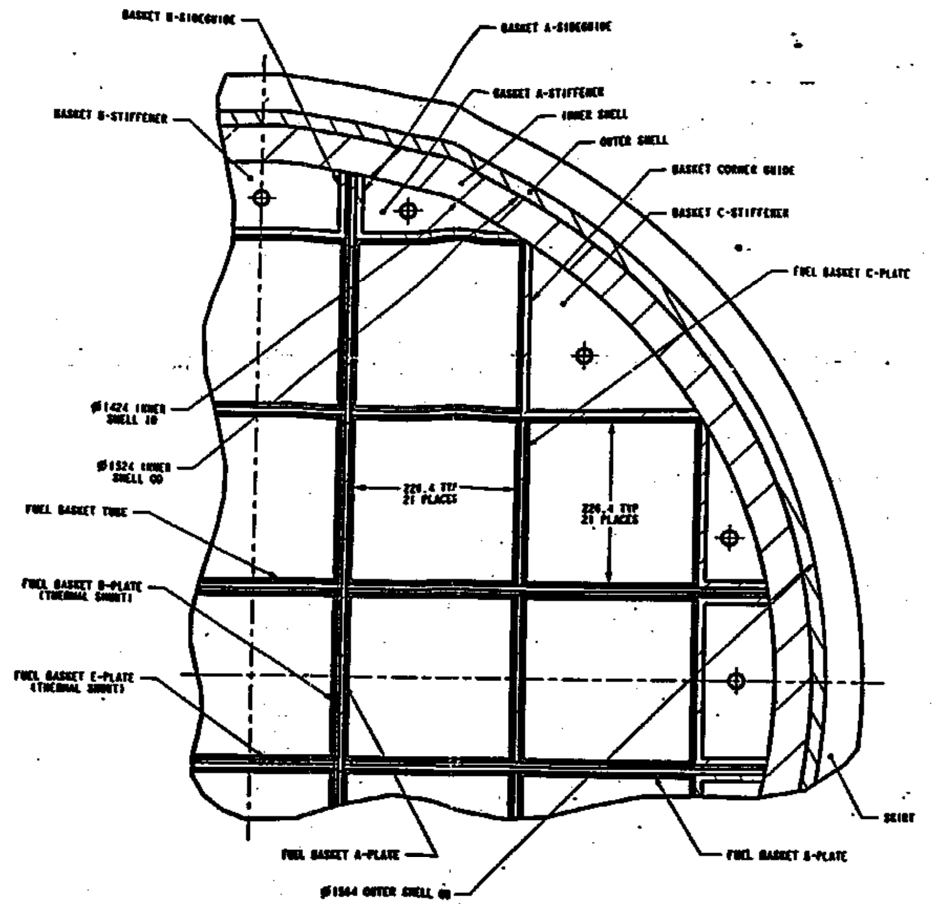
	A	B	C	D	E	F	G	H	I	J
617	76.000%	72.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	A	B	C	D	E	F	G	H	I	J
618	76.500%	72.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
619	77.000%	73.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
620	77.500%	73.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
621	78.000%	74.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
622	78.500%	74.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
623	79.000%	75.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
624	79.500%	75.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
625	80.000%	76.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
626	80.500%	76.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
627	81.000%	77.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
628	81.500%	77.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
629	82.000%	77.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
630	82.500%	78.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
631	83.000%	78.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
632	83.500%	79.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
633	84.000%	79.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
634	84.500%	80.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
635	85.000%	80.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
636	85.500%	81.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
637	86.000%	81.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
638	86.500%	82.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
639	87.000%	82.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
640	87.500%	83.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
641	88.000%	83.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
642	88.500%	84.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
643	89.000%	84.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
644	89.500%	85.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
645	90.000%	85.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
646	90.500%	86.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
647	91.000%	86.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
648	91.500%	86.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
649	92.000%	87.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
650	92.500%	87.9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
651	93.000%	88.4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
652	93.500%	88.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
653	94.000%	89.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
654	94.500%	89.8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
655	95.000%	90.3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
656	95.500%	90.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
657	96.000%	91.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
658	96.500%	91.7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
659	97.000%	92.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
660	97.500%	92.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
661	98.000%	93.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
662	98.500%	93.6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
663	99.000%	94.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
664	99.500%	94.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
665	100.000%	95.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
666								1.21E+00		

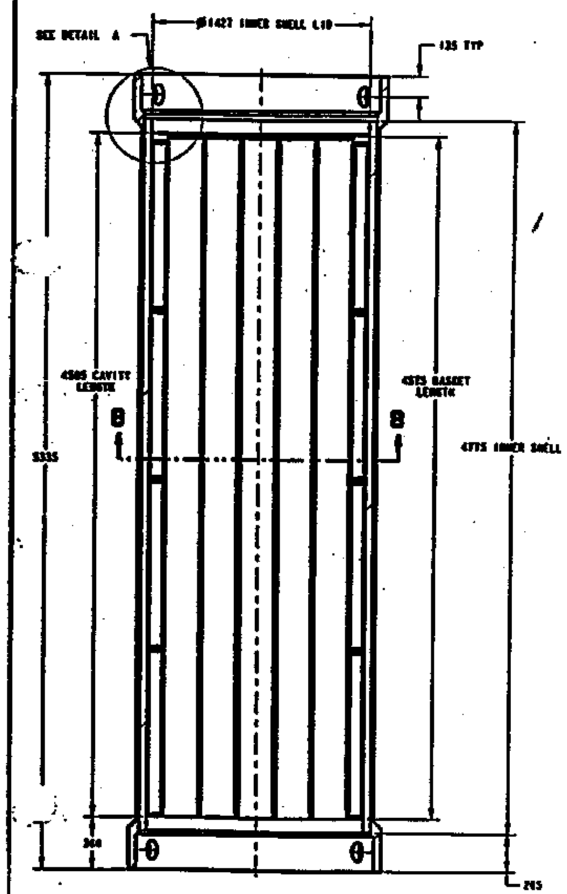




DETAIL A



SECTION B-B



SECTION A-A

COMPONENT NAME	MATERIAL	THICKNESS	MASS (kg)	QTY REQ
BASKET A-SIDEGUIDE	SA-516 K02700	10	27	32
BASKET A-STIFFENER	SA-516 K02700	10	0.72	64
BASKET B-SIDEGUIDE	SA-516 K02700	10	36	16
BASKET B-STIFFENER	SA-516 K02700	10	1.5	32
BASKET C-STIFFENER	SA-516 K02700	10	2.3	32
BASKET CORNER GUIDE	SA-516 K02700	10	42	16
FUEL BASKET A-PLATE	NEUTRONIT A 978	7	85	8
FUEL BASKET B-PLATE	NEUTRONIT A 978	7	85	8
FUEL BASKET C-PLATE	NEUTRONIT A 978	7	44	16
FUEL BASKET D-PLATE	SB-209 A96061 T4	5	21	8
FUEL BASKET E-PLATE	SB-209 A96061 T4	5	21	8
FUEL BASKET TUBE	SA-516 K02700	5	164	21
INNER SHELL	SA-240 S31600	50	8812	1
INNER SHELL LID	SA-240 S31600	95	1212	2
OUTER SHELL	SB-575 N06022	20	5464	1
OUTER SHELL LID	SB-575 N06022	25	390	2
WASTE PACKAGE ASSEMBLY	-	-	25419	1
PWR FUEL ASSEMBLY	-	-	773.4*	21
WP ASSEMBLY WITH SNF	-	-	41660	1

* CRWMS M&O 1997. WASTE CONTAINER CAVITY SIZE DETERMINATION. BBAA00000-01717-0200-00026 REV 00. LAS VEGAS, NV: CRWMS M&O. ACC: MOL.19980106.0061

REVISION 03	
ITEM NUMBER	ITEM
1	Ø130 LIFTING FEATURE WAS Ø125 ON TOP VIEW
2	5464 OUTER SHELL MASS WAS 5445 ON DATA TABLE
3	25419 WASTE PACKAGE ASSEMBLY MASS WAS 25400 ON DATA TABLE
4	41660 WP ASSEMBLY WITH SNF WAS 41641 ON DATA TABLE
5	5335 WASTE PACKAGE ASSEMBLY LENGTH WAS 5325 ON SECTION A-A
6	240 SKIRT LENGTH WAS 235 ON DETAIL A
7	345 FLARED SKIRT LENGTH WAS 340 ON DETAIL A
8	265 SKIRT END TO LID LENGTH WAS 260 ON SECTION A-A
9	360 SKIRT END TO INNER LID LENGTH WAS 355 ON SECTION A-A

UNITS: mm

DO NOT SCALE FROM SKETCH

"FOR INFORMATION ONLY"

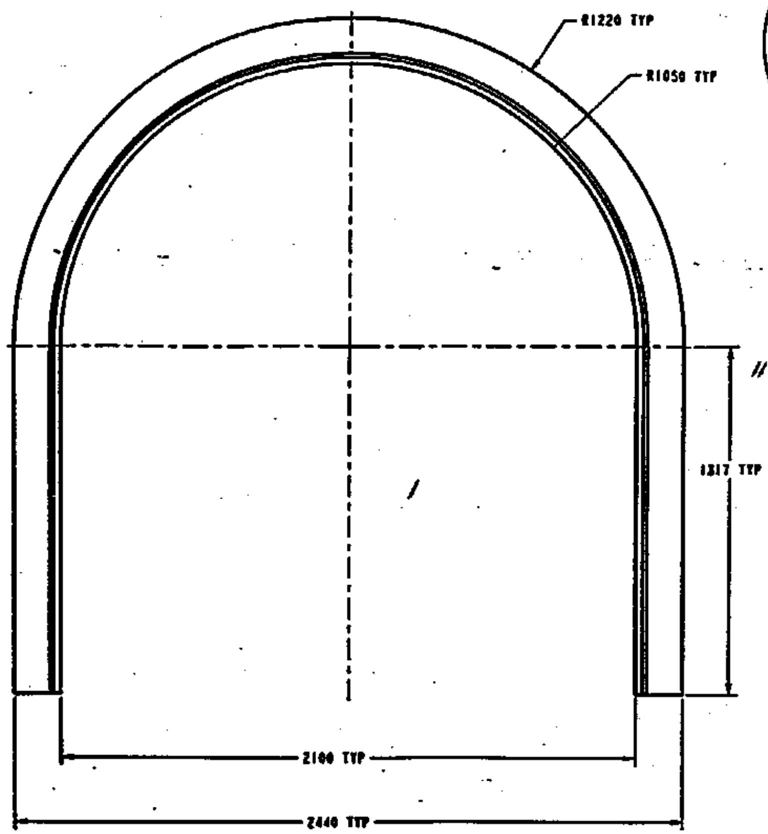
SINGLE CRM 21-PWR WASTE PACKAGE

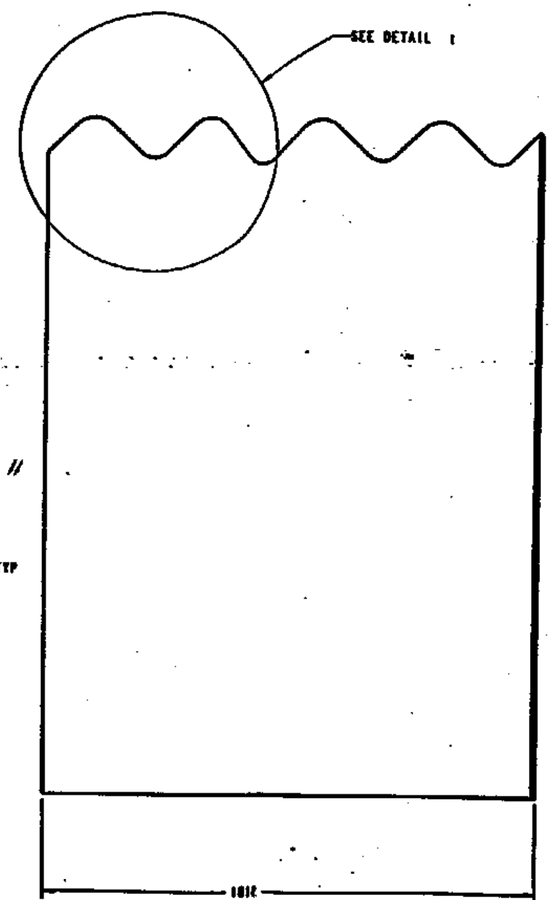
SKETCH NUMBER: SK-0132 REV 03

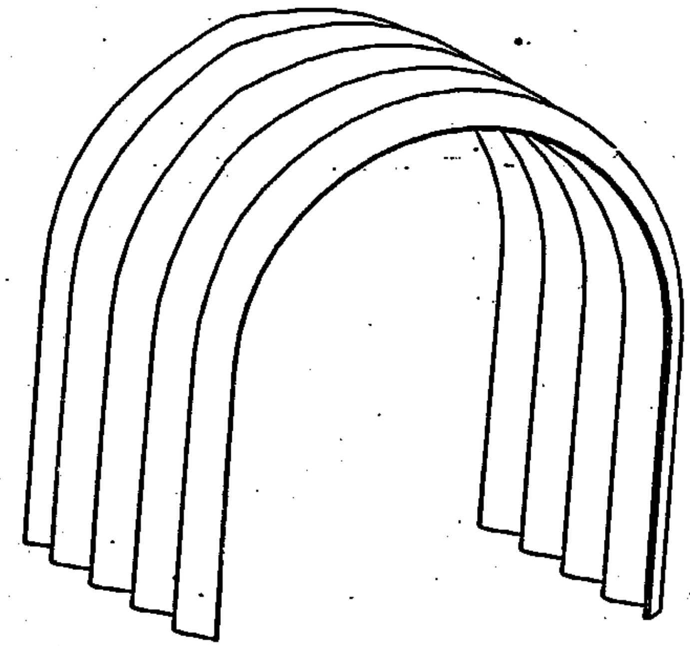
SKETCHED BY: BRYAN HARKINS 16 July 99 BH JWS 7/16/99 JCP 7.16.99

DATE: 07/16/99

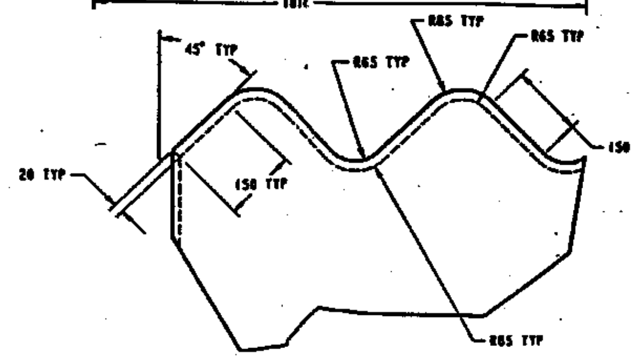
FILE: [illegible]







COMPONENT NAME	MATERIAL	THICKNESS	MASS (kg)	QTY REQ
CORRUGATED DRIP SHIELD	SB-265 R52400	20	1263	1



DETAIL 1

DO NOT SCALE FROM SKETCH

UNITS: mm

"FOR INFORMATION ONLY"

CORRUGATED DRIP SHIELD	
SKETCH NUMBER:	SK-0128 REV 01
SKETCHED BY:	MICHAEL PLINSKI
DATE:	03-23-99
FILE:	/home/pro_library/checkout/drip_shield_sk/SK-0128-1.dr

3/25/99