



PECO NUCLEAR

A Unit of PECO Energy

Nuclear Group Headquarters
200 Exelon Way
Kennett Square, PA 19348

October 27, 2000

Docket No. 50-353
License No. NPF-85

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: Limerick Generating Station, Unit 2
Updated Analysis of Core Shroud Structural Integrity

Dear Sir/Madam:

By letter dated June 24, 1999, and as supplemented by letter dated July 9, 1999, PECO Energy submitted a supplemental response to Generic Letter (GL) 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors," for Limerick Generating Station (LGS), Unit 2. The information provided in our June 24, 1999, letter contained a Summary Report discussing the inspection results and evaluations associated with the LGS, Unit 2, reactor vessel core shroud examinations that were performed during the Spring 1999 refueling outage, 2R05.

Included as attachments to the 1999 Summary Report were Structural Integrity Associates (SIA) Report SIR-99-061, "Evaluation of the Limerick, Unit 2 Shroud Examination Results," dated May 14, 1999, (Attachment 3) and General Electric Nuclear Energy (GENE) Report GE-NE-B13-02010-33, "The Evaluation of Limerick Unit 2 Shroud Cracking for at Least One Fuel Cycle of Operation," dated June 1999 (Attachment 5). Subsequent to these analyses, LGS has begun implementation of noble metals chemical application (NMCA) to enhance the hydrogen water chemistry (HWC) environment of both Units 1 and 2. NMCA was implemented on LGS, Unit 1, during the Spring 2000 refueling outage, 1R08, and will be implemented on LGS, Unit 2, during the upcoming Spring 2001 refueling outage, 2R06. The purpose of this letter is to submit plant specific analyses which update these previous evaluations of the LGS, Unit 2, core shroud structural margins by considering plant operation under HWC/NMCA conditions.

The Exhibit to this letter contains a Summary Report discussing the plant specific analyses. These updated structural margin evaluations are included as attachments to the Exhibit. Attachment 1, SIA Report No. SIR-00-110, "Evaluation of Limerick, Unit 2 Shroud Examination Results," dated September 22, 2000, provides the updated evaluation for welds H1 through H7. Attachment 2, GENE Report No. GE-NE-B13-02080-00-03, "The Evaluation of Limerick Unit 2 Shroud H4 Cracking for Two Fuel Cycles of Operation," dated August 2000 addresses only the high fluence weld H4.

AP01

Attachment 2 of the Exhibit contains information that GENE considers to be of a confidential and proprietary nature. A vertical bar in the right margin of the document identifies the proprietary/confidential information. GENE is requesting that this information in Attachment 2 be withheld from public disclosure in accordance with the requirements of 10CFR2.790(a)(4). An affidavit supporting this request is provided in Enclosure 1. A non-proprietary version of Attachment 2, GENE Report No. GE-NE-B13-02080-00-03 is provided in Enclosure 2.

Based on the analyses provided by General Electric Nuclear Energy and Structural Integrity Associates, a deferral of the reinspection of the LGS, Unit 2 core shroud limiting horizontal welds for one (1) additional two (2) year operating cycle is justified. Engineering analysis results show that structural integrity criteria are satisfied for at least one additional operating cycle for all horizontal welds. The engineering analysis includes hydrodynamic loads as part of the load combinations as well as special consideration of the affect of high fluence ($> 5 \times 10^{20}$ n/cm²) at weld H4. A crack growth rate specifically applicable to H4 has been derived for use in this analysis. Credit is taken in the derivation for implementation of Noble Metals Chemical Application which is planned at LGS, Unit 2 during 2R06. A factor of improvement (FOI) equal to 5 is justified both by using laboratory test results involving irradiated specimens as well as by use of a theoretical corrosion mechanism model that includes irradiation sensitization. The irradiated specimen data and the theoretical corrosion model are both proprietary to the General Electric Nuclear Energy. In addition, a separate evaluation using the 95th percentile BWRVIP-14 crack growth rate correlation was used to develop an irradiated crack growth rate FOI equal to 2.

If you have any questions regarding this analysis, we request that you contact us as soon as possible such that we can achieve resolution prior to January 15, 2001, in order to avoid any unnecessary expenditures associated with the upcoming outage.

Very truly yours,



James A. Hutton
Director - Licensing

Attachments/Enclosure

cc: H. J. Miller, Administrator, USNRC, Region I (w/attach/enc)
A. L. Burritt, USNRC Senior Resident Inspector, LGS (w/attach/enc)

EXHIBIT

**PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 2
REACTOR PRESSURE VESSEL CORE SHROUD
UPDATED EVALUATION OF STRUCTURAL MARGIN**

Including Attachments

PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 2
REACTOR PRESSURE VESSEL CORE SHROUD
UPDATED EVALUATION OF STRUCTURAL MARGIN

In May 1999, during the fifth refueling outage (2R05) of Limerick Generating Station (LGS), Unit 2, portions of the core shroud structure were inspected. These inspections were conducted to determine the condition of specific core shroud welds considered, based on industry experience, to be most susceptible to Intergranular Stress Corrosion Cracking (IGSCC). This effort is discussed in the PECO Energy response to NRC Generic Letter 94-03, dated August 24, 1994, the Safety Evaluation contained in NRC letter dated March 13, 1995, and the LGS, Unit 2, core shroud Inspection Plan, forwarded to the NRC in our letter dated January 12, 1999. The inspections and flaw evaluations were conducted in accordance with the guidance provided by the Boiling Water Reactor Vessel and Internals Project (BWRVIP), as specified in BWRVIP-01, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines", Revision 2, dated October 1996 [1]. Additional guidance was utilized from BWRVIP-03, "Reactor Pressure Vessel and Internals Examination Guidelines", Revision 1, dated March 1999 [2], BWRVIP-07, "Guidelines for Reinspection of BWR Core Shrouds", dated February 1996 [3], and GENE-B13-01980-14, "Shroud Vertical Weld Inspection and Evaluation Guidelines" (Draft), dated March 1999 [4]. A Summary Report providing the results of the inspection and flaw evaluations was forwarded to the NRC in our letter dated June 24, 1999 and as supplemented by our letter dated July 9, 1999.

Included as attachments to the 1999 Summary Report were Structural Integrity Associates (SIA) Report SIR-99-061, "Evaluation of the Limerick, Unit 2 Shroud Examination Results," dated May 14, 1999 (Attachment 3) and General Electric Nuclear Energy (GENE) Report GE-NE-B13-02010-33, "The Evaluation of Limerick Unit 2 Shroud Cracking for at Least One Fuel Cycle of Operation," dated June 1999 (Attachment 5). These analyses were completed during the refuel outage, immediately upon completion of the inspection. Thus, the evaluation for continued service of the core shroud structure used bounding conservative assumptions and considered only one (1) two year cycle of operation for calculating the extent of crack growth for any as-found or assumed flaw.

Subsequent to these analyses LGS has begun implementation of noble metals chemical application (NMCA) to enhance the hydrogen water chemistry (HWC) environment of both Units 1 and 2. NMCA was implemented on LGS, Unit 1, during the Spring 2000 refueling outage, 1R08, and will be implemented on LGS, Unit 2, during the upcoming Spring 2001 refueling outage, 2R06.

This Report provides plant specific analyses which update the previous evaluations of the LGS, Unit 2, core shroud structural margins by considering plant operation under HWC/NMCA conditions. Attachment 1, SIA Report No. SIR-00-110, "Evaluation of Limerick, Unit 2 Shroud Examination Results," dated September 22, 2000 provides the updated evaluation for welds H1 through H7. Attachment 2, GENE Report No. GE-NE-B13-02080-00-03, "The Evaluation of Limerick Unit 2 Shroud H4 Cracking for Two Fuel Cycles of Operation," dated August 2000 addresses only the high fluence i.e., $> 5 \times 10^{20} \text{ n/cm}^2$ ($E > 1\text{MeV}$), weld H4. The SIA and GENE Reports both include a crack growth rate analysis to determine the appropriate crack growth rate to be applied to structural margin evaluations during two (2) distinct periods of water chemistry operation; one period under normal water chemistry (NWC) or low level HWC and one under HWC/NMCA.

The primary concern is for an apparent flaw on the outside surface of shroud weld H4. The SIA crack growth rate analysis develops an irradiated crack growth rate based on actually measured open literature crack growth rate data and the statistically developed 95th percentile BWRVIP-14 [5] crack growth rate model. The GENE crack growth rate analysis develops an irradiated crack growth rate based on laboratory test conducted on irradiated BWR components or measured in-situ at the Halden test reactor.

The GENE analysis also uses the Irradiated PLEDGE model that includes irradiation sensitization and which has been benchmarked using both non-irradiated and irradiated crack growth data. The laboratory data and the Irradiated PLEDGE model are both proprietary to GENE. The SIA and GENE crack growth rate analyses supplement each other in that the two (2) different analytical approaches both conclude that a factor-of-improvement (FOI) reduction to the bounding crack growth rate of 5×10^{-5} inches/hour is justified based on reduced Electrochemical Corrosion Potential (ECP) during HWC/NMCA.

BACKGROUND:

The LGS, Unit 2, core shroud was fabricated by Sun Shipbuilding and Drydock Co., Chester PA. The product forms used for this fabrication included 2" thick SA-240, Type 304L stainless steel plate (for shroud cylinders), and varying thickness of SA-240, Type 304L stainless steel plate for the rings. The plate materials have a low carbon content (.018% to .026%). The product forms were joined using the submerged arc welding process. The weld filler metal was ASME SFA-5.9, Class ER308L. Welds H-1 through H-6 were welded from both surfaces, using double bevel weld end preparations. Weld H-7 was welded from the inside surface of the core shroud using single bevel weld end preparations and a backing ring. The H-7 weld was made at the LGS site, and it connected the prefabricated core shroud structure to the Reactor Pressure Vessel. This weld is a dissimilar metal weld (304 stainless to Alloy 600). The filler metal for this weld was ASME SFA-5.14, Class ERNiCr-3 (Alloy 82) for the root, and ASME SFA-5.11,

Class ENiCrFe-3 (Alloy 182) for the remainder of the weld. The processes used for this joint were the Gas Tungsten Arc Welding and Shielded Metal Arc Welding. The LGS, Unit 2, H-7 weld has an additional Alloy 82 fillet weld on the OD between the lower core shroud cylinder and the backing ring for crevice mitigation.

PLANT WATER CHEMISTRY:

The LGS, Unit 2, core shroud has been in service since January 8, 1990. During this first decade of operation, LGS, Unit 2, operated with relatively low, primary-water conductivity. Unit 2's mean conductivity has been maintained well below the EPRI recommended value of .20 μ S/cm for a majority of this time period.

LGS, Unit 2, is currently operating (cycle 6, from Spring 1999 through Spring 2001) with a low level HWC environment. LGS, Unit 2, operates in this environment > 93% of the time. This is based on a HWC system availability of > 98% (and improving) and factors in Unit outage operations with a normal water chemistry environment. Although the current level of hydrogen injection, i.e., ~16 SCFM, is not sufficient to reduce the corrosion potential of stainless steel to below the threshold level for the initiation of intergranular stress corrosion cracking (IGSCC), it will reduce the crack growth rate. The current low level HWC will be enhanced with noble metal chemical application (NMCA, commercially known as NobleChem™) during the next LGS, Unit 2, fuel cycle (cycle 7, from Spring 2001 to Spring 2003). Based on LGS, Unit 1's present experience with NMCA, the application of NMCA to LGS, Unit 2, is expected to lower the corrosion potential of stainless steel substantially below the threshold level for IGSCC, such that crack initiation will be completely mitigated and crack growth of any existing flaws will be extremely low.

NMCA includes the use of a Noble Metals Monitoring System (NMMS) which provides a means of gauging the success of the noble metals treatment in mitigating IGSCC of RPV wetted internals, components and piping. The monitoring system consists of two major instruments: a durability monitor and an electrochemical corrosion potential (ECP) monitor. The durability monitor provides a means of measuring the surface density of the noble metals coating, both after the initial application, and over the

course of the subsequent operating cycles. The ECP monitor measures the corrosivity of the reactor water with respect to the noble metals treated surfaces.

The durability monitor is a series of Type 304L stainless steel tubing sections that are exposed to the RWCU System process fluid obtained prior to the RWCU heat exchangers and demineralizers. The purpose of this section of the monitoring system is to provide a means of removing sections of this tubing upon completion of the noble metals chemical application and during subsequent operating cycles. These samples are analyzed to determine the deposition thickness and to evaluate wear rate of the noble metals under reactor temperature, pressure, flow and chemistry conditions.

The ECP monitor consists of two reference probes (a platinum probe and an iron/iron oxide probe) inserted into the RWCU system process fluid. The ECP voltage is measured between these two reference probes and the stainless steel piping. RWCU system process fluid is used, since the fluid is indicative of temperature, pressure and chemistry conditions of the water in the Reactor Vessel. The measured ECP is recorded and analyzed on a periodic basis to determine the effectiveness of the noble metals in mitigating IGSCC in the vessel.

The sample is obtained in the RWCU system, from a tap on the regenerative heat exchanger tube side inlet. At this location the sample is at reactor temperature and pressure. Its nominal composition is 15% Reactor Vessel Bottom Head Drain flow and 85% Recirculation flow. Therefore, the sample accurately reflects the conditions of the reactor coolant. Hydrogen (H_2) concentrations in the sample are calculated based on GENE model flow rates and benchmark testing performed by PECO Energy. Stoichiometric excess molar ratios of H_2 to O_2 are maintained in the range of 4.3: 1 to 7.5: 1 to ensure that Reactor Vessel wetted surfaces are made catalytic using NobleChem™.

EVALUATIONS:

SIA Structural Analysis

Based upon the inspection data for welds H1 through H7 reported in 1999, flaw evaluations were performed to justify continued operation and to determine the required inspection interval for all the core shroud welds. The analyses were performed using limit load as the failure criterion for each of the welds. The analyses performed take into account the distribution of good material at each weld around the circumference of the shroud. In addition, the H4 weld, which is the most highly irradiated, was evaluated using the Linear Elastic Fracture Mechanics (LEFM) methodology.

Substantial conservatism was built into the SIA evaluation to account for the weld area examined, the weld area which was not examined, evaluation guidelines' detection and sizing uncertainties, crack growth, and the evaluation guidelines' flaw proximity criteria as applied to adjacent flaws. The specific conservatism utilized in the SIA evaluation are as follows:

1. All areas not examined were considered cracked at the depth of the deepest flaw. For cracking reported on both the inside and outside surfaces at the same azimuthal location, the shroud was analyzed for through-wall flaws at these locations, and the uninspected regions were assumed cracked through-wall.
2. A bounding crack growth rate (5×10^{-5} inches/hour) [6] in the length direction was applied to all identified flaws, as well as to all the uninspected regions.
3. UT inspection uncertainty factors were applied to all identified indications.
4. ASME Code, Section XI proximity criteria for adjacent flaws were applied, after accounting for crack growth and inspection uncertainties.

5. ASME Code, Section XI pressure boundary safety margins were applied to these evaluations even though the core shroud is not a primary pressure boundary.
6. A K-independent crack growth rate in the depth direction of 2.2×10^{-5} inches/hour [5] was used for the first cycle for all welds except the most highly irradiated weld H4, where a crack growth rate of 10^{-5} inches/hour was used. For all subsequent cycles, since noble metal chemical application (NMCA) will be implemented in the Spring 2001 refueling outage, 2R06, a crack growth rate of half of these values was used, except where NMCA has not been shown to be totally effective. Per the industry guidance provided in Table 4-4 of BWRVIP-62 [7], the inside surface of welds H1, H2, H5, and H6 may not see a reduced crack growth rate with the implementation of NMCA. Therefore, the factor-of-improvement (FOI) of two was not used for indications reported on the inside surface of these welds.
7. It was assumed that the outside surface of weld H4 was characterized by the same fluence as the inside surface, i.e., 8.9×10^{20} n/cm². However, the outside surface fluence would actually be attenuated by the 2 inch thickness of the stainless steel shroud by a factor of $e^{(-0.24t)}$, where t is the thickness of the H4 weld [8].
8. The degree of sensitization due to irradiation, i.e., chromium depletion at the grain boundaries, is less severe than thermal sensitization [9]. (The LGS, Unit 2, FOI evaluation was based on a metallurgically worst-case furnace sensitized material that metallurgically bounds the weld sensitized data even at elevated fluences.)
9. The strong possibility of crack branching that results in a decrease in stress intensity and, subsequently, decreased crack growth rate was ignored.
10. No credit was taken for irradiation-induced stress relaxation.
11. The anticipated LGS, Unit 2, HWC/NMCA FOI utilized in the SIA evaluation was based on the 95th percentile BWRVIP-14 model. Industry crack growth rate models producing dramatically higher FOI were not used. A crack growth rate FOI of only 2 was used when an FOI >> 8.77 was justified.

GENE Structural Analysis

Based upon the inspection data for weld H4 reported in 1999, flaw evaluations were performed to justify continued operation for two cycles of operation i.e., the current cycle under NWC and the coming cycle under HWC with NobleChem™. The H4 weld is considered to be in the bellline region (estimated peak fluence greater than 3×10^{20} n/cm²) and therefore, both a limit load and an LEFM evaluation was conducted for this weld. This methodology is consistent with the methodology described in Section 4.0 of BWRVIP-01 [1].

Substantial conservatisms were built into the GENE evaluation to account for the weld area examined, the weld area which was not examined, evaluation guidelines' detection and sizing uncertainties and crack growth. The specific conservatisms utilized in the GENE evaluation are as follows:

1. A 360° part through-wall crack was assumed for the LEFM evaluation. The crack depth was assumed to have an initial depth (i.e., before the application of NDE uncertainty and projected crack growth) equal to the maximum indication depth reported at the H4 weld (0.11 in). Thus, the initial crack depth in the indication free weld regions as well as the inaccessible weld regions was assumed equal to the maximum measured depth.

2. The initial assumed 0.11 inch crack depth was increased to account for UT uncertainty (0.131 in) per BWRVIP-03 [2].
3. A fracture mechanics solution for a single edge notch flat plate was conservatively applied. This approach is considered conservative since the flat plate solution includes back wall bending caused by the eccentricity of the applied load, which is not present in the cylindrical model.
4. Limit load calculations for the H4 weld were performed using the Distributed Length Ligament computer program [10]. The flow stress was taken as $3S_m$. The S_m value for the shroud material (Type 304L stainless steel) is 14.4 ksi at the approximate normal operating temperature of 550°F.
5. ASME Code Section XI pressure boundary safety margins were applied to these evaluations even though the core shroud is not a primary pressure boundary per BWRVIP-01 [1].
6. A bounding crack growth rate of 5×10^{-5} in/hr was used for both length and depth for the current cycle (through spring 2001). For the next cycle, a crack growth rate of 1.4×10^{-5} in/hr was used for depth. The basis for this crack growth rate is detailed in Appendix C of Attachment 2. A conservative value of 1×10^{-5} in/hr was proposed for the evaluation of the H4 weld under HWC operation. Assuming that HWC availability is 90%, (i.e. HWC operation for 90% of the time and NWC for 10% of the time), the effective crack growth rate for the coming cycle was determined to be 1.4×10^{-5} in/hr.
7. A conservative upper bound value of $10\text{C}/\text{cm}^2$ for Type 304 stainless steel was used for the material sensitization Electrochemical Potentiokinetic Reactivation (EPR) value when a value of $< 5\text{C}/\text{cm}^2$ for Type 304L stainless steel has been justified.
8. A conservative ECP value of $-230\text{mV}_{\text{she}}$ was used to evaluate the factor of improvement when an ECP value lower than $-400\text{mV}_{\text{she}}$ has been justified.
9. A crack growth rate FOI of 5 was used in the evaluation when an FOI $>> 10$ has been justified.

ANALYSIS RESULTS:

The membrane and bending stress magnitudes for the normal/upset and emergency/faulted service levels were calculated. From the calculated stresses, the normal/upset condition was determined to be limiting.

Based upon a review of the examination data for circumferential welds H1 through H7, there is substantial margin for each of these welds under conservative, bounding conditions to allow for continued operation for at least two twenty-four month cycles. The analyses performed included limit load analyses under bounding design basis conditions, and LEFM evaluations for the postulated highest fluence weld H4. Required safety margins were used, and were exceeded in all cases.

The benefit of reduced Electrochemical Corrosion Potential (ECP) during operation in a HWC/NMCA environment was quantified using real-time crack growth rate test data, crack growth modeling results, extensive laboratory and reactor in-situ test results and also the results of the GENE Irradiated PLEDGE model which is based on fundamental principles and benchmarked by comparison with test data. These results and experience with LGS, Unit 1, operation clearly indicate that the anticipated LGS, Unit 2, HWC/NMCA environment will essentially mitigate crack growth. The evaluation determined that the H4 weld meets the structural margin requirements for continued operation for at least one additional fuel cycle following the Spring 2001 refueling outage, 2R06, given that HWC/NMCA is implemented during 2R06.

The results of the SIA limit load analyses for each of the horizontal welds examined concluded that reinspection is required for welds H1, H2 and H5 five operating cycles after the Spring 1999 refueling outage, 2R05 baseline inspection, i.e., reinspection during the 2009 refueling outage, 2R10. Welds H3, H4 and H6, will require reinspection in four cycles after the Spring 1999 refueling outage, 2R05 baseline inspection i.e., reinspection during the 2007 refueling outage, 2R09. Weld H7 did not have any reported indications. Per BWRVIP-07 [3], reinspection is required in 10 years.

The LEFM evaluation of the H4 weld was performed by SIA to determine the applied stress intensity factor resulting from the bounding loading conditions. The results of this analysis demonstrate that the 150 ksi $\sqrt{\text{inch}}$ material toughness, which is presented in BWRVIP-76 [6] as the acceptable fracture toughness for this material under irradiation conditions, is met. The BWRVIP-76 [6] evaluation guidelines' minimum required factors-of-safety have been met for weld H4 for at least two operating cycles after the Spring 1999 refueling outage, 2R05 baseline inspection i.e., reinspection during the 2003 refueling outage, 2R07.

In addition GENE performed both a limit load and an LEFM evaluation of the highest fluence weld, H4. In each case, an allowable flaw depth was calculated based on a 360° flaw. The allowable flaw depth was then compared to the end-of-cycle crack depth and determined to be less than the limiting allowable flaw size. Thus, structural margin exists for the H4 weld. The LEFM evaluation concluded that structural margins have been met for at least two operating cycles after the Spring 1999 refueling outage, 2R05 baseline inspection i.e., reinspection during the 2003 refueling outage, 2R07.

SUMMARY:

PECO Energy intends to defer the reinspection of the LGS, Unit 2, core shroud limiting horizontal welds for one additional two (2) year operating cycle. Engineering analysis results show that structural integrity criteria are satisfied for at least one additional operating cycle for all horizontal welds. The engineering analysis includes hydrodynamic loads as part of the load combinations as well as special consideration of the affect of high fluence ($> 5 \times 10^{20} \text{ n/cm}^2$) at weld H4. A crack growth rate specifically applicable to H4 has been derived for use in this analysis. Credit is taken in the derivation for implementation of Noble Metals Chemical Application which is planned at LGS, Unit 2, during 2R06. A factor of improvement (FOI) equal to 5 is justified both by using laboratory test results involving irradiated specimens as well as by use of a theoretical corrosion mechanism model that includes irradiation sensitization. The irradiated specimen data and the theoretical corrosion model are both proprietary to General Electric Nuclear Energy. In addition, a separate evaluation using the 95th percentile BWRVIP-14 crack growth rate correlation was used to develop an irradiated crack growth rate FOI equal to 2.

REFERENCES:

1. BWRVIP-01, BWR Vessel and Internals Project, "BWR Core Shroud Inspection And Flaw Evaluation Guideline," Revision 2, EPRI Report No. TR-107079, October 1996.
2. BWRVIP-03, BWR Vessel and Internals Project, "Reactor Pressure Vessel and Internals Examination Guidelines," Revision 2, EPRI Report No. TR-105696-R2, December 1999.
3. BWRVIP-07, BWR Vessel and Internals Project, "Guidelines for Reinspection of BWR Core Shrouds," EPRI Report No. TR-105747, February 1996.
4. BWR Vessel and Internals Project, "Shroud Vertical Weld Inspection and Evaluation Guidelines," DRAFT Report # GENE-B13-01980-14, March 1999.

5. BWRVIP-14, BWR Vessel and Internals Project, "Evaluation of Crack Growth in BWR Stainless Steel RPV Internals," EPRI Report No. TR-105873, March 1996.
6. BWRVIP-76, BWR Vessel and Internals Project, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines," EPRI Report No. TR-114232, November 1999.
7. BWRVIP-62, BWR Vessel and Internals Project, "Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection," EPRI Report No. TR-108705, December 1998.
8. Regulatory Guide 1.99, U. S. Nuclear Regulatory Commission, "Radiation Embrittlement of Reactor Vessel Materials", Revision 2, May 1988.
9. E. Indig, J. L. Nelson and G. P. Wozadlo, "Investigation of Protection Potential Against IASCC," paper presented at the Fifth International Symposium on the Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors, Monterey, CA, August 25-29, 1991, published in proceedings of same, ANS, La Grange, IL, p. 941, 1992.
10. BWRVIP-20, BWR Vessel and Internals Project, "BWR Core Shroud Distributed Ligament Length (DLL) Computer Program (Version 2.1)," EPRI Report No. TR-107283, December 1996.

ATTACHMENTS:

1. Structural Integrity Associates, Evaluation of the Limerick, Unit 2 Shroud Examination Results, Report No. SIR-00-110, Revision 0, September 22, 2000.
2. General Electric Nuclear Energy, The Evaluation of Limerick Unit 2 Shroud H4 Cracking for Two Fuel Cycles of Operation, GE-NE-B13-02080-00-03, dated August 2000.

**PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 2
REACTOR PRESSURE VESSEL CORE SHROUD
UPDATED EVALUATION OF STRUCTURAL MARGIN**

ENCLOSURE 1

General Electric Nuclear Energy Affidavit

General Electric Company

AFFIDAVIT

I, David J. Robare, being duly sworn, depose and state as follows:

- (1) I am Technical Projects Manager, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in the GE proprietary report GE-NE-B13-02080-00-03, *The Evaluation of Limerick Unit 2 Shroud H4 Cracking for Two Fuel Cycles of Operation*, Revision 0, Class III (GE Nuclear Energy Proprietary Information), dated September 2000. The proprietary information is delineated by bars marked in the margin adjacent to the specific material.
- (3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (4) Some examples of categories of information which fit into the definition of proprietary information are:
 - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;
 - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

- c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;
- d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;
- e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a. and (4)b., above.

- (5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- (8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results of analytical models, methods and processes, including computer codes, which GE has developed and applied to perform flaw evaluations for the BWR.

The development of fluence estimation methodology that are used to evaluate BWRs was achieved at a significant cost, on the order of one million dollars, to GE.

The development of the evaluation process contained in the paragraph (2) document along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF CALIFORNIA)
)
COUNTY OF SANTA CLARA) ss:

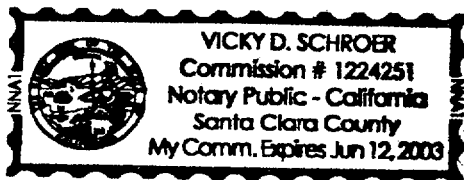
David J. Robare, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this 30TH day of AUGUST 2000.

David J. Robare
David J. Robare
General Electric Company

Subscribed and sworn before me this 30th day of August 2000.



Vicky D. Schroer
Notary Public, State of California

**PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 2
REACTOR PRESSURE VESSEL CORE SHROUD
UPDATED EVALUATION OF STRUCTURAL MARGIN**

ENCLOSURE 2

**General Electric Nuclear Energy
The Evaluation of Limerick Unit 2 Shroud H4 Cracking
for Two Fuel Cycles of Operation
GE-NE-B13-02080-00-03
August 2000**

NON-PROPRIETARY DOCUMENT

**PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 2
REACTOR PRESSURE VESSEL CORE SHROUD
UPDATED EVALUATION OF STRUCTURAL MARGIN**

ATTACHMENT 1

**Structural Integrity Associates
Evaluation of the Limerick, Unit 2 Shroud Examination Results
Report No. SIR-00-110, Revision 0
September 22, 2000.**



September 22, 2000
SIR-00-110
RAM-00-078

3315 Almaden Expressway
Suite 24
San Jose, CA 95118-1557
Phone: 408-978-8200
Fax: 408-978-8964
www.structint.com
rmattson@structint.com

Mr. David L. Schmidt
PECO Energy Systems
Limerick Nuclear Generating Station
Evergreen & Sanatoga Roads
Pottstown, PA 19464

Subject: Evaluation of Limerick, Unit 2 Shroud Examination Results

Dear David:

Structural Integrity Associates (SI) has performed an evaluation of the ultrasonic examination results recorded during the 1999 inspection of shroud circumferential welds H1 through H7 at Limerick, Unit 2, in order to determine acceptance for continued operation. The evaluations performed and documented herein were designed to justify operation without reinspection of these welds for at least two, two year operating cycles. The evaluations were performed following the approach used in the BWR Vessel and Internals Project (BWRVIP) shroud evaluation guidelines [1], based on limit load and linear elastic fracture mechanics (LEFM) techniques. The following sections of this report describe the methodology used to evaluate each weld and the resulting safety margins.

INSPECTION AND EVALUATION METHODOLOGY

The inspection and evaluation approach employed at Limerick, Unit 2 provides the necessary information for determination of the required amount of unflawed material to meet specified safety margins, including the appropriate amount for postulated crack growth and nondestructive examination (NDE) detection and sizing uncertainties. Ultrasonic examination (UT) techniques were utilized which provided complete through-thickness interrogation of all welds. Due to accessibility limitations, the circumferential extent of examination of these welds varied. However, sufficient weld length was adequately interrogated to quantifiably demonstrate the condition, and hence, the structural integrity of all welds evaluated. Because both limit load and LEFM assessments have been performed, evaluation methodologies will be addressed separately with respect to structural integrity evaluation.

ACCEPTANCE CRITERIA

The core shroud is a core support structure which provides lateral support for the fuel. The applicable codes, standards and classification for the core shroud are as follows:

- The core shroud is classified as a safety-related component.
- The core shroud is not an ASME Code, Section III component. However, the original design is in accordance with the intent of Section III of the ASME Code.
- The evaluation of the core shroud was performed in accordance with the requirements of the BWRVIP's shroud evaluation guidelines [1].

FLAW EVALUATION RESULTS

Based upon the inspection data reported in 1999, flaw evaluations were performed to justify continued operation, with the results documented herein. The analyses were performed using limit load as the failure criterion for each of the welds. The analyses performed take into account the distribution of good material at each weld around the circumference of the shroud. In addition, the H4 weld, which is the most highly irradiated, was evaluated using the LEFM methodology.

Substantial conservatisms were built into the evaluation to account for the weld area examined, the weld area which was not examined, evaluation guidelines' detection and sizing uncertainties, crack growth, and the evaluation guidelines' flaw proximity criteria as applied to adjacent flaws. The specific conservatisms utilized in this evaluation are as follows:

1. All areas not examined were considered cracked at the depth of the deepest reported indication. For cracking reported on both the inside and outside surfaces at the same azimuthal location, the shroud was analyzed for through-wall flaws at these locations. If cracking was reported on both surfaces, the uninspected regions were assumed cracked through-wall.
2. A bounding crack growth rate (5×10^{-5} inches/hour) [1] in the length direction was applied to all identified flaws, as well as to all the uninspected regions.
3. UT inspection uncertainty factors were applied to all identified indications.
4. ASME Code, Section XI proximity criteria for adjacent flaws were applied, after accounting for crack growth and inspection uncertainties.

5. ASME Code, Section XI pressure boundary safety margins were applied to these evaluations even though the core shroud is not a primary pressure boundary.

A K-independent crack growth rate in the depth direction of 2.2×10^{-5} inches/hour [12] was used for the first cycle for all welds except the most highly irradiated weld H4, where a crack growth rate of 5×10^{-5} inches/hour was used. For all subsequent cycles, since noble metal chemical application (NMCA) will be implemented in the 2001 outage, a conservative crack growth rate of half of these values was used, except where NMCA has not been shown to be totally effective. Per Table 4-4 of BWRVIP-62 [9], the inside surface of welds H1, H2, H5, and H6 may not see a reduced crack growth rate with the implementation of NMCA. Therefore, the factor-of-improvement of two described above was not used for indications reported on the inside surface of these welds.

The U.S. NRC has accepted the 2.2×10^{-5} inches/hour crack growth rate for fluences less than 5×10^{20} n/cm² [13] under normal water chemistry conditions. Subsequently, the U.S. NRC accepted a reduction in crack growth rate from 2.2×10^{-5} inches/hour to 1.1×10^{-5} inches/hour for plants on hydrogen water chemistry, again for fluences less than 5×10^{20} n/cm² [14]. Since all welds evaluated herein, except weld H4, have fluences less than 5×10^{20} n/cm², the above crack growth rates are acceptable. Appendix D of this report provides justification for crack growth in the depth direction for weld H4, where the fluence is projected to exceed 5×10^{20} n/cm². The conclusions of this appendix are that during the current cycle, with Limerick, Unit 2 operating with a low hydrogen injection rate, a crack growth rate of 5×10^{-5} inches/hour is bounding. With NMCA in the next cycle, the expected crack growth rate would be far lower than the rate of 2.5×10^{-5} inches/hour used in the analyses documented in this report.

The conservative assumptions described above were applied to each of the horizontal welds examined in this report. Table 1 documents the input data. Tables 2 through 8 present the results of the ultrasonic examination for each of the horizontal welds evaluated in this report.

The results of the limit load analyses for each of the horizontal welds examined are presented in Table 9, based upon the stresses reported in Table 1, and the examination results reported in Tables 2 through 8, with the detailed inspection results contained in Appendix A. Based upon the results in Table 9, reinspection is not required for five cycles of operation for all welds except welds H3, H4 and H6, which will require reinspection in four cycles. One should note that the conservatisms utilized in this study are as described previously in this section. (Weld H7 did not have any reported indications. Per BWRVIP-76 [1], reinspection is required in 10 years.)

Finally, an evaluation of the H4 weld was performed using the LEFM methodology to determine the applied stress intensity factor resulting from the bounding loading conditions. The results of this analysis demonstrate that the 150 ksi $\sqrt{\text{inch}}$ material toughness, which is presented in the evaluation guidelines [1] as the acceptable fracture toughness for this material under irradiated conditions, is met, when considering an appropriate factor-of-safety. Appendix C illustrates that the evaluation guidelines [1] minimum required factors-of-safety have been met for weld H4.



SUMMARY

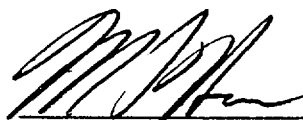
Based upon a review of the examination data for circumferential welds H1 through H7, there is substantial margin for each of these welds under conservative, bounding conditions to allow for continued operation for at least two twenty-four month cycles. The analyses performed included limit load analyses under bounding design basis conditions, and an LEFM evaluation for the postulated highest fluence weld. The evaluations were performed with the assumption that all regions uninspected were cracked at the maximum flaw depth for all calculations. Additionally, all uninspected areas and areas with reported cracking were grown in the length and depth directions at bounding crack growth rates, and increased in length and depth by UT uncertainty factors. Required safety margins were used, and were exceeded in all cases.

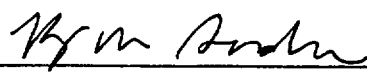
Very truly yours,

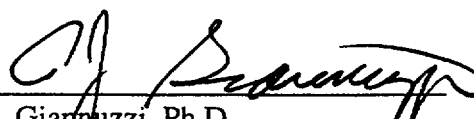
Prepared by:


R. A. Mattson, P. E.

Reviewed by:


M. L. Herrera, P. E.


B. M. Gordon, P. E.


A. J. Giannuzzi, Ph.D.

jj
Attachments
cc: PECO-30QB

REFERENCES

1. BWR Vessel and Internals Project, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines (BWRVIP-76)," EPRI Report No. TR-114232, November 1999, SI File No. BWRVIP-01-276P.
2. Fax from Rich Ciemiewicz (PECO) to Dick Mattson (SI) with Attached Figure, May 9, 1999, SI File No. PECO-30Q-211.
3. GE Nuclear Energy, "Determination of Inspection Lengths for the Limerick Unit-1 Shroud," Report No. GENE-523-A037-0495, July 1995, SI File No. PECO-30Q-205.
4. GE Nuclear Energy, "Core Shroud Loads at Horizontal Welds H1 Through H8," Report No. B13-02066-00-20-LT1, September 19, 2000, SI File No. PECO-30Q-217.
5. Sun Shipbuilding and Drydock Company, "Core Support As-Built Dimensions," Drawing No. 42598-42, Revision 2, SI File No. PECO-30Q-207.
6. BWR Vessel and Internals Project, "Reactor Pressure Vessel and Internals Examination Guidelines (BWRVIP-03) Revision 2," EPRI Report No. TR-105696-R2, December 1999, SI File No. BWRVIP-01-203P.
7. E-mail from Richard Ciemiewicz (PECO) to Dick Mattson (SI) dated May 13, 1999, 9:52 a.m., SI File No. PECO-30Q-213.
8. Structural Integrity Associates, Software User Manual, "ANSC for Determining Net Section Collapse of Arbitrarily Thinned Cylinder," Report No. SIR-94-035, Revision 0, April 29, 1994, SI File No. QA-1900.
9. BWR Vessel and Internals Project, "Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection (BWRVIP-62)," EPRI Report No. TR-108705, December 1998, SI File No. BWRVIP-01-262P.
10. E-mail from Richard Ciemiewicz (PECO) to Dick Mattson (SI) dated September 1, 2000, 6:59 a.m., SI File No. PECO-30Q-209.
11. Letter from Carl Terry (BWRVIP Chairman) to C. E. Carpenter (U.S. NRC), "Project No. 704 - BWRVIP Response to NRC Safety Evaluation of BWRVIP-14," November 24, 1998, SI File No. PECO-28Q-206.
12. BWR Vessel and Internals Project, "Evaluation of Crack Growth in BWR Stainless Steel RPV Internals (BWRVIP-14)," EPRI Report No. TR-105873, March 1996, SI File No. BWRVIP-01-214P.

13. Letter from Gus C. Lainas (U.S. NRC) to Carl Terry (BWRVIP Chairman), "Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-14 Report (TAC No. M94975)," June 8, 1998, SI File No. PECO-28Q-206.
14. Letter from Jack R. Strosnider (U. S. NRC) to Carl Terry (BWRVIP Chairman)," Final Safety Evaluation of Proprietary Report TR 105873 "BWR Vessel and Internals Project, Evaluation of Crack Growth in BWR Stainless Steel Internals (BWRVIP-14)" (TAC No. M94975)," December 3, 1999, SI File No. PECO-28Q-206.



Table 1
Design Input¹

Weld Designation	Shroud Mean Radius [2]	Shroud Thickness [2]	Bending Moment Stresses ² (ksi)		Pressure Differential Stresses ³ (ksi)		Axial Force Stresses ⁴ (ksi)	
			Upset	Faulted	Upset	Faulted	Upset	Faulted
H1	109.0"	2.0"	0.478	0.806	0.335	0.808	0.016	0.084
H2	109.0"	2.0"	0.646	1.080	0.335	0.808	0.006	0.074
H3	102.5625"	2.0"	0.746	1.247	0.356	0.859	0.006	0.078
H4	102.5625"	2.0"	1.154	1.967	0.356	0.859	-	0.058
H5	102.5625"	2.0"	2.133	3.677	0.356	0.859	-	0.159
H6	99.375"	2.0"	2.321	3.997	0.634	1.161	-	0.163
H7	99.375"	2.0"	2.917	5.222	0.634	1.161	-	0.148

- Notes: 1. Other design input includes the following:
- The shroud material is Type 304L stainless steel, with S_m equal to 14.4 ksi at 550°F [3].
 - For purposes of this evaluation, it is assumed that Limerick, Unit 2 is on twenty-four month fuel cycles, with 16,000 hours per cycle.
 - The factors-of-safety to be considered are 2.77 for the upset condition, and 1.39 for the faulted condition [1].
2. The stresses are calculated based upon the bending moments in Reference 4.
3. The stresses are calculated based upon the pressures in Reference 4. The shroud head pressure differential is used in conjunction with the inside radius of 108". The core plate pressure differential is used in conjunction with the inside radius of 98.375" and 185-10.875" diameter holes [5].
4. The stresses are calculated based upon the vertical loads and dead weights in Reference 4, considering a buoyancy factor of 0.90. Only tensile stresses are reported.

Table 2

Weld Designation H1
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ^{5,6} (inches)
1	0.00 ⁴	11.01 ⁴	2.0
2	12.06 ¹	39.46 ¹	2.0 ³
3	39.46 ⁴	50.51 ⁴	2.0
4	54.86 ¹	59.81 ¹	0.15
5	61.97 ¹	64.17 ¹	0.19
6	65.27	70.57	0.17*
7	72.22	73.32	0.05*
8	74.97 ¹	80.27 ¹	2.0 ³
9	84.47 ¹	94.92 ¹	2.0 ³
10	98.02	99.12	0.08
11	99.67 ¹	101.32 ¹	0.09
12	101.67	103.32	0.12
13	103.87	106.62	0.14
14	107.17 ¹	126.46 ¹	2.0 ³
15	126.46 ⁴	190.51 ⁴	2.0
16	206.01 ¹	209.31 ¹	0.24*
17	212.18 ¹	214.38 ¹	0.16
18	215.48	217.13	0.15*
19	219.88 ⁴	233.56 ⁴	2.0
20	238.46	240.11	0.31*
21	243.07 ¹	244.17 ¹	0.14
22	261.92	264.67	0.19*
23	277.47	280.57	0.29*
24	294.36 ¹	304.26 ¹	2.0 ³
25	305.36	306.46	0.16*
26	306.46 ⁴	360.00 ⁴	2.0

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for both the creeping wave and 45° shear [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. The flaws are assumed through-wall because of reported indications on both the inside and outside surfaces.
 4. Uninspected regions are assumed flawed through-wall because of two sided cracking.
 5. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.131" for 45° shear [6, 7].
 6. Inside surface cracking is noted with an *. All other cracking, except that assumed through-wall, is on the outside surface.



Table 3

Weld Designation H2
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ^{3,5} (inches)
1	0.00 ⁴	10.98 ⁴	0.31
2	12.72 ¹	20.82 ¹	0.12
3	23.49	25.14	0.17
4	34.49	35.59	0.05
5	36.14	38.34	0.05
6	39.30 ⁴	50.48 ⁴	0.31
7	50.57 ¹	57.33 ¹	0.17
8	64.28	70.88	0.28
9	72.33	73.98	0.31
10	74.53 ¹	81.48 ¹	0.14
11	98.48	99.58	0.23
12	102.33	106.18	0.24
13	106.18 ¹	109.48 ¹	0.19
14	114.47	116.12	0.11
15	117.77	119.97	0.05
16	124.92	125.47	0.17
17	126.43 ⁴	190.48 ⁴	0.31
18	191.12 ¹	198.52 ¹	0.24
19	201.72	203.37	0.20
20	203.92	205.63	0.25
21	219.85 ⁴	233.40 ⁴	0.31
22	233.48	235.68	0.18
23	243.18 ¹	261.48 ¹	0.18
24	278.13 ¹	287.83 ¹	0.11
25	291.72	295.57	0.19
26	304.37	305.47	0.05
27	306.57 ⁴	360.00 ⁴	0.31

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for 45° shear [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.106" for 60° longitudinal [6, 7].
 4. Uninspected regions are assumed flawed at the maximum flaw depth.
 5. All cracking is on the inside surface.



Table 4

Weld Designation H3
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ⁵ (inches)
1	0.00 ⁴	5.04 ⁴	2.0
2	6.09 ¹	39.91 ¹	2.0 ³
3	39.91 ⁴	50.04 ⁴	2.0
4	51.09 ¹	80.94 ¹	2.0 ³
5	81.41	83.14	2.0 ³
6	84.71 ¹	89.46 ¹	0.24
7	90.56	91.66	0.22
8	99.51 ¹	117.77 ¹	2.0 ³
9	124.84	126.49	0.27
10	126.49 ⁴	182.66 ⁴	2.0
11	186.46 ¹	203.29 ¹	2.0 ³
12	208.79	210.56	0.05
13	212.21 ¹	219.91 ¹	2.0 ³
14	219.91 ⁴	233.46 ⁴	2.0
15	233.49 ¹	263.14 ¹	2.0 ³
16	263.69	265.89	0.11
17	266.24 ¹	269.54 ¹	0.15
18	270.99 ¹	281.24 ¹	0.11
19	282.34	286.19	0.24
20	291.09	292.19	0.10
21	292.27 ¹	298.79 ¹	2.0 ³
22	301.07	302.17	0.05
23	303.27 ¹	304.92 ¹	0.05
24	306.49 ⁴	360.00 ⁴	2.0

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for both the creeping wave and 45° shear [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. The flaws are assumed through-wall because of reported indications on both the inside and outside surfaces.
 4. Uninspected regions are assumed flawed through-wall because of two sided cracking.
 5. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.131" for 45° shear [6, 7]



Table 5

Weld Designation H4
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ³ (inches)
1	0.00 ⁴	5.01 ⁴	0.11
2	7.79	11.09	0.10
3	12.11	13.76	0.10
4	13.76 ⁴	15.93 ⁴	0.11
5	16.59	18.24	0.10
6	21.06	22.16	0.10
7	23.03 ¹	26.56 ¹	0.10
8	28.76	32.06	0.10
9	33.16 ¹	35.91 ¹	0.10
10	36.46 ⁴	50.01 ⁴	0.11
11	51.13	52.78	0.10
12	53.33	55.53	0.10
13	57.68 ¹	70.58 ¹	0.11
14	73.88	76.63	0.10
15	86.68	89.98	0.10
16	96.58	98.23	0.10
17	104.98	107.73	0.10
18	110.48	111.58	0.10
19	114.82 ¹	118.12 ¹	0.10
20	119.22	120.32	0.10
21	126.37	126.92	0.10
22	126.92 ⁴	163.67 ⁴	0.11
23	166.20	167.70	0.10
24	170.77 ⁴	182.58 ⁴	0.11
25	186.06	187.71	0.10
26	189.91 ¹	194.31 ¹	0.10
27	194.66	197.41	0.10
28	203.81 ¹	208.76 ¹	0.10
29	219.88 ⁴	234.50 ⁴	0.11
30	236.94	239.69	0.10
31	244.35	246.00	0.10
32	248.20	249.30	0.10
33	253.40	256.70	0.10
34	258.35 ¹	259.45 ¹	0.10
35	260.00	261.10	0.10
36	262.20	263.30	0.10



Table 5 (concluded)

Weld Designation H4
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ³ (inches)
37	280.70 ¹	282.70 ¹	0.10
38	294.93 ¹	298.23 ¹	0.10
39	298.78	301.53	0.10
40	305.38	306.48	0.10
41	306.48 ⁴	343.67 ⁴	0.11
42	343.70	344.70	0.10
43	344.70	348.20	0.10
44	350.77 ⁴	360.00 ⁴	0.11

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for the creeping wave [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.131" for 45° shear [6, 7].
 4. Uninspected regions are assumed flawed at the maximum flaw depth.



Table 6

Weld Designation H5
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ^{5,6} (inches)
1	0.00 ⁴	5.07 ⁴	2.0
2	39.94 ⁴	50.07 ⁴	2.0
3	58.44	59.97	0.05
4	77.01 ¹	80.31 ¹	2.0 ³
5	83.49	86.25	0.05*
6	90.91 ¹	94.76 ¹	0.05
7	97.51	100.26	0.05
8	109.49	112.82	0.05
9	121.62 ¹	123.82 ¹	0.05
10	126.52 ⁴	182.58 ⁴	2.0
11	183.11 ¹	184.21 ¹	0.05
12	219.33 ⁴	233.49 ⁴	2.0
13	306.52 ⁴	360.00 ⁴	2.0

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for the creeping wave and 45° shear [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. The flaw is assumed through-wall because of reported indications on both the inside and outside surfaces.
 4. Uninspected regions are assumed flawed through-wall because of two sided cracking.
 5. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.131" for 45° shear [6, 7].
 6. Outside surface cracking is noted with an *. All other cracking, except that assumed through-wall, is on the inside surface.



Table 7

Weld Designation H6
Flaw Detection Results²

Flaw Number	Starting Azimuth (°)	Ending Azimuth (°)	Depth ^{3,5} (inches)
1	0.00 ⁴	5.04 ⁴	0.35
2	6.09 ¹	21.84 ¹	0.08
3	22.19 ¹	39.36 ¹	0.21
4	39.36 ⁴	50.04 ⁴	0.35
5	51.09 ¹	63.11 ¹	0.29
6	65.86	68.61	0.19
7	69.16 ¹	79.76 ¹	0.24
8	82.51 ¹	88.36 ¹	0.12
9	91.11 ¹	96.96 ¹	0.27
10	97.51 ¹	123.19 ¹	0.28
11	126.49 ⁴	182.66 ⁴	0.35
12	187.74 ¹	193.24 ¹	0.35
13	204.39	205.49	0.05
14	209.34 ¹	214.41 ¹	0.28
15	215.51	219.36	0.15
16	219.36 ⁴	237.54 ⁴	0.35
17	238.59	239.69	0.07
18	245.31	247.39	0.05
19	248.06	250.26	0.05
20	262.51	265.26	0.27
21	275.31	276.96	0.30
22	283.91 ¹	294.94 ¹	0.28
23	296.04 ¹	298.24 ¹	0.16
24	301.54 ¹	304.29 ¹	0.05
25	304.29 ⁴	360.00 ⁴	0.35

- Notes:
1. Flaws which cross over lug sets are increased in length by 0.5° at each end [6, 7].
 2. UT uncertainty factors for length are based upon the transducer which determines the length. For near side detection, the factor is 0.000" for 45° shear [6, 7]. The uncertainty factor is added to each end of the flaws.
 3. UT uncertainty factors for depth are based upon the transducer which determines the depth. For near side detection, the factor is 0.106" for 60° longitudinal [6, 7].
 4. Uninspected regions are assumed flawed at the maximum flaw depth.
 5. All cracking is on the inside surface.



Table 8

Weld Designation H7
Flaw Detection Results

- No reported indications.
- Total inspected length equals 208°.



Table 9

Limit Load Factors-of-Safety^{1, 2}

Weld Designation	Factor-of-Safety ^{3,4,5}	
	Calculated	Allowable
H1	5.06/2.17	2.77/1.39
H2	9.59/4.58	2.77/1.39
H3	4.56/2.06	2.77/1.39
H4	4.85/2.37	2.77/1.39
H5	9.51/5.00	2.77/1.39
H6	2.78/1.42	2.77/1.39

- Notes:
1. Based upon five cycles (ten years) of crack growth for all welds except welds H3, H4 and H6, which were evaluated for four cycles (eight years) of crack growth.
 2. See Appendix B for the detailed ANSC [8] output.
 3. The allowable factors-of-safety are 2.77 for the upset condition, and 1.39 for the faulted condition.
 4. The factors-of-safety are calculated as follows, with all stresses in ksi:

$$S.F. = \frac{P'_b + P_m}{P_b + P_m}$$

- where:
- P_b = bending moment stress from Table 1
 - P_m = pressure differential plus axial force stress from Table 1
 - P'_b = minimum failure bending stress from Appendix B output

5. Values shown are for upset/faulted conditions.



APPENDIX A
Inspection Results





GE Nuclear Energy

Core Shroud Assembly
Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2Procedure No: GE-UT-503Report No.: RS-01Project No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04/05Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H1Weld Configuration: Circumferential Weld – Top Flange Ring-to-PlateMaterials: SA-240, Type 304L (Welded Ring); SA-240, Type 304L (Plate)System Operator: Michael Webster
Level IISystem Operator: Paul Weeks
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Terry Rockwood
Level IIIData Analyst: James Halley
Level III

During the examination of Weld H1, the ultrasonic system recorded 34 flaw indications, 18 of which originate at the inside surface of the component and 16 of which originate at the outside surface of the component. All of the detected flaws are located in the heat-affected zone on the plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations were performed from the lower side of the weld (upper cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Weld Examination Coverage: 206.66°, or 57.41% of the weld length.

Paul Weeks HSB 6/10/99
ANII 1/99

<i>J. F. Halley</i> Data Analyst	<u>III</u> Level	<u>5-14-99</u> Date	<i>R. L. Keck</i> GE Reviewer	<u>5-24-99</u> Date	Page <u>1</u> of <u>91</u>
<i>John J. Hayden</i> Data Analyst	<u>III</u> Level	<u>5/14/99</u> Date	<i>Thomas Anderson</i> Utility Reviewer	<u>5/24/99</u> Date	



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H1

Examination from Bottom Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.)	206.66°	Shroud Thickness (In.)	2.00
Total Scan Length Examined (In.)	396.78	Circumference (In.)	691.15
Percent of Weld Length Examined	67.41%	Inches per Degree	1.92
Percent of Examined OD Weld Length Flawed	34.30%		
Percent of Total OD Weld Length Flawed	19.69%		
Percent of Examined ID Weld Length Flawed	31.96%		
Percent of Total ID Weld Length Flawed	18.34%		

45° - ODCr										
Looking Up Data Files	45° Scan Start	45° Scan End	ODCr Scan Start	ODCr Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length
TriModal H1H2011-1	12.06°	16.46°	11.01°	15.41°	4.40°	5.46°	3.96°			
TriModal H1H2018-1	13.56°	24.01°	12.61°	22.96°	10.45°	11.60°	4.00°	11.01°	39.46°	28.45°
TriModal H1H2026-1	21.06°	31.51°	20.01°	30.46°	10.45°	11.60°	7.95°			
TriModal H1H2033-1	24.61°	39.46°	23.56°	38.41°	14.85°	15.90°				
TriModal H1H2055-1	51.56°	66.41°	50.51°	65.36°	14.85°	15.90°	12.99°			
TriModal H1H2063-1	54.47°	64.37°	53.42°	63.32°	9.90°	10.95°	3.45°	50.61°	126.46°	75.95°
TriModal H1H2071-1	61.97°	72.42°	60.92°	71.37°	10.45°	11.60°	4.00°			
TriModal H1H1078-1	69.47°	79.92°	68.42°	78.87°	10.45°	11.60°	4.00°			
TriModal H1H2086-1	76.97°	87.42°	75.92°	86.37°	10.45°	11.60°	4.00°			
TriModal H1H2093-1	84.47°	94.92°	83.42°	93.87°	10.45°	11.60°	4.00°			
TriModal H1H2101-1	91.97°	102.42°	90.92°	101.37°	10.45°	11.60°	4.00°			
TriModal H1H2108-1	99.47°	112.67°	98.42°	111.82°	13.20°	14.25°	2.66°			
TriModal H1H2116-1	111.06°	126.46°	110.01°	125.41°	15.40°	16.45°				
TriModal H1H2191-1	191.56°	196.51°	190.51°	195.46°	4.95°	6.00°	2.97°	190.51°	219.88°	29.37°
TriModal H1H2198-1	194.59°	205.04°	193.54°	203.99°	10.45°	11.60°	6.03°			
TriModal H1H2206-1	201.06°	211.51°	200.01°	210.46°	10.45°	11.60°	7.95°			
TriModal H1H2213-1	204.61°	219.88°	203.56°	218.83°	15.27°	16.32°				
TriModal H1H2243-1	234.61°	244.92°	233.56°	243.87°	10.31°	11.36°	4.00°	233.56°	306.46°	72.90°
TriModal H1H2251-1	241.97°	252.42°	240.92°	251.37°	10.45°	11.60°	4.00°			
TriModal H1H2258-1	249.47°	259.92°	248.42°	258.87°	10.45°	11.60°	4.00°			
TriModal H1H2266-1	256.97°	267.42°	255.92°	266.37°	10.45°	11.60°	4.00°			
TriModal H1H2273-1	264.47°	274.92°	263.42°	273.87°	10.45°	11.60°	4.00°			
TriModal H1H2281-1	271.97°	281.87°	270.92°	280.82°	9.90°	10.95°	3.45°			
TriModal H1H2288-1	279.47°	292.67°	278.42°	291.62°	13.20°	14.25°	2.66°			
TriModal H1H2296-1	291.06°	306.46°	290.01°	305.41°	15.40°	16.45°				
Total Scanned:			303.66°							
Overlap:			97.00°							
Net Coverage:			206.66°							
Percentage of Weld Scanned:			67.41%							
								Total Ligament Length:	206.66°	
								Percentage of Total Weld Length:	67.41%	

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer: J. L. Keef 5-24-99

Utility Reviewer: Thomas L. Anderson 5/24/99



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999
Weld H1

Outside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length	
					Degrees	Inches
1*	NS	OD	13.16°	21.28°	8.10°	15.55
2*	NS	OD	21.28°	22.91°	1.63°	3.13
3*	NS	OD	24.38°	28.21°	3.85°	7.39
4*	NS	OD	54.88°	59.81°	4.95°	9.50
5*	NS	OD	61.97°	64.17°	2.20°	4.22
6*	NS	OD	76.62°	80.27°	3.65°	7.01
7*	NS	OD	85.22°	91.62°	6.40°	12.29
8*	NS	OD	92.17°	94.92°	2.75°	5.28
9*	NS	OD	98.02°	99.12°	1.10°	2.11
10*	NS	OD	99.67°	101.32°	1.65°	3.17
11*	NS	OD	101.67°	103.32°	1.65°	3.17
12*	NS	OD	103.87°	106.62°	2.75°	5.28
13*	NS	OD	107.17°	126.46°	19.29°	37.04
14*	NS	OD	212.18°	214.38°	2.20°	4.22
15*	NS	OD	243.07°	244.17°	1.10°	2.11
16*	NS	OD	294.91°	297.66°	2.75°	5.28

Length Totals: 66.02° 126.76

Length sizing of Outside Surface flaws performed with ODCr search unit.
*Flaw detected in adjacent overlapping scan regions.

Outside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	13.56°	0.13	23	78.27°	0.14	45	116.14°	0.13
2	13.71°	0.10	24	79.37°	0.14	46	117.79°	0.16
3	15.21°	0.14	25	86.67°	0.15	47	117.79°	0.16
4	15.76°	0.18	26	86.87°	0.12	48	121.51°	<0.05
5	17.41°	0.15	27	88.87°	0.12	49	121.09°	0.08
6	17.96°	0.15	28	89.42°	0.15	50	122.19°	0.19
7	19.06°	0.13	29	89.97°	0.14	51	123.29°	0.18
8	20.36°	0.14	30	93.07°	0.18	52	124.39°	0.14
9	20.71°	0.16	31	93.62°	0.15	53	212.73°	0.14
10	22.16°	0.14	32	93.82°	0.19	54	213.28°	0.16
11	22.36°	0.18	33	99.12°	0.08	55	243.62°	0.14
12	24.91°	0.14	34	100.22°	0.09	56	295.46°	0.13
13	25.06°	0.12	35	102.22°	0.12	57	296.56°	0.19
14	25.46°	0.14	36	102.42°	0.10	58	297.11°	0.09
15	27.11°	0.16	37	105.52°	0.14			
16	27.23°	0.13	38	108.27°	0.15			
17	55.57°	0.18	39	109.37°	0.13			
18	55.96°	0.14	40	109.92°	0.18			
19	58.51°	0.14	41	110.47°	0.18			
20	57.61°	0.15	42	111.61°	0.18			
21	63.62°	0.19	43	112.16°	0.15			
22	77.17°	0.14	44	113.88°	0.20			

Through-wall sizing of Outside Surface flaws performed with 45 search unit.

GE Data Analyst: John J. Hayden 5/18/99

Utility Reviewer: Thomas L. Anderson 5/24/99

GE Reviewer: R. L. Keck 5-24-99

Weld H1

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1*	NS	ID	12.06°	16.46°	4.40°	8.45
2*	NS	ID	19.06°	39.46°	20.40°	39.17
3	NS	ID	65.27°	70.57°	5.30°	10.18
4	NS	ID	72.22°	73.32°	1.10°	2.11
5*	NS	ID	74.97°	79.17°	4.20°	8.06
6*	NS	ID	84.47°	88.32°	3.85°	7.39
7	NS	ID	91.07°	94.31°	3.24°	6.22
8*	NS	ID	116.01°	120.41°	4.40°	8.45
9*	NS	ID	120.96°	122.06°	1.10°	2.11
10*	NS	ID	206.01°	209.31°	3.30°	6.34
11	NS	ID	215.48°	217.13°	1.65°	3.17
12	NS	ID	238.46°	240.11°	1.65°	3.17
13*	NS	ID	261.92°	264.67°	2.75°	5.28
14*	NS	ID	277.47°	280.57°	3.10°	5.95
15	NS	ID	294.36°	296.56°	2.20°	4.22
16*	NS	ID	297.11°	304.26°	7.15°	13.73
17	NS	ID	305.36°	306.46°	1.10°	2.11

Length Totals: 70.89° 136.11

Length Sizing of Inside Surface flaws performed with 45° S search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	13.79°	0.15	23	93.16°	0.12
2	15.44°	0.19	24	117.19°	0.18
3	20.24°	0.19	25	118.84°	0.28
4	21.34°	0.23	26	119.94°	0.20
5	23.54°	0.14	26A	121.59°	<0.05
6	24.99°	0.24	27	207.19°	0.24
7	26.64°	0.39	28	207.74°	0.17
8	28.29°	0.43	29	208.41°	0.24
9	31.04°	0.41	30	208.84°	0.19
10	33.36°	0.27	31	216.11°	0.15
11	35.56°	0.19	32	239.61°	0.31
12	38.31°	0.23	33	262.56°	0.07
13	65.91°	0.07	34	263.66°	0.19
14	67.01°	0.08	35	279.56°	0.29
15	68.11°	0.17	36	294.99°	0.36
16	69.76°	0.17	37	295.54°	0.25
17	72.77°	<0.05	38	297.74°	0.22
18	77.61°	0.17	39	298.84°	0.19
19	78.16°	0.25	40	300.49°	0.30
20	84.56°	0.29	41	301.59°	0.25
21	87.31°	<0.05	42	303.24°	<0.05
22	92.81°	0.13	43	305.99	0.16

Note: All numbers in bold are changes from report submitted November 1999



GE Inspection Services

Limerick Unit 2 RPOs Core Shroud Ultrasonic Examination Project - May 1999
Weld H1

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface		Flaw Start	Flaw End	Flaw Length	
		ID	Surface			Degrees	Inches
1*	NS	ID		12.06°	16.46°	4.40°	8.45
2*	NS	ID		19.06°	39.46°	20.40°	39.17
3*	NS	ID		66.27°	70.57°	5.30°	10.18
4	NS	ID		72.22°	73.32°	1.10°	2.11
5*	NS	ID		74.97°	79.17°	4.20°	8.06
6*	NS	ID		84.47°	88.32°	3.85°	7.39
7*	NS	ID		91.07°	94.31°	3.24°	6.22
8*	NS	ID		116.01°	120.41°	4.40°	8.45
9	NS	ID		120.96°	122.06°	1.10°	2.11
10*	NS	ID		206.01°	209.31°	3.30°	6.34
11	NS	ID		217.13°	217.13°	1.65°	3.17
12	NS	ID		238.46°	240.11°	1.65°	3.17
13*	NS	ID		261.92°	264.67°	2.75°	5.28
14*	NS	ID		277.47°	280.57°	3.10°	5.95
15	NS	ID		294.36°	296.56°	2.20°	4.22
16*	NS	ID		297.11°	304.28°	7.15°	13.73
17	NS	ID		305.36°	306.46°	1.10°	2.11

Length Totals: 70.89°

Length sizing of Inside Surface flaws performed with 45 search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall		Flaw No.	Location	Thru-Wall	
		Thru-Wall	Location			Thru-Wall	Location
1	13.79°	0.15	93.16°	23		0.12	
2	18.44°	0.19	117.19°	24		0.18	
3	20.24°	0.19	118.84°	25		0.28	
4	21.34°	0.23	119.94°	26		0.20	
5	23.64°	0.14	207.19°	27		0.24	
6	24.99°	0.24	207.74°	28		0.17	
7	26.54°	0.39	208.41°	29		0.24	
8	28.29°	0.43	208.84°	30		0.19	
9	31.04°	0.41	216.11°	31		0.15	
10	33.36°	0.27	239.61°	32		0.31	
11	35.96°	0.19	262.56°	33		0.07	
12	38.31°	0.23	263.66°	34		0.19	
13	65.91°	0.07	278.66°	35		0.29	
14	67.01°	0.08	294.96°	36		0.36	
15	68.11°	0.17	295.54°	37		0.25	
16	69.76°	0.17	297.74°	38		0.22	
17	72.77°	<0.05	298.84°	39		0.19	
18	77.61°	0.17	300.46°	40		0.30	
19	78.16°	0.25	301.59°	41		0.25	
20	84.56°	0.29	303.24°	42		<0.05	
21	87.31°	<0.05	305.99°	43		0.16	
22	92.61°	0.13					

Through-wall sizing of Inside Surface flaws performed with 60 search unit.

GE Data Analyst:

John J. Hayden 11/23/99

GE Reviewer:

G.L. Clark 12/09/99

Utility Reviewer:

Thomas L. Anderson, Jr. 12/6/99



GE Nuclear Energy

Core Shroud Assembly
Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-02Project No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04/05Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H2Weld Configuration: Circumferential Weld – Plate-to-Top Guide Support RingMaterials: SA-240, Type 304L (Plate); SA-240, Type 304L (Welded Ring)System Operator: Michael Webster
Level IISystem Operator: Paul Weeks
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Terry Rockwood
Level IIIData Analyst: James Halley
Level III

During the examination of Weld H2, the ultrasonic system recorded 20 flaw indications, all of which originate at the inside surface of the component. All of the detected flaws are located in the heat-affected zone on the plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations were performed from the upper side of the weld (upper cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Weld Examination Coverage: 206.80°, or 57.44% of the weld length.

J. F. Halley
Data AnalystIII
Level Date 5-14-99P. L. Keck
GE Reviewer5-24-99
DateJohn J. Hayden
Data AnalystIII
Level Date 5/14/99Thomas L. Anderson
Utility Review5/24/99
DatePage 13 of 91



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H2

Examination of Top Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.)	206.80°	Shroud Thickness (In.)	2.00
Total Scan Length Examined (In.)	397.05	Circumference (In.)	691.15
Percent of Weld Length Examined	57.44%	Inches per Degree	1.92
Percent of Examined ID Weld Length Flawed	39.54%		
Percent of Total ID Weld Length Flawed	22.71%		

45-ODCr											
Looking Down Data Files	ODCr Scan Start	ODCr Scan End	45° Scan Start	45° Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length	
TriModal H1H2011-1	12.03°	16.43°	10.98°	15.38°	4.40°	5.45°	3.95°				
TriModal H1H2018-1	13.53°	23.98°	12.48°	22.93°	10.45°	11.50°	4.00°	10.98°	39.30°	28.32°	
TriModal H1H2026-1	21.03°	31.48°	19.98°	30.43°	10.45°	11.50°	8.28°			0.00°	
TriModal H1H2033-1	24.25°	39.30°	23.20°	38.25°	15.05°	16.10°				0.00°	
TriModal H1H2056-1	51.53°	66.38°	50.48°	65.33°	14.85°	15.90°	12.98°			0.00°	
TriModal H1H2063-1	54.45°	64.35°	53.40°	63.30°	9.90°	10.95°	3.32°	50.48°	126.43°	75.95°	
TriModal H1H2071-1	62.08°	72.53°	61.03°	71.48°	10.45°	11.50°	4.13°			0.00°	
TriModal H1H2078-1	69.45°	79.90°	68.40°	78.85°	10.45°	11.50°	4.00°			0.00°	
TriModal H1H2086-1	76.95°	87.40°	75.90°	86.35°	10.45°	11.50°	3.98°			0.00°	
TriModal H1H2093-1	84.47°	94.90°	83.42°	93.85°	10.43°	11.48°	4.00°			0.00°	
TriModal H1H2101-1	91.95°	102.40°	90.90°	101.35°	10.45°	11.50°	4.00°			0.00°	
TriModal H1H2108-1	99.45°	112.65°	98.40°	111.60°	13.20°	14.25°	2.67°			0.00°	
TriModal H1H2116-1	111.03°	126.43°	109.98°	125.38°	16.40°	16.45°				0.00°	
TriModal H1H2191-1	191.53°	196.48°	190.48°	195.43°	4.95°	6.00°	3.00°	190.48°	219.85°	29.37°	
TriModal H1H2198-1	194.53°	204.95°	193.48°	203.90°	10.42°	11.47°	4.97°			0.00°	
TriModal H1H2206-1	201.03°	211.48°	199.98°	210.43°	10.45°	11.50°	8.55°			0.00°	
TriModal H1H2213-1	203.98°	219.85°	202.93°	218.80°	15.87°	16.92°				0.00°	
TriModal H1H2243-1	234.45°	244.90°	233.40°	243.85°	10.45°	11.50°	4.00°	233.40°	306.57°	73.17°	
TriModal H1H2251-1	241.95°	252.40°	240.90°	251.35°	10.45°	11.50°	4.00°			0.00°	
TriModal H1H2258-1	249.45°	259.90°	248.40°	258.85°	10.45°	11.50°	4.00°			0.00°	
TriModal H1H2266-1	256.95°	267.40°	255.90°	266.35°	10.45°	11.50°	4.00°			0.00°	
TriModal H1H2273-1	264.45°	275.03°	263.40°	273.98°	10.58°	11.63°	4.13°			0.00°	
TriModal H1H2281-1	271.95°	281.98°	270.90°	280.93°	10.03°	11.08°	3.58°			0.00°	
TriModal H1H2288-1	279.45°	292.65°	278.40°	291.60°	13.20°	14.25°	2.55°			0.00°	
TriModal H1H2296-1	291.15°	306.57°	290.10°	305.52°	15.42°	16.47°				0.00°	
Total Scanned:						304.83°		Total Ligament Length:			
Overlap:						98.03°		206.80°			
Net Coverage:						206.80°		Percentage of Total Weld Length:			
Percentage of Weld Scanned:						57.44%		57.44%			

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer: R. L. Koch 5-24-99

Utility Reviewer: Thomas P. Anderson 5/24/99

Weld H2

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1*	NS	ID	12.72°	20.82°	8.10°	15.55
2*	NS	ID	23.49°	25.14°	1.65°	3.17
3	NS	ID	34.49°	35.59°	1.10°	2.11
4	NS	ID	36.14°	38.34°	2.20°	4.22
5*	NS	ID	50.57°	57.33°	6.76°	12.98
6*	NS	ID	64.28°	70.88°	6.60°	12.67
7	NS	ID	72.33°	73.98°	1.65°	3.17
8*	NS	ID	74.53°	81.48°	6.95°	13.34
9*	NS	ID	98.48°	99.58°	1.10°	2.11
9A	NS	ID	102.33°	106.18°	3.85°	7.39
9B	NS	ID	106.18°	109.48°	3.30°	6.34
10	NS	ID	114.47°	116.12°	1.65°	3.17
11	NS	ID	117.77°	119.97°	2.20°	4.22
12	NS	ID	124.92°	125.47°	0.55°	1.06
13	NS	ID	191.12°	198.52°	7.40°	14.21
14	NS	ID	201.72°	203.37°	1.65°	3.17
15*	NS	ID	203.92°	205.63°	1.71°	3.28
16	NS	ID	233.48°	235.68°	2.20°	4.22
17*	NS	ID	243.18°	261.48°	18.30°	35.14
18*	NS	ID	278.13°	287.83°	9.70°	18.62
19	NS	ID	291.72°	295.57°	3.85°	7.39
20	NS	ID	304.37°	305.47°	1.10°	2.11

Length Totals: 93.57° 179.65

Length Sizing of Inside Surface flaws performed with 45° S search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	13.18°	0.12	23	98.95°	0.17	43	248.68°	0.18
2	13.03°	0.12	24	102.88°	0.24	44	251.43°	0.11
3	14.68°	0.11	24A	108.85°	0.19	45	256.10°	0.15
4	17.43°	0.09	25	115.02°	0.11	46	257.75°	0.17
5	20.18°	0.11	26	118.79°	<0.05	47	256.45°	0.18
6	20.53°	0.11	27	125.39°	0.17	48	257.55°	0.16
7**	23.28°	0.17	28	191.67°	0.08	49	259.75°	0.18
8	24.50°	0.10	29	192.37°	<0.05	50	278.60°	<0.05
9	34.95°	<0.05	30	192.68°	0.09	51	280.25°	<0.05
10	37.15°	<0.05	31	194.42°	0.24	52	282.80°	<0.05
11	51.03°	0.10	32	195.13°	0.17	53	283.43°	0.11
12	53.23°	0.12	33	196.23°	0.18	54	258.63°	<0.05
13	54.33°	0.17	33A	202.73°	0.20	55	286.73°	<0.05
14	54.50°	0.09	34	203.93°	0.25	56	292.94°	<0.05
15	64.75°	0.28	35	204.93°	0.24	56A	293.92°	0.19
16	69.15°	0.18	36	204.50°	<0.05	57	305.39°	<0.05
17	69.50°	0.18	37	234.50°	0.18			
18	72.80°	0.31	38	235.05°	0.16			
19	77.00°	0.14	39	235.60°	0.09			
20	78.10°	0.08	40	244.40°	0.18			
21	80.85°	<0.05	41	245.38°	0.07			
22	99.15°	0.23	42	247.03°	0.14			

** Through Wall Flaw #7 is located within Flaw #2 listed in Flaw Length Summary

Note: All numbers in bold are changes from report submitted May 1999



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H2

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating		Flaw Start	Flaw End	Flaw Length	
		Surface	ID			Degrees	Inches
1*	NS	ID	ID	12.72°	20.82°	8.10°	15.55
2*	NS	ID	ID	23.49°	25.14°	1.65°	3.17
3	NS	ID	ID	34.49°	35.59°	1.10°	2.11
4	NS	ID	ID	36.14°	38.34°	2.20°	4.22
5*	NS	ID	ID	50.57°	57.33°	6.76°	12.98
6*	NS	ID	ID	64.28°	70.88°	6.60°	12.67
7	NS	ID	ID	72.33°	73.98°	1.65°	3.17
8*	NS	ID	ID	74.53°	81.48°	6.95°	13.34
9*	NS	ID	ID	98.48°	99.58°	1.10°	2.11
10	NS	ID	ID	114.47°	116.12°	1.65°	3.17
11	NS	ID	ID	117.77°	119.97°	2.20°	4.22
12	NS	ID	ID	124.92°	125.47°	1.65°	3.17
13	NS	ID	ID	191.12°	195.52°	4.40°	8.45
14	NS	ID	ID	201.72°	203.37°	1.65°	3.17
15*	NS	ID	ID	203.92°	205.63°	1.71°	3.28
16	NS	ID	ID	233.48°	236.88°	2.20°	4.22
17*	NS	ID	ID	243.18°	261.48°	18.30°	35.14
18*	NS	ID	ID	278.13°	287.83°	9.70°	18.62
19	NS	ID	ID	294.47°	295.57°	1.10°	2.11
20	NS	ID	ID	304.37°	305.47°	1.10°	2.11

Length Totals: 81.77° 157.00

Length sizing of Inside Surface flaws performed with 45 search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	13.18°	0.12	23	98.95°	0.17	45	256.10°	0.15
2	13.03°	0.12	24	102.88°	0.24	46	257.75°	0.17
3	14.68°	0.11	25	115.02°	0.11	47	256.45°	0.18
4	17.43°	0.09	26	118.79°	<0.05	48	257.55°	0.16
5	20.18°	0.11	27	125.39°	0.17	49	259.75°	0.18
6	20.53°	0.11	28	191.67°	0.08	50	278.60°	<0.05
7	23.28°	0.17	29	192.37°	<0.05	51	280.25°	<0.05
8	24.50°	0.10	30	192.68°	0.09	52	282.80°	<0.05
9	34.95°	<0.05	31	194.42°	0.24	53	283.43°	0.11
10	37.15°	<0.05	32	195.13°	0.17	54	258.63°	<0.05
11	51.03°	0.10	33	196.23°	0.18	55	286.73°	<0.05
12	53.23°	0.12	34	203.93°	0.25	56	292.94°	<0.05
13	54.33°	0.17	35	204.83°	0.24	57	305.39°	<0.05
14	54.50°	0.09	36	204.50°	<0.05			
15	64.75°	0.28	37	234.50°	0.18			
16	69.15°	0.18	38	235.05°	0.16			
17	69.50°	0.18	39	235.80°	0.09			
18	72.80°	0.31	40	244.40°	0.18			
19	77.00°	0.14	41	245.38°	0.07			
20	78.10°	0.08	42	247.03°	0.14			
21	80.85°	<0.05	43	248.68°	0.18			
22	99.15°	0.23	44	251.43°	0.11			

Through-wall sizing of Inside Surface flaws performed with 60 search unit.

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer: F. H. Reck 5-24-99

Utility Reviewer: Thomas L. Anderson 5/24/99



GE Nuclear Energy

Core Shroud Assembly Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-03Project No.: 1H61R Version: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04/05Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H3Weld Configuration: Circumferential Weld -Top Guide Support Ring-to-PlateMaterials: SA-240, Type 304L (Welded Ring); SA-240, Type 304L (Plate)System Operator: Michael Webster
Level IISystem Operator: Nicholas Labella
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Paul Weeks
Level II

During the examination of Weld H3, the ultrasonic system recorded 39 flaw indications, 18 of which originate at the inside surface of the component and 21 of which originate at the outside surface of the component. All of the detected flaws are located in the heat-affected zone on the plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping-waves were generated in the component during the examinations.

The examinations were performed from the lower side of the weld (upper-middle cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Weld Examination Coverage: 221.51°, or 61.53% of the weld length.

<u>John J. Hayden</u> Data Analyst	<u>III</u> Level	<u>5/14/99</u> Date	<u>R. L. Keck</u> GE Reviewer	<u>5-24-99</u> Date	<u>Paul Kennedy</u> HSB 6/10/99 ANDI
			<u>Thomas L. Anderson</u> Utility Review	<u>5/24/99</u> Date	Page <u>24</u> of <u>91</u>



Weld H3

Examination from Bottom Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.) 221.51°
 Total Scan Length Examined (In.) 400.36
 Percent of Weld Length Examined 61.53%
 Percent of Examined OD Weld Length Flawed 56.4%
 Percent of Total OD Weld Length Flawed 30.7%
 Percent of Examined ID Weld Length Flawed 61.4%
 Percent of Total ID Weld Length Flawed 37.8%

Shroud Thickness (In.) 2.00
 Circumference (In.) 650.69
 Inches per Degree 1.81

45° - ODCr										
Looking Up Data Files	45° Scan Start	45° Scan End	ODCr Scan Start	ODCr Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length
TriModal	H3011LU1	6.09°	15.99°	5.04°	14.94°	9.90°	10.95°	3.45°		
TriModal	H3018LU1	13.59°	24.04°	12.54°	22.99°	10.45°	11.50°	4.00°	5.04°	34.87°
TriModal	H3026LU1	21.09°	31.54°	20.04°	30.49°	10.45°	11.50°	8.08°		
TriModal	H3033LD1	24.51°	39.91°	23.46°	38.86°	15.40°	16.45°			
TriModal	H3056LU1	51.09°	61.54°	50.04°	60.49°	10.45°	11.50°	8.08°		
TriModal	H3063LU1	54.51°	64.96°	53.46°	63.91°	10.45°	11.50°	4.00°	50.04°	69.92°
TriModal	H3071LU1	62.01°	72.46°	60.96°	71.41°	10.45°	11.50°	4.00°	109.96°	
TriModal	H3078LU1	69.51°	79.96°	68.46°	78.91°	10.45°	11.50°	4.00°		
TriModal	H3086LU1	77.01°	87.46°	75.96°	86.41°	10.45°	11.50°	4.00°		
TriModal	H3093LU1	84.51°	94.96°	83.46°	93.91°	10.45°	11.50°	4.00°		
TriModal	H3101LU1	92.01°	102.46°	90.96°	101.41°	10.45°	11.50°	4.00°		
TriModal	H3108LU1	99.51°	109.96°	98.46°	108.91°	10.45°	11.50°	4.00°		
TriModal	H3116LU1	111.09°	126.49°	110.04°	125.44°	15.40°	16.45°			
TriModal	H3191-0	183.71°	193.61°	182.66°	192.56°	9.90°	10.95°	8.57°	110.04°	126.49°
TriModal	H3191-1	186.09°	196.54°	185.04°	195.49°	10.45°	11.50°	4.00°	182.66°	219.91°
TriModal	H3198-1	193.59°	204.04°	192.54°	202.99°	10.45°	11.50°	4.00°		37.25°
TriModal	H3206-1	201.09°	211.54°	200.04°	210.49°	10.45°	11.50°	8.08°		
TriModal	H3213-1	204.51°	219.91°	203.46°	218.86°	15.40°	16.45°			
TriModal	H3243LU1	234.51°	244.41°	233.46°	243.36°	9.90°	10.95°	3.45°	233.46°	306.49°
TriModal	H3261LU1	242.01°	252.46°	240.96°	251.41°	10.45°	11.50°	4.00°		73.03°
TriModal	H3268LU1	249.51°	259.96°	248.46°	258.91°	10.45°	11.50°	4.00°		
TriModal	H3273LU1	257.01°	267.46°	255.96°	266.41°	10.45°	11.50°	4.00°		
TriModal	H3281LU1	264.51°	274.96°	263.46°	273.91°	10.45°	11.50°	4.00°		
TriModal	H3286LU1	272.01°	282.46°	270.96°	281.41°	10.45°	11.50°	4.00°		
TriModal	H3288LU1	279.51°	289.96°	278.46°	288.91°	13.20°	14.25°	2.75°		
TriModal	H3296LU1	291.01°	306.49°	289.96°	305.44°	15.48°	16.53°			
Total Scanned:				319.90°						
Overlap:				98.40°						
Net Coverage:				221.51°						
Percentage of Weld Scanned:				61.53%						
								Total Ligament Length:	221.51°	
								Percentage of Total Weld Length:	61.53%	

GE Data Analyst:

John J. Hayden 5/14/99

GE Reviewer:

P. L. Keef 5-24-99

Utility Reviewer:

J. L. Anderson 5/24/99

Weld H3

Outside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1*	NS	ID	6.17°	14.97°	8.80°	15.93
2*	NS	ID	18.62°	22.27°	3.65°	6.61
3	NS	ID	60.69°	63.94°	3.25°	5.88
4	NS	ID	68.69°	73.44°	4.75°	8.60
5	NS	ID	73.99°	76.74°	2.75°	4.98
6*	NS	ID	79.29°	80.94°	1.65°	2.99
7	NS	ID	81.49°	83.14°	1.65°	2.99
8*	NS	ID	105.64°	108.94°	3.30°	5.97
9	NS	ID	113.92°	117.77°	3.85°	6.97
10	NS	ID	186.46°	198.54°	12.08°	21.86
11	NS	ID	208.79°	210.56°	1.77°	3.20
12	NS	ID	212.21°	218.81°	6.60°	11.95
13	NS	ID	233.49°	263.14°	29.65°	53.67
14	NS	ID	263.69°	265.89°	2.20°	3.98
15	NS	ID	266.24°	269.54°	3.30°	5.97
16	NS	ID	270.99°	281.24°	10.25°	18.55
17	NS	ID	282.34°	286.19°	3.85°	6.97
18	NS	ID	292.27°	295.02°	2.75°	4.98
19	NS	ID	296.67°	298.32°	1.65°	2.99
20	NS	ID	301.07°	302.17°	1.10°	1.99
21	NS	ID	303.27°	304.92°	1.65°	2.99

Length Totals: 110.50° 200.01

Length Sizing of Inside Surface flaws performed with 45° S search unit.

*Flaw detected in adjacent overlapping scan regions.

Outside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	6.64°	0.15	25A	210.01°	<0.05	51	301.62°	<0.05
2	8.29°	0.11	26	216.06°	<0.05	52	304.37°	<0.05
3	9.39°	0.11	27	217.71°	<0.05			
4	10.49°	0.16	28	235.06°	0.29			
5	12.14°	0.11	29	236.71°	0.14			
6	13.24°	0.17	30	240.67°	0.33			
7	19.64°	0.21	31	242.76°	0.15			
8	62.76°	0.20	32	243.86°	0.15			
9	72.26°	0.19	33	245.86°	0.15			
10	74.46°	0.07	34	249.71°	0.14			
11	75.56°	0.18	35	251.36°	0.14			
12	76.11°	0.21	36	253.38°	0.17			
13	80.31°	0.19	37	254.46°	0.16			
13A	81.49°	0.33	38	255.56°	0.15			
14	106.66°	0.17	39	258.11°	0.15			
15	107.76°	0.16	40	261.06°	<0.05			
16	108.86°	0.22	41	262.51°	0.10			
17	114.39°	0.17	42	265.26°	0.11			
18	116.04°	0.14	43	266.71°	0.15			
19	187.57°	<0.05	44	268.91°	0.10			
20	188.67°	<0.05	45	274.41°	0.10			
21	189.77°	0.09	46	276.41°	0.06			
22	191.97°	<0.05	47	280.26°	<0.11			
23	192.69°	<0.05	48	282.94°	0.24			
24	194.34°	<0.05	49	292.74°	0.12			
25	195.99°	<0.05	50	297.14	0.12			

Note: All numbers in bold are changes from report submitted November 1999



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H3

Outside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length	
					Degrees	Inches
1*	NS	ID	6.17°	14.97°	8.80°	15.93
2	NS	ID	18.62°	22.27°	3.65°	6.61
3	NS	ID	60.69°	63.94°	3.25°	5.88
4*	NS	ID	68.69°	73.44°	4.75°	8.60
5	NS	ID	73.99°	76.74°	2.75°	4.98
6	NS	ID	79.29°	80.94°	1.65°	2.99
7	NS	ID	81.49°	83.14°	1.65°	2.99
8	NS	ID	105.64°	108.94°	3.30°	5.97
9	NS	ID	113.92°	117.77°	3.85°	6.97
10*	NS	ID	186.46°	198.54°	12.08°	21.86
11*	NS	ID	208.79°	210.56°	1.77°	3.20
12	NS	ID	212.21°	218.81°	6.60°	11.95
13*	NS	ID	233.49°	283.14°	29.65°	53.67
14	NS	ID	263.69°	265.89°	2.20°	3.98
15	NS	ID	266.24°	269.64°	3.30°	5.97
16	NS	ID	270.99°	281.24°	10.25°	18.55
17*	NS	ID	282.34°	288.19°	3.85°	6.97
18*	NS	ID	292.27°	295.02°	2.75°	4.98
19	NS	ID	296.67°	298.32°	1.65°	2.99
20	NS	ID	301.07°	302.17°	1.10°	1.99
21	NS	ID	303.27°	304.92°	1.65°	2.99
			Length Totals:		110.50°	200.01

Length sizing of Outside Surface flaws performed with ODCr search unit.

*Flaw detected in adjacent overlapping scan regions.

Outside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	6.64°	0.15	26	216.06°	<0.05
2	8.29°	0.11	27	217.71°	<0.05
3	9.39°	0.11	28	235.06°	0.29
4	10.49°	0.16	29	236.71°	0.14
5	12.14°	0.11	30	240.67°	0.33
6	13.24°	0.17	31	242.76°	0.15
7	19.64°	0.21	32	243.86°	0.15
8	62.76°	0.2	33	245.86°	0.15
9	72.26°	0.19	34	249.71°	0.14
10	74.46°	0.07	35	251.36°	0.14
11	75.58°	0.18	36	253.36°	0.17
12	76.11°	0.21	37	254.46°	0.16
13	80.31°	0.19	38	255.56°	0.15
14	106.66°	0.17	39	258.11°	0.15
15	107.76°	0.16	40	261.06°	<0.05
16	108.86°	0.22	41	262.51°	0.10
17	114.39°	0.17	42	265.26°	0.11
18	116.04°	0.14	43	266.71°	0.15
19	187.57°	<0.05	44	268.91°	0.10
20	188.67°	<0.05	45	274.41°	0.10
21	189.77°	0.09	46	276.41°	0.06
22	191.97°	<0.05	47	280.26°	0.11
23	192.69°	<0.05	48	282.94°	0.24
24	194.34°	<0.05	49	292.74°	0.12
25	195.99°	<0.05	50	297.14°	0.12

Through-wall sizing of Outside Surface flaws performed with 45 search unit.

GE Data Analyst:

John J. Hayden 5/19/99

GE Reviewer:

A. L. Keck 5-24-99

Utility Reviewer:

J. L. Anderson 5/24/99

Weld H3

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1*	NS	ID	6.09°	39.91°	33.82°	61.21
2*	NS	ID	51.09°	80.86°	29.77°	53.88
3	NS	ID	81.41°	83.06°	1.65°	2.99
4	NS	ID	84.71°	89.46°	4.75°	8.60
5	NS	ID	90.56°	91.66°	1.10°	1.99
6*	NS	ID	99.51°	117.69°	18.18°	32.91
7	NS	ID	124.84°	126.49°	1.65°	2.99
8*	NS	ID	188.12°	203.29°	15.17°	27.46
9	NS	ID	213.86°	219.91°	6.05°	10.95
10	NS	ID	234.51°	237.26°	2.75°	4.98
11	NS	ID	238.31°	240.01°	1.70°	3.08
12	NS	ID	243.11°	249.16°	6.05°	10.95
13	NS	ID	250.06°	251.91°	1.85°	3.35
14	NS	ID	252.81°	253.91°	1.10°	1.99
15	NS	ID	255.56°	258.86°	3.30°	5.97
16	NS	ID	259.96°	262.16°	2.20°	3.98
17	NS	ID	291.09°	292.19°	1.10°	1.99
18	NS	ID	294.94°	298.79°	3.85°	6.97
Length Totals:					136.04°	246.23

Length Sizing of Inside Surface flaws performed with 45° S search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	6.69°	0.22	26	68.86°	0.27	51	125.99°	0.27
2	9.99°	0.19	27	69.76°	0.23	52	194.39°	<0.05
3	11.09°	0.16	28	72.31°	0.25	53	197.49°	0.19
4	13.29°	0.25	29	73.96°	0.36	54	**Deleted**	
5	14.94°	0.10	30	75.06°	0.37	55	214.46°	<0.05
6	16.89°	0.28	31	76.16°	0.24	56	217.21°	0.19
7	21.84°	0.36	32	77.81°	0.27	57	218.31°	<0.05
8	22.24°	0.25	33	78.71°	0.24	58	235.11°	0.10
9	23.49°	0.24	34	80.36°	0.32	59	236.21°	0.19
10	26.64°	0.34	35	82.59°	<0.05	59A	238.96°	0.11
11	27.74°	0.25	36	85.31°	0.24	60	243.71°	0.16
12	30.49°	0.31	37	85.66°	0.22	61	244.26°	0.19
13	31.71°	0.27	38	88.41°	0.24	62	245.36°	0.19
14	33.36°	0.26	39	91.16°	0.22	63	246.46°	0.10
15	34.46°	0.17	40	100.66°	0.10	64	248.11°	0.14
16	36.11°	0.25	41	101.76°	0.10	65	250.86°	0.17
17	51.69°	0.21	42	103.41°	0.26	66	253.41°	0.11
18	53.34°	0.18	43	104.51°	0.21	67	256.71°	0.10
19	56.64°	0.35	44	105.61°	0.24	68	257.06°	0.17
20	57.74°	0.28	45	107.26°	0.10	69	258.16°	0.30
21	61.71°	0.15	46	110.54°	0.20	70	258.71°	0.13
22	63.36°	0.3	47	111.64°	0.10	70A	259.96	0.39
23	64.46°	0.25	48	113.84°	0.21	71	291.14°	0.10
24	65.91°	0.31	49	115.49°	0.18	72	296.09°	0.11
25	67.01°	0.39	50	117.14°	0.20	73	296.94°	0.10
						74	**Deleted**	
						75	**Deleted**	

Note: All numbers in bold are changes from report submitted November 1999



GE Inspection Services

Limerick Unit 2 RPO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H3

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length	
					Degrees	Inches
1*	NS	ID	6.09°	39.91°	33.82°	61.21
2*	NS	ID	61.09°	80.86°	29.77°	53.88
3	NS	ID	81.41°	83.06°	1.65°	2.99
4	NS	ID	84.71°	89.46°	4.75°	8.60
5	NS	ID	90.56°	91.66°	1.10°	1.99
6*	NS	ID	99.51°	117.69°	18.18°	32.91
7	NS	ID	124.84°	126.49°	1.65°	2.99
8*	NS	ID	188.12°	203.29°	15.17°	27.46
9	NS	ID	213.86°	219.91°	6.05°	10.96
10	NS	ID	234.51°	237.26°	2.75°	4.98
11	NS	ID	238.31°	240.01°	1.70°	3.08
12	NS	ID	243.11°	249.16°	6.05°	10.96
13	NS	ID	250.06°	251.91°	1.85°	3.36
14	NS	ID	252.81°	253.91°	1.10°	1.99
15	NS	ID	256.56°	258.86°	3.30°	5.97
16	NS	ID	259.96°	262.16°	2.20°	3.98
17	NS	ID	291.08°	292.19°	1.10°	1.99
18	NS	ID	294.94°	298.79°	3.85°	6.97
Length Totals:					136.04°	246.23

Length sizing of Inside Surface flaws performed with 45 search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall	Flaw No.	Location	Thru-Wall
1	6.68°	0.22	26	68.86°	0.27	51	125.99°	0.27
2	9.99°	0.19	27	69.76°	0.23	52	194.39°	<0.05
3	11.09°	0.16	28	72.31°	0.25	53	197.49°	0.19
4	13.29°	0.25	29	73.96°	0.36	54	210.01°	<0.05
5	14.94°	0.10	30	75.06°	0.37	55	214.46°	<0.05
6	16.89°	0.28	31	76.16°	0.24	56	217.21°	0.19
7	21.84°	0.36	32	77.81°	0.27	57	218.31°	<0.05
8	22.24°	0.25	33	78.71°	0.24	58	235.11°	0.10
9	23.49°	0.24	34	80.36°	0.32	59	236.21°	0.19
10	26.64°	0.34	35	82.59°	<0.05	60	243.71°	0.16
11	27.74°	0.25	36	85.31°	0.24	61	244.26°	0.19
12	30.49°	0.31	37	85.66°	0.22	62	245.36°	0.19
13	31.71°	0.27	38	88.41°	0.24	63	246.46°	0.10
14	33.36°	0.26	39	91.16°	0.22	64	248.11°	0.14
15	34.46°	0.17	40	100.66°	0.10	65	250.86°	0.17
16	36.11°	0.25	41	101.76°	0.10	66	253.41°	0.11
17	51.69°	0.21	42	103.41°	0.26	67	256.71°	0.10
18	53.34°	0.18	43	104.51°	0.21	68	257.06°	0.17
19	56.64°	0.35	44	105.61°	0.24	69	258.16°	0.30
20	57.74°	0.28	45	107.26°	0.10	70	258.71°	0.13
21	61.71°	0.15	46	110.54°	0.20	71	291.14°	0.10
22	63.36°	0.30	47	111.84°	0.10	72	296.09°	0.11
23	64.46°	0.25	48	113.84°	0.21	73	296.94°	0.10
24	65.91°	0.31	49	115.49°	0.18	74	301.52°	<0.05
25	67.01°	0.39	50	117.14°	0.20	75	304.37°	<0.05

Through-wall sizing of Inside Surface flaws performed with 60 search unit.

GE Data Analyst:

John J. Hayden 11/23/99

GE Reviewer:

P. J. Clark 12/6/99

Utility Reviewer:

Thomas L. Anderson 12/6/99



GE Nuclear Energy

Core Shroud Assembly
Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-04aProject No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H4Weld Configuration: Circumferential Weld - Plate-to-PlateMaterials: SA-240, Type 304L (Welded Plate); SA-240, Type 304L (Plate)System Operator: Michael Webster
Level IISystem Operator: Nicholas Labella
Level IISystem Operator: Terry Rockwood
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Scott Hamel
Level IIData Analyst: John Hayden
Level III

During the examination of Weld H4 from the upper side, the ultrasonic system recorded 36 flaw indications, all of which originate at the outside surface of the component. All of the detected flaws are located in the heat-affected zone on the upper plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions. Extensive welding defects were detected in the mid-wall region of the weld.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Two supplemental examination regions were scanned using the GE Suction Cup local-area scanning device. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations performed with the OD Tracker device from the upper side of the weld (upper-middle cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

The examinations performed with the Suction Cup device from the upper side of the weld (upper-middle cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.50 deg.
Axial	0.036 in.

Total Upper Side Weld Examination Coverage: 229.65°, or 63.79% of the weld length.

John J. Hayden
Data AnalystIII
Level
5/18/99
DateP. L. Leach
GE Reviewer5-24-99
DatePage 36 of 91Thomas C. Anderson
Utility Review5/24/99
DatePaul Henning HSB 6/10/99
ANTI



Weld H4

Examination from Top Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.)	229.65°	Shroud Thickness (In.)	2.00
Total Scan Length Examined (In.)	415.08	Circumference (In.)	650.69
Percent of Weld Length Examined	63.79%	Inches per Degree	1.81
Percent of Examined OD Weld Length Flawed	40.85%	Total Flawed Length (In.)	169.80
Percent of Total OD Weld Length Flawed	26.06%	Total Flawed Length (Deg.)	93.81°

45-ODCr

Looking Down Data Files	ODCr Scan Start	ODCr Scan End	45° Scan Start	45° Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length
TriModal	H4011-1	6.06°	13.76°	6.01°	12.71°	7.70°	8.75°			
TriModal	H4026-1	16.98°	25.78°	15.93°	24.73°	8.80°	9.85°	5.01°	13.76°	8.75°
TriModal	H4026-2	21.06°	36.46°	20.01°	35.41°	15.40°	16.45°	15.93°	36.46°	20.53°
TriModal	H4056-1	51.06°	66.46°	50.01°	65.41°	15.40°	16.45°	50.01°	126.92°	76.91°
TriModal	H4063-1	54.48°	69.88°	53.43°	68.83°	15.40°	16.45°			
TriModal	H4078-1	69.50°	84.90°	68.45°	83.85°	15.40°	16.45°			
TriModal	H4098-1	84.48°	99.88°	83.43°	98.83°	15.40°	16.45°			
TriModal	H4106-1	99.48°	114.88°	98.43°	113.83°	15.40°	16.45°			
TriModal	H4116-1	111.52°	126.92°	110.47°	125.87°	15.40°	16.45°			
TriModal(SC)	H4168-1	164.72°	170.77°	163.67°	169.72°	6.05°	7.10°	163.67°	170.77°	7.10°
TriModal	H4191-0	183.63°	194.08°	182.58°	193.03°	10.45°	11.50°	182.58°	219.88°	37.30°
TriModal	H4191-1	186.06°	196.51°	185.01°	195.46°	10.45°	11.50°			
TriModal	H4198-1	193.56°	204.01°	192.51°	202.96°	10.45°	11.50°			
TriModal	H4206-1	201.06°	211.51°	200.01°	210.46°	10.45°	11.50°			
TriModal	H4213-1	204.48°	219.88°	203.43°	218.83°	15.40°	16.45°			
TriModal	H4243-1	235.55°	249.85°	234.50°	248.80°	14.30°	15.35°	234.50°	306.48°	71.98°
TriModal	H4258-1	249.50°	264.90°	248.45°	263.85°	15.40°	16.45°			
TriModal	H4273-1	264.50°	279.90°	263.45°	278.85°	15.40°	16.45°			
TriModal	H4288-1	279.50°	294.95°	278.45°	293.90°	15.45°	16.50°			
TriModal	H4296-1	291.08°	306.48°	290.03°	305.43°	15.40°	16.45°			
Trimodal(SC)	H4341-3	344.72°	350.77°	343.67°	349.72°	6.05°	7.10°	343.67°	350.77°	7.10°
Total Scanned:					291.54°					
Overlap:					61.89°					
Net Coverage:					229.65°					
Percentage of Weld Scanned:					63.79%					
Total Ligament Length:									229.65°	
Percentage of Total Weld Length:									63.79%	

(SC) = Suction Cup Scanner

GE Data Analyst: John J. Hayden 5/14/99GE Reviewer: J. L. Leif 5-24-99Utility Reviewer: J. L. Anderson, 5/24/99



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H4

Flaw No.	Weld Side	Initiating Surface	Flaw Start (Degrees)	Flaw End (Degrees)	Flaw Length (Degrees)	Flaw Length (Inches)	Maximum Thru-Wall
1	NS	OD	7.79°	11.09°	3.30°	5.97	0.10
2*	NS	OD	12.11°	15.46°	3.35°	6.12	0.10
3	NS	OD	16.59°	19.24°	1.65°	2.99	0.10
4	NS	OD	21.06°	22.16°	1.10°	1.99	0.10
5*	NS	OD	23.03°	26.56°	3.53°	6.39	0.10
6	NS	OD	26.76°	32.06°	3.30°	5.97	0.10
7	NS	OD	33.16°	35.91°	2.75°	4.98	0.10
8	NS	OD	51.13°	52.78°	1.65°	2.99	0.10
9	NS	OD	53.33°	55.53°	2.20°	3.98	0.10
10*	NS	OD	57.88°	70.58°	12.90°	23.35	0.11
11	NS	OD	73.88°	76.63°	2.75°	4.98	0.10
12	NS	OD	86.68°	89.98°	3.30°	5.97	0.10
13	NS	OD	96.58°	98.23°	1.65°	2.99	0.10
14	NS	OD	104.98°	107.73°	2.75°	4.98	0.10
15	NS	OD	110.48°	111.58°	1.10°	1.99	0.10
16*	NS	OD	114.82°	118.12°	3.30°	5.97	0.10
17	NS	OD	119.22°	120.32°	1.10°	1.99	0.10
18	NS	OD	126.37°	127.47°	1.10°	1.99	0.10
19	NS	OD	166.20°	167.70°	1.50°	2.72	0.10
20	NS	OD	188.06°	187.71°	1.65°	2.99	0.10
21	NS	OD	189.91°	194.31°	4.40°	7.98	0.10
22	NS	OD	194.66°	197.41°	2.75°	4.98	0.10
23	NS	OD	203.81°	208.76°	4.95°	8.98	0.10
24	NS	OD	238.94°	239.69°	2.75°	4.98	0.10
25	NS	OD	244.35°	246.00°	1.65°	2.99	0.10
26	NS	OD	248.20°	249.30°	1.10°	1.99	0.10
27	NS	OD	253.40°	256.70°	3.30°	5.97	0.10
28	NS	OD	258.36°	259.46°	1.10°	1.99	0.10
29	NS	OD	260.00°	261.10°	1.10°	1.99	0.10
30	NS	OD	262.20°	263.30°	1.10°	1.99	0.10
31	NS	OD	280.70°	282.70°	2.00°	3.62	0.10
32	NS	OD	284.93°	298.23°	3.30°	5.97	0.10
33	NS	OD	298.78°	301.53°	2.75°	4.98	0.10
34	NS	OD	305.38°	306.48°	1.10°	1.99	0.10
35	NS	OD	343.70°	344.70°	1.00°	1.81	0.10
36	NS	OD	344.70°	348.20°	3.50°	6.34	0.10
Length Totals:					93.81°	189.80	

Length sizing of Outside Surface flaws performed with ODCr search unit.

*Flaw detected in adjacent overlapping scan regions.

Through-wall sizing of Outside Surface flaws performed with 45 search unit.

GE Data Analyst:

John J. Hayden 5/15/99

GE Reviewer:

J. L. Keck 5-24-99

Utility Reviewer:

J. L. Anderson 5-24-99



GE Nuclear Energy

Core Shroud Assembly Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No: GE-UT-503Report No.: RS-04bProject No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H4Weld Configuration: Circumferential Weld - Plate to-PlateMaterials: SA-240, Type 304L (Welded Plate); SA-240, Type 304L (Plate)System Operator: Michael Webster
Level IISystem Operator: Nicholas Labella
Level IISystem Operator: Terry Rockwood
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Scott Hamel
Level IIData Analyst: John Hayden
Level III

During the examination of Weld H4 from the lower side, the ultrasonic system recorded no flaw indications.

Detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions. Extensive welding defects were detected in the mid-wall region of the weld.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations performed with the OD Tracker device from the lower side of the weld (lower-middle cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Lower Side Weld Examination Coverage: 218.23°, or 60.62% of the weld length.

John J. Hayden
Data AnalystIII
Level5/15/99
DateP. L. Keef
GE Reviewer5-24-99
DatePage 46 of 91Thomas L. Anderson
Utility Review5-24-99
DateAnthony M. B. 6/10/99
ANTI



Weld H4

Examination from Bottom Side of Weld - 45 & ODCr Coverage

Total Scan Length Examined (Deg.)	218.23°	Shroud Thickness (In.)	2.00
Total Scan Length Examined (In.)	394.44	Circumference (In.)	650.69
Percent of Weld Length Examined	60.62%	Inches per Degree	1.81
Percent of Examined Weld Length Flawed	0.0%	Total Flawed Length (In.)	0.00
Percent of Total Weld Length Flawed	0.0%	Total Flawed Length (Deg.)	0.00°

45-ODCr										
Looking Up	45° Scan	45°	ODCr							
Data Files	Start	Scan End	Scan Start	ODCr Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length
TriModal H4011-1	4.02°	11.72°	5.07°	12.77°	7.70°	8.75°				
TriModal H4026-1	15.96°	24.76°	17.01°	25.81°	8.80°	9.85°	6.79°	4.02°	12.77°	8.75°
TriModal H4026-2	19.02°	34.42°	20.07°	35.47°	15.40°	16.45°		15.96°	35.47°	19.51°
TriModal H4056-1	50.04°	65.53°	51.09°	66.58°	15.49°	16.54°	13.12°	50.04°	130.25°	80.21°
TriModal H4063-1	53.46°	68.86°	54.51°	69.91°	15.40°	16.45°	1.45°			
TriModal H4076-1	68.46°	83.86°	69.51°	84.91°	15.40°	16.45°	1.45°			
TriModal H4096-1	83.46°	98.86°	84.51°	99.91°	15.40°	16.45°	1.45°			
TriModal H4108-1	98.46°	113.86°	99.51°	114.91°	15.40°	16.45°	1.11°			
TriModal H4116-1	113.80°	129.20°	114.85°	130.25°	15.40°	16.45°				
TriModal H4191-0	182.12°	192.54°	183.17°	193.59°	10.42°	11.47°	8.55°	182.12°	219.91°	37.79°
TriModal H4191-1	185.04°	195.49°	186.09°	196.54°	10.45°	11.50°	4.00°			
TriModal H4198-1	192.54°	202.99°	193.59°	204.04°	10.45°	11.50°	4.00°			
TriModal H4206-1	200.04°	210.49°	201.09°	211.54°	10.45°	11.50°	8.08°			
TriModal H4213-1	203.46°	218.86°	204.51°	219.91°	15.40°	16.45°				
TriModal H4243-1	234.50°	248.80°	235.55°	249.85°	14.30°	15.35°	1.35°	234.50°	306.48°	71.98°
TriModal H4258-1	248.50°	263.90°	249.55°	264.95°	15.40°	16.45°	1.50°			
TriModal H4273-1	263.45°	278.85°	264.50°	279.90°	15.40°	16.45°	1.45°			
TriModal H4288-2	278.45°	293.85°	279.50°	294.90°	15.40°	16.45°	4.87°			
TriModal H4296-1	290.03°	305.43°	291.08°	306.48°	15.40°	16.45°				
Total Scanned:				277.35°						
Overlap:				59.13°						
Net Coverage:				218.23°						
Percentage of Weld Scanned:				60.62%						
								Total Ligament Length:		218.23°
								Percentage of Total Weld Length:		60.62%

GE Data Analyst: John J. Hayden 5/14/99GE Reviewer: R. L. Keck 5-24-99Utility Reviewer: Thomas L. Anderson 5-24-99



GE Nuclear Energy

Core Shroud Assembly Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-05Project No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04/05Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H5Weld Configuration: Circumferential Weld – Plate-to-Core Plate Support RingMaterials: SA-240, Type 304L (Plate); SA-240, Type 304L (Welded Plate)System Operator: Michael Webster
Level IISystem Operator: Nicholas Labella
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Scott Hamel
Level IIData Analyst: James Halley
Level III

During the examination of Weld H5 from the upper side, the ultrasonic system recorded nine flaw indications, seven of which originate at the inside surface of the component and two of which originate at the outside surface of the component. All of the detected flaws are located in the heat-affected zone on the plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations performed with the OD Tracker device from the upper side of the weld (upper-middle cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Upper Side Weld Examination Coverage: 221.09°, or 61.41% of the weld length.

Paul Roman HSB 6/10/99
ANII

John J. Hayden
Data Analyst

III
Level Date 5/14/99

R. L. Keck
GE Reviewer

5-24-99
Date

Page 55 of 91

F. Halley
Data Analyst

III
Level Date 5-14-99

Thomas L. Anderson, Jr.
Utility Review

5-24-99
Date



Weld H5

Examination from Top Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.) 221.09°
 Total Scan Length Examined (In.) 399.61
 Percent of Weld Length Examined 61.41%
 Percent of Examined OD Weld Length Flawed 1.73%
 Percent of Total OD Weld Length Flawed 1.06%
 Percent of Examined ID Weld Length Flawed 8.17%
 Percent of Total ID Weld Length Flawed 5.02%

Shroud Thickness (In.) 2.00
 Circumference (In.) 660.69
 Inches per Degree 1.81

45-ODCr											
Looking Down	ODCr Scan	ODCr	45° Scan	45° Scan		45-ODCr	45-ODCr	Ligament		Ligament	
Data Files	Start	Scan End	Start	End	Scan Length	Coverage	Overlap	Start	Ligament End	Length	
TriModal H5011LD1	6.12°	16.57°	5.07°	16.52°	10.45°	11.50°	4.00°	5.07°	39.94°	34.87°	
TriModal H5018LD1	13.62°	24.07°	12.57°	23.02°	10.45°	11.50°	4.00°				
TriModal H5026LD1	21.12°	31.57°	20.07°	30.52°	10.45°	11.50°	8.08°				
TriModal H5033LD1	24.54°	39.94°	23.49°	38.89°	15.40°	16.45°					
TriModal H5058LD1	31.12°	61.57°	30.07°	60.52°	10.45°	11.50°	8.08°	50.07°	126.52°	76.45°	
TriModal H5063LD1	34.54°	64.99°	33.49°	63.94°	10.45°	11.50°	4.00°				
TriModal H5071LD1	42.04°	72.49°	40.99°	71.44°	10.45°	11.50°	4.00°				
TriModal H5078LD1	49.54°	79.99°	48.49°	78.94°	10.45°	11.50°	4.00°				
TriModal H5086LD1	57.04°	87.49°	55.99°	86.44°	10.45°	11.50°	4.00°				
TriModal H5093LD1	64.54°	94.99°	63.49°	93.94°	10.45°	11.50°	4.00°				
TriModal H5101LD1	72.04°	102.49°	70.99°	101.44°	10.45°	11.50°	4.00°				
TriModal H5108LD1	79.54°	112.74°	78.49°	111.69°	13.20°	14.25°	2.67°				
TriModal H5116LD1	111.12°	126.52°	110.07°	125.47°	15.40°	16.45°					
TriModal H5190-1	183.63°	194.08°	182.58°	193.03°	10.45°	11.50°	9.07°	182.58°	219.33°	36.75°	
TriModal H5191-1	186.06°	195.96°	185.01°	194.91°	9.90°	10.95°	4.44°				
TriModal H5198-1	192.57°	203.02°	191.52°	201.97°	10.45°	11.50°	3.01°				
TriModal H5206-1	201.06°	211.51°	200.01°	210.46°	10.45°	11.50°	8.08°				
TriModal H5213-1	204.48°	219.33°	203.43°	218.28°	14.85°	15.90°					
TriModal H5243LD1	234.54°	244.99°	233.49°	243.94°	10.45°	11.50°	4.00°	233.49°	308.52°	73.03°	
TriModal H5251LD1	242.04°	252.49°	240.99°	251.44°	10.45°	11.50°	4.00°				
TriModal H5258LD1	249.54°	259.99°	248.49°	258.94°	10.45°	11.50°	4.00°				
TriModal H5266LD1	257.04°	267.49°	255.99°	266.44°	10.45°	11.50°	4.00°				
TriModal H5273LD1	264.54°	274.99°	263.49°	273.94°	10.45°	11.50°	4.00°				
TriModal H5281LD1	272.04°	282.49°	270.99°	281.44°	10.45°	11.50°	4.00°				
TriModal H5288LD1	279.54°	292.74°	278.49°	291.69°	13.20°	14.25°	2.67°				
TriModal H5296LD1	291.12°	306.52°	290.07°	305.47°	15.40°	16.45°					
Total Scanned:						323.12°		Total Ligament Length:		221.09°	
Overlap:						102.03°					
Net Coverage:						221.09°		Percentage of Total Weld Length:			61.41%
Percentage of Weld Scanned:						61.41%					

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer: R. L. Keck 5-24-99

Utility Reviewer: Thomas L. Anderson, Jr. 5/24/99



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H5

Outside Surface Flaw Length Summary

<u>Flaw No.</u>	<u>Weld Side</u>	<u>Initiating Surface</u>	<u>Flaw Start</u>	<u>Flaw End</u>	<u>Flaw Length</u>	
					<u>Degrees</u>	<u>Inches</u>
1	NS	OD	77.29°	78.36°	1.07°	1.94
2	NS	OD	83.49°	86.25°	2.76°	5.00

Length Totals: 3.83° 6.93

Length sizing of *Outside Surface* flaws performed with ODCr search unit.

Outside Surface Flaw Through-Wall Height Summary

<u>Flaw No.</u>	<u>Location</u>	<u>Thru-Wall</u>
1	77.84°	<0.05
2	84.04°	<0.05

Through-wall sizing of *Outside Surface* flaws performed with 45 search unit.

GE Data Analyst: John J Hayden 5/14/99

GE Reviewer: J. L. Keck 5-24-99

Utility Reviewer: Thomas L. Anderson 5/24/99



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H5

Inside Surface Flaw Length Summary

Flaw No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1	NS	ID	58.44°	59.97°	1.53°	2.77
2*	NS	ID	77.01°	80.31°	3.30°	5.97
3	NS	ID	90.91°	94.76°	3.85°	4.98
4*	NS	ID	97.51°	100.26°	2.75°	6.03
5*	NS	ID	109.49°	112.82°	3.33°	6.03
6	NS	ID	121.62°	123.82°	2.20°	3.98
7	NS	ID	183.11°	184.21°	1.10°	1.99

Length Totals: 18.06° 31.75

Length sizing of *Inside Surface* flaws performed with 45 search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw No.	Location	Thru-Wall
1	59.42°	<0.05
2	58.96°	<0.05
3	78.39°	<0.05
4	92.09°	<0.05
5	93.74°	<0.05
6	98.14°	<0.05
7	99.79°	<0.05
8	111.72°	<0.05
9	122.17°	<0.05
10	123.82°	<0.05
11	183.11	<0.05

Through-wall sizing of *Inside Surface* flaws performed with 60 search unit.

GE Data Analyst: John J. Hayden 5/19/99

Utility Reviewer: Thomas L. Anderson 5-24-99

GE Reviewer: P. L. Keck 5-24-99



GE Nuclear Energy

Core Shroud Assembly
Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-06Project No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03/04/05Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H6Weld Configuration: Circumferential Weld – Core Plate Support Ring-to-PlateMaterials: SA-240, Type 304L (Welded Ring); SA-240, Type 304L (Plate)System Operator: Michael Webster
Level IISystem Operator: Paul Weeks
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Terry Rockwood
Level IIIData Analyst: James Halley
Level III

During the examination of Weld H6 from the lower side, the ultrasonic system recorded 21 flaw indications, all of which originate at the inside surface of the component. All of the detected flaws are located in the heat-affected zone on the plate side of the weld.

Also detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations performed with the OD Tracker device from the lower side of the weld (lower cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Upper Side Weld Examination Coverage: 214.21°, or 59.50% of the weld length.

Paul Weeks HSB 6/10/99
NII

J. F. Halley
Data Analyst

III
Level

5-14-99
Date

P. L. Keck
GE Reviewer

5-24-99
Date

Page 67 of 91

John J. Hayden
Data Analyst

III
Level

5/14/99
Date

Thomas L. Anderson
Utility Review

5/24/99
Date



Weld H6

Examination from Bottom Side of Weld - 45° & ODCr Coverage

Total Scan Length Examined (Deg.) 214.21°
 Total Scan Length Examined (In.) 346.69
 Percent of Weld Length Examined 59.50%
 Percent of Examined ID Weld Length Flawed 64.8%
 Percent of Total ID Weld Length Flawed 38.6%

Shroud Thickness (In.) 2.00
 Circumference (In.) 630.67
 Inches per Degree 1.75
 Total Flawed Length (In.) 242.90
 Total Flawed Length (Deg.) 138.80°

45° - ODCr											
Looking Up Data Files	45° Scan Start	45° Scan End	ODCr Scan Start	ODCr Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length	
TriModal H6011LU1	6.09°	16.54°	6.04°	16.49°	10.45°	11.50°	4.00°				
TriModal H6018LU1	13.59°	24.04°	12.54°	22.99°	10.45°	11.50°	4.00°	5.04°	39.36°	34.32°	
TriModal H6026LU1	21.09°	31.54°	20.04°	30.49°	10.45°	11.50°	8.08°				
TriModal H6033LD1	24.51°	39.36°	23.46°	38.31°	14.85°	15.90°					
TriModal H6056LU1	51.09°	61.54°	50.04°	60.49°	10.45°	11.50°	11.50°				
TriModal H6063LU1	51.09°	61.54°	50.04°	60.49°	10.45°	11.50°	0.58°	50.04°	126.49°	76.45°	
TriModal H6071LU1	62.01°	72.46°	60.96°	71.41°	10.45°	11.50°	4.00°				
TriModal H6078LU1	69.51°	79.96°	68.46°	78.91°	10.45°	11.50°	4.00°				
TriModal H6086LU1	77.01°	87.46°	75.96°	86.41°	10.45°	11.50°	4.00°				
TriModal H6093LU1	84.51°	94.96°	83.46°	93.91°	10.45°	11.50°	4.00°				
TriModal H6101LU1	92.01°	102.46°	90.96°	101.41°	10.45°	11.50°	4.00°				
TriModal H6108LU2	99.51°	112.16°	98.46°	111.11°	12.85°	13.70°	2.12°				
TriModal H6116LU2	111.09°	126.49°	110.04°	125.44°	15.40°	16.45°					
TriModal H6191-0	183.71°	193.61°	182.66°	192.56°	9.90°	10.95°	6.57°	182.66°	219.36°	36.70°	
TriModal H6191-1	186.09°	196.54°	185.04°	195.49°	10.45°	11.50°	3.00°				
TriModal H6198LU1	194.59°	205.04°	193.54°	203.99°	10.45°	11.50°	6.00°				
TriModal H6206LU1	201.09°	211.54°	200.04°	210.49°	10.45°	11.50°	8.08°				
TriModal H6213LU1	204.51°	219.36°	203.46°	218.31°	14.85°	15.90°					
TriModal H6243LU1	238.59°	247.47°	237.54°	246.42°	8.88°	9.93°	6.51°	237.54°	304.29°	66.75°	
TriModal H6251LU1	242.01°	252.46°	240.96°	251.41°	10.45°	11.50°	4.00°				
TriModal H6258LU1	249.51°	259.96°	248.46°	258.91°	10.45°	11.50°	4.00°				
TriModal H6266LU1	257.01°	267.46°	255.96°	266.41°	10.45°	11.50°	4.00°				
TriModal H6273LU1	264.51°	275.04°	263.46°	273.99°	10.53°	11.58°	4.08°				
TriModal H6281LU1	272.01°	282.46°	270.96°	281.41°	10.45°	11.50°	4.00°				
TriModal H6288LU1	279.51°	292.71°	278.46°	291.66°	13.20°	14.25°	2.67°				
TriModal H6296LU1	291.09°	304.29°	290.04°	303.24°	13.20°	14.25°					
Total Scanned:					318.33°	Total Ligament Length:					214.21°
Overlap:					104.12°						
Net Coverage:					214.21°						
Percentage of Weld Scanned:					59.50%	Percentage of Total Weld Length:					69.50%

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer:

F. L. Keef 5-24-99

Utility Reviewer:

Thomas L. Anderson 5-24-99



GE Inspection Services

Linnick Unit 2 RFO's Core Shroud Ultrasonic Examination Project - May 1999

Weld H6

Inside Surface Flaw Length Summary

Flaw	No.	Weld Side	Initiating Surface	Flaw Start	Flaw End	Flaw Length Degrees	Flaw Length Inches
1	1	NS	ID	6.09°	21.84°	15.75°	27.56
2	2	NS	ID	22.19°	39.36°	17.17°	30.05
3	3	NS	ID	51.08°	63.11°	12.02°	21.04
4	4	NS	ID	65.88°	68.61°	2.75°	4.81
5	5	NS	ID	69.16°	79.76°	10.60°	18.55
6	6	NS	ID	82.51°	88.36°	5.85°	10.24
7	7	NS	ID	91.11°	93.86°	2.75°	4.81
8	8	NS	ID	92.01°	96.96°	4.95°	8.68
9	9	NS	ID	97.51°	123.19°	25.68°	44.94
10	10	NS	ID	187.74°	193.24°	5.50°	9.83
11	11	NS	ID	204.39°	206.49°	1.10°	1.93
12	12	NS	ID	209.34°	214.41°	5.07°	8.87
13	13	NS	ID	215.61°	219.36°	3.85°	6.74
14	14	NS	ID	238.69°	239.69°	1.10°	1.92
15	15	NS	ID	245.31°	247.39°	2.08°	3.64
16	16	NS	ID	248.08°	250.26°	2.20°	3.85
17	17	NS	ID	262.51°	268.26°	2.75°	4.81
18	18	NS	ID	275.31°	278.96°	1.65°	2.89
19	19	NS	ID	283.91°	294.94°	11.03°	19.30
20	20	NS	ID	296.04°	298.24°	2.20°	3.86
21	21	NS	ID	301.64°	304.29°	2.75°	4.81
Length Totals:						122.82°	214.94

Length sizing of inside surface flaws performed with 45 search unit.

*Flaw detected in adjacent overlapping scan regions.

Inside Surface Flaw Through-Wall Height Summary

Flaw	No.	Location	Thru-Wall	Flaw	No.	Location	Thru-Wall
1	1	7.79°	0.05	26	26	84.76°	0.12
2	2	9.99°	0.07	27	27	88.78°	0.10
3	3	12.74°	0.06	28	28	93.86°	0.27
4	4	14.39°	0.06	29	29	96.91°	0.24
5	5	16.39°	0.06	30	30	98.68°	0.18
6	6	19.14°	0.06	31	31	100.66°	0.28
7	7	20.24°	<0.05	32	32	103.96°	0.23
8	8	23.89°	0.10	33	33	105.08°	0.16
9	9	25.54°	0.06	34	34	107.26°	0.17
10	10	29.39°	0.16	35	35	111.69°	0.18
11	11	30.06°	0.16	36	36	113.34°	0.17
12	12	31.83°	0.21	37	37	117.74°	0.24
13	13	37.21°	0.17	38	38	119.94°	0.19
14	14	51.14°	0.16	39	39	188.88°	0.21
15	15	52.24°	0.27	40	40	191.64°	0.27
16	16	53.85°	0.23	41	41	192.74°	0.35
17	17	52.24°	0.23	42	42	204.94°	<0.05
18	18	54.99°	0.14	43	43	210.48°	0.28
19	19	58.84°	0.23	44	44	211.26°	0.28
20	20	61.51°	0.22	45	45	212.90°	0.20
21	21	67.01°	0.19	46	46	217.03°	0.15
22	22	70.86°	0.18	47	47	239.19°	0.07
23	23	73.96°	0.24	48	48	246.36°	<0.05
24	24	76.16°	0.20	49	49	250.11°	<0.05
25	25	83.11°	<0.05	50	50	263.66°	0.27

Through-wall sizing of inside surface flaws performed with 60 search unit.

GE Data Analyst:

John J. Hayden 5/19/99

GE Reviewer:

R. P. Keef 5-24-99

Utility Reviewer:

Thomas L. Anderson 5/24/99

Pg. 69 of 91



GE Nuclear Energy

Core Shroud Assembly Examination Summary Sheet

Automated TriModal Technique

Site: Limerick Unit: 2 Procedure No.: GE-UT-503Report No.: RS-07Project No.: 1H61RVersion: 8 DRR No.: 010Data Sheet No.: DS-01/02/03Calibration Sheet No.: CS-01, 02, 03, 04, 05, 06Weld Number: H7Weld Configuration: Circumferential Weld – Plate-to-Shroud Support PlateMaterials: SA-240, Type 304L (Welded Ring); Alloy 600 Inconel (Plate)System Operator: Michael Webster
Level IISystem Operator: Nicholas Labella
Level IIData Analyst: John Hayden
Level IIISystem Operator: Martin Crane
Level IISystem Operator: Terry Rockwood
Level III

During the examination of Weld H7 from the upper side, no flaw indications were detected.

Detected were geometric responses originating from component outside and inside surface and weld contour, along with normal austenitic weld interface metallurgical conditions.

The R/D Tech MicroTomo™ Ultrasonic System, in conjunction with the GE OD Tracker remote scanner and a GE Trimodal search unit, was used to conduct the examinations. Shear waves of 45°, longitudinal waves of 60° and OD/ID Creeping waves were generated in the component during the examinations.

The examinations performed with the OD Tracker device from the lower side of the weld (lower cylinder plate) using a raster-scan pattern with the following data acquisition intervals:

Axis	Interval
Azimuthal	0.55 deg.
Axial	0.036 in.

Total Weld Examination Coverage: 207.89°, or 57.75% of the weld length.

John J. Hayden
Data AnalystIII
Level5/15/99
DateJ. L. Keef
GE Reviewer5-24-99
DateThomas L. Anderson, Jr.
Utility Review5-24-99
DatePage 78 of 91



GE Inspection Services

Limerick Unit 2 RFO5 Core Shroud Ultrasonic Examination Project - May 1999

Weld H7

Total Scan Length Examined (Deg.) 212.74°
 Total Scan Length Examined (In.) 372.69
 Percent of Weld Length Examined 59.09%
 Percent of Examined Weld Length Flawed 0.0%
 Percent of Total Weld Length Flawed 0.0%

Shroud Thickness (In.) 2.00
 Circumference (In.) 630.67
 Inches per Degree 1.75

45-ODCr											
Looking Down Data Files	ODCr Scan Start	ODCr Scan End	45° Scan Start	45° Scan End	Scan Length	45-ODCr Coverage	45-ODCr Overlap	Ligament Start	Ligament End	Ligament Length	
TriModal	H7011LD1	6.08°	21.48°	5.03°	20.43°	15.40°	16.45°	5.53°			
TriModal	H7026LD1	17.00°	22.50°	15.95°	21.45°	5.50°	6.55°	2.47°	5.03°	36.42°	31.39°
TriModal	H7026LD2	21.08°	36.42°	20.03°	35.37°	15.34°	16.39°				
TriModal	H7083LD1	54.50°	69.90°	53.45°	68.85°	15.40°	16.45°	1.45°	53.45°	126.48°	73.03°
TriModal	H7078LD1	69.50°	84.90°	68.48°	83.85°	15.40°	16.45°	1.45°			
TriModal	H7093LD1	84.50°	99.90°	83.45°	98.85°	15.40°	16.45°	1.45°			
TriModal	H7108LD1	99.50°	114.90°	98.45°	113.85°	15.40°	16.45°	4.87°			
TriModal	H7116LD1	111.08°	126.48°	110.03°	125.43°	15.40°	16.45°				
TriModal	H7191LD1	186.08°	201.48°	185.03°	200.43°	15.40°	16.45°	1.45°	185.03°	216.48°	31.45°
TriModal	H7206LD1	201.08°	216.48°	200.03°	215.43°	15.40°	16.45°				
TriModal	H7243LD	235.55°	249.87°	234.50°	248.82°	14.32°	15.37°	1.42°	234.50°	306.53°	72.03°
TriModal	H7258LD1	249.50°	264.95°	248.45°	263.90°	15.45°	16.50°	1.50°			
TriModal	H7273LD1	264.50°	279.95°	263.45°	278.90°	15.45°	16.50°	1.50°			
TriModal	H7288LD1	279.50°	294.95°	278.45°	293.90°	15.45°	16.50°	4.92°			
TriModal	H7296LD1	291.08°	306.53°	290.03°	305.48°	15.45°	16.50°				
Total Scanned:						235.87°	Total Ligament Length:				
Overlap:						27.98°					
Net Coverage:						207.89°					
Percentage of Weld Scanned:						57.75%	Percentage of Total Weld Length:				

GE Data Analyst: John J. Hayden 5/14/99

GE Reviewer: P. L. Keef 5-24-99

Utility Reviewer: J. L. Anderson 5-24-99

APPENDIX B

Limit Load Flaw Evaluation Results Using the ANSC Software [8]

The bases for the limit load flaw evaluations are as follows:

- All welds except welds H3, H4, and H6 were evaluated for five cycles (ten years) of crack growth. Welds H3, H4, and H6 were evaluated for four cycles (eight years) of crack growth.
- The stresses from Table 1 were utilized.
- The inspection results from Tables 2 through 7 were used in conjunction with the appropriate NDE length and depth uncertainty factors.
- The length crack growth rate utilized for all evaluations was 5×10^{-5} inches/hour.
- The depth crack growth rate utilized for all evaluations was dependent upon the weld being evaluated. For the first cycle, a crack growth rate of 2.2×10^{-5} inches/hour was used for all welds except weld H4, where a crack growth rate 5×10^{-5} inches/hour was used. For the subsequent cycles, since NMCA is being applied at the end-of-cycle 6, a crack growth rate of 1.1×10^{-5} inches/hour was used for all welds except weld H4 which are protected, a value of 2.2×10^{-5} inches/hour was used for all welds which are not projected to be protected per Table 4-4 of Reference 9 (the inside surface of welds H1, H2, H5, and H6), and a value of 2.5×10^{-5} inches/hour was used for weld H4.
- If flaws were closer than 4" apart after considering NDE uncertainty and crack growth, they were combined.



Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:58:19

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H1 -- 10 Years of Crack Growth -- Upset Conditions

Crack assumed to take compression across face

RADIUS (IN) = 109 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.351 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 17 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	52.7600	(DTHETA =	52.760)	DEPTH (IN) =	2.000
2 ANGLES:	52.7600 TO	64.1700	(DTHETA =	11.410)	DEPTH (IN) =	1.377
3 ANGLES:	64.1700 TO	73.3200	(DTHETA =	9.150)	DEPTH (IN) =	2.000
4 ANGLES:	73.3200 TO	97.5200	(DTHETA =	24.200)	DEPTH (IN) =	2.000
5 ANGLES:	97.5200 TO	106.6200	(DTHETA =	9.100)	DEPTH (IN) =	1.327
6 ANGLES:	106.6200 TO	192.6100	(DTHETA =	85.990)	DEPTH (IN) =	2.000
7 ANGLES:	203.4100 TO	211.9100	(DTHETA =	8.500)	DEPTH (IN) =	2.000
8 ANGLES:	211.9100 TO	214.3800	(DTHETA =	2.470)	DEPTH (IN) =	1.347
9 ANGLES:	214.3800 TO	219.2300	(DTHETA =	4.850)	DEPTH (IN) =	2.000
10 ANGLES:	219.2300 TO	236.3600	(DTHETA =	17.130)	DEPTH (IN) =	2.000
11 ANGLES:	236.3600 TO	242.2100	(DTHETA =	5.850)	DEPTH (IN) =	2.000
12 ANGLES:	242.2100 TO	246.7700	(DTHETA =	4.560)	DEPTH (IN) =	1.327
13 ANGLES:	259.8200 TO	266.7700	(DTHETA =	6.950)	DEPTH (IN) =	2.000
14 ANGLES:	275.3700 TO	282.6700	(DTHETA =	7.300)	DEPTH (IN) =	2.000
15 ANGLES:	291.7600 TO	305.3600	(DTHETA =	13.600)	DEPTH (IN) =	2.000
16 ANGLES:	305.3600 TO	306.4600	(DTHETA =	1.100)	DEPTH (IN) =	2.000
17 ANGLES:	306.4600 TO	360.0000	(DTHETA =	53.540)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1369.734

REMAINING DEGRADED SECTION AREA (IN2) = 192.1329

(APPROX. DEGRADED METAL AREA = 192.1328)

Program Output:

* Angle = Angle that tension-to-compression axis x' is rotated
 t = Thickness in wall at position corresponding to angle
 delta = Distance from center to tension-to-compression axis
 Pb,x' = Bending stress due to moment about tension-to-compression axis
 Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis
 Pb,max = Maximum bending stress due to total limit moment
 Anglemax = Angle for total limit moment relative to original Y axis
 Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	102.387	8.444	-6.419	10.606	322.76	163.78
1.00	0.000	102.603	8.332	-6.353	10.478	323.67	161.25
2.00	0.000	102.815	8.222	-6.273	10.341	324.66	158.71
3.00	0.000	103.024	8.112	-6.210	10.216	325.57	156.17
4.00	0.000	103.229	8.005	-6.148	10.093	326.47	153.64
5.00	0.000	103.431	7.898	-6.073	9.963	327.44	151.10
6.00	0.000	103.436	7.792	-6.059	9.870	328.13	151.04
7.00	0.000	103.436	7.686	-6.043	9.777	328.82	151.04
8.00	0.000	103.436	7.580	-6.024	9.683	329.52	151.04
9.00	0.000	103.436	7.475	-6.004	9.588	330.22	151.04
10.00	0.000	103.436	7.370	-5.983	9.493	330.93	151.04
11.00	0.000	103.436	7.266	-5.959	9.397	331.64	151.04
12.00	0.000	103.436	7.162	-5.933	9.300	332.36	151.04
13.00	0.000	103.436	7.058	-5.906	9.203	333.08	151.04
14.00	0.000	103.476	6.955	-5.877	9.106	333.80	150.53
15.00	0.000	103.559	6.853	-5.817	8.989	334.67	149.47
16.00	0.000	103.642	6.752	-5.772	8.883	335.47	148.40
17.00	0.000	103.675	6.651	-5.726	8.776	336.27	147.97
18.00	0.000	103.675	6.551	-5.693	8.679	337.01	147.97
19.00	0.000	103.675	6.452	-5.658	8.582	337.75	147.97
20.00	0.000	103.675	6.353	-5.622	8.484	338.50	147.97
21.00	0.000	103.675	6.255	-5.584	8.385	339.25	147.97
22.00	0.000	103.675	6.158	-5.544	8.286	340.00	147.97
23.00	0.000	103.675	6.062	-5.502	8.186	340.77	147.97
24.00	0.000	103.675	5.966	-5.459	8.086	341.54	147.97
25.00	0.000	103.675	5.871	-5.414	7.986	342.32	147.97
26.00	0.000	103.675	5.776	-5.367	7.885	343.10	147.97
27.00	0.000	103.675	5.683	-5.319	7.784	343.89	147.97
28.00	0.000	103.675	5.590	-5.269	7.682	344.69	147.97
29.00	0.000	103.675	5.498	-5.218	7.580	345.50	147.97
30.00	0.000	103.675	5.408	-5.165	7.478	346.31	147.97
31.00	0.000	103.595	5.318	-5.112	7.376	347.13	149.01
32.00	0.000	103.396	5.230	-4.993	7.230	348.33	151.54
33.00	0.000	103.194	5.144	-4.869	7.082	349.57	154.08
34.00	0.000	102.988	5.059	-4.771	6.954	350.68	156.62
35.00	0.000	102.778	4.977	-4.636	6.802	352.03	159.15
36.00	0.000	102.565	4.898	-4.497	6.649	353.44	161.69
37.00	0.000	102.349	4.820	-4.385	6.516	354.70	164.22
38.00	0.000	102.129	4.745	-4.236	6.360	356.24	166.76
39.00	0.000	101.906	4.672	-4.081	6.204	357.86	169.30
40.00	0.000	101.679	4.602	-3.956	6.069	359.31	171.83
41.00	0.000	101.466	4.535	-3.792	5.911	1.09	174.19
42.00	0.000	101.327	4.470	-3.589	5.733	3.24	175.70
43.00	0.000	101.187	4.410	-3.382	5.557	5.51	177.21
44.00	0.000	101.046	4.353	-3.172	5.386	7.92	178.73
45.00	0.000	100.957	4.299	-2.922	5.198	10.80	179.67
46.00	0.000	101.063	4.251	-2.688	5.029	13.69	178.55
47.00	0.000	101.299	4.205	-2.512	4.898	16.15	176.01
48.00	0.000	101.531	4.162	-2.356	4.783	18.49	173.47
49.00	0.000	101.760	4.123	-2.203	4.674	20.88	170.94

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	101.985	4.086	-2.036	4.565	23.51	168.40
51.00	0.000	102.208	4.051	-1.888	4.470	26.01	165.86
52.00	0.000	102.420	4.019	-1.744	4.381	28.55	163.39
53.00	0.623	102.552	3.991	-1.554	4.283	31.72	161.85
54.00	0.623	102.683	3.965	-1.366	4.194	34.99	160.30
55.00	0.623	102.894	3.943	-1.207	4.123	37.98	157.76
56.00	0.623	103.101	3.923	-1.072	4.066	40.72	155.22
57.00	0.623	103.305	3.905	-0.939	4.016	43.48	152.69
58.00	0.623	103.506	3.890	-0.795	3.970	46.45	150.15
59.00	0.623	103.703	3.877	-0.669	3.934	49.21	147.62
60.00	0.623	103.896	3.866	-0.546	3.905	51.96	145.08
61.00	0.623	104.086	3.858	-0.412	3.880	54.90	142.54
62.00	0.623	104.273	3.852	-0.296	3.863	57.60	140.01
63.00	0.623	104.456	3.847	-0.183	3.852	60.27	137.47
64.00	0.623	104.515	3.845	-0.087	3.846	62.71	136.64
65.00	0.000	104.515	3.844	-0.017	3.844	64.74	136.64
66.00	0.000	104.515	3.844	0.052	3.844	66.77	136.64
67.00	0.000	104.515	3.845	0.121	3.847	68.80	136.64
68.00	0.000	104.515	3.848	0.190	3.852	70.83	136.64
69.00	0.000	104.515	3.851	0.259	3.860	72.85	136.64
70.00	0.000	104.515	3.856	0.328	3.870	74.86	136.64
71.00	0.000	104.644	3.863	0.423	3.886	77.25	134.81
72.00	0.000	104.820	3.871	0.529	3.907	79.78	132.27
73.00	0.000	104.992	3.881	0.643	3.934	82.41	129.73
74.00	0.000	105.160	3.893	0.741	3.963	84.78	127.20
75.00	0.000	105.326	3.907	0.835	3.995	87.07	124.66
76.00	0.000	105.487	3.922	0.938	4.033	89.45	122.12
77.00	0.000	105.619	3.939	1.029	4.071	91.63	120.00
78.00	0.000	105.712	3.958	1.149	4.121	94.18	118.49
79.00	0.000	105.804	3.979	1.266	4.176	96.65	116.97
80.00	0.000	105.894	4.002	1.380	4.234	99.02	115.46
81.00	0.000	105.930	4.028	1.516	4.303	101.63	114.85
82.00	0.000	105.891	4.055	1.649	4.378	104.13	115.51
83.00	0.000	105.739	4.085	1.739	4.440	106.06	118.05
84.00	0.000	105.583	4.116	1.833	4.506	108.00	120.59
85.00	0.000	105.424	4.149	1.906	4.565	109.67	123.12
86.00	0.000	105.261	4.183	2.005	4.639	111.61	125.66
87.00	0.000	105.094	4.219	2.109	4.716	113.56	128.20
88.00	0.000	105.058	4.257	2.265	4.822	116.02	128.74
89.00	0.000	105.058	4.298	2.446	4.945	118.65	128.74
90.00	0.000	105.058	4.342	2.626	5.075	121.17	128.74
91.00	0.000	105.058	4.389	2.806	5.210	123.59	128.74
92.00	0.000	105.058	4.440	2.985	5.350	125.91	128.74
93.00	0.000	105.058	4.494	3.163	5.495	128.14	128.74
94.00	0.000	105.058	4.550	3.340	5.644	130.28	128.74
95.00	0.000	105.058	4.610	3.516	5.798	132.33	128.74
96.00	0.000	105.180	4.673	3.628	5.916	133.83	126.90
97.00	0.000	105.315	4.737	3.708	6.015	135.06	124.83
98.00	0.673	105.315	4.802	3.749	6.092	135.98	124.83
99.00	0.673	105.315	4.867	3.788	6.168	136.89	124.83

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.673	105.315	4.934	3.826	6.243	137.79	124.83
101.00	0.673	105.315	5.001	3.863	6.319	138.69	124.83
102.00	0.673	105.267	5.068	3.903	6.397	139.60	125.56
103.00	0.673	105.101	5.137	3.990	6.505	140.84	128.10
104.00	0.673	104.931	5.207	4.054	6.599	141.90	130.63
105.00	0.673	104.758	5.279	4.146	6.713	143.15	133.17
106.00	0.673	104.581	5.352	4.241	6.829	144.39	135.71
107.00	0.000	104.400	5.427	4.311	6.931	145.46	138.24
108.00	0.000	104.216	5.503	4.410	7.052	146.71	140.78
109.00	0.000	104.029	5.581	4.512	7.177	147.96	143.31
110.00	0.000	103.838	5.661	4.588	7.286	149.02	145.85
111.00	0.000	103.643	5.742	4.694	7.416	150.27	148.39
112.00	0.000	103.445	5.825	4.803	7.550	151.51	150.92
113.00	0.000	103.243	5.909	4.884	7.666	152.57	153.46
114.00	0.000	103.038	5.996	4.997	7.805	153.81	156.00
115.00	0.000	102.911	6.084	5.092	7.933	154.93	157.55
116.00	0.000	102.911	6.173	5.143	8.035	155.80	157.55
117.00	0.000	102.911	6.263	5.193	8.136	156.66	157.55
118.00	0.000	102.911	6.354	5.241	8.237	157.52	157.55
119.00	0.000	102.911	6.446	5.288	8.337	158.36	157.55
120.00	0.000	102.911	6.538	5.332	8.437	159.20	157.55
121.00	0.000	102.911	6.632	5.376	8.537	160.03	157.55
122.00	0.000	102.893	6.726	5.422	8.639	160.88	157.77
123.00	0.000	102.682	6.821	5.495	8.759	161.86	160.31
124.00	0.000	102.467	6.918	5.603	8.902	163.00	162.85
125.00	0.000	102.249	7.017	5.712	9.048	164.15	165.38
126.00	0.000	102.028	7.117	5.790	9.175	165.13	167.92
127.00	0.000	101.803	7.219	5.903	9.325	166.27	170.46
128.00	0.000	101.575	7.323	6.018	9.479	167.41	172.99
129.00	0.000	101.343	7.429	6.100	9.612	168.39	175.53
130.00	0.000	101.108	7.537	6.218	9.771	169.52	178.06
131.00	0.000	100.869	7.646	6.339	9.932	170.66	180.60
132.00	0.000	100.627	7.758	6.424	10.072	171.63	183.14
133.00	0.000	100.382	7.871	6.547	10.238	172.75	185.67
134.00	0.000	100.133	7.987	6.673	10.407	173.88	188.21
135.00	0.000	99.880	8.104	6.761	10.554	174.84	190.75
136.00	0.000	99.741	8.223	6.882	10.723	175.92	192.13
137.00	0.000	99.741	8.343	6.931	10.846	176.72	192.13
138.00	0.000	99.741	8.464	6.978	10.970	177.50	192.13
139.00	0.000	99.741	8.586	7.022	11.092	178.28	192.13
140.00	0.000	99.741	8.709	7.065	11.214	179.05	192.13
141.00	0.000	99.741	8.832	7.106	11.336	179.82	192.13
142.00	0.000	99.741	8.956	7.144	11.457	180.58	192.13
143.00	0.000	99.741	9.081	7.180	11.577	181.33	192.13
144.00	0.000	99.741	9.206	7.214	11.696	182.08	192.13
145.00	0.000	99.741	9.332	7.246	11.815	182.83	192.13
146.00	0.000	99.741	9.459	7.276	11.933	183.57	192.13
147.00	0.000	99.741	9.586	7.303	12.051	184.30	192.13
148.00	0.000	99.741	9.713	7.328	12.167	185.03	192.13
149.00	0.000	99.741	9.841	7.351	12.283	185.76	192.13

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	99.741	9.969	7.372	12.399	186.48	192.13
151.00	0.000	99.741	10.098	7.390	12.513	187.20	192.13
152.00	0.000	99.741	10.226	7.406	12.627	187.91	192.13
153.00	0.000	99.741	10.356	7.420	12.740	188.62	192.13
154.00	0.000	99.741	10.485	7.432	12.852	189.33	192.13
155.00	0.000	99.741	10.614	7.442	12.963	190.03	192.13
156.00	0.000	99.741	10.744	7.449	13.074	190.73	192.13
157.00	0.000	99.741	10.874	7.454	13.183	191.43	192.13
158.00	0.000	99.741	11.004	7.456	13.292	192.12	192.13
159.00	0.000	99.741	11.133	7.457	13.400	192.81	192.13
160.00	0.000	99.741	11.263	7.455	13.507	193.50	192.13
161.00	0.000	99.741	11.393	7.451	13.613	194.18	192.13
162.00	0.000	99.741	11.523	7.445	13.719	194.87	192.13
163.00	0.000	99.741	11.652	7.436	13.823	195.54	192.13
164.00	0.000	99.741	11.782	7.425	13.926	196.22	192.13
165.00	0.000	99.741	11.911	7.412	14.029	196.89	192.13
166.00	0.000	99.741	12.040	7.396	14.130	197.56	192.13
167.00	0.000	99.741	12.169	7.379	14.231	198.23	192.13
168.00	0.000	99.741	12.297	7.359	14.331	198.90	192.13
169.00	0.000	99.741	12.425	7.337	14.429	199.56	192.13
170.00	0.000	99.741	12.552	7.312	14.527	200.22	192.13
171.00	0.000	99.741	12.680	7.286	14.624	200.88	192.13
172.00	0.000	99.741	12.806	7.257	14.719	201.54	192.13
173.00	0.000	99.741	12.932	7.226	14.814	202.19	192.13
174.00	0.000	99.741	13.058	7.193	14.908	202.85	192.13
175.00	0.000	99.741	13.183	7.157	15.000	203.50	192.13
176.00	0.000	99.741	13.307	7.120	15.092	204.15	192.13
177.00	0.000	99.741	13.431	7.080	15.182	204.80	192.13
178.00	0.000	99.741	13.554	7.038	15.272	205.44	192.13
179.00	0.000	99.741	13.676	6.994	15.360	206.09	192.13
180.00	0.000	99.741	13.797	6.948	15.448	206.73	192.13
181.00	0.000	99.741	13.918	6.900	15.534	207.37	192.13
182.00	0.000	99.741	14.037	6.849	15.619	208.01	192.13
183.00	0.000	99.741	14.156	6.797	15.703	208.65	192.13
184.00	0.000	99.741	14.274	6.742	15.786	209.28	192.13
185.00	0.000	99.741	14.391	6.686	15.868	209.92	192.13
186.00	0.000	99.741	14.507	6.627	15.949	210.55	192.13
187.00	0.000	99.741	14.622	6.567	16.028	211.18	192.13
188.00	0.000	99.741	14.735	6.504	16.107	211.82	192.13
189.00	0.000	99.741	14.848	6.439	16.184	212.45	192.13
190.00	0.000	99.741	14.960	6.373	16.261	213.07	192.13
191.00	0.000	99.741	15.070	6.304	16.336	213.70	192.13
192.00	0.000	99.741	15.179	6.234	16.409	214.33	192.13
193.00	2.000	99.741	15.287	6.162	16.482	214.95	192.13
194.00	2.000	99.741	15.394	6.088	16.554	215.58	192.13
195.00	2.000	99.741	15.499	6.012	16.624	216.20	192.13
196.00	2.000	99.741	15.603	5.934	16.693	216.82	192.13
197.00	2.000	99.741	15.705	5.854	16.761	217.44	192.13
198.00	2.000	99.741	15.807	5.773	16.828	218.06	192.13
199.00	2.000	99.741	15.906	5.690	16.893	218.68	192.13

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	99.741	16.005	5.605	16.958	219.30	192.13
201.00	2.000	99.741	16.101	5.518	17.021	219.92	192.13
202.00	2.000	99.741	16.197	5.430	17.083	220.53	192.13
203.00	2.000	99.741	16.290	5.340	17.143	221.15	192.13
204.00	0.000	99.741	16.382	5.249	17.203	221.76	192.13
205.00	0.000	99.741	16.473	5.155	17.261	222.38	192.13
206.00	0.000	99.741	16.562	5.061	17.318	222.99	192.13
207.00	0.000	99.741	16.649	4.964	17.373	223.60	192.13
208.00	0.000	99.741	16.735	4.867	17.428	224.22	192.13
209.00	0.000	99.745	16.818	4.768	17.481	224.83	192.09
210.00	0.000	99.847	16.901	4.686	17.538	225.50	191.08
211.00	0.000	99.950	16.982	4.601	17.594	226.16	190.06
212.00	0.653	100.052	17.061	4.533	17.653	226.88	189.03
213.00	0.653	100.153	17.139	4.444	17.706	227.53	188.00
214.00	0.653	100.254	17.216	4.352	17.757	228.19	186.98
215.00	0.000	100.354	17.291	4.276	17.812	228.89	185.95
216.00	0.000	100.454	17.365	4.179	17.860	229.53	184.93
217.00	0.000	100.553	17.437	4.079	17.908	230.17	183.90
218.00	0.000	100.652	17.507	3.996	17.957	230.86	182.88
219.00	0.000	100.750	17.576	3.892	18.002	231.49	181.85
220.00	0.000	100.848	17.643	3.786	18.044	232.11	180.83
221.00	0.000	100.945	17.708	3.695	18.089	232.79	179.80
222.00	0.000	101.041	17.771	3.584	18.129	233.40	178.78
223.00	0.000	101.057	17.833	3.453	18.164	233.96	178.61
224.00	0.000	101.057	17.892	3.321	18.197	234.52	178.61
225.00	0.000	101.057	17.948	3.188	18.229	235.07	178.61
226.00	0.000	101.057	18.003	3.055	18.260	235.63	178.61
227.00	0.000	101.057	18.055	2.920	18.290	236.19	178.61
228.00	0.000	101.057	18.105	2.784	18.318	236.74	178.61
229.00	0.000	101.057	18.152	2.648	18.344	237.30	178.61
230.00	0.000	101.057	18.197	2.510	18.369	237.85	178.61
231.00	0.000	101.057	18.240	2.372	18.393	238.41	178.61
232.00	0.000	101.057	18.280	2.233	18.416	238.97	178.61
233.00	0.000	101.057	18.318	2.094	18.437	239.52	178.61
234.00	0.000	101.057	18.353	1.954	18.457	240.08	178.61
235.00	0.000	101.057	18.386	1.813	18.475	240.63	178.61
236.00	0.000	101.057	18.416	1.672	18.492	241.19	178.61
237.00	0.000	101.057	18.444	1.530	18.507	241.74	178.61
238.00	0.000	101.057	18.470	1.388	18.522	242.30	178.61
239.00	0.000	101.057	18.492	1.245	18.534	242.85	178.61
240.00	0.000	101.057	18.513	1.102	18.546	243.41	178.61
241.00	0.000	101.057	18.531	0.959	18.556	243.96	178.61
242.00	0.000	101.057	18.546	0.815	18.564	244.52	178.61
243.00	0.673	101.057	18.559	0.671	18.571	245.07	178.61
244.00	0.673	101.057	18.570	0.527	18.577	245.63	178.61
245.00	0.673	101.057	18.578	0.383	18.582	246.18	178.61
246.00	0.673	101.057	18.583	0.238	18.584	246.73	178.61
247.00	2.000	101.057	18.586	0.094	18.586	247.29	178.61
248.00	2.000	101.057	18.586	-0.051	18.586	247.84	178.61
249.00	2.000	101.057	18.584	-0.195	18.585	248.40	178.61

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	2.000	101.057	18.579	-0.340	18.582	248.95	178.61
251.00	2.000	101.057	18.572	-0.484	18.578	249.51	178.61
252.00	2.000	101.057	18.562	-0.628	18.573	250.06	178.61
253.00	2.000	101.057	18.550	-0.772	18.566	250.61	178.61
254.00	2.000	101.057	18.535	-0.916	18.558	251.17	178.61
255.00	2.000	101.034	18.518	-1.052	18.548	251.75	178.85
256.00	2.000	100.998	18.499	-1.138	18.534	252.48	179.24
257.00	2.000	101.004	18.478	-1.224	18.518	253.21	179.17
258.00	2.000	101.011	18.455	-1.310	18.502	253.94	179.10
259.00	2.000	101.018	18.432	-1.395	18.484	254.67	179.02
260.00	0.000	101.025	18.406	-1.480	18.466	255.40	178.95
261.00	0.000	101.031	18.380	-1.565	18.446	256.13	178.88
262.00	0.000	101.038	18.352	-1.649	18.426	256.86	178.81
263.00	0.000	101.045	18.322	-1.733	18.404	257.60	178.74
264.00	0.000	101.052	18.291	-1.817	18.381	258.33	178.66
265.00	0.000	101.018	18.259	-1.899	18.357	259.06	179.02
266.00	0.000	100.922	18.224	-2.004	18.334	259.72	180.05
267.00	2.000	100.880	18.188	-2.138	18.313	260.30	180.48
268.00	2.000	100.880	18.149	-2.273	18.291	260.86	180.48
269.00	2.000	100.880	18.108	-2.408	18.268	261.43	180.48
270.00	2.000	100.880	18.065	-2.541	18.243	261.99	180.48
271.00	2.000	100.880	18.019	-2.675	18.217	262.56	180.48
272.00	2.000	100.880	17.971	-2.807	18.189	263.12	180.48
273.00	2.000	100.880	17.921	-2.938	18.160	263.69	180.48
274.00	2.000	100.880	17.868	-3.069	18.130	264.25	180.48
275.00	2.000	100.880	17.814	-3.198	18.098	264.82	180.48
276.00	0.000	100.880	17.756	-3.327	18.065	265.39	180.48
277.00	0.000	100.880	17.697	-3.455	18.031	265.95	180.48
278.00	0.000	100.880	17.635	-3.581	17.995	266.52	180.48
279.00	0.000	100.880	17.572	-3.707	17.958	267.09	180.48
280.00	0.000	100.880	17.506	-3.831	17.920	267.65	180.48
281.00	0.000	100.880	17.438	-3.954	17.880	268.22	180.48
282.00	0.000	100.880	17.367	-4.076	17.839	268.79	180.48
283.00	2.000	100.880	17.295	-4.197	17.797	269.36	180.48
284.00	2.000	100.880	17.221	-4.316	17.753	269.93	180.48
285.00	2.000	100.880	17.144	-4.434	17.708	270.50	180.48
286.00	2.000	100.880	17.065	-4.551	17.662	271.07	180.48
287.00	2.000	100.880	16.985	-4.666	17.614	271.64	180.48
288.00	2.000	100.880	16.902	-4.780	17.565	272.21	180.48
289.00	2.000	100.880	16.818	-4.893	17.515	272.78	180.48
290.00	2.000	100.880	16.731	-5.004	17.463	273.35	180.48
291.00	2.000	100.880	16.643	-5.113	17.410	273.92	180.48
292.00	0.000	100.880	16.552	-5.221	17.356	274.49	180.48
293.00	0.000	100.880	16.460	-5.327	17.301	275.06	180.48
294.00	0.000	100.880	16.366	-5.432	17.244	275.64	180.48
295.00	0.000	100.880	16.270	-5.535	17.186	276.21	180.48
296.00	0.000	100.880	16.172	-5.636	17.126	276.78	180.48
297.00	0.000	100.880	16.073	-5.736	17.066	277.36	180.48
298.00	0.000	100.880	15.972	-5.834	17.004	277.93	180.48
299.00	0.000	100.880	15.869	-5.930	16.941	278.51	180.48

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	100.857	15.765	-6.013	16.872	279.12	180.73
301.00	0.000	100.753	15.659	-6.092	16.802	279.74	181.82
302.00	0.000	100.648	15.552	-6.143	16.721	280.44	182.92
303.00	0.000	100.542	15.444	-6.216	16.648	281.07	184.02
304.00	0.000	100.436	15.335	-6.261	16.564	281.79	185.11
305.00	0.000	100.329	15.225	-6.328	16.488	282.43	186.21
306.00	0.000	100.222	15.114	-6.366	16.400	283.16	187.30
307.00	0.000	100.114	15.003	-6.401	16.311	283.89	188.40
308.00	0.000	100.005	14.890	-6.459	16.231	284.55	189.50
309.00	0.000	99.896	14.777	-6.487	16.138	285.30	190.59
310.00	0.000	99.786	14.663	-6.538	16.055	285.97	191.69
311.00	0.000	99.741	14.549	-6.572	15.964	286.69	192.13
312.00	0.000	99.741	14.433	-6.631	15.884	287.32	192.13
313.00	0.000	99.741	14.317	-6.689	15.802	287.96	192.13
314.00	0.000	99.741	14.199	-6.744	15.719	288.59	192.13
315.00	0.000	99.741	14.081	-6.797	15.635	289.23	192.13
316.00	0.000	99.741	13.961	-6.848	15.551	289.87	192.13
317.00	0.000	99.741	13.841	-6.897	15.464	290.51	192.13
318.00	0.000	99.741	13.720	-6.944	15.377	291.15	192.13
319.00	0.000	99.741	13.598	-6.989	15.289	291.80	192.13
320.00	0.000	99.741	13.475	-7.032	15.200	292.44	192.13
321.00	0.000	99.741	13.352	-7.072	15.109	293.09	192.13
322.00	0.000	99.741	13.228	-7.111	15.018	293.74	192.13
323.00	0.000	99.741	13.103	-7.147	14.926	294.39	192.13
324.00	0.000	99.741	12.978	-7.181	14.832	295.04	192.13
325.00	0.000	99.741	12.852	-7.213	14.738	295.70	192.13
326.00	0.000	99.741	12.726	-7.242	14.642	296.35	192.13
327.00	0.000	99.741	12.599	-7.270	14.546	297.01	192.13
328.00	0.000	99.741	12.471	-7.295	14.448	297.67	192.13
329.00	0.000	99.741	12.344	-7.318	14.350	298.34	192.13
330.00	0.000	99.741	12.215	-7.338	14.250	299.00	192.13
331.00	0.000	99.741	12.087	-7.357	14.150	299.67	192.13
332.00	0.000	99.741	11.958	-7.373	14.048	300.34	192.13
333.00	0.000	99.741	11.829	-7.387	13.946	301.01	192.13
334.00	0.000	99.741	11.700	-7.399	13.843	301.69	192.13
335.00	0.000	99.741	11.570	-7.408	13.739	302.37	192.13
336.00	0.000	99.741	11.440	-7.416	13.634	303.05	192.13
337.00	0.000	99.741	11.311	-7.421	13.528	303.73	192.13
338.00	0.000	99.741	11.181	-7.423	13.421	304.42	192.13
339.00	0.000	99.741	11.051	-7.424	13.313	305.11	192.13
340.00	0.000	99.741	10.921	-7.422	13.204	305.80	192.13
341.00	0.000	99.741	10.791	-7.418	13.095	306.50	192.13
342.00	0.000	99.741	10.662	-7.411	12.984	307.19	192.13
343.00	0.000	99.741	10.532	-7.403	12.873	307.90	192.13
344.00	0.000	99.741	10.403	-7.392	12.761	308.60	192.13
345.00	0.000	99.741	10.273	-7.379	12.649	309.31	192.13
346.00	0.000	99.741	10.145	-7.363	12.535	310.03	192.13
347.00	0.000	99.741	10.016	-7.345	12.421	310.74	192.13
348.00	0.000	99.741	9.888	-7.326	12.306	311.46	192.13
349.00	0.000	99.786	9.760	-7.303	12.190	312.19	191.69

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 08:59:12

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	100.040	9.633	-7.204	12.029	313.21	189.15
351.00	0.000	100.290	9.507	-7.125	11.881	314.15	186.61
352.00	0.000	100.536	9.384	-7.048	11.735	315.09	184.08
353.00	0.000	100.780	9.261	-6.953	11.581	316.10	181.54
354.00	0.000	101.020	9.140	-6.877	11.439	317.04	179.00
355.00	0.000	101.256	9.021	-6.803	11.299	317.98	176.47
356.00	0.000	101.489	8.903	-6.713	11.150	318.98	173.93
357.00	0.000	101.719	8.786	-6.641	11.014	319.91	171.39
358.00	0.000	101.945	8.670	-6.571	10.879	320.84	168.86
359.00	0.000	102.168	8.556	-6.486	10.737	321.84	166.32

MINIMUM STRESS (Pb,x') = 3.844 AT 65.00 DEGREES

MINIMUM TOTAL STRESS (Pb,max) = 3.844 AT 64.74 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:14:40

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H1 -- 10 Years of Crack Growth -- Faulted Conditions

Crack assumed to take compression across face

RADIUS (IN) = 109 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.892 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 17 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	52.7600	(DTHETA =	52.760)	DEPTH (IN) =	2.000
2 ANGLES:	52.7600 TO	64.1700	(DTHETA =	11.410)	DEPTH (IN) =	1.377
3 ANGLES:	64.1700 TO	73.3200	(DTHETA =	9.150)	DEPTH (IN) =	2.000
4 ANGLES:	73.3200 TO	97.5200	(DTHETA =	24.200)	DEPTH (IN) =	2.000
5 ANGLES:	97.5200 TO	106.6200	(DTHETA =	9.100)	DEPTH (IN) =	1.327
6 ANGLES:	106.6200 TO	192.6100	(DTHETA =	85.990)	DEPTH (IN) =	2.000
7 ANGLES:	203.4100 TO	211.9100	(DTHETA =	8.500)	DEPTH (IN) =	2.000
8 ANGLES:	211.9100 TO	214.3800	(DTHETA =	2.470)	DEPTH (IN) =	1.347
9 ANGLES:	214.3800 TO	219.2300	(DTHETA =	4.850)	DEPTH (IN) =	2.000
10 ANGLES:	219.2300 TO	236.3600	(DTHETA =	17.130)	DEPTH (IN) =	2.000
11 ANGLES:	236.3600 TO	242.2100	(DTHETA =	5.850)	DEPTH (IN) =	2.000
12 ANGLES:	242.2100 TO	246.7700	(DTHETA =	4.560)	DEPTH (IN) =	1.327
13 ANGLES:	259.8200 TO	266.7700	(DTHETA =	6.950)	DEPTH (IN) =	2.000
14 ANGLES:	275.3700 TO	282.6700	(DTHETA =	7.300)	DEPTH (IN) =	2.000
15 ANGLES:	291.7600 TO	305.3600	(DTHETA =	13.600)	DEPTH (IN) =	2.000
16 ANGLES:	305.3600 TO	306.4600	(DTHETA =	1.100)	DEPTH (IN) =	2.000
17 ANGLES:	306.4600 TO	360.0000	(DTHETA =	53.540)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1369.734

REMAINING DEGRADED SECTION AREA (IN2) = 192.1329

(APPROX. DEGRADED METAL AREA = 192.1328)

Program Output:

* Angle = Angle that tension-to-compression axis x' is rotated
 t = Thickness in wall at position corresponding to angle
 delta = Distance from center to tension-to-compression axis
 Pb,x' = Bending stress due to moment about tension-to-compression axis
 Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis
 Pb,max = Maximum bending stress due to total limit moment
 Anglemax = Angle for total limit moment relative to original Y axis
 Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	103.332	7.422	-6.539	9.892	318.62	169.50
1.00	0.000	103.532	7.309	-6.471	9.762	319.48	166.97
2.00	0.000	103.729	7.196	-6.389	9.624	320.40	164.43
3.00	0.000	103.922	7.085	-6.324	9.497	321.25	161.89
4.00	0.000	104.111	6.975	-6.260	9.373	322.09	159.36
5.00	0.000	104.297	6.867	-6.184	9.241	322.99	156.82
6.00	0.000	104.480	6.759	-6.124	9.121	323.82	154.28
7.00	0.000	104.659	6.653	-6.065	9.002	324.64	151.75
8.00	0.000	104.708	6.547	-6.033	8.903	325.34	151.04
9.00	0.000	104.708	6.442	-6.013	8.812	325.97	151.04
10.00	0.000	104.708	6.337	-5.991	8.721	326.60	151.04
11.00	0.000	104.708	6.233	-5.968	8.629	327.24	151.04
12.00	0.000	104.708	6.129	-5.942	8.536	327.88	151.04
13.00	0.000	104.708	6.025	-5.915	8.443	328.53	151.04
14.00	0.000	104.708	5.922	-5.886	8.349	329.17	151.04
15.00	0.000	104.708	5.819	-5.855	8.255	329.82	151.04
16.00	0.000	104.724	5.717	-5.822	8.160	330.48	150.80
17.00	0.000	104.798	5.616	-5.762	8.046	331.26	149.74
18.00	0.000	104.871	5.516	-5.715	7.943	331.99	148.67
19.00	0.000	104.919	5.417	-5.667	7.839	332.71	147.97
20.00	0.000	104.919	5.318	-5.630	7.745	333.37	147.97
21.00	0.000	104.919	5.220	-5.592	7.650	334.03	147.97
22.00	0.000	104.919	5.123	-5.552	7.554	334.69	147.97
23.00	0.000	104.919	5.026	-5.511	7.458	335.37	147.97
24.00	0.000	104.919	4.930	-5.467	7.362	336.04	147.97
25.00	0.000	104.919	4.835	-5.423	7.265	336.72	147.97
26.00	0.000	104.919	4.741	-5.376	7.168	337.41	147.97
27.00	0.000	104.919	4.647	-5.328	7.070	338.10	147.97
28.00	0.000	104.919	4.555	-5.278	6.972	338.79	147.97
29.00	0.000	104.804	4.463	-5.201	6.854	339.63	149.65
30.00	0.000	104.628	4.373	-5.092	6.712	340.66	152.19
31.00	0.000	104.449	4.285	-5.004	6.588	341.57	154.72
32.00	0.000	104.265	4.199	-4.884	6.441	342.68	157.26
33.00	0.000	104.079	4.115	-4.759	6.291	343.85	159.80
34.00	0.000	103.889	4.033	-4.657	6.160	344.89	162.33
35.00	0.000	103.695	3.953	-4.522	6.006	346.16	164.87
36.00	0.000	103.498	3.875	-4.381	5.849	347.49	167.41
37.00	0.000	103.297	3.799	-4.266	5.712	348.69	169.94
38.00	0.000	103.093	3.726	-4.115	5.551	350.16	172.48
39.00	0.000	102.885	3.656	-3.959	5.389	351.71	175.02
40.00	0.000	102.674	3.588	-3.831	5.248	353.12	177.55
41.00	0.000	102.459	3.522	-3.665	5.084	354.86	180.09
42.00	0.000	102.246	3.460	-3.495	4.918	356.71	182.57
43.00	0.000	102.114	3.400	-3.288	4.730	358.97	184.08
44.00	0.000	101.982	3.345	-3.076	4.544	1.39	185.60
45.00	0.000	102.054	3.292	-2.930	4.407	3.33	184.77
46.00	0.000	102.150	3.242	-2.802	4.285	5.16	183.67
47.00	0.000	102.319	3.194	-2.642	4.145	7.41	181.73
48.00	0.000	102.536	3.150	-2.484	4.011	9.74	179.19
49.00	0.000	102.749	3.108	-2.312	3.873	12.34	176.65

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	102.959	3.068	-2.160	3.752	14.86	174.12
51.00	0.000	103.150	3.032	-2.000	3.632	17.58	171.77
52.00	0.000	103.274	2.998	-1.807	3.501	20.92	170.23
53.00	0.623	103.408	2.968	-1.622	3.383	24.34	168.55
54.00	0.623	103.606	2.941	-1.464	3.285	27.54	166.02
55.00	0.623	103.802	2.917	-1.323	3.203	30.60	163.48
56.00	0.623	103.993	2.895	-1.185	3.128	33.74	160.94
57.00	0.623	104.182	2.875	-1.036	3.056	37.18	158.41
58.00	0.623	104.366	2.858	-0.905	2.998	40.44	155.87
59.00	0.623	104.547	2.843	-0.776	2.947	43.73	153.33
60.00	0.623	104.725	2.831	-0.638	2.902	47.31	150.80
61.00	0.623	104.899	2.821	-0.516	2.867	50.63	148.26
62.00	0.623	105.070	2.813	-0.397	2.840	53.96	145.72
63.00	0.623	105.237	2.807	-0.270	2.819	57.51	143.19
64.00	0.623	105.400	2.803	-0.158	2.807	60.77	140.65
65.00	0.000	105.560	2.801	-0.050	2.801	63.98	138.11
66.00	0.000	105.651	2.801	0.044	2.801	66.89	136.64
67.00	0.000	105.651	2.802	0.113	2.804	69.31	136.64
68.00	0.000	105.651	2.804	0.182	2.810	71.71	136.64
69.00	0.000	105.651	2.808	0.251	2.819	74.11	136.64
70.00	0.000	105.651	2.813	0.320	2.831	76.49	136.64
71.00	0.000	105.651	2.819	0.389	2.846	78.86	136.64
72.00	0.000	105.651	2.827	0.458	2.863	81.20	136.64
73.00	0.000	105.724	2.835	0.550	2.888	83.97	135.45
74.00	0.000	105.876	2.845	0.650	2.919	86.87	132.91
75.00	0.000	106.025	2.858	0.747	2.953	89.64	130.38
76.00	0.000	106.140	2.871	0.862	2.998	92.70	128.38
77.00	0.000	106.225	2.888	0.985	3.051	95.84	126.87
78.00	0.000	106.309	2.906	1.106	3.109	98.84	125.36
79.00	0.000	106.392	2.926	1.224	3.171	101.69	123.84
80.00	0.000	106.415	2.948	1.355	3.245	104.68	123.43
81.00	0.000	106.415	2.974	1.511	3.335	107.93	123.43
82.00	0.000	106.415	3.001	1.667	3.433	111.04	123.43
83.00	0.000	106.396	3.032	1.822	3.537	114.00	123.77
84.00	0.000	106.257	3.065	1.917	3.615	116.02	126.30
85.00	0.000	106.114	3.099	1.993	3.684	117.75	128.84
86.00	0.000	105.967	3.135	2.094	3.770	119.74	131.38
87.00	0.000	105.817	3.172	2.198	3.859	121.72	133.91
88.00	0.000	105.663	3.211	2.282	3.939	123.40	136.45
89.00	0.000	105.609	3.252	2.439	4.065	125.87	137.32
90.00	0.000	105.609	3.296	2.620	4.211	128.48	137.32
91.00	0.000	105.609	3.344	2.800	4.361	130.94	137.32
92.00	0.000	105.609	3.394	2.978	4.516	133.27	137.32
93.00	0.000	105.609	3.448	3.156	4.674	135.47	137.32
94.00	0.000	105.609	3.505	3.333	4.837	137.56	137.32
95.00	0.000	105.742	3.564	3.451	4.961	139.07	135.16
96.00	0.000	105.894	3.625	3.537	5.065	140.30	132.62
97.00	0.000	106.042	3.687	3.631	5.175	141.56	130.08
98.00	0.673	106.187	3.751	3.708	5.275	142.67	127.55
99.00	0.673	106.328	3.817	3.781	5.373	143.73	125.02

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.673	106.263	3.883	3.844	5.464	144.71	126.20
101.00	0.673	106.120	3.951	3.906	5.556	145.67	128.74
102.00	0.673	105.973	4.020	3.992	5.665	146.80	131.28
103.00	0.673	105.823	4.090	4.080	5.777	147.93	133.81
104.00	0.673	105.669	4.162	4.148	5.876	148.90	136.35
105.00	0.673	105.512	4.235	4.241	5.994	150.04	138.89
106.00	0.673	105.351	4.310	4.337	6.114	151.18	141.42
107.00	0.000	105.186	4.387	4.410	6.220	152.15	143.96
108.00	0.000	105.018	4.465	4.511	6.347	153.30	146.50
109.00	0.000	104.846	4.544	4.614	6.476	154.44	149.03
110.00	0.000	104.671	4.626	4.693	6.590	155.42	151.57
111.00	0.000	104.493	4.709	4.801	6.725	156.56	154.11
112.00	0.000	104.310	4.793	4.911	6.863	157.70	156.64
113.00	0.000	104.244	4.880	4.991	6.980	158.64	157.55
114.00	0.000	104.244	4.967	5.045	7.080	159.45	157.55
115.00	0.000	104.244	5.055	5.098	7.179	160.24	157.55
116.00	0.000	104.244	5.145	5.149	7.279	161.02	157.55
117.00	0.000	104.244	5.235	5.199	7.377	161.80	157.55
118.00	0.000	104.244	5.326	5.247	7.476	162.57	157.55
119.00	0.000	104.244	5.417	5.293	7.574	163.34	157.55
120.00	0.000	104.181	5.510	5.328	7.665	164.04	158.42
121.00	0.000	103.992	5.604	5.431	7.804	165.10	160.95
122.00	0.000	103.801	5.700	5.535	7.945	166.16	163.49
123.00	0.000	103.605	5.797	5.612	8.069	167.07	166.03
124.00	0.000	103.407	5.896	5.721	8.215	168.13	168.56
125.00	0.000	103.204	5.997	5.831	8.365	169.20	171.10
126.00	0.000	102.999	6.099	5.913	8.495	170.11	173.64
127.00	0.000	102.789	6.204	6.027	8.649	171.17	176.17
128.00	0.000	102.577	6.310	6.143	8.806	172.23	178.71
129.00	0.000	102.360	6.418	6.228	8.943	173.14	181.25
130.00	0.000	102.141	6.528	6.348	9.105	174.20	183.78
131.00	0.000	101.918	6.640	6.469	9.270	175.26	186.32
132.00	0.000	101.691	6.754	6.558	9.414	176.16	188.86
133.00	0.000	101.461	6.869	6.683	9.584	177.21	191.39
134.00	0.000	101.393	6.987	6.766	9.726	178.08	192.13
135.00	0.000	101.393	7.105	6.819	9.848	178.82	192.13
136.00	0.000	101.393	7.225	6.871	9.970	179.56	192.13
137.00	0.000	101.393	7.345	6.920	10.091	180.29	192.13
138.00	0.000	101.393	7.466	6.967	10.211	181.02	192.13
139.00	0.000	101.393	7.588	7.011	10.331	181.74	192.13
140.00	0.000	101.393	7.711	7.054	10.450	182.45	192.13
141.00	0.000	101.393	7.834	7.095	10.569	183.16	192.13
142.00	0.000	101.393	7.958	7.133	10.687	183.87	192.13
143.00	0.000	101.393	8.083	7.169	10.804	184.57	192.13
144.00	0.000	101.393	8.208	7.203	10.920	185.27	192.13
145.00	0.000	101.393	8.334	7.235	11.036	185.96	192.13
146.00	0.000	101.393	8.460	7.264	11.151	186.65	192.13
147.00	0.000	101.393	8.587	7.292	11.266	187.34	192.13
148.00	0.000	101.393	8.715	7.317	11.379	188.02	192.13
149.00	0.000	101.393	8.842	7.340	11.492	188.70	192.13

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	101.393	8.971	7.361	11.604	189.37	192.13
151.00	0.000	101.393	9.099	7.379	11.715	190.04	192.13
152.00	0.000	101.393	9.228	7.395	11.826	190.71	192.13
153.00	0.000	101.393	9.357	7.409	11.935	191.37	192.13
154.00	0.000	101.393	9.486	7.421	12.044	192.04	192.13
155.00	0.000	101.393	9.616	7.431	12.152	192.69	192.13
156.00	0.000	101.393	9.746	7.438	12.260	193.35	192.13
157.00	0.000	101.393	9.875	7.443	12.366	194.00	192.13
158.00	0.000	101.393	10.005	7.445	12.472	194.66	192.13
159.00	0.000	101.393	10.135	7.446	12.576	195.30	192.13
160.00	0.000	101.393	10.265	7.444	12.680	195.95	192.13
161.00	0.000	101.393	10.395	7.440	12.783	196.59	192.13
162.00	0.000	101.393	10.524	7.434	12.885	197.23	192.13
163.00	0.000	101.393	10.654	7.425	12.986	197.87	192.13
164.00	0.000	101.393	10.783	7.414	13.086	198.51	192.13
165.00	0.000	101.393	10.913	7.401	13.185	199.14	192.13
166.00	0.000	101.393	11.042	7.385	13.284	199.78	192.13
167.00	0.000	101.393	11.170	7.368	13.381	200.41	192.13
168.00	0.000	101.393	11.298	7.348	13.478	201.04	192.13
169.00	0.000	101.393	11.426	7.326	13.573	201.66	192.13
170.00	0.000	101.393	11.554	7.301	13.668	202.29	192.13
171.00	0.000	101.393	11.681	7.275	13.761	202.91	192.13
172.00	0.000	101.393	11.808	7.246	13.854	203.54	192.13
173.00	0.000	101.393	11.934	7.215	13.945	204.16	192.13
174.00	0.000	101.393	12.059	7.182	14.036	204.78	192.13
175.00	0.000	101.393	12.184	7.146	14.125	205.39	192.13
176.00	0.000	101.393	12.309	7.109	14.214	206.01	192.13
177.00	0.000	101.393	12.432	7.069	14.301	206.62	192.13
178.00	0.000	101.393	12.555	7.027	14.388	207.24	192.13
179.00	0.000	101.393	12.677	6.983	14.473	207.85	192.13
180.00	0.000	101.393	12.799	6.937	14.558	208.46	192.13
181.00	0.000	101.393	12.919	6.889	14.641	209.07	192.13
182.00	0.000	101.393	13.039	6.838	14.723	209.67	192.13
183.00	0.000	101.393	13.158	6.786	14.804	210.28	192.13
184.00	0.000	101.393	13.276	6.731	14.885	210.89	192.13
185.00	0.000	101.393	13.392	6.675	14.964	211.49	192.13
186.00	0.000	101.393	13.508	6.616	15.042	212.09	192.13
187.00	0.000	101.393	13.623	6.556	15.118	212.70	192.13
188.00	0.000	101.393	13.737	6.493	15.194	213.30	192.13
189.00	0.000	101.393	13.850	6.428	15.269	213.90	192.13
190.00	0.000	101.393	13.961	6.362	15.342	214.50	192.13
191.00	0.000	101.393	14.072	6.293	15.415	215.10	192.13
192.00	0.000	101.393	14.181	6.223	15.486	215.69	192.13
193.00	2.000	101.393	14.289	6.151	15.556	216.29	192.13
194.00	2.000	101.393	14.395	6.077	15.625	216.89	192.13
195.00	2.000	101.393	14.500	6.001	15.693	217.48	192.13
196.00	2.000	101.393	14.604	5.923	15.760	218.08	192.13
197.00	2.000	101.393	14.707	5.843	15.825	218.67	192.13
198.00	2.000	101.393	14.808	5.762	15.890	219.26	192.13
199.00	2.000	101.393	14.908	5.679	15.953	219.85	192.13

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	101.393	15.006	5.594	16.015	220.44	192.13
201.00	2.000	101.393	15.103	5.507	16.076	221.03	192.13
202.00	2.000	101.393	15.198	5.419	16.135	221.62	192.13
203.00	2.000	101.393	15.292	5.329	16.194	222.21	192.13
204.00	0.000	101.393	15.384	5.238	16.251	222.80	192.13
205.00	0.000	101.393	15.475	5.144	16.307	223.39	192.13
206.00	0.000	101.393	15.563	5.050	16.362	223.98	192.13
207.00	0.000	101.393	15.651	4.953	16.416	224.56	192.13
208.00	0.000	101.393	15.736	4.856	16.468	225.15	192.13
209.00	0.000	101.393	15.820	4.757	16.520	225.73	192.13
210.00	0.000	101.393	15.902	4.656	16.570	226.32	192.13
211.00	0.000	101.393	15.982	4.554	16.618	226.90	192.13
212.00	0.653	101.466	16.061	4.468	16.671	227.54	191.34
213.00	0.653	101.559	16.138	4.396	16.726	228.24	190.32
214.00	0.653	101.652	16.214	4.305	16.776	228.87	189.29
215.00	0.000	101.744	16.288	4.211	16.824	229.50	188.27
216.00	0.000	101.836	16.361	4.132	16.874	230.18	187.24
217.00	0.000	101.927	16.432	4.034	16.920	230.79	186.21
218.00	0.000	102.017	16.501	3.933	16.963	231.41	185.19
219.00	0.000	102.107	16.569	3.846	17.009	232.07	184.16
220.00	0.000	102.197	16.635	3.741	17.050	232.67	183.14
221.00	0.000	102.286	16.699	3.633	17.090	233.27	182.11
222.00	0.000	102.374	16.762	3.539	17.131	233.92	181.09
223.00	0.000	102.462	16.822	3.427	17.168	234.51	180.06
224.00	0.000	102.549	16.881	3.312	17.203	235.10	179.04
225.00	0.000	102.585	16.938	3.196	17.236	235.68	178.61
226.00	0.000	102.585	16.992	3.062	17.266	236.21	178.61
227.00	0.000	102.585	17.044	2.927	17.294	236.74	178.61
228.00	0.000	102.585	17.094	2.791	17.320	237.27	178.61
229.00	0.000	102.585	17.141	2.655	17.346	237.80	178.61
230.00	0.000	102.585	17.186	2.518	17.370	238.33	178.61
231.00	0.000	102.585	17.229	2.379	17.392	238.86	178.61
232.00	0.000	102.585	17.269	2.241	17.414	239.39	178.61
233.00	0.000	102.585	17.307	2.101	17.434	239.92	178.61
234.00	0.000	102.585	17.342	1.961	17.453	240.45	178.61
235.00	0.000	102.585	17.375	1.820	17.470	240.98	178.61
236.00	0.000	102.585	17.405	1.679	17.486	241.51	178.61
237.00	0.000	102.585	17.433	1.537	17.501	242.04	178.61
238.00	0.000	102.585	17.459	1.395	17.514	242.57	178.61
239.00	0.000	102.585	17.482	1.252	17.526	243.10	178.61
240.00	0.000	102.585	17.502	1.109	17.537	243.63	178.61
241.00	0.000	102.585	17.520	0.966	17.547	244.16	178.61
242.00	0.000	102.585	17.535	0.822	17.555	244.68	178.61
243.00	0.673	102.585	17.548	0.678	17.561	245.21	178.61
244.00	0.673	102.585	17.559	0.534	17.567	245.74	178.61
245.00	0.673	102.585	17.567	0.390	17.571	246.27	178.61
246.00	0.673	102.585	17.572	0.245	17.574	246.80	178.61
247.00	2.000	102.585	17.575	0.101	17.575	247.33	178.61
248.00	2.000	102.585	17.575	-0.044	17.575	247.86	178.61
249.00	2.000	102.585	17.573	-0.188	17.574	248.39	178.61

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	2.000	102.585	17.568	-0.333	17.572	248.91	178.61
251.00	2.000	102.585	17.561	-0.477	17.568	249.44	178.61
252.00	2.000	102.585	17.551	-0.621	17.562	249.97	178.61
253.00	2.000	102.543	17.539	-0.764	17.556	250.50	179.11
254.00	2.000	102.456	17.525	-0.877	17.547	251.13	180.13
255.00	2.000	102.368	17.508	-0.989	17.536	251.77	181.16
256.00	2.000	102.280	17.490	-1.121	17.526	252.33	182.18
257.00	2.000	102.191	17.469	-1.229	17.512	252.97	183.21
258.00	2.000	102.183	17.447	-1.315	17.496	253.69	183.29
259.00	2.000	102.190	17.423	-1.400	17.479	254.40	183.22
260.00	0.000	102.196	17.398	-1.485	17.461	255.12	183.15
261.00	0.000	102.202	17.371	-1.569	17.442	255.84	183.08
262.00	0.000	102.208	17.343	-1.654	17.421	256.55	183.01
263.00	0.000	102.215	17.313	-1.737	17.400	257.27	182.93
264.00	0.000	102.221	17.282	-1.821	17.378	257.98	182.86
265.00	0.000	102.273	17.250	-1.909	17.355	258.68	182.26
266.00	0.000	102.368	17.215	-2.012	17.332	259.33	181.16
267.00	2.000	102.426	17.179	-2.147	17.313	259.87	180.48
268.00	2.000	102.426	17.140	-2.283	17.292	260.41	180.48
269.00	2.000	102.426	17.099	-2.417	17.269	260.95	180.48
270.00	2.000	102.426	17.056	-2.551	17.246	261.49	180.48
271.00	2.000	102.426	17.010	-2.684	17.221	262.03	180.48
272.00	2.000	102.426	16.962	-2.817	17.194	262.57	180.48
273.00	2.000	102.426	16.912	-2.948	17.167	263.11	180.48
274.00	2.000	102.426	16.859	-3.079	17.138	263.65	180.48
275.00	2.000	102.426	16.804	-3.208	17.108	264.19	180.48
276.00	0.000	102.426	16.747	-3.337	17.076	264.73	180.48
277.00	0.000	102.426	16.688	-3.464	17.044	265.27	180.48
278.00	0.000	102.426	16.626	-3.591	17.010	265.81	180.48
279.00	0.000	102.426	16.563	-3.716	16.974	266.35	180.48
280.00	0.000	102.426	16.497	-3.841	16.938	266.89	180.48
281.00	0.000	102.426	16.428	-3.964	16.900	267.43	180.48
282.00	0.000	102.426	16.358	-4.086	16.861	267.97	180.48
283.00	2.000	102.426	16.286	-4.207	16.820	268.52	180.48
284.00	2.000	102.426	16.211	-4.326	16.779	269.06	180.48
285.00	2.000	102.426	16.135	-4.444	16.736	269.60	180.48
286.00	2.000	102.426	16.056	-4.561	16.691	270.14	180.48
287.00	2.000	102.426	15.976	-4.676	16.646	270.68	180.48
288.00	2.000	102.426	15.893	-4.790	16.599	271.23	180.48
289.00	2.000	102.426	15.808	-4.903	16.551	271.77	180.48
290.00	2.000	102.426	15.722	-5.014	16.502	272.31	180.48
291.00	2.000	102.426	15.633	-5.123	16.451	272.85	180.48
292.00	0.000	102.426	15.543	-5.231	16.400	273.40	180.48
293.00	0.000	102.426	15.451	-5.337	16.347	273.94	180.48
294.00	0.000	102.426	15.357	-5.442	16.292	274.49	180.48
295.00	0.000	102.426	15.261	-5.545	16.237	275.03	180.48
296.00	0.000	102.426	15.163	-5.646	16.180	275.58	180.48
297.00	0.000	102.426	15.064	-5.746	16.122	276.12	180.48
298.00	0.000	102.381	14.963	-5.823	16.056	276.74	181.01
299.00	0.000	102.287	14.860	-5.906	15.991	277.32	182.10

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	102.192	14.757	-5.964	15.916	277.99	183.20
301.00	0.000	102.096	14.652	-6.042	15.849	278.59	184.29
302.00	0.000	102.000	14.546	-6.094	15.771	279.27	185.39
303.00	0.000	101.903	14.439	-6.142	15.691	279.95	186.49
304.00	0.000	101.805	14.331	-6.211	15.619	280.57	187.58
305.00	0.000	101.707	14.222	-6.253	15.536	281.27	188.68
306.00	0.000	101.608	14.112	-6.315	15.461	281.89	189.78
307.00	0.000	101.509	14.002	-6.350	15.375	282.60	190.87
308.00	0.000	101.408	13.891	-6.406	15.297	283.24	191.97
309.00	0.000	101.393	13.778	-6.458	15.217	283.88	192.13
310.00	0.000	101.393	13.665	-6.522	15.141	284.49	192.13
311.00	0.000	101.393	13.550	-6.583	15.065	285.09	192.13
312.00	0.000	101.393	13.435	-6.642	14.987	285.69	192.13
313.00	0.000	101.393	13.318	-6.700	14.908	286.29	192.13
314.00	0.000	101.393	13.201	-6.755	14.829	286.90	192.13
315.00	0.000	101.393	13.082	-6.808	14.748	287.51	192.13
316.00	0.000	101.393	12.963	-6.859	14.666	288.11	192.13
317.00	0.000	101.393	12.843	-6.908	14.583	288.72	192.13
318.00	0.000	101.393	12.722	-6.955	14.499	289.33	192.13
319.00	0.000	101.393	12.600	-7.000	14.414	289.94	192.13
320.00	0.000	101.393	12.477	-7.043	14.327	290.56	192.13
321.00	0.000	101.393	12.354	-7.083	14.240	291.17	192.13
322.00	0.000	101.393	12.230	-7.122	14.152	291.79	192.13
323.00	0.000	101.393	12.105	-7.158	14.063	292.40	192.13
324.00	0.000	101.393	11.980	-7.192	13.973	293.02	192.13
325.00	0.000	101.393	11.854	-7.224	13.881	293.64	192.13
326.00	0.000	101.393	11.727	-7.253	13.789	294.26	192.13
327.00	0.000	101.393	11.600	-7.281	13.696	294.89	192.13
328.00	0.000	101.393	11.473	-7.306	13.602	295.51	192.13
329.00	0.000	101.393	11.345	-7.329	13.506	296.14	192.13
330.00	0.000	101.393	11.217	-7.349	13.410	296.77	192.13
331.00	0.000	101.393	11.088	-7.368	13.313	297.40	192.13
332.00	0.000	101.393	10.960	-7.384	13.215	298.03	192.13
333.00	0.000	101.393	10.830	-7.398	13.116	298.66	192.13
334.00	0.000	101.393	10.701	-7.410	13.016	299.30	192.13
335.00	0.000	101.393	10.572	-7.419	12.915	299.94	192.13
336.00	0.000	101.393	10.442	-7.427	12.814	300.58	192.13
337.00	0.000	101.393	10.312	-7.432	12.711	301.22	192.13
338.00	0.000	101.393	10.182	-7.434	12.607	301.87	192.13
339.00	0.000	101.393	10.053	-7.435	12.503	302.51	192.13
340.00	0.000	101.393	9.923	-7.433	12.398	303.16	192.13
341.00	0.000	101.393	9.793	-7.429	12.292	303.82	192.13
342.00	0.000	101.393	9.663	-7.422	12.185	304.47	192.13
343.00	0.000	101.393	9.534	-7.414	12.077	305.13	192.13
344.00	0.000	101.393	9.404	-7.403	11.968	305.79	192.13
345.00	0.000	101.393	9.275	-7.390	11.859	306.45	192.13
346.00	0.000	101.393	9.146	-7.374	11.749	307.12	192.13
347.00	0.000	101.393	9.017	-7.356	11.638	307.79	192.13
348.00	0.000	101.393	8.889	-7.337	11.526	308.46	192.13
349.00	0.000	101.393	8.761	-7.314	11.413	309.14	192.13

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 09:15:33

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	101.393	8.634	-7.290	11.300	309.82	192.13
351.00	0.000	101.393	8.506	-7.263	11.186	310.51	192.13
352.00	0.000	101.606	8.380	-7.183	11.038	311.40	189.79
353.00	0.000	101.834	8.256	-7.087	10.880	312.35	187.26
354.00	0.000	102.059	8.132	-7.010	10.736	313.24	184.72
355.00	0.000	102.280	8.011	-6.933	10.594	314.12	182.18
356.00	0.000	102.497	7.890	-6.842	10.443	315.07	179.65
357.00	0.000	102.711	7.771	-6.768	10.305	315.95	177.11
358.00	0.000	102.922	7.654	-6.695	10.169	316.82	174.58
359.00	0.000	103.129	7.537	-6.609	10.024	317.75	172.04

MINIMUM STRESS (Pb,x') = 2.801 AT 66.00 DEGREES

MINIMUM TOTAL STRESS (Pb,max) = 2.801 AT 66.89 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)
08-19-2000 11:54:52
Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage
Weld H2 -- 10 Years of Crack Growth -- Upset Conditions
Crack assumed to take compression across face

RADIUS (IN) = 109 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.341 KSI
MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 8 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	27.2400	(DTHETA =	27.240)	DEPTH (IN) =	2.000
2 ANGLES:	32.3900 TO	59.9300	(DTHETA =	27.540)	DEPTH (IN) =	2.000
3 ANGLES:	62.1800 TO	84.0800	(DTHETA =	21.900)	DEPTH (IN) =	2.000
4 ANGLES:	96.3800 TO	207.7300	(DTHETA =	111.350)	DEPTH (IN) =	2.000
5 ANGLES:	217.7500 TO	237.7800	(DTHETA =	20.030)	DEPTH (IN) =	2.000
6 ANGLES:	240.5800 TO	264.0800	(DTHETA =	23.500)	DEPTH (IN) =	2.000
7 ANGLES:	275.5300 TO	297.6700	(DTHETA =	22.140)	DEPTH (IN) =	2.000
8 ANGLES:	302.2700 TO	360.0000	(DTHETA =	57.730)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1369.734
REMAINING DEGRADED SECTION AREA (IN2) = 184.7998
(APPROX. DEGRADED METAL AREA = 184.8)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated
t = Thickness in wall at position corresponding to angle
delta = Distance from center to tension-to-compression axis
Pb,x' = Bending stress due to moment about tension-to-compression axis
Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis
Pb,max = Maximum bending stress due to total limit moment
Anglemax = Angle for total limit moment relative to original Y axis
Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	100.436	10.185	-1.530	10.299	351.45	184.80
1.00	0.000	100.436	10.158	-1.521	10.271	352.48	184.80
2.00	0.000	100.436	10.131	-1.512	10.244	353.51	184.80
3.00	0.000	100.436	10.105	-1.502	10.216	354.54	184.80
4.00	0.000	100.436	10.079	-1.492	10.188	355.58	184.80
5.00	0.000	100.469	10.052	-1.481	10.161	356.62	184.46
6.00	0.000	100.713	10.027	-1.397	10.124	358.06	181.92
7.00	0.000	100.954	10.003	-1.335	10.092	359.39	179.39
8.00	0.000	101.191	9.980	-1.276	10.061	0.71	176.85
9.00	0.000	101.425	9.958	-1.203	10.031	2.11	174.31
10.00	0.000	101.656	9.938	-1.149	10.004	3.40	171.78
11.00	0.000	101.883	9.918	-1.099	9.979	4.67	169.24
12.00	0.000	102.106	9.899	-1.035	9.953	6.03	166.70
13.00	0.000	102.327	9.881	-0.991	9.931	7.27	164.17
14.00	0.000	102.543	9.864	-0.951	9.910	8.49	161.63
15.00	0.000	102.757	9.848	-0.897	9.889	9.80	159.09
16.00	0.000	102.967	9.832	-0.862	9.870	10.99	156.56
17.00	0.000	103.173	9.818	-0.831	9.853	12.16	154.02
18.00	0.000	103.376	9.803	-0.787	9.835	13.41	151.48
19.00	0.000	103.575	9.790	-0.762	9.819	14.55	148.95
20.00	0.000	103.751	9.776	-0.740	9.804	15.67	146.68
21.00	0.000	103.751	9.763	-0.764	9.793	16.53	146.68
22.00	0.000	103.751	9.749	-0.787	9.781	17.38	146.68
23.00	0.000	103.751	9.735	-0.810	9.769	18.24	146.68
24.00	0.000	103.751	9.721	-0.832	9.757	19.10	146.68
25.00	0.000	103.751	9.706	-0.855	9.744	19.97	146.68
26.00	0.000	103.751	9.691	-0.877	9.730	20.83	146.68
27.00	0.000	103.751	9.675	-0.899	9.717	21.69	146.68
28.00	2.000	103.751	9.659	-0.920	9.703	22.56	146.68
29.00	2.000	103.751	9.643	-0.941	9.689	23.42	146.68
30.00	2.000	103.751	9.626	-0.962	9.674	24.29	146.68
31.00	2.000	103.751	9.609	-0.983	9.659	25.16	146.68
32.00	2.000	103.751	9.591	-1.004	9.644	26.03	146.68
33.00	0.000	103.751	9.574	-1.024	9.628	26.90	146.68
34.00	0.000	103.751	9.555	-1.043	9.612	27.77	146.68
35.00	0.000	103.751	9.537	-1.063	9.596	28.64	146.68
36.00	0.000	103.751	9.518	-1.082	9.579	29.51	146.68
37.00	0.000	103.751	9.499	-1.101	9.562	30.39	146.68
38.00	0.000	103.751	9.479	-1.119	9.545	31.26	146.68
39.00	0.000	103.751	9.460	-1.137	9.528	32.14	146.68
40.00	0.000	103.765	9.439	-1.155	9.510	33.02	146.49
41.00	0.000	103.957	9.419	-1.116	9.485	34.24	143.95
42.00	0.000	104.146	9.400	-1.095	9.463	35.36	141.41
43.00	0.000	104.332	9.381	-1.076	9.442	36.45	138.88
44.00	0.000	104.513	9.362	-1.047	9.421	37.62	136.34
45.00	0.000	104.388	9.344	-1.050	9.403	38.59	138.09
46.00	0.000	104.204	9.326	-1.018	9.381	39.77	140.63
47.00	0.000	104.016	9.308	-0.981	9.360	40.98	143.17
48.00	0.000	103.825	9.291	-0.970	9.342	42.04	145.70
49.00	0.000	103.630	9.275	-0.925	9.321	43.30	148.24

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A	tension
50.00	0.000	103.432	9.259	-0.877	9.300	44.59		150.77
51.00	0.000	103.230	9.244	-0.855	9.283	45.71		153.31
52.00	0.000	103.025	9.229	-0.799	9.264	47.05		155.85
53.00	0.000	102.816	9.216	-0.738	9.245	48.42		158.38
54.00	0.000	102.604	9.203	-0.706	9.230	49.61		160.92
55.00	0.000	102.388	9.191	-0.638	9.213	51.03		163.46
56.00	0.000	102.169	9.181	-0.566	9.198	52.47		165.99
57.00	0.000	101.946	9.171	-0.524	9.186	53.73		168.53
58.00	0.000	101.720	9.163	-0.444	9.173	55.22		171.07
59.00	0.000	101.490	9.155	-0.360	9.163	56.74		173.60
60.00	2.000	101.440	9.149	-0.336	9.155	57.90		174.15
61.00	2.000	101.440	9.143	-0.320	9.149	59.00		174.15
62.00	2.000	101.440	9.138	-0.304	9.143	60.10		174.15
63.00	0.000	101.529	9.132	-0.270	9.136	61.30		173.17
64.00	0.000	101.758	9.128	-0.204	9.130	62.72		170.64
65.00	0.000	101.984	9.125	-0.125	9.126	64.22		168.10
66.00	0.000	102.206	9.123	-0.065	9.124	65.59		165.56
67.00	0.000	102.425	9.123	-0.009	9.123	66.94		163.03
68.00	0.000	102.640	9.123	0.059	9.123	68.37		160.49
69.00	0.000	102.852	9.124	0.108	9.125	69.68		157.95
70.00	0.000	103.060	9.127	0.154	9.128	70.97		155.42
71.00	0.000	103.265	9.130	0.211	9.132	72.33		152.88
72.00	0.000	103.466	9.134	0.250	9.137	73.57		150.34
73.00	0.000	103.664	9.138	0.285	9.143	74.79		147.81
74.00	0.000	103.858	9.143	0.331	9.149	76.07		145.27
75.00	0.000	104.048	9.149	0.359	9.156	77.25		142.73
76.00	0.000	104.065	9.157	0.459	9.168	78.87		142.51
77.00	0.000	104.065	9.166	0.585	9.184	80.65		142.51
78.00	0.000	104.086	9.177	0.722	9.206	82.50		142.23
79.00	0.000	104.159	9.190	0.717	9.218	83.46		141.24
80.00	0.000	104.159	9.202	0.698	9.229	84.34		141.24
81.00	0.000	104.159	9.214	0.679	9.239	85.21		141.24
82.00	0.000	104.159	9.226	0.659	9.249	86.09		141.24
83.00	0.000	104.159	9.237	0.640	9.259	86.96		141.24
84.00	0.000	104.159	9.248	0.620	9.269	87.84		141.24
85.00	2.000	104.159	9.258	0.600	9.278	88.71		141.24
86.00	2.000	104.159	9.269	0.580	9.287	89.58		141.24
87.00	2.000	104.159	9.278	0.559	9.295	90.45		141.24
88.00	2.000	104.159	9.288	0.539	9.303	91.32		141.24
89.00	2.000	104.159	9.297	0.518	9.311	92.19		141.24
90.00	2.000	104.159	9.306	0.497	9.319	93.06		141.24
91.00	2.000	104.159	9.314	0.476	9.326	93.93		141.24
92.00	2.000	104.159	9.322	0.455	9.333	94.79		141.24
93.00	2.000	104.159	9.330	0.434	9.340	95.66		141.24
94.00	2.000	104.159	9.337	0.412	9.346	96.53		141.24
95.00	2.000	104.159	9.344	0.391	9.352	97.39		141.24
96.00	2.000	104.159	9.351	0.369	9.358	98.26		141.24
97.00	0.000	104.159	9.357	0.347	9.363	99.12		141.24
98.00	0.000	104.159	9.362	0.325	9.368	99.99		141.24
99.00	0.000	104.159	9.368	0.303	9.373	100.85		141.24

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	104.159	9.373	0.281	9.377	101.72	141.24
101.00	0.000	104.246	9.378	0.287	9.382	102.75	140.05
102.00	0.000	104.255	9.383	0.392	9.391	104.39	139.93
103.00	0.000	104.255	9.391	0.508	9.405	106.10	139.93
104.00	0.000	104.255	9.401	0.624	9.422	107.80	139.93
105.00	0.000	104.255	9.413	0.740	9.442	109.50	139.93
106.00	0.000	104.126	9.426	0.801	9.460	110.86	141.69
107.00	0.000	103.936	9.440	0.809	9.475	111.90	144.23
108.00	0.000	103.744	9.455	0.848	9.493	113.12	146.77
109.00	0.000	103.547	9.470	0.891	9.511	114.37	149.30
110.00	0.000	103.347	9.485	0.907	9.528	115.46	151.84
111.00	0.000	103.144	9.501	0.957	9.549	116.75	154.38
112.00	0.000	102.937	9.518	1.010	9.572	118.06	156.91
113.00	0.000	102.727	9.536	1.035	9.592	119.19	159.45
114.00	0.000	102.513	9.555	1.095	9.617	120.54	161.99
115.00	0.000	102.296	9.574	1.158	9.644	121.90	164.52
116.00	0.000	102.075	9.595	1.192	9.668	123.08	167.06
117.00	0.000	102.054	9.616	1.215	9.692	124.20	167.30
118.00	0.000	102.054	9.637	1.215	9.713	125.19	167.30
119.00	0.000	102.054	9.658	1.215	9.734	126.17	167.30
120.00	0.000	102.054	9.679	1.215	9.755	127.16	167.30
121.00	0.000	102.054	9.700	1.215	9.775	128.14	167.30
122.00	0.000	102.054	9.721	1.214	9.796	129.12	167.30
123.00	0.000	102.054	9.742	1.213	9.817	130.10	167.30
124.00	0.000	102.054	9.763	1.211	9.837	131.07	167.30
125.00	0.000	102.054	9.784	1.209	9.858	132.04	167.30
126.00	0.000	102.054	9.804	1.207	9.878	133.02	167.30
127.00	0.000	102.054	9.825	1.204	9.899	133.99	167.30
128.00	0.000	102.054	9.846	1.201	9.919	134.95	167.30
129.00	0.000	102.054	9.867	1.197	9.939	135.92	167.30
130.00	0.000	102.054	9.888	1.194	9.959	136.88	167.30
131.00	0.000	102.054	9.908	1.190	9.979	137.85	167.30
132.00	0.000	102.054	9.929	1.185	9.999	138.81	167.30
133.00	0.000	102.054	9.949	1.180	10.019	139.76	167.30
134.00	0.000	102.054	9.969	1.175	10.038	140.72	167.30
135.00	0.000	102.054	9.990	1.169	10.058	141.68	167.30
136.00	0.000	102.054	10.010	1.163	10.077	142.63	167.30
137.00	0.000	102.054	10.030	1.157	10.097	143.58	167.30
138.00	0.000	102.054	10.050	1.151	10.116	144.53	167.30
139.00	0.000	101.883	10.070	1.166	10.137	145.61	169.24
140.00	0.000	101.656	10.091	1.231	10.166	146.96	171.78
141.00	0.000	101.425	10.113	1.299	10.196	148.32	174.31
142.00	0.000	101.191	10.136	1.335	10.224	149.50	176.85
143.00	0.000	100.954	10.160	1.409	10.257	150.90	179.39
144.00	0.000	100.713	10.185	1.487	10.293	152.31	181.92
145.00	0.000	100.469	10.211	1.531	10.326	153.53	184.46
146.00	0.000	100.436	10.239	1.571	10.358	154.72	184.80
147.00	0.000	100.436	10.266	1.578	10.387	155.74	184.80
148.00	0.000	100.436	10.293	1.585	10.415	156.76	184.80
149.00	0.000	100.436	10.321	1.592	10.443	157.77	184.80

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	100.436	10.348	1.598	10.471	158.78	184.80
151.00	0.000	100.436	10.376	1.604	10.499	159.79	184.80
152.00	0.000	100.436	10.404	1.609	10.528	160.79	184.80
153.00	0.000	100.436	10.432	1.614	10.556	161.79	184.80
154.00	0.000	100.436	10.460	1.618	10.584	162.79	184.80
155.00	0.000	100.436	10.488	1.622	10.613	163.79	184.80
156.00	0.000	100.436	10.516	1.625	10.641	164.78	184.80
157.00	0.000	100.436	10.544	1.627	10.669	165.77	184.80
158.00	0.000	100.436	10.572	1.630	10.697	166.76	184.80
159.00	0.000	100.436	10.601	1.631	10.726	167.75	184.80
160.00	0.000	100.436	10.629	1.633	10.754	168.73	184.80
161.00	0.000	100.436	10.657	1.633	10.782	169.71	184.80
162.00	0.000	100.436	10.686	1.634	10.810	170.69	184.80
163.00	0.000	100.436	10.714	1.633	10.838	171.67	184.80
164.00	0.000	100.436	10.742	1.633	10.866	172.64	184.80
165.00	0.000	100.436	10.770	1.631	10.893	173.61	184.80
166.00	0.000	100.436	10.799	1.630	10.921	174.58	184.80
167.00	0.000	100.436	10.827	1.627	10.949	175.55	184.80
168.00	0.000	100.436	10.855	1.625	10.976	176.51	184.80
169.00	0.000	100.436	10.883	1.622	11.003	177.47	184.80
170.00	0.000	100.436	10.911	1.618	11.031	178.43	184.80
171.00	0.000	100.436	10.939	1.614	11.058	179.39	184.80
172.00	0.000	100.436	10.967	1.609	11.085	180.35	184.80
173.00	0.000	100.436	10.995	1.604	11.111	181.30	184.80
174.00	0.000	100.436	11.023	1.598	11.138	182.25	184.80
175.00	0.000	100.436	11.050	1.592	11.164	183.20	184.80
176.00	0.000	100.436	11.078	1.585	11.191	184.15	184.80
177.00	0.000	100.436	11.105	1.578	11.217	185.09	184.80
178.00	0.000	100.436	11.133	1.571	11.243	186.03	184.80
179.00	0.000	100.436	11.160	1.563	11.269	186.97	184.80
180.00	0.000	100.436	11.187	1.554	11.294	187.91	184.80
181.00	0.000	100.436	11.214	1.545	11.320	188.85	184.80
182.00	0.000	100.436	11.240	1.536	11.345	189.78	184.80
183.00	0.000	100.436	11.267	1.526	11.370	190.71	184.80
184.00	0.000	100.436	11.293	1.516	11.394	191.64	184.80
185.00	0.000	100.589	11.319	1.541	11.424	192.75	183.22
186.00	0.000	100.831	11.347	1.582	11.456	193.94	180.68
187.00	0.000	101.071	11.375	1.637	11.492	195.19	178.14
188.00	0.000	101.306	11.403	1.670	11.525	196.33	175.61
189.00	0.000	101.539	11.432	1.699	11.558	197.45	173.07
190.00	0.000	101.767	11.462	1.742	11.594	198.64	170.53
191.00	0.000	101.993	11.493	1.763	11.627	199.72	168.00
192.00	0.000	102.214	11.524	1.781	11.660	200.78	165.47
193.00	0.000	102.237	11.554	1.762	11.688	201.67	165.21
194.00	0.000	102.237	11.585	1.727	11.713	202.48	165.21
195.00	0.000	102.237	11.614	1.691	11.737	203.28	165.21
196.00	0.000	102.237	11.643	1.654	11.760	204.09	165.21
197.00	0.000	102.237	11.671	1.617	11.783	204.89	165.20
198.00	0.000	102.237	11.699	1.580	11.805	205.69	165.21
199.00	0.000	102.237	11.726	1.542	11.827	206.49	165.21

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	0.000	102.237	11.752	1.503	11.848	207.29	165.21
201.00	0.000	102.237	11.778	1.465	11.869	208.09	165.21
202.00	0.000	102.237	11.803	1.425	11.889	208.89	165.21
203.00	0.000	102.237	11.827	1.385	11.908	209.68	165.21
204.00	0.000	102.237	11.851	1.345	11.927	210.48	165.21
205.00	0.000	102.237	11.874	1.305	11.945	211.27	165.21
206.00	0.000	102.237	11.896	1.264	11.963	212.06	165.21
207.00	0.000	102.237	11.917	1.222	11.980	212.86	165.21
208.00	2.000	102.237	11.938	1.181	11.996	213.65	165.21
209.00	2.000	102.237	11.958	1.139	12.012	214.44	165.21
210.00	2.000	102.237	11.977	1.096	12.027	215.23	165.21
211.00	2.000	102.237	11.996	1.053	12.042	216.02	165.21
212.00	2.000	102.237	12.013	1.010	12.056	216.81	165.21
213.00	2.000	102.237	12.030	0.967	12.069	217.60	165.21
214.00	2.000	102.237	12.047	0.923	12.082	218.38	165.21
215.00	2.000	102.237	12.062	0.879	12.094	219.17	165.21
216.00	2.000	102.237	12.077	0.835	12.106	219.96	165.21
217.00	2.000	102.237	12.091	0.791	12.116	220.74	165.21
218.00	0.000	102.237	12.104	0.746	12.127	221.53	165.21
219.00	0.000	102.237	12.116	0.701	12.136	222.31	165.21
220.00	0.000	102.316	12.128	0.672	12.146	223.17	164.29
221.00	0.000	102.533	12.139	0.674	12.158	224.18	161.76
222.00	0.000	102.746	12.151	0.672	12.170	225.16	159.22
223.00	0.000	102.953	12.163	0.682	12.182	226.21	156.72
224.00	0.000	102.959	12.174	0.627	12.190	226.95	156.64
225.00	0.000	102.959	12.184	0.572	12.198	227.69	156.64
226.00	0.000	102.959	12.194	0.517	12.205	228.43	156.64
227.00	0.000	102.835	12.202	0.488	12.212	229.29	158.16
228.00	0.000	102.623	12.211	0.499	12.221	230.34	160.69
229.00	0.000	102.407	12.219	0.482	12.229	231.26	163.23
230.00	0.000	102.188	12.228	0.501	12.238	232.34	165.77
231.00	0.000	101.966	12.237	0.523	12.248	233.45	168.30
232.00	0.000	101.740	12.245	0.514	12.256	234.41	170.84
233.00	0.000	101.511	12.255	0.544	12.267	235.54	173.38
234.00	0.000	101.278	12.264	0.576	12.278	236.69	175.91
235.00	0.000	101.248	12.274	0.538	12.286	237.51	176.24
236.00	0.000	101.248	12.283	0.502	12.293	238.34	176.24
237.00	0.000	101.248	12.291	0.465	12.300	239.17	176.24
238.00	2.000	101.248	12.299	0.428	12.306	239.99	176.24
239.00	2.000	101.248	12.306	0.391	12.312	240.82	176.24
240.00	2.000	101.248	12.312	0.354	12.317	241.65	176.24
241.00	0.000	101.248	12.318	0.317	12.322	242.47	176.24
242.00	0.000	101.248	12.323	0.280	12.326	243.30	176.24
243.00	0.000	101.402	12.328	0.277	12.331	244.29	174.57
244.00	0.000	101.633	12.333	0.307	12.337	245.42	172.03
245.00	0.000	101.860	12.338	0.315	12.342	246.46	169.49
246.00	0.000	102.084	12.343	0.320	12.348	247.48	166.96
247.00	0.000	102.305	12.349	0.338	12.354	248.57	164.42
248.00	0.000	102.522	12.355	0.336	12.359	249.56	161.88
249.00	0.000	102.736	12.360	0.330	12.365	250.53	159.35

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	102.946	12.366	0.337	12.371	251.56	156.81
251.00	0.000	103.152	12.372	0.324	12.376	252.50	154.28
252.00	0.000	103.356	12.377	0.308	12.381	253.43	151.74
253.00	0.000	103.555	12.382	0.304	12.386	254.40	149.20
254.00	0.000	103.751	12.387	0.280	12.390	255.30	146.67
255.00	0.000	103.944	12.392	0.254	12.394	256.17	144.13
256.00	0.000	104.133	12.396	0.238	12.398	257.10	141.59
257.00	0.000	104.289	12.400	0.199	12.401	257.92	139.47
258.00	0.000	104.289	12.404	0.262	12.407	259.21	139.47
259.00	0.000	104.289	12.409	0.325	12.413	260.50	139.47
260.00	0.000	104.395	12.415	0.300	12.419	261.38	138.00
261.00	0.000	104.395	12.419	0.221	12.421	262.02	138.00
262.00	0.000	104.395	12.423	0.142	12.423	262.66	138.00
263.00	0.000	104.395	12.424	0.064	12.425	263.29	138.00
264.00	0.000	104.395	12.425	-0.015	12.425	263.93	138.00
265.00	2.000	104.395	12.424	-0.094	12.424	264.56	138.00
266.00	2.000	104.395	12.421	-0.173	12.423	265.20	138.00
267.00	2.000	104.395	12.418	-0.252	12.420	265.84	138.00
268.00	2.000	104.395	12.413	-0.330	12.417	266.47	138.00
269.00	2.000	104.395	12.406	-0.409	12.413	267.11	138.00
270.00	2.000	104.395	12.398	-0.487	12.408	267.75	138.00
271.00	2.000	104.395	12.389	-0.565	12.402	268.39	138.00
272.00	2.000	104.395	12.378	-0.643	12.395	269.02	138.00
273.00	2.000	104.395	12.366	-0.721	12.387	269.66	138.00
274.00	2.000	104.395	12.353	-0.799	12.379	270.30	138.00
275.00	2.000	104.395	12.338	-0.876	12.370	270.94	138.00
276.00	0.000	104.395	12.322	-0.954	12.359	271.57	138.00
277.00	0.000	104.395	12.305	-1.030	12.348	272.21	138.00
278.00	0.000	104.395	12.286	-1.107	12.336	272.85	138.00
279.00	0.000	104.395	12.266	-1.183	12.323	273.49	138.00
280.00	0.000	104.395	12.245	-1.259	12.310	274.13	138.00
281.00	0.000	104.357	12.222	-1.318	12.293	274.84	138.52
282.00	0.000	104.172	12.199	-1.363	12.275	275.62	141.06
283.00	0.000	103.984	12.175	-1.376	12.253	276.55	143.60
284.00	0.000	103.792	12.151	-1.385	12.230	277.50	146.13
285.00	0.000	103.597	12.127	-1.419	12.209	278.32	148.67
286.00	0.000	103.398	12.102	-1.420	12.185	279.31	151.21
287.00	0.000	103.195	12.077	-1.417	12.160	280.31	153.74
288.00	0.000	102.989	12.052	-1.440	12.138	281.18	156.28
289.00	0.000	102.780	12.027	-1.428	12.112	282.23	158.82
290.00	0.000	102.567	12.002	-1.412	12.085	283.29	161.35
291.00	0.000	102.351	11.977	-1.425	12.062	284.21	163.89
292.00	0.000	102.131	11.953	-1.401	12.035	285.31	166.43
293.00	0.000	101.908	11.929	-1.373	12.007	286.43	168.96
294.00	0.000	101.681	11.905	-1.375	11.984	287.41	171.50
295.00	0.000	101.451	11.881	-1.339	11.956	288.57	174.03
296.00	0.000	101.217	11.858	-1.298	11.929	289.75	176.57
297.00	0.000	100.980	11.835	-1.290	11.905	290.78	179.11
298.00	2.000	100.740	11.813	-1.241	11.878	292.00	181.64
299.00	2.000	100.496	11.792	-1.189	11.852	293.24	184.18

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	2.000	100.436	11.771	-1.193	11.831	294.21	184.80
301.00	2.000	100.436	11.750	-1.212	11.812	295.11	184.80
302.00	2.000	100.436	11.728	-1.230	11.793	296.01	184.80
303.00	0.000	100.436	11.707	-1.248	11.773	296.91	184.80
304.00	0.000	100.436	11.684	-1.266	11.753	297.82	184.80
305.00	0.000	100.436	11.662	-1.283	11.732	298.72	184.80
306.00	0.000	100.436	11.639	-1.300	11.712	299.63	184.80
307.00	0.000	100.436	11.616	-1.316	11.691	300.53	184.80
308.00	0.000	100.436	11.593	-1.332	11.669	301.44	184.80
309.00	0.000	100.436	11.569	-1.348	11.648	302.35	184.80
310.00	0.000	100.436	11.545	-1.363	11.626	303.26	184.80
311.00	0.000	100.436	11.521	-1.378	11.603	304.18	184.80
312.00	0.000	100.436	11.497	-1.392	11.581	305.09	184.80
313.00	0.000	100.436	11.472	-1.406	11.558	306.01	184.80
314.00	0.000	100.436	11.447	-1.420	11.535	306.93	184.80
315.00	0.000	100.436	11.422	-1.433	11.512	307.85	184.80
316.00	0.000	100.436	11.397	-1.445	11.488	308.77	184.80
317.00	0.000	100.436	11.371	-1.458	11.464	309.69	184.80
318.00	0.000	100.436	11.346	-1.469	11.440	310.62	184.80
319.00	0.000	100.436	11.320	-1.481	11.416	311.55	184.80
320.00	0.000	100.436	11.294	-1.492	11.392	312.48	184.80
321.00	0.000	100.436	11.267	-1.502	11.367	313.41	184.80
322.00	0.000	100.436	11.241	-1.512	11.342	314.34	184.80
323.00	0.000	100.436	11.214	-1.521	11.317	315.27	184.80
324.00	0.000	100.436	11.187	-1.530	11.291	316.21	184.80
325.00	0.000	100.436	11.160	-1.539	11.266	317.15	184.80
326.00	0.000	100.436	11.133	-1.547	11.240	318.09	184.80
327.00	0.000	100.436	11.106	-1.554	11.214	319.03	184.80
328.00	0.000	100.436	11.078	-1.561	11.188	319.98	184.80
329.00	0.000	100.436	11.051	-1.568	11.162	320.92	184.80
330.00	0.000	100.436	11.023	-1.574	11.135	321.87	184.80
331.00	0.000	100.436	10.996	-1.580	11.108	322.82	184.80
332.00	0.000	100.436	10.968	-1.585	11.082	323.78	184.80
333.00	0.000	100.436	10.940	-1.590	11.055	324.73	184.80
334.00	0.000	100.436	10.912	-1.594	11.028	325.69	184.80
335.00	0.000	100.436	10.884	-1.598	11.000	326.65	184.80
336.00	0.000	100.436	10.856	-1.601	10.973	327.61	184.80
337.00	0.000	100.436	10.827	-1.604	10.945	328.57	184.80
338.00	0.000	100.436	10.799	-1.606	10.918	329.54	184.80
339.00	0.000	100.436	10.771	-1.607	10.890	330.51	184.80
340.00	0.000	100.436	10.743	-1.609	10.862	331.48	184.80
341.00	0.000	100.436	10.714	-1.609	10.835	332.46	184.80
342.00	0.000	100.436	10.686	-1.610	10.807	333.43	184.80
343.00	0.000	100.436	10.658	-1.609	10.779	334.41	184.80
344.00	0.000	100.436	10.629	-1.609	10.750	335.39	184.80
345.00	0.000	100.436	10.601	-1.607	10.722	336.38	184.80
346.00	0.000	100.436	10.573	-1.606	10.694	337.36	184.80
347.00	0.000	100.436	10.545	-1.604	10.666	338.35	184.80
348.00	0.000	100.436	10.517	-1.601	10.638	339.34	184.80
349.00	0.000	100.436	10.488	-1.598	10.609	340.34	184.80

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:55:45

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	100.436	10.460	-1.594	10.581	341.33	184.80
351.00	0.000	100.436	10.432	-1.590	10.553	342.33	184.80
352.00	0.000	100.436	10.404	-1.585	10.525	343.34	184.80
353.00	0.000	100.436	10.377	-1.580	10.496	344.34	184.80
354.00	0.000	100.436	10.349	-1.574	10.468	345.35	184.80
355.00	0.000	100.436	10.321	-1.568	10.440	346.36	184.80
356.00	0.000	100.436	10.294	-1.562	10.412	347.37	184.80
357.00	0.000	100.436	10.266	-1.555	10.383	348.39	184.80
358.00	0.000	100.436	10.239	-1.547	10.355	349.41	184.80
359.00	0.000	100.436	10.212	-1.539	10.327	350.43	184.80

MINIMUM STRESS (Pb,x') = 9.123 AT 67.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 9.123 AT 66.94 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)
08-19-2000 11:42:36
Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage
Weld H2 -- 10 Years of Crack Growth -- Faulted Conditions
Crack assumed to take compression across face

RADIUS (IN) = 109 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.882 KSI
MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 8 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	27.2400	(DTHETA =	27.240)	DEPTH (IN) =	2.000
2 ANGLES:	32.3900 TO	59.9300	(DTHETA =	27.540)	DEPTH (IN) =	2.000
3 ANGLES:	62.1800 TO	84.0800	(DTHETA =	21.900)	DEPTH (IN) =	2.000
4 ANGLES:	96.3800 TO	207.7300	(DTHETA =	111.350)	DEPTH (IN) =	2.000
5 ANGLES:	217.7500 TO	237.7800	(DTHETA =	20.030)	DEPTH (IN) =	2.000
6 ANGLES:	240.5800 TO	264.0800	(DTHETA =	23.500)	DEPTH (IN) =	2.000
7 ANGLES:	275.5300 TO	297.6700	(DTHETA =	22.140)	DEPTH (IN) =	2.000
8 ANGLES:	302.2700 TO	360.0000	(DTHETA =	57.730)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1369.734
REMAINING DEGRADED SECTION AREA (IN2) = 184.7998
(APPROX. DEGRADED METAL AREA = 184.8)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated
t = Thickness in wall at position corresponding to angle
delta = Distance from center to tension-to-compression axis
Pb,x' = Bending stress due to moment about tension-to-compression axis
Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis
Pb,max = Maximum bending stress due to total limit moment
Anglemax = Angle for total limit moment relative to original Y axis
Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	102.024	9.180	-1.541	9.308	350.47	184.80
1.00	0.000	102.024	9.153	-1.532	9.280	351.50	184.80
2.00	0.000	102.024	9.126	-1.522	9.252	352.53	184.80
3.00	0.000	102.024	9.100	-1.512	9.225	353.56	184.80
4.00	0.000	102.024	9.074	-1.502	9.197	354.60	184.80
5.00	0.000	102.024	9.047	-1.491	9.169	355.64	184.80
6.00	0.000	102.024	9.021	-1.480	9.142	356.68	184.80
7.00	0.000	102.024	8.996	-1.468	9.115	357.73	184.80
8.00	0.000	102.219	8.971	-1.407	9.080	359.09	182.57
9.00	0.000	102.437	8.947	-1.332	9.045	0.53	180.03
10.00	0.000	102.652	8.924	-1.276	9.014	1.86	177.49
11.00	0.000	102.864	8.902	-1.224	8.985	3.17	174.96
12.00	0.000	103.072	8.881	-1.159	8.956	4.57	172.42
13.00	0.000	103.276	8.861	-1.112	8.930	5.84	169.89
14.00	0.000	103.477	8.842	-1.069	8.906	7.10	167.35
15.00	0.000	103.675	8.823	-1.014	8.881	8.44	164.81
16.00	0.000	103.869	8.806	-0.977	8.860	9.67	162.28
17.00	0.000	104.059	8.789	-0.943	8.839	10.87	159.74
18.00	0.000	104.246	8.773	-0.899	8.819	12.15	157.20
19.00	0.000	104.430	8.757	-0.871	8.800	13.32	154.67
20.00	0.000	104.610	8.742	-0.847	8.783	14.47	152.13
21.00	0.000	104.786	8.728	-0.813	8.765	15.68	149.59
22.00	0.000	104.959	8.713	-0.795	8.750	16.79	147.06
23.00	0.000	104.985	8.699	-0.818	8.738	17.63	146.68
24.00	0.000	104.985	8.685	-0.840	8.725	18.47	146.68
25.00	0.000	104.985	8.670	-0.863	8.713	19.32	146.68
26.00	0.000	104.985	8.655	-0.885	8.700	20.16	146.68
27.00	0.000	104.985	8.639	-0.907	8.686	21.01	146.68
28.00	2.000	104.985	8.623	-0.928	8.673	21.85	146.68
29.00	2.000	104.985	8.607	-0.949	8.659	22.70	146.68
30.00	2.000	104.985	8.590	-0.970	8.645	23.55	146.68
31.00	2.000	104.985	8.573	-0.991	8.630	24.40	146.68
32.00	2.000	104.985	8.555	-1.012	8.615	25.26	146.68
33.00	0.000	104.985	8.537	-1.032	8.600	26.11	146.68
34.00	0.000	104.985	8.519	-1.051	8.584	26.96	146.68
35.00	0.000	104.985	8.501	-1.071	8.568	27.82	146.68
36.00	0.000	104.985	8.482	-1.090	8.552	28.68	146.68
37.00	0.000	104.985	8.463	-1.109	8.535	29.53	146.68
38.00	0.000	104.985	8.443	-1.127	8.518	30.39	146.68
39.00	0.000	104.985	8.423	-1.145	8.501	31.26	146.68
40.00	0.000	104.985	8.403	-1.163	8.483	32.12	146.68
41.00	0.000	104.985	8.383	-1.180	8.465	32.98	146.68
42.00	0.000	104.985	8.362	-1.197	8.447	33.85	146.68
43.00	0.000	105.123	8.341	-1.177	8.424	34.97	144.60
44.00	0.000	105.130	8.322	-1.085	8.392	36.57	144.49
45.00	0.000	105.130	8.304	-0.977	8.361	38.29	144.49
46.00	0.000	105.007	8.287	-0.918	8.338	39.68	146.35
47.00	0.000	104.835	8.272	-0.880	8.318	40.93	148.88
48.00	0.000	104.660	8.256	-0.865	8.301	42.02	151.42
49.00	0.000	104.481	8.242	-0.819	8.282	43.32	153.96

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	104.298	8.228	-0.769	8.264	44.66	156.49
51.00	0.000	104.112	8.214	-0.744	8.248	45.82	159.03
52.00	0.000	103.923	8.202	-0.686	8.231	47.21	161.57
53.00	0.000	103.730	8.190	-0.625	8.214	48.64	164.10
54.00	0.000	103.533	8.180	-0.589	8.201	49.88	166.64
55.00	0.000	103.333	8.170	-0.520	8.187	51.36	169.17
56.00	0.000	103.129	8.162	-0.446	8.174	52.87	171.71
57.00	0.000	102.932	8.154	-0.401	8.164	54.19	174.13
58.00	0.000	102.931	8.147	-0.377	8.156	55.35	174.15
59.00	0.000	102.931	8.141	-0.361	8.149	56.46	174.15
60.00	2.000	102.931	8.135	-0.345	8.142	57.57	174.15
61.00	2.000	102.931	8.129	-0.329	8.136	58.68	174.15
62.00	2.000	102.931	8.123	-0.313	8.129	59.79	174.15
63.00	0.000	102.931	8.118	-0.297	8.123	60.90	174.15
64.00	0.000	102.931	8.113	-0.281	8.118	62.02	174.15
65.00	0.000	102.958	8.108	-0.249	8.112	63.24	173.82
66.00	0.000	103.164	8.104	-0.187	8.106	64.68	171.28
67.00	0.000	103.367	8.101	-0.129	8.102	66.09	168.74
68.00	0.000	103.567	8.100	-0.059	8.100	67.58	166.21
69.00	0.000	103.763	8.099	-0.008	8.099	68.94	163.67
70.00	0.000	103.955	8.099	0.040	8.099	70.29	161.13
71.00	0.000	104.144	8.100	0.099	8.101	71.70	158.60
72.00	0.000	104.329	8.102	0.140	8.103	72.99	156.06
73.00	0.000	104.511	8.105	0.178	8.107	74.25	153.52
74.00	0.000	104.683	8.108	0.228	8.112	75.61	151.09
75.00	0.000	104.683	8.113	0.354	8.121	77.50	151.09
76.00	0.000	104.683	8.120	0.479	8.135	79.38	151.09
77.00	0.000	104.725	8.130	0.576	8.150	81.05	150.48
78.00	0.000	104.899	8.140	0.618	8.163	82.34	147.94
79.00	0.000	105.070	8.151	0.644	8.176	83.51	145.41
80.00	0.000	105.237	8.162	0.665	8.189	84.66	142.87
81.00	0.000	105.342	8.174	0.684	8.203	85.78	141.24
82.00	0.000	105.342	8.186	0.664	8.213	86.64	141.24
83.00	0.000	105.342	8.197	0.645	8.222	87.50	141.24
84.00	0.000	105.342	8.208	0.625	8.232	88.35	141.24
85.00	2.000	105.342	8.218	0.605	8.241	89.21	141.24
86.00	2.000	105.342	8.229	0.585	8.249	90.06	141.24
87.00	2.000	105.342	8.238	0.564	8.258	90.92	141.24
88.00	2.000	105.342	8.248	0.544	8.266	91.77	141.24
89.00	2.000	105.342	8.257	0.523	8.274	92.62	141.24
90.00	2.000	105.342	8.266	0.502	8.281	93.48	141.24
91.00	2.000	105.342	8.274	0.481	8.288	94.33	141.24
92.00	2.000	105.342	8.282	0.460	8.295	95.18	141.24
93.00	2.000	105.342	8.290	0.438	8.301	96.03	141.24
94.00	2.000	105.342	8.297	0.417	8.308	96.88	141.24
95.00	2.000	105.342	8.304	0.395	8.313	97.73	141.24
96.00	2.000	105.342	8.311	0.374	8.319	98.58	141.24
97.00	0.000	105.342	8.317	0.352	8.324	99.42	141.24
98.00	0.000	105.342	8.323	0.330	8.329	100.27	141.24
99.00	0.000	105.337	8.328	0.311	8.334	101.14	141.32

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	105.172	8.333	0.315	8.339	102.16	143.86
101.00	0.000	105.003	8.339	0.348	8.346	103.39	146.40
102.00	0.000	104.861	8.345	0.385	8.354	104.64	148.50
103.00	0.000	104.861	8.353	0.501	8.368	106.43	148.50
104.00	0.000	104.861	8.363	0.617	8.386	108.22	148.50
105.00	0.000	104.861	8.375	0.733	8.407	110.00	148.50
106.00	0.000	104.861	8.389	0.849	8.431	111.78	148.50
107.00	0.000	104.762	8.404	0.912	8.454	113.20	149.95
108.00	0.000	104.585	8.421	0.953	8.474	114.46	152.48
109.00	0.000	104.404	8.437	0.997	8.496	115.74	155.02
110.00	0.000	104.220	8.455	1.017	8.516	116.86	157.56
111.00	0.000	104.033	8.473	1.068	8.540	118.18	160.09
112.00	0.000	103.842	8.492	1.122	8.566	119.53	162.63
113.00	0.000	103.647	8.512	1.151	8.589	120.70	165.17
114.00	0.000	103.481	8.532	1.201	8.617	122.01	167.30
115.00	0.000	103.481	8.553	1.203	8.638	123.01	167.30
116.00	0.000	103.481	8.574	1.204	8.659	123.99	167.30
117.00	0.000	103.481	8.595	1.205	8.679	124.98	167.30
118.00	0.000	103.481	8.616	1.206	8.700	125.97	167.30
119.00	0.000	103.481	8.637	1.206	8.721	126.95	167.30
120.00	0.000	103.481	8.658	1.206	8.742	127.93	167.30
121.00	0.000	103.481	8.679	1.205	8.763	128.91	167.30
122.00	0.000	103.481	8.700	1.205	8.783	129.88	167.30
123.00	0.000	103.481	8.721	1.203	8.804	130.86	167.30
124.00	0.000	103.481	8.742	1.202	8.825	131.83	167.30
125.00	0.000	103.481	8.763	1.200	8.845	132.80	167.30
126.00	0.000	103.481	8.784	1.197	8.865	133.76	167.30
127.00	0.000	103.481	8.805	1.195	8.886	134.73	167.30
128.00	0.000	103.481	8.826	1.192	8.906	135.69	167.30
129.00	0.000	103.481	8.847	1.188	8.926	136.65	167.30
130.00	0.000	103.481	8.867	1.184	8.946	137.61	167.30
131.00	0.000	103.481	8.888	1.180	8.966	138.56	167.30
132.00	0.000	103.481	8.908	1.176	8.986	139.52	167.30
133.00	0.000	103.481	8.929	1.171	9.005	140.47	167.30
134.00	0.000	103.481	8.949	1.166	9.025	141.42	167.30
135.00	0.000	103.481	8.969	1.160	9.044	142.37	167.30
136.00	0.000	103.474	8.990	1.154	9.063	143.32	167.39
137.00	0.000	103.276	9.010	1.199	9.090	144.58	169.89
138.00	0.000	103.072	9.032	1.259	9.119	145.94	172.42
139.00	0.000	102.864	9.054	1.290	9.145	147.11	174.96
140.00	0.000	102.652	9.077	1.356	9.178	148.50	177.49
141.00	0.000	102.437	9.101	1.425	9.212	149.90	180.03
142.00	0.000	102.219	9.126	1.464	9.243	151.12	182.57
143.00	0.000	102.024	9.153	1.535	9.280	152.52	184.80
144.00	0.000	102.024	9.179	1.544	9.308	153.55	184.80
145.00	0.000	102.024	9.206	1.552	9.336	154.57	184.80
146.00	0.000	102.024	9.234	1.560	9.365	155.59	184.80
147.00	0.000	102.024	9.261	1.568	9.393	156.61	184.80
148.00	0.000	102.024	9.288	1.575	9.421	157.62	184.80
149.00	0.000	102.024	9.316	1.582	9.449	158.64	184.80

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	102.024	9.343	1.588	9.477	159.64	184.80
151.00	0.000	102.024	9.371	1.594	9.506	160.65	184.80
152.00	0.000	102.024	9.399	1.599	9.534	161.65	184.80
153.00	0.000	102.024	9.427	1.603	9.562	162.65	184.80
154.00	0.000	102.024	9.455	1.608	9.591	163.65	184.80
155.00	0.000	102.024	9.483	1.611	9.619	164.64	184.80
156.00	0.000	102.024	9.511	1.614	9.647	165.63	184.80
157.00	0.000	102.024	9.539	1.617	9.675	166.62	184.80
158.00	0.000	102.024	9.567	1.619	9.704	167.61	184.80
159.00	0.000	102.024	9.596	1.621	9.732	168.59	184.80
160.00	0.000	102.024	9.624	1.622	9.760	169.57	184.80
161.00	0.000	102.024	9.652	1.623	9.788	170.55	184.80
162.00	0.000	102.024	9.681	1.623	9.816	171.52	184.80
163.00	0.000	102.024	9.709	1.623	9.844	172.49	184.80
164.00	0.000	102.024	9.737	1.622	9.871	173.46	184.80
165.00	0.000	102.024	9.765	1.621	9.899	174.43	184.80
166.00	0.000	102.024	9.794	1.619	9.927	175.39	184.80
167.00	0.000	102.024	9.822	1.617	9.954	176.35	184.80
168.00	0.000	102.024	9.850	1.614	9.982	177.31	184.80
169.00	0.000	102.024	9.878	1.611	10.009	178.26	184.80
170.00	0.000	102.024	9.906	1.608	10.036	179.22	184.80
171.00	0.000	102.024	9.934	1.603	10.063	180.17	184.80
172.00	0.000	102.024	9.962	1.599	10.090	181.12	184.80
173.00	0.000	102.024	9.990	1.594	10.116	182.06	184.80
174.00	0.000	102.024	10.018	1.588	10.143	183.01	184.80
175.00	0.000	102.024	10.045	1.582	10.169	183.95	184.80
176.00	0.000	102.024	10.073	1.575	10.195	184.89	184.80
177.00	0.000	102.024	10.100	1.568	10.221	185.83	184.80
178.00	0.000	102.024	10.128	1.561	10.247	186.76	184.80
179.00	0.000	102.024	10.155	1.553	10.273	187.69	184.80
180.00	0.000	102.024	10.182	1.544	10.298	188.62	184.80
181.00	0.000	102.024	10.209	1.535	10.323	189.55	184.80
182.00	0.000	102.024	10.235	1.526	10.348	190.48	184.80
183.00	0.000	102.024	10.262	1.516	10.373	191.40	184.80
184.00	0.000	102.024	10.288	1.505	10.398	192.32	184.80
185.00	0.000	102.024	10.314	1.495	10.422	193.24	184.80
186.00	0.000	102.024	10.340	1.483	10.446	194.16	184.80
187.00	0.000	102.106	10.366	1.505	10.475	195.26	183.86
188.00	0.000	102.326	10.392	1.540	10.506	196.43	181.33
189.00	0.000	102.543	10.419	1.572	10.537	197.58	178.79
190.00	0.000	102.756	10.447	1.616	10.571	198.79	176.25
191.00	0.000	102.966	10.475	1.639	10.603	199.89	173.72
192.00	0.000	103.172	10.504	1.659	10.634	200.98	171.18
193.00	0.000	103.375	10.533	1.690	10.668	202.12	168.64
194.00	0.000	103.575	10.563	1.702	10.699	203.16	166.11
195.00	0.000	103.645	10.592	1.681	10.725	204.02	165.21
196.00	0.000	103.645	10.621	1.645	10.748	204.80	165.21
197.00	0.000	103.645	10.649	1.608	10.770	205.59	165.21
198.00	0.000	103.645	10.677	1.570	10.792	206.37	165.21
199.00	0.000	103.645	10.704	1.532	10.813	207.15	165.21

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	0.000	103.645	10.730	1.494	10.834	207.93	165.21
201.00	0.000	103.645	10.756	1.455	10.854	208.70	165.21
202.00	0.000	103.645	10.781	1.416	10.873	209.48	165.21
203.00	0.000	103.645	10.805	1.376	10.892	210.26	165.21
204.00	0.000	103.645	10.829	1.336	10.911	211.03	165.21
205.00	0.000	103.645	10.852	1.295	10.929	211.81	165.21
206.00	0.000	103.645	10.874	1.254	10.946	212.58	165.21
207.00	0.000	103.645	10.895	1.213	10.962	213.35	165.21
208.00	2.000	103.645	10.916	1.171	10.979	214.12	165.21
209.00	2.000	103.645	10.936	1.129	10.994	214.89	165.21
210.00	2.000	103.645	10.955	1.086	11.009	215.66	165.21
211.00	2.000	103.645	10.974	1.044	11.023	216.43	165.21
212.00	2.000	103.645	10.991	1.001	11.037	217.20	165.21
213.00	2.000	103.645	11.008	0.957	11.050	217.97	165.21
214.00	2.000	103.645	11.025	0.914	11.062	218.74	165.21
215.00	2.000	103.645	11.040	0.870	11.074	219.50	165.21
216.00	2.000	103.645	11.055	0.825	11.086	220.27	165.21
217.00	2.000	103.645	11.069	0.781	11.096	221.04	165.21
218.00	0.000	103.645	11.082	0.736	11.106	221.80	165.21
219.00	0.000	103.645	11.094	0.691	11.116	222.57	165.21
220.00	0.000	103.645	11.106	0.646	11.125	223.33	165.21
221.00	0.000	103.645	11.117	0.601	11.133	224.09	165.21
222.00	0.000	103.665	11.127	0.555	11.140	224.86	164.94
223.00	0.000	103.859	11.136	0.567	11.151	225.91	162.40
224.00	0.000	104.050	11.146	0.560	11.160	226.88	159.87
225.00	0.000	104.128	11.156	0.615	11.173	228.16	158.81
226.00	0.000	103.940	11.166	0.592	11.182	229.04	161.34
227.00	0.000	103.747	11.177	0.602	11.193	230.08	163.87
228.00	0.000	103.551	11.187	0.614	11.204	231.14	166.41
229.00	0.000	103.351	11.198	0.601	11.214	232.07	168.95
230.00	0.000	103.148	11.209	0.620	11.226	233.17	171.48
231.00	0.000	102.941	11.219	0.644	11.238	234.28	174.02
232.00	0.000	102.757	11.231	0.653	11.250	235.33	176.24
233.00	0.000	102.757	11.241	0.617	11.258	236.14	176.24
234.00	0.000	102.757	11.252	0.581	11.267	236.96	176.24
235.00	0.000	102.757	11.261	0.545	11.274	237.77	176.24
236.00	0.000	102.757	11.270	0.508	11.282	238.58	176.24
237.00	0.000	102.757	11.279	0.472	11.288	239.40	176.24
238.00	2.000	102.757	11.286	0.435	11.295	240.21	176.24
239.00	2.000	102.757	11.293	0.398	11.300	241.02	176.24
240.00	2.000	102.757	11.300	0.361	11.305	241.83	176.24
241.00	0.000	102.757	11.305	0.324	11.310	242.64	176.24
242.00	0.000	102.757	11.310	0.287	11.314	243.45	176.24
243.00	0.000	102.757	11.315	0.249	11.318	244.26	176.24
244.00	0.000	102.757	11.319	0.212	11.321	245.07	176.24
245.00	0.000	102.843	11.322	0.190	11.323	245.96	175.21
246.00	0.000	103.051	11.325	0.197	11.327	247.00	172.68
247.00	0.000	103.256	11.329	0.217	11.331	248.10	170.14
248.00	0.000	103.457	11.332	0.217	11.334	249.10	167.60
249.00	0.000	103.655	11.336	0.214	11.338	250.08	165.07

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	103.850	11.340	0.222	11.342	251.12	162.53
251.00	0.000	104.041	11.343	0.211	11.345	252.07	159.99
252.00	0.000	104.228	11.347	0.198	11.348	253.00	157.46
253.00	0.000	104.412	11.350	0.194	11.352	253.98	154.92
254.00	0.000	104.592	11.353	0.173	11.354	254.87	152.38
255.00	0.000	104.769	11.356	0.149	11.357	255.75	149.85
256.00	0.000	104.892	11.358	0.157	11.359	256.79	148.05
257.00	0.000	104.892	11.361	0.219	11.364	258.11	148.05
258.00	0.000	104.899	11.366	0.279	11.369	259.41	147.94
259.00	0.000	105.070	11.370	0.249	11.373	260.25	145.41
260.00	0.000	105.236	11.374	0.214	11.376	261.08	142.87
261.00	0.000	105.400	11.378	0.189	11.379	261.95	140.33
262.00	0.000	105.547	11.380	0.148	11.381	262.74	138.00
263.00	0.000	105.547	11.382	0.069	11.382	263.35	138.00
264.00	0.000	105.547	11.383	-0.010	11.383	263.95	138.00
265.00	2.000	105.547	11.382	-0.089	11.382	264.55	138.00
266.00	2.000	105.547	11.379	-0.168	11.380	265.15	138.00
267.00	2.000	105.547	11.376	-0.246	11.378	265.76	138.00
268.00	2.000	105.547	11.370	-0.325	11.375	266.36	138.00
269.00	2.000	105.547	11.364	-0.403	11.371	266.97	138.00
270.00	2.000	105.547	11.356	-0.482	11.366	267.57	138.00
271.00	2.000	105.547	11.347	-0.560	11.361	268.17	138.00
272.00	2.000	105.547	11.336	-0.638	11.354	268.78	138.00
273.00	2.000	105.547	11.324	-0.716	11.347	269.38	138.00
274.00	2.000	105.547	11.311	-0.794	11.339	269.98	138.00
275.00	2.000	105.547	11.296	-0.871	11.330	270.59	138.00
276.00	0.000	105.547	11.280	-0.948	11.320	271.19	138.00
277.00	0.000	105.547	11.263	-1.025	11.310	271.80	138.00
278.00	0.000	105.547	11.244	-1.102	11.298	272.40	138.00
279.00	0.000	105.474	11.224	-1.175	11.286	273.02	139.17
280.00	0.000	105.312	11.204	-1.200	11.268	273.89	141.70
281.00	0.000	105.147	11.183	-1.220	11.249	274.77	144.24
282.00	0.000	104.978	11.161	-1.261	11.232	275.55	146.78
283.00	0.000	104.805	11.139	-1.273	11.211	276.48	149.31
284.00	0.000	104.629	11.116	-1.281	11.190	277.43	151.85
285.00	0.000	104.450	11.094	-1.312	11.171	278.26	154.39
286.00	0.000	104.267	11.071	-1.311	11.148	279.24	156.92
287.00	0.000	104.080	11.048	-1.307	11.125	280.25	159.46
288.00	0.000	103.890	11.025	-1.326	11.105	281.14	162.00
289.00	0.000	103.696	11.002	-1.314	11.080	282.19	164.53
290.00	0.000	103.499	10.979	-1.296	11.056	283.26	167.07
291.00	0.000	103.299	10.957	-1.306	11.034	284.20	169.61
292.00	0.000	103.094	10.934	-1.280	11.009	285.32	172.14
293.00	0.000	102.887	10.912	-1.251	10.984	286.46	174.68
294.00	0.000	102.676	10.890	-1.249	10.962	287.45	177.22
295.00	0.000	102.461	10.869	-1.212	10.936	288.64	179.75
296.00	0.000	102.243	10.848	-1.170	10.911	289.84	182.29
297.00	0.000	102.026	10.828	-1.158	10.889	290.89	184.78
298.00	2.000	102.024	10.807	-1.165	10.870	291.85	184.80
299.00	2.000	102.024	10.787	-1.184	10.852	292.73	184.80

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	2.000	102.024	10.766	-1.203	10.833	293.62	184.80
301.00	2.000	102.024	10.745	-1.222	10.814	294.51	184.80
302.00	2.000	102.024	10.723	-1.240	10.795	295.40	184.80
303.00	0.000	102.024	10.702	-1.258	10.775	296.29	184.80
304.00	0.000	102.024	10.679	-1.276	10.755	297.18	184.80
305.00	0.000	102.024	10.657	-1.293	10.735	298.08	184.80
306.00	0.000	102.024	10.634	-1.310	10.715	298.98	184.80
307.00	0.000	102.024	10.611	-1.327	10.694	299.87	184.80
308.00	0.000	102.024	10.588	-1.343	10.673	300.77	184.80
309.00	0.000	102.024	10.564	-1.358	10.651	301.67	184.80
310.00	0.000	102.024	10.540	-1.373	10.629	302.57	184.80
311.00	0.000	102.024	10.516	-1.388	10.607	303.48	184.80
312.00	0.000	102.024	10.492	-1.403	10.585	304.38	184.80
313.00	0.000	102.024	10.467	-1.417	10.563	305.29	184.80
314.00	0.000	102.024	10.442	-1.430	10.540	306.20	184.80
315.00	0.000	102.024	10.417	-1.443	10.517	307.11	184.80
316.00	0.000	102.024	10.392	-1.456	10.493	308.02	184.80
317.00	0.000	102.024	10.366	-1.468	10.470	308.94	184.80
318.00	0.000	102.024	10.341	-1.480	10.446	309.86	184.80
319.00	0.000	102.024	10.315	-1.491	10.422	310.77	184.80
320.00	0.000	102.024	10.289	-1.502	10.398	311.69	184.80
321.00	0.000	102.024	10.262	-1.512	10.373	312.62	184.80
322.00	0.000	102.024	10.236	-1.522	10.348	313.54	184.80
323.00	0.000	102.024	10.209	-1.532	10.323	314.47	184.80
324.00	0.000	102.024	10.182	-1.541	10.298	315.40	184.80
325.00	0.000	102.024	10.155	-1.549	10.273	316.33	184.80
326.00	0.000	102.024	10.128	-1.557	10.247	317.26	184.80
327.00	0.000	102.024	10.101	-1.565	10.221	318.19	184.80
328.00	0.000	102.024	10.073	-1.572	10.195	319.13	184.80
329.00	0.000	102.024	10.046	-1.578	10.169	320.07	184.80
330.00	0.000	102.024	10.018	-1.584	10.143	321.01	184.80
331.00	0.000	102.024	9.991	-1.590	10.116	321.96	184.80
332.00	0.000	102.024	9.963	-1.595	10.090	322.90	184.80
333.00	0.000	102.024	9.935	-1.600	10.063	323.85	184.80
334.00	0.000	102.024	9.907	-1.604	10.036	324.80	184.80
335.00	0.000	102.024	9.879	-1.608	10.009	325.75	184.80
336.00	0.000	102.024	9.851	-1.611	9.981	326.71	184.80
337.00	0.000	102.024	9.822	-1.614	9.954	327.67	184.80
338.00	0.000	102.024	9.794	-1.616	9.927	328.63	184.80
339.00	0.000	102.024	9.766	-1.618	9.899	329.59	184.80
340.00	0.000	102.024	9.738	-1.619	9.871	330.56	184.80
341.00	0.000	102.024	9.709	-1.620	9.844	331.53	184.80
342.00	0.000	102.024	9.681	-1.620	9.816	332.50	184.80
343.00	0.000	102.024	9.653	-1.620	9.788	333.47	184.80
344.00	0.000	102.024	9.624	-1.619	9.760	334.45	184.80
345.00	0.000	102.024	9.596	-1.618	9.732	335.43	184.80
346.00	0.000	102.024	9.568	-1.616	9.703	336.41	184.80
347.00	0.000	102.024	9.540	-1.614	9.675	337.40	184.80
348.00	0.000	102.024	9.512	-1.611	9.647	338.38	184.80
349.00	0.000	102.024	9.483	-1.608	9.619	339.38	184.80

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-19-2000 11:43:29

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	102.024	9.455	-1.604	9.591	340.37	184.80
351.00	0.000	102.024	9.427	-1.600	9.562	341.37	184.80
352.00	0.000	102.024	9.399	-1.595	9.534	342.37	184.80
353.00	0.000	102.024	9.372	-1.590	9.506	343.37	184.80
354.00	0.000	102.024	9.344	-1.585	9.477	344.37	184.80
355.00	0.000	102.024	9.316	-1.578	9.449	345.38	184.80
356.00	0.000	102.024	9.289	-1.572	9.421	346.39	184.80
357.00	0.000	102.024	9.261	-1.565	9.393	347.41	184.80
358.00	0.000	102.024	9.234	-1.557	9.364	348.43	184.80
359.00	0.000	102.024	9.207	-1.549	9.336	349.45	184.80

MINIMUM STRESS (Pb,x') = 8.099 AT 69.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 8.099 AT 68.94 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:27:25

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H3 -- 8 Years of Crack Growth -- Upset Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.362 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 11 (AS FOLLOWS)

1	ANGLES:	0.0000	TO	84.7100	(DTHETA =	84.710)	DEPTH (IN) =	2.000
2	ANGLES:	84.7100	TO	93.4500	(DTHETA =	8.740)	DEPTH (IN) =	1.251
3	ANGLES:	97.2200	TO	120.0600	(DTHETA =	22.840)	DEPTH (IN) =	2.000
4	ANGLES:	123.0500	TO	126.4900	(DTHETA =	3.440)	DEPTH (IN) =	1.281
5	ANGLES:	126.4900	TO	207.0000	(DTHETA =	80.510)	DEPTH (IN) =	2.000
6	ANGLES:	207.0000	TO	210.5600	(DTHETA =	3.560)	DEPTH (IN) =	1.061
7	ANGLES:	210.5600	TO	263.6900	(DTHETA =	53.130)	DEPTH (IN) =	2.000
8	ANGLES:	263.6900	TO	292.1900	(DTHETA =	28.500)	DEPTH (IN) =	1.251
9	ANGLES:	292.1900	TO	301.0700	(DTHETA =	8.880)	DEPTH (IN) =	2.000
10	ANGLES:	301.0700	TO	304.9200	(DTHETA =	3.850)	DEPTH (IN) =	1.061
11	ANGLES:	304.9200	TO	360.0000	(DTHETA =	55.080)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1288.838

REMAINING DEGRADED SECTION AREA (IN2) = 91.01357

(APPROX. DEGRADED METAL AREA = 91.01311)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:18

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	100.608	4.962	-0.527	4.990	353.94	91.01
1.00	0.000	100.608	4.953	-0.520	4.980	355.00	91.01
2.00	0.000	100.608	4.944	-0.513	4.970	356.07	91.01
3.00	0.000	100.608	4.935	-0.506	4.961	357.14	91.01
4.00	0.000	100.608	4.926	-0.499	4.951	358.21	91.01
5.00	0.000	100.608	4.917	-0.492	4.942	359.29	91.01
6.00	0.000	100.608	4.909	-0.484	4.933	0.36	91.01
7.00	0.000	100.608	4.900	-0.477	4.923	1.44	91.01
8.00	0.000	100.608	4.892	-0.469	4.914	2.53	91.01
9.00	0.000	100.608	4.884	-0.461	4.906	3.61	91.01
10.00	0.000	100.608	4.876	-0.453	4.897	4.69	91.01
11.00	0.000	100.608	4.868	-0.445	4.888	5.78	91.01
12.00	0.000	100.608	4.860	-0.436	4.880	6.87	91.01
13.00	0.000	100.608	4.853	-0.428	4.872	7.96	91.01
14.00	0.000	100.608	4.846	-0.419	4.864	9.06	91.01
15.00	0.000	100.608	4.838	-0.410	4.856	10.15	91.01
16.00	0.000	100.622	4.831	-0.392	4.847	11.36	90.74
17.00	0.000	100.687	4.824	-0.366	4.838	12.66	89.38
18.00	0.000	100.751	4.818	-0.342	4.830	13.94	88.02
19.00	0.000	100.814	4.812	-0.319	4.823	15.21	86.65
20.00	0.000	100.876	4.807	-0.307	4.816	16.35	85.29
21.00	0.000	100.888	4.801	-0.295	4.811	17.48	85.03
22.00	0.000	100.888	4.796	-0.293	4.805	18.50	85.03
23.00	0.000	100.888	4.791	-0.290	4.800	19.53	85.03
24.00	0.000	100.888	4.786	-0.287	4.794	20.56	85.03
25.00	0.000	100.888	4.781	-0.284	4.789	21.59	85.03
26.00	0.000	100.888	4.776	-0.281	4.784	22.63	85.03
27.00	0.000	100.888	4.771	-0.278	4.779	23.66	85.03
28.00	0.000	100.888	4.766	-0.275	4.774	24.69	85.03
29.00	0.000	100.888	4.761	-0.272	4.769	25.73	85.03
30.00	0.000	100.888	4.756	-0.269	4.764	26.77	85.03
31.00	0.000	100.888	4.751	-0.265	4.759	27.80	85.03
32.00	0.000	100.888	4.747	-0.262	4.754	28.84	85.03
33.00	0.000	100.888	4.742	-0.258	4.749	29.88	85.03
34.00	0.000	100.888	4.737	-0.255	4.744	30.92	85.03
35.00	0.000	100.888	4.733	-0.251	4.740	31.96	85.03
36.00	0.000	100.888	4.728	-0.247	4.735	33.01	85.03
37.00	0.000	100.888	4.724	-0.243	4.730	34.05	85.03
38.00	0.000	100.849	4.720	-0.227	4.725	35.24	85.89
39.00	0.000	100.787	4.716	-0.206	4.720	36.50	87.25
40.00	0.000	100.723	4.712	-0.182	4.716	37.78	88.61
41.00	0.000	100.658	4.709	-0.157	4.712	39.09	89.97
42.00	0.000	100.608	4.707	-0.136	4.709	40.34	91.01
43.00	0.000	100.608	4.705	-0.125	4.706	41.47	91.01
44.00	0.000	100.608	4.702	-0.114	4.704	42.61	91.01
45.00	0.000	100.608	4.701	-0.103	4.702	43.74	91.01
46.00	0.000	100.608	4.699	-0.092	4.700	44.88	91.01
47.00	0.000	100.608	4.697	-0.080	4.698	46.02	91.01
48.00	0.000	100.608	4.696	-0.069	4.697	47.16	91.01
49.00	0.000	100.608	4.695	-0.058	4.695	48.29	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	100.608	4.694	-0.047	4.694	49.43	91.01
51.00	0.000	100.608	4.693	-0.035	4.693	50.57	91.01
52.00	0.000	100.608	4.693	-0.024	4.693	51.71	91.01
53.00	0.000	100.608	4.692	-0.012	4.693	52.85	91.01
54.00	0.000	100.608	4.692	-0.001	4.692	53.98	91.01
55.00	0.000	100.608	4.692	0.010	4.692	55.12	91.01
56.00	0.000	100.608	4.693	0.022	4.693	56.26	91.01
57.00	0.000	100.608	4.693	0.033	4.693	57.40	91.01
58.00	0.000	100.608	4.694	0.044	4.694	58.54	91.01
59.00	0.000	100.608	4.695	0.056	4.695	59.68	91.01
60.00	0.000	100.608	4.696	0.067	4.696	60.82	91.01
61.00	0.000	100.608	4.697	0.078	4.698	61.95	91.01
62.00	0.000	100.608	4.699	0.089	4.699	63.09	91.01
63.00	0.000	100.608	4.700	0.101	4.701	64.23	91.01
64.00	0.000	100.608	4.702	0.112	4.703	65.36	91.01
65.00	0.000	100.608	4.704	0.123	4.706	66.50	91.01
66.00	0.000	100.608	4.706	0.134	4.708	67.63	91.01
67.00	0.000	100.608	4.709	0.145	4.711	68.77	91.01
68.00	0.000	100.608	4.711	0.156	4.714	69.90	91.01
69.00	0.000	100.608	4.714	0.167	4.717	71.03	91.01
70.00	0.000	100.608	4.717	0.178	4.721	72.16	91.01
71.00	0.000	100.608	4.720	0.189	4.724	73.30	91.01
72.00	0.000	100.608	4.724	0.200	4.728	74.42	91.01
73.00	0.000	100.636	4.727	0.220	4.733	75.66	90.43
74.00	0.000	100.690	4.731	0.248	4.738	77.00	89.31
75.00	0.000	100.744	4.736	0.265	4.743	78.20	88.18
76.00	0.000	100.796	4.741	0.289	4.749	79.49	87.05
77.00	0.000	100.848	4.746	0.312	4.756	80.76	85.92
78.00	0.000	100.899	4.751	0.324	4.762	81.91	84.79
79.00	0.000	100.949	4.757	0.344	4.769	83.13	83.66
80.00	0.000	100.999	4.763	0.353	4.776	84.24	82.53
81.00	0.000	101.048	4.769	0.370	4.784	85.43	81.40
82.00	0.000	101.096	4.776	0.376	4.791	86.50	80.27
83.00	0.000	101.143	4.782	0.389	4.798	87.65	79.14
84.00	0.000	101.189	4.789	0.400	4.806	88.77	78.01
85.00	0.749	101.235	4.796	0.402	4.813	89.79	76.88
86.00	0.749	101.280	4.803	0.409	4.821	90.87	75.75
87.00	0.749	101.324	4.810	0.408	4.827	91.85	74.62
88.00	0.749	101.367	4.817	0.412	4.835	92.89	73.50
89.00	0.749	101.410	4.824	0.415	4.842	93.92	72.37
90.00	0.749	101.452	4.832	0.409	4.849	94.84	71.24
91.00	0.749	101.493	4.839	0.408	4.856	95.82	70.11
92.00	0.749	101.527	4.846	0.402	4.862	96.74	69.16
93.00	0.749	101.527	4.853	0.411	4.870	97.84	69.16
94.00	2.000	101.527	4.860	0.419	4.878	98.93	69.16
95.00	2.000	101.527	4.867	0.428	4.886	100.03	69.16
96.00	2.000	101.527	4.875	0.437	4.894	101.12	69.16
97.00	2.000	101.527	4.882	0.445	4.903	102.21	69.16
98.00	0.000	101.527	4.890	0.453	4.911	103.29	69.16
99.00	0.000	101.527	4.898	0.461	4.920	104.38	69.16

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	101.527	4.906	0.469	4.929	105.46	69.16
101.00	0.000	101.527	4.914	0.477	4.938	106.55	69.16
102.00	0.000	101.527	4.923	0.485	4.947	107.62	69.16
103.00	0.000	101.527	4.931	0.492	4.956	108.70	69.16
104.00	0.000	101.526	4.940	0.500	4.965	109.78	69.16
105.00	0.000	101.488	4.949	0.489	4.973	110.64	70.24
106.00	0.000	101.447	4.957	0.489	4.981	111.63	71.37
107.00	0.000	101.405	4.965	0.481	4.989	112.53	72.50
108.00	0.000	101.362	4.974	0.484	4.997	113.56	73.63
109.00	0.000	101.319	4.982	0.478	5.005	114.48	74.76
110.00	0.000	101.274	4.991	0.484	5.014	115.54	75.89
111.00	0.000	101.229	4.999	0.481	5.022	116.50	77.02
112.00	0.000	101.200	5.007	0.490	5.031	117.59	77.75
113.00	0.000	101.209	5.016	0.510	5.042	118.80	77.51
114.00	0.000	101.219	5.025	0.539	5.054	120.13	77.27
115.00	0.000	101.229	5.035	0.558	5.065	121.32	77.03
116.00	0.000	101.221	5.044	0.576	5.077	122.51	77.21
117.00	0.000	101.176	5.054	0.574	5.087	123.47	78.34
118.00	0.000	101.129	5.064	0.583	5.098	124.57	79.47
119.00	0.000	101.082	5.075	0.584	5.108	125.56	80.60
120.00	0.000	101.033	5.085	0.585	5.118	126.56	81.73
121.00	2.000	100.984	5.095	0.599	5.130	127.71	82.86
122.00	2.000	100.935	5.106	0.603	5.141	128.74	83.99
123.00	2.000	100.910	5.116	0.615	5.153	129.86	84.54
124.00	0.719	100.910	5.127	0.612	5.163	130.81	84.54
125.00	0.719	100.910	5.137	0.608	5.173	131.75	84.54
126.00	0.719	100.910	5.148	0.604	5.183	132.69	84.54
127.00	0.000	100.910	5.158	0.600	5.193	133.64	84.54
128.00	0.000	100.910	5.168	0.596	5.203	134.58	84.54
129.00	0.000	100.910	5.178	0.591	5.212	135.51	84.54
130.00	0.000	100.910	5.189	0.587	5.222	136.45	84.54
131.00	0.000	100.910	5.199	0.582	5.231	137.39	84.54
132.00	0.000	100.871	5.209	0.577	5.241	138.32	85.40
133.00	0.000	100.809	5.219	0.589	5.252	139.44	86.76
134.00	0.000	100.746	5.229	0.616	5.266	140.72	88.12
135.00	0.000	100.682	5.240	0.631	5.278	141.87	89.48
136.00	0.000	100.616	5.251	0.648	5.291	143.04	90.85
137.00	0.000	100.608	5.262	0.646	5.302	144.00	91.01
138.00	0.000	100.608	5.274	0.647	5.313	145.00	91.01
139.00	0.000	100.608	5.285	0.648	5.325	145.99	91.01
140.00	0.000	100.608	5.296	0.649	5.336	146.99	91.01
141.00	0.000	100.608	5.308	0.650	5.347	147.98	91.01
142.00	0.000	100.608	5.319	0.650	5.359	148.97	91.01
143.00	0.000	100.608	5.330	0.651	5.370	149.96	91.01
144.00	0.000	100.608	5.342	0.651	5.381	150.95	91.01
145.00	0.000	100.608	5.353	0.651	5.392	151.93	91.01
146.00	0.000	100.608	5.364	0.651	5.404	152.92	91.01
147.00	0.000	100.608	5.376	0.650	5.415	153.90	91.01
148.00	0.000	100.608	5.387	0.649	5.426	154.87	91.01
149.00	0.000	100.608	5.398	0.649	5.437	155.85	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	100.608	5.410	0.648	5.448	156.83	91.01
151.00	0.000	100.608	5.421	0.646	5.459	157.80	91.01
152.00	0.000	100.608	5.432	0.645	5.470	158.77	91.01
153.00	0.000	100.608	5.444	0.643	5.481	159.74	91.01
154.00	0.000	100.608	5.455	0.641	5.492	160.71	91.01
155.00	0.000	100.608	5.466	0.639	5.503	161.67	91.01
156.00	0.000	100.608	5.477	0.637	5.514	162.63	91.01
157.00	0.000	100.608	5.488	0.635	5.525	163.60	91.01
158.00	0.000	100.608	5.499	0.632	5.535	164.56	91.01
159.00	0.000	100.608	5.510	0.629	5.546	165.51	91.01
160.00	0.000	100.608	5.521	0.626	5.556	166.47	91.01
161.00	0.000	100.608	5.532	0.623	5.567	167.42	91.01
162.00	0.000	100.608	5.543	0.620	5.577	168.38	91.01
163.00	0.000	100.608	5.554	0.616	5.588	169.33	91.01
164.00	0.000	100.608	5.564	0.612	5.598	170.28	91.01
165.00	0.000	100.608	5.575	0.608	5.608	171.23	91.01
166.00	0.000	100.608	5.586	0.604	5.618	172.17	91.01
167.00	0.000	100.608	5.596	0.600	5.628	173.12	91.01
168.00	0.000	100.608	5.606	0.595	5.638	174.06	91.01
169.00	0.000	100.608	5.617	0.591	5.648	175.00	91.01
170.00	0.000	100.608	5.627	0.586	5.657	175.94	91.01
171.00	0.000	100.608	5.637	0.581	5.667	176.88	91.01
172.00	0.000	100.608	5.647	0.575	5.677	177.82	91.01
173.00	0.000	100.608	5.657	0.570	5.686	178.75	91.01
174.00	0.000	100.608	5.667	0.564	5.695	179.69	91.01
175.00	0.000	100.608	5.677	0.559	5.704	180.62	91.01
176.00	0.000	100.608	5.687	0.553	5.714	181.55	91.01
177.00	0.000	100.608	5.696	0.547	5.722	182.48	91.01
178.00	0.000	100.608	5.706	0.540	5.731	183.41	91.01
179.00	0.000	100.608	5.715	0.534	5.740	184.34	91.01
180.00	0.000	100.608	5.724	0.527	5.749	185.26	91.01
181.00	0.000	100.608	5.734	0.521	5.757	186.19	91.01
182.00	0.000	100.608	5.743	0.514	5.766	187.11	91.01
183.00	0.000	100.608	5.752	0.507	5.774	188.04	91.01
184.00	0.000	100.608	5.760	0.500	5.782	188.96	91.01
185.00	0.000	100.608	5.769	0.492	5.790	189.88	91.01
186.00	0.000	100.608	5.777	0.485	5.798	190.80	91.01
187.00	0.000	100.608	5.786	0.477	5.805	191.71	91.01
188.00	0.000	100.608	5.794	0.469	5.813	192.63	91.01
189.00	0.000	100.608	5.802	0.461	5.821	193.55	91.01
190.00	0.000	100.608	5.810	0.453	5.828	194.46	91.01
191.00	0.000	100.608	5.818	0.445	5.835	195.37	91.01
192.00	0.000	100.608	5.826	0.437	5.842	196.29	91.01
193.00	0.000	100.608	5.833	0.428	5.849	197.20	91.01
194.00	0.000	100.608	5.841	0.420	5.856	198.11	91.01
195.00	0.000	100.608	5.848	0.411	5.862	199.02	91.01
196.00	0.000	100.608	5.855	0.402	5.869	199.93	91.01
197.00	0.000	100.608	5.862	0.393	5.875	200.83	91.01
198.00	0.000	100.608	5.869	0.384	5.881	201.74	91.01
199.00	0.000	100.608	5.875	0.375	5.887	202.65	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	0.000	100.608	5.882	0.365	5.893	203.55	91.01
201.00	0.000	100.608	5.888	0.356	5.899	204.46	91.01
202.00	0.000	100.608	5.894	0.346	5.904	205.36	91.01
203.00	0.000	100.608	5.900	0.337	5.910	206.26	91.01
204.00	0.000	100.608	5.906	0.327	5.915	207.17	91.01
205.00	0.000	100.608	5.912	0.317	5.920	208.07	91.01
206.00	0.000	100.608	5.917	0.307	5.925	208.97	91.01
207.00	0.470	100.608	5.922	0.297	5.930	209.87	91.01
208.00	0.939	100.608	5.927	0.287	5.934	210.77	91.01
209.00	0.939	100.608	5.932	0.276	5.939	211.67	91.01
210.00	0.939	100.608	5.937	0.266	5.943	212.57	91.01
211.00	0.000	100.608	5.942	0.256	5.947	213.46	91.01
212.00	0.000	100.608	5.946	0.245	5.951	214.36	91.01
213.00	0.000	100.608	5.950	0.235	5.955	215.26	91.01
214.00	0.000	100.608	5.954	0.224	5.958	216.16	91.01
215.00	0.000	100.608	5.958	0.213	5.962	217.05	91.01
216.00	0.000	100.608	5.962	0.203	5.965	217.95	91.01
217.00	0.000	100.608	5.965	0.192	5.968	218.84	91.01
218.00	0.000	100.608	5.968	0.181	5.971	219.74	91.01
219.00	0.000	100.608	5.971	0.170	5.974	220.63	91.01
220.00	0.000	100.608	5.974	0.159	5.976	221.52	91.01
221.00	0.000	100.608	5.977	0.148	5.979	222.42	91.01
222.00	0.000	100.608	5.979	0.137	5.981	223.31	91.01
223.00	0.000	100.608	5.982	0.126	5.983	224.20	91.01
224.00	0.000	100.608	5.984	0.115	5.985	225.10	91.01
225.00	0.000	100.608	5.986	0.103	5.986	225.99	91.01
226.00	0.000	100.608	5.987	0.092	5.988	226.88	91.01
227.00	0.000	100.608	5.989	0.081	5.989	227.77	91.01
228.00	0.000	100.608	5.990	0.070	5.990	228.67	91.01
229.00	0.000	100.608	5.991	0.058	5.991	229.56	91.01
230.00	0.000	100.608	5.992	0.047	5.992	230.45	91.01
231.00	0.000	100.608	5.993	0.036	5.993	231.34	91.01
232.00	0.000	100.608	5.993	0.024	5.993	232.23	91.01
233.00	0.000	100.608	5.994	0.013	5.994	233.12	91.01
234.00	0.000	100.608	5.994	0.002	5.994	234.02	91.01
235.00	0.000	100.608	5.994	-0.010	5.994	234.91	91.01
236.00	0.000	100.608	5.993	-0.021	5.993	235.80	91.01
237.00	0.000	100.608	5.993	-0.032	5.993	236.69	91.01
238.00	0.000	100.608	5.992	-0.044	5.992	237.58	91.01
239.00	0.000	100.608	5.991	-0.055	5.992	238.47	91.01
240.00	0.000	100.608	5.990	-0.066	5.991	239.36	91.01
241.00	0.000	100.608	5.989	-0.078	5.990	240.26	91.01
242.00	0.000	100.608	5.988	-0.089	5.988	241.15	91.01
243.00	0.000	100.608	5.986	-0.100	5.987	242.04	91.01
244.00	0.000	100.608	5.984	-0.111	5.985	242.93	91.01
245.00	0.000	100.608	5.982	-0.123	5.983	243.82	91.01
246.00	0.000	100.608	5.980	-0.134	5.981	244.72	91.01
247.00	0.000	100.608	5.977	-0.145	5.979	245.61	91.01
248.00	0.000	100.608	5.975	-0.156	5.977	246.50	91.01
249.00	0.000	100.608	5.972	-0.167	5.974	247.40	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	100.608	5.969	-0.178	5.972	248.29	91.01
251.00	0.000	100.608	5.966	-0.189	5.969	249.19	91.01
252.00	0.000	100.608	5.962	-0.200	5.966	250.08	91.01
253.00	0.000	100.608	5.959	-0.210	5.962	250.98	91.01
254.00	0.000	100.635	5.955	-0.212	5.959	251.96	90.46
255.00	0.000	100.689	5.951	-0.205	5.955	253.02	89.33
256.00	0.000	100.743	5.948	-0.210	5.951	253.98	88.20
257.00	0.000	100.795	5.944	-0.206	5.948	255.01	87.07
258.00	0.000	100.847	5.940	-0.204	5.944	256.03	85.94
259.00	0.000	100.898	5.937	-0.213	5.940	256.95	84.81
260.00	0.000	100.948	5.933	-0.214	5.937	257.94	83.68
261.00	0.000	100.998	5.929	-0.225	5.933	258.83	82.55
262.00	0.000	101.047	5.925	-0.229	5.929	259.79	81.42
263.00	0.000	101.095	5.921	-0.242	5.926	260.65	80.29
264.00	0.749	101.148	5.916	-0.249	5.922	261.58	79.02
265.00	0.749	101.245	5.912	-0.244	5.917	262.64	76.63
266.00	0.749	101.338	5.908	-0.249	5.913	263.59	74.24
267.00	0.749	101.429	5.903	-0.258	5.909	264.50	71.86
268.00	0.749	101.515	5.898	-0.263	5.904	265.44	69.47
269.00	0.749	101.599	5.894	-0.279	5.900	266.29	67.08
270.00	0.749	101.642	5.889	-0.305	5.896	267.04	65.80
271.00	0.749	101.642	5.883	-0.343	5.893	267.66	65.80
272.00	0.749	101.642	5.876	-0.382	5.889	268.28	65.80
273.00	0.749	101.619	5.869	-0.414	5.884	268.96	66.49
274.00	0.749	101.581	5.862	-0.445	5.879	269.66	67.62
275.00	0.749	101.541	5.854	-0.464	5.872	270.47	68.74
276.00	0.749	101.501	5.845	-0.491	5.866	271.20	69.87
277.00	0.749	101.460	5.837	-0.516	5.859	271.94	71.00
278.00	0.749	101.418	5.827	-0.531	5.852	272.80	72.13
279.00	0.749	101.376	5.818	-0.553	5.844	273.57	73.26
280.00	0.749	101.333	5.808	-0.563	5.835	274.46	74.39
281.00	0.749	101.289	5.798	-0.582	5.827	275.26	75.52
282.00	0.749	101.244	5.788	-0.589	5.818	276.18	76.65
283.00	0.749	101.187	5.777	-0.598	5.808	277.09	78.07
284.00	0.749	101.088	5.767	-0.603	5.798	278.03	80.46
285.00	0.749	100.985	5.756	-0.588	5.786	279.17	82.84
286.00	0.749	100.879	5.746	-0.569	5.774	280.35	85.23
287.00	0.749	100.770	5.736	-0.563	5.764	281.39	87.62
288.00	0.749	100.657	5.727	-0.536	5.752	282.65	90.00
289.00	0.749	100.625	5.717	-0.523	5.741	283.77	90.67
290.00	0.749	100.739	5.708	-0.504	5.731	284.96	88.29
291.00	0.749	100.849	5.700	-0.479	5.720	286.19	85.90
292.00	0.749	100.956	5.691	-0.467	5.711	287.31	83.51
293.00	0.000	101.059	5.683	-0.458	5.702	288.39	81.13
294.00	0.000	101.124	5.675	-0.460	5.694	289.36	79.59
295.00	0.000	101.169	5.667	-0.464	5.686	290.32	78.50
296.00	0.000	101.214	5.659	-0.477	5.679	291.18	77.41
297.00	0.000	101.257	5.651	-0.483	5.671	292.11	76.32
298.00	0.000	101.275	5.642	-0.498	5.664	292.95	75.88
299.00	0.000	101.275	5.633	-0.521	5.657	293.72	75.88

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:28:19

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	101.275	5.624	-0.543	5.650	294.48	75.88
301.00	0.000	101.275	5.614	-0.565	5.642	295.25	75.88
302.00	0.939	101.275	5.604	-0.587	5.634	296.02	75.88
303.00	0.939	101.275	5.593	-0.609	5.626	296.78	75.88
304.00	0.939	101.275	5.582	-0.631	5.618	297.55	75.88
305.00	0.000	101.275	5.571	-0.652	5.609	298.32	75.88
306.00	0.000	101.275	5.559	-0.674	5.600	299.09	75.88
307.00	0.000	101.275	5.547	-0.695	5.590	299.86	75.88
308.00	0.000	101.275	5.535	-0.716	5.581	300.63	75.88
309.00	0.000	101.275	5.522	-0.736	5.571	301.40	75.88
310.00	0.000	101.193	5.509	-0.737	5.558	302.38	77.91
311.00	0.000	101.094	5.496	-0.738	5.545	303.35	80.30
312.00	0.000	100.992	5.483	-0.718	5.530	304.53	82.69
313.00	0.000	100.886	5.471	-0.695	5.515	305.76	85.07
314.00	0.000	100.799	5.459	-0.682	5.501	306.88	86.99
315.00	0.000	100.748	5.447	-0.667	5.488	308.01	88.08
316.00	0.000	100.697	5.435	-0.664	5.476	309.03	89.17
317.00	0.000	100.645	5.424	-0.646	5.462	310.20	90.26
318.00	0.000	100.608	5.412	-0.647	5.451	311.18	91.01
319.00	0.000	100.608	5.401	-0.648	5.440	312.16	91.01
320.00	0.000	100.608	5.390	-0.649	5.429	313.14	91.01
321.00	0.000	100.608	5.379	-0.649	5.418	314.11	91.01
322.00	0.000	100.608	5.367	-0.650	5.406	315.09	91.01
323.00	0.000	100.608	5.356	-0.650	5.395	316.08	91.01
324.00	0.000	100.608	5.344	-0.650	5.384	317.06	91.01
325.00	0.000	100.608	5.333	-0.650	5.373	318.05	91.01
326.00	0.000	100.608	5.322	-0.650	5.361	319.03	91.01
327.00	0.000	100.608	5.310	-0.650	5.350	320.02	91.01
328.00	0.000	100.608	5.299	-0.649	5.339	321.02	91.01
329.00	0.000	100.608	5.288	-0.648	5.327	322.01	91.01
330.00	0.000	100.608	5.276	-0.647	5.316	323.01	91.01
331.00	0.000	100.608	5.265	-0.646	5.305	324.01	91.01
332.00	0.000	100.608	5.254	-0.644	5.293	325.01	91.01
333.00	0.000	100.608	5.243	-0.643	5.282	326.01	91.01
334.00	0.000	100.608	5.231	-0.641	5.271	327.02	91.01
335.00	0.000	100.608	5.220	-0.639	5.259	328.02	91.01
336.00	0.000	100.608	5.209	-0.637	5.248	329.03	91.01
337.00	0.000	100.608	5.198	-0.634	5.237	330.04	91.01
338.00	0.000	100.608	5.187	-0.631	5.225	331.06	91.01
339.00	0.000	100.608	5.176	-0.629	5.214	332.07	91.01
340.00	0.000	100.608	5.165	-0.626	5.203	333.09	91.01
341.00	0.000	100.608	5.154	-0.622	5.192	334.11	91.01
342.00	0.000	100.608	5.143	-0.619	5.180	335.14	91.01
343.00	0.000	100.608	5.133	-0.615	5.169	336.16	91.01
344.00	0.000	100.608	5.122	-0.612	5.158	337.19	91.01
345.00	0.000	100.608	5.111	-0.608	5.147	338.22	91.01
346.00	0.000	100.608	5.101	-0.604	5.136	339.25	91.01
347.00	0.000	100.608	5.090	-0.599	5.125	340.28	91.01
348.00	0.000	100.608	5.080	-0.595	5.114	341.32	91.01
349.00	0.000	100.608	5.069	-0.590	5.104	342.36	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)
08-27-2000 10:28:19
Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	100.608	5.059	-0.585	5.093	343.40	91.01
351.00	0.000	100.608	5.049	-0.580	5.082	344.44	91.01
352.00	0.000	100.608	5.039	-0.575	5.072	345.49	91.01
353.00	0.000	100.608	5.029	-0.570	5.061	346.54	91.01
354.00	0.000	100.608	5.019	-0.564	5.051	347.59	91.01
355.00	0.000	100.608	5.009	-0.558	5.040	348.64	91.01
356.00	0.000	100.608	4.999	-0.552	5.030	349.69	91.01
357.00	0.000	100.608	4.990	-0.546	5.020	350.75	91.01
358.00	0.000	100.608	4.980	-0.540	5.010	351.81	91.01
359.00	0.000	100.608	4.971	-0.534	5.000	352.87	91.01

MINIMUM STRESS (Pb,x') = 4.692 AT 54.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 4.692 AT 53.98 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:38:27

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H3 -- 8 Years of Crack Growth -- Faulted Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.937 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 11 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	84.7100	(DTHETA =	84.710)	DEPTH (IN) =	2.000
2 ANGLES:	84.7100 TO	93.4500	(DTHETA =	8.740)	DEPTH (IN) =	1.251
3 ANGLES:	97.2200 TO	120.0600	(DTHETA =	22.840)	DEPTH (IN) =	2.000
4 ANGLES:	123.0500 TO	126.4900	(DTHETA =	3.440)	DEPTH (IN) =	1.281
5 ANGLES:	126.4900 TO	207.0000	(DTHETA =	80.510)	DEPTH (IN) =	2.000
6 ANGLES:	207.0000 TO	210.5600	(DTHETA =	3.560)	DEPTH (IN) =	1.061
7 ANGLES:	210.5600 TO	263.6900	(DTHETA =	53.130)	DEPTH (IN) =	2.000
8 ANGLES:	263.6900 TO	292.1900	(DTHETA =	28.500)	DEPTH (IN) =	1.251
9 ANGLES:	292.1900 TO	301.0700	(DTHETA =	8.880)	DEPTH (IN) =	2.000
10 ANGLES:	301.0700 TO	304.9200	(DTHETA =	3.850)	DEPTH (IN) =	1.061
11 ANGLES:	304.9200 TO	360.0000	(DTHETA =	55.080)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1288.838

REMAINING DEGRADED SECTION AREA (IN2) = 91.01357

(APPROX. DEGRADED METAL AREA = 91.01311)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	101.353	3.829	-0.527	3.865	352.17	91.01
1.00	0.000	101.353	3.820	-0.520	3.855	353.25	91.01
2.00	0.000	101.353	3.811	-0.513	3.846	354.33	91.01
3.00	0.000	101.353	3.802	-0.506	3.836	355.42	91.01
4.00	0.000	101.353	3.793	-0.499	3.826	356.51	91.01
5.00	0.000	101.353	3.785	-0.491	3.817	357.60	91.01
6.00	0.000	101.353	3.776	-0.484	3.807	358.70	91.01
7.00	0.000	101.353	3.768	-0.476	3.798	359.79	91.01
8.00	0.000	101.353	3.760	-0.469	3.789	0.90	91.01
9.00	0.000	101.353	3.752	-0.461	3.780	2.00	91.01
10.00	0.000	101.353	3.744	-0.452	3.771	3.11	91.01
11.00	0.000	101.353	3.736	-0.444	3.762	4.22	91.01
12.00	0.000	101.353	3.728	-0.436	3.753	5.33	91.01
13.00	0.000	101.353	3.720	-0.427	3.745	6.45	91.01
14.00	0.000	101.353	3.713	-0.419	3.737	7.56	91.01
15.00	0.000	101.353	3.706	-0.410	3.728	8.68	91.01
16.00	0.000	101.353	3.699	-0.401	3.720	9.81	91.01
17.00	0.000	101.353	3.692	-0.392	3.713	10.93	91.01
18.00	0.000	101.353	3.685	-0.383	3.705	12.06	91.01
19.00	0.000	101.395	3.678	-0.360	3.696	13.41	89.92
20.00	0.000	101.446	3.672	-0.338	3.688	14.73	88.55
21.00	0.000	101.495	3.667	-0.319	3.680	16.03	87.19
22.00	0.000	101.544	3.661	-0.301	3.673	17.30	85.83
23.00	0.000	101.572	3.656	-0.291	3.667	18.44	85.03
24.00	0.000	101.572	3.651	-0.288	3.662	19.48	85.03
25.00	0.000	101.572	3.646	-0.285	3.657	20.52	85.03
26.00	0.000	101.572	3.641	-0.283	3.651	21.56	85.03
27.00	0.000	101.572	3.636	-0.279	3.646	22.60	85.03
28.00	0.000	101.572	3.631	-0.276	3.641	23.65	85.03
29.00	0.000	101.572	3.626	-0.273	3.636	24.69	85.03
30.00	0.000	101.572	3.621	-0.270	3.631	25.74	85.03
31.00	0.000	101.572	3.616	-0.266	3.626	26.79	85.03
32.00	0.000	101.572	3.611	-0.263	3.621	27.84	85.03
33.00	0.000	101.572	3.607	-0.259	3.616	28.89	85.03
34.00	0.000	101.572	3.602	-0.256	3.611	29.94	85.03
35.00	0.000	101.570	3.598	-0.252	3.607	30.99	85.07
36.00	0.000	101.522	3.593	-0.235	3.601	32.25	86.43
37.00	0.000	101.474	3.589	-0.217	3.596	33.54	87.79
38.00	0.000	101.423	3.586	-0.196	3.591	34.86	89.15
39.00	0.000	101.372	3.582	-0.174	3.587	36.21	90.51
40.00	0.000	101.353	3.580	-0.158	3.583	37.47	91.01
41.00	0.000	101.353	3.577	-0.147	3.580	38.64	91.01
42.00	0.000	101.353	3.574	-0.136	3.577	39.82	91.01
43.00	0.000	101.353	3.572	-0.125	3.574	40.99	91.01
44.00	0.000	101.353	3.570	-0.114	3.572	42.17	91.01
45.00	0.000	101.353	3.568	-0.103	3.570	43.35	91.01
46.00	0.000	101.353	3.566	-0.091	3.568	44.53	91.01
47.00	0.000	101.353	3.565	-0.080	3.566	45.71	91.01
48.00	0.000	101.353	3.564	-0.069	3.564	46.89	91.01
49.00	0.000	101.353	3.563	-0.058	3.563	48.07	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	101.353	3.562	-0.046	3.562	49.25	91.01
51.00	0.000	101.353	3.561	-0.035	3.561	50.44	91.01
52.00	0.000	101.353	3.560	-0.024	3.560	51.62	91.01
53.00	0.000	101.353	3.560	-0.012	3.560	52.80	91.01
54.00	0.000	101.353	3.560	-0.001	3.560	53.98	91.01
55.00	0.000	101.353	3.560	0.010	3.560	55.17	91.01
56.00	0.000	101.353	3.560	0.022	3.560	56.35	91.01
57.00	0.000	101.353	3.561	0.033	3.561	57.53	91.01
58.00	0.000	101.353	3.561	0.045	3.562	58.72	91.01
59.00	0.000	101.353	3.562	0.056	3.563	59.90	91.01
60.00	0.000	101.353	3.563	0.067	3.564	61.08	91.01
61.00	0.000	101.353	3.565	0.078	3.566	62.26	91.01
62.00	0.000	101.353	3.566	0.090	3.567	63.44	91.01
63.00	0.000	101.353	3.568	0.101	3.569	64.62	91.01
64.00	0.000	101.353	3.570	0.112	3.571	65.80	91.01
65.00	0.000	101.353	3.572	0.123	3.574	66.98	91.01
66.00	0.000	101.353	3.574	0.134	3.576	68.15	91.01
67.00	0.000	101.353	3.576	0.146	3.579	69.33	91.01
68.00	0.000	101.353	3.579	0.157	3.582	70.51	91.01
69.00	0.000	101.353	3.582	0.168	3.586	71.68	91.01
70.00	0.000	101.353	3.585	0.179	3.589	72.85	91.01
71.00	0.000	101.353	3.588	0.189	3.593	74.02	91.01
72.00	0.000	101.353	3.591	0.200	3.597	75.19	91.01
73.00	0.000	101.353	3.595	0.211	3.601	76.36	91.01
74.00	0.000	101.353	3.599	0.222	3.606	77.53	91.01
75.00	0.000	101.358	3.603	0.240	3.611	78.81	90.88
76.00	0.000	101.401	3.607	0.257	3.616	80.07	89.75
77.00	0.000	101.443	3.612	0.279	3.622	81.42	88.62
78.00	0.000	101.484	3.616	0.293	3.628	82.64	87.49
79.00	0.000	101.525	3.622	0.313	3.635	83.93	86.36
80.00	0.000	101.564	3.627	0.330	3.642	85.20	85.23
81.00	0.000	101.603	3.633	0.339	3.649	86.34	84.11
82.00	0.000	101.641	3.639	0.354	3.656	87.55	82.98
83.00	0.000	101.679	3.645	0.360	3.663	88.64	81.85
84.00	0.000	101.715	3.652	0.371	3.670	89.80	80.72
85.00	0.749	101.751	3.658	0.374	3.677	90.84	79.59
86.00	0.749	101.786	3.665	0.382	3.684	91.94	78.46
87.00	0.749	101.821	3.671	0.387	3.692	93.02	77.33
88.00	0.749	101.854	3.678	0.386	3.698	93.99	76.20
89.00	0.749	101.887	3.685	0.388	3.705	95.02	75.07
90.00	0.749	101.919	3.691	0.384	3.711	95.93	73.94
91.00	0.749	101.922	3.698	0.389	3.718	97.01	73.83
92.00	0.749	101.922	3.705	0.398	3.726	98.13	73.83
93.00	0.749	101.922	3.712	0.407	3.734	99.26	73.83
94.00	2.000	101.922	3.719	0.416	3.742	100.38	73.83
95.00	2.000	101.922	3.727	0.424	3.751	101.50	73.83
96.00	2.000	101.922	3.734	0.433	3.759	102.61	73.83
97.00	2.000	101.922	3.742	0.441	3.768	103.73	73.83
98.00	0.000	101.922	3.749	0.450	3.776	104.84	73.83
99.00	0.000	101.922	3.757	0.458	3.785	105.94	73.83

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	101.922	3.766	0.466	3.794	107.05	73.83
101.00	0.000	101.922	3.774	0.473	3.803	108.15	73.83
102.00	0.000	101.922	3.782	0.481	3.813	109.25	73.83
103.00	0.000	101.922	3.791	0.489	3.822	110.35	73.83
104.00	0.000	101.922	3.799	0.496	3.831	111.44	73.83
105.00	0.000	101.922	3.808	0.503	3.841	112.53	73.83
106.00	0.000	101.915	3.817	0.510	3.851	113.62	74.08
107.00	0.000	101.883	3.826	0.511	3.860	114.61	75.21
108.00	0.000	101.850	3.834	0.506	3.868	115.52	76.34
109.00	0.000	101.817	3.843	0.502	3.876	116.44	77.47
110.00	0.000	101.782	3.852	0.507	3.885	117.50	78.60
111.00	0.000	101.747	3.861	0.505	3.894	118.46	79.72
112.00	0.000	101.711	3.870	0.513	3.904	119.56	80.85
113.00	0.000	101.674	3.879	0.515	3.913	120.56	81.98
114.00	0.000	101.662	3.888	0.534	3.924	121.82	82.36
115.00	0.000	101.670	3.897	0.553	3.936	123.08	82.12
116.00	0.000	101.678	3.907	0.572	3.948	124.33	81.89
117.00	0.000	101.685	3.917	0.598	3.962	125.68	81.65
118.00	0.000	101.668	3.927	0.607	3.974	126.79	82.18
119.00	0.000	101.630	3.938	0.609	3.985	127.79	83.31
120.00	0.000	101.592	3.949	0.621	3.997	128.94	84.44
121.00	2.000	101.588	3.959	0.614	4.007	129.81	84.54
122.00	2.000	101.588	3.970	0.611	4.017	130.74	84.54
123.00	2.000	101.588	3.981	0.607	4.027	131.67	84.54
124.00	0.719	101.588	3.991	0.604	4.037	132.60	84.54
125.00	0.719	101.588	4.002	0.600	4.046	133.52	84.54
126.00	0.719	101.588	4.012	0.596	4.056	134.45	84.54
127.00	0.000	101.588	4.023	0.592	4.066	135.37	84.54
128.00	0.000	101.588	4.033	0.587	4.075	136.29	84.54
129.00	0.000	101.587	4.043	0.583	4.085	137.21	84.59
130.00	0.000	101.540	4.053	0.599	4.097	138.40	85.94
131.00	0.000	101.491	4.064	0.608	4.109	139.51	87.30
132.00	0.000	101.442	4.074	0.620	4.121	140.65	88.66
133.00	0.000	101.391	4.085	0.633	4.134	141.80	90.02
134.00	0.000	101.353	4.096	0.641	4.146	142.89	91.01
135.00	0.000	101.353	4.107	0.643	4.158	143.90	91.01
136.00	0.000	101.353	4.119	0.645	4.169	144.90	91.01
137.00	0.000	101.353	4.130	0.646	4.180	145.89	91.01
138.00	0.000	101.353	4.141	0.647	4.192	146.89	91.01
139.00	0.000	101.353	4.153	0.649	4.203	147.88	91.01
140.00	0.000	101.353	4.164	0.650	4.214	148.87	91.01
141.00	0.000	101.353	4.175	0.650	4.226	149.85	91.01
142.00	0.000	101.353	4.187	0.651	4.237	150.84	91.01
143.00	0.000	101.353	4.198	0.651	4.248	151.82	91.01
144.00	0.000	101.353	4.209	0.651	4.259	152.79	91.01
145.00	0.000	101.353	4.221	0.651	4.271	153.77	91.01
146.00	0.000	101.353	4.232	0.651	4.282	154.74	91.01
147.00	0.000	101.353	4.243	0.650	4.293	155.71	91.01
148.00	0.000	101.353	4.255	0.650	4.304	156.68	91.01
149.00	0.000	101.353	4.266	0.649	4.315	157.65	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	101.353	4.277	0.648	4.326	158.61	91.01
151.00	0.000	101.353	4.289	0.647	4.337	159.57	91.01
152.00	0.000	101.353	4.300	0.645	4.348	160.53	91.01
153.00	0.000	101.353	4.311	0.643	4.359	161.49	91.01
154.00	0.000	101.353	4.322	0.642	4.370	162.44	91.01
155.00	0.000	101.353	4.333	0.640	4.380	163.39	91.01
156.00	0.000	101.353	4.345	0.637	4.391	164.34	91.01
157.00	0.000	101.353	4.356	0.635	4.402	165.29	91.01
158.00	0.000	101.353	4.367	0.632	4.412	166.24	91.01
159.00	0.000	101.353	4.378	0.629	4.423	167.18	91.01
160.00	0.000	101.353	4.389	0.626	4.433	168.12	91.01
161.00	0.000	101.353	4.400	0.623	4.443	169.06	91.01
162.00	0.000	101.353	4.410	0.620	4.454	170.00	91.01
163.00	0.000	101.353	4.421	0.616	4.464	170.93	91.01
164.00	0.000	101.353	4.432	0.612	4.474	171.87	91.01
165.00	0.000	101.353	4.443	0.608	4.484	172.80	91.01
166.00	0.000	101.353	4.453	0.604	4.494	173.73	91.01
167.00	0.000	101.353	4.464	0.600	4.504	174.66	91.01
168.00	0.000	101.353	4.474	0.595	4.513	175.58	91.01
169.00	0.000	101.353	4.484	0.591	4.523	176.51	91.01
170.00	0.000	101.353	4.495	0.586	4.533	177.43	91.01
171.00	0.000	101.353	4.505	0.581	4.542	178.35	91.01
172.00	0.000	101.353	4.515	0.576	4.551	179.27	91.01
173.00	0.000	101.353	4.525	0.570	4.561	180.18	91.01
174.00	0.000	101.353	4.535	0.565	4.570	181.10	91.01
175.00	0.000	101.353	4.545	0.559	4.579	182.01	91.01
176.00	0.000	101.353	4.554	0.553	4.588	182.92	91.01
177.00	0.000	101.353	4.564	0.547	4.597	183.83	91.01
178.00	0.000	101.353	4.573	0.541	4.605	184.74	91.01
179.00	0.000	101.353	4.583	0.534	4.614	185.65	91.01
180.00	0.000	101.353	4.592	0.528	4.622	186.56	91.01
181.00	0.000	101.353	4.601	0.521	4.631	187.46	91.01
182.00	0.000	101.353	4.610	0.514	4.639	188.36	91.01
183.00	0.000	101.353	4.619	0.507	4.647	189.26	91.01
184.00	0.000	101.353	4.628	0.500	4.655	190.16	91.01
185.00	0.000	101.353	4.637	0.492	4.663	191.06	91.01
186.00	0.000	101.353	4.645	0.485	4.670	191.96	91.01
187.00	0.000	101.353	4.653	0.477	4.678	192.86	91.01
188.00	0.000	101.353	4.662	0.470	4.685	193.75	91.01
189.00	0.000	101.353	4.670	0.462	4.693	194.65	91.01
190.00	0.000	101.353	4.678	0.453	4.700	195.54	91.01
191.00	0.000	101.353	4.686	0.445	4.707	196.43	91.01
192.00	0.000	101.353	4.693	0.437	4.714	197.32	91.01
193.00	0.000	101.353	4.701	0.428	4.720	198.21	91.01
194.00	0.000	101.353	4.708	0.420	4.727	199.10	91.01
195.00	0.000	101.353	4.715	0.411	4.733	199.98	91.01
196.00	0.000	101.353	4.723	0.402	4.740	200.87	91.01
197.00	0.000	101.353	4.730	0.393	4.746	201.75	91.01
198.00	0.000	101.353	4.736	0.384	4.752	202.64	91.01
199.00	0.000	101.353	4.743	0.375	4.758	203.52	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	0.000	101.353	4.749	0.366	4.763	204.40	91.01
201.00	0.000	101.353	4.756	0.356	4.769	205.28	91.01
202.00	0.000	101.353	4.762	0.346	4.774	206.16	91.01
203.00	0.000	101.353	4.768	0.337	4.780	207.04	91.01
204.00	0.000	101.353	4.773	0.327	4.785	207.92	91.01
205.00	0.000	101.353	4.779	0.317	4.790	208.80	91.01
206.00	0.000	101.353	4.785	0.307	4.794	209.67	91.01
207.00	0.470	101.353	4.790	0.297	4.799	210.55	91.01
208.00	0.939	101.353	4.795	0.287	4.803	211.43	91.01
209.00	0.939	101.353	4.800	0.277	4.808	212.30	91.01
210.00	0.939	101.353	4.805	0.266	4.812	213.17	91.01
211.00	0.000	101.353	4.809	0.256	4.816	214.05	91.01
212.00	0.000	101.353	4.813	0.246	4.820	214.92	91.01
213.00	0.000	101.353	4.818	0.235	4.823	215.79	91.01
214.00	0.000	101.353	4.822	0.224	4.827	216.66	91.01
215.00	0.000	101.353	4.825	0.214	4.830	217.54	91.01
216.00	0.000	101.353	4.829	0.203	4.833	218.41	91.01
217.00	0.000	101.353	4.833	0.192	4.836	219.28	91.01
218.00	0.000	101.353	4.836	0.181	4.839	220.15	91.01
219.00	0.000	101.353	4.839	0.170	4.842	221.01	91.01
220.00	0.000	101.353	4.842	0.159	4.844	221.88	91.01
221.00	0.000	101.353	4.844	0.148	4.847	222.75	91.01
222.00	0.000	101.353	4.847	0.137	4.849	223.62	91.01
223.00	0.000	101.353	4.849	0.126	4.851	224.49	91.01
224.00	0.000	101.353	4.851	0.115	4.853	225.36	91.01
225.00	0.000	101.353	4.853	0.104	4.854	226.22	91.01
226.00	0.000	101.353	4.855	0.092	4.856	227.09	91.01
227.00	0.000	101.353	4.856	0.081	4.857	227.96	91.01
228.00	0.000	101.353	4.858	0.070	4.858	228.82	91.01
229.00	0.000	101.353	4.859	0.059	4.859	229.69	91.01
230.00	0.000	101.353	4.860	0.047	4.860	230.56	91.01
231.00	0.000	101.353	4.860	0.036	4.861	231.42	91.01
232.00	0.000	101.353	4.861	0.025	4.861	232.29	91.01
233.00	0.000	101.353	4.861	0.013	4.861	233.16	91.01
234.00	0.000	101.353	4.861	0.002	4.861	234.02	91.01
235.00	0.000	101.353	4.861	-0.009	4.861	234.89	91.01
236.00	0.000	101.353	4.861	-0.021	4.861	235.75	91.01
237.00	0.000	101.353	4.861	-0.032	4.861	236.62	91.01
238.00	0.000	101.353	4.860	-0.044	4.860	237.49	91.01
239.00	0.000	101.353	4.859	-0.055	4.859	238.35	91.01
240.00	0.000	101.353	4.858	-0.066	4.858	239.22	91.01
241.00	0.000	101.353	4.857	-0.077	4.857	240.09	91.01
242.00	0.000	101.353	4.855	-0.089	4.856	240.95	91.01
243.00	0.000	101.353	4.854	-0.100	4.855	241.82	91.01
244.00	0.000	101.353	4.852	-0.111	4.853	242.69	91.01
245.00	0.000	101.353	4.850	-0.122	4.851	243.55	91.01
246.00	0.000	101.353	4.847	-0.133	4.849	244.42	91.01
247.00	0.000	101.353	4.845	-0.145	4.847	245.29	91.01
248.00	0.000	101.353	4.842	-0.156	4.845	246.16	91.01
249.00	0.000	101.353	4.840	-0.167	4.842	247.03	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	101.353	4.837	-0.178	4.840	247.90	91.01
251.00	0.000	101.353	4.833	-0.188	4.837	248.77	91.01
252.00	0.000	101.353	4.830	-0.199	4.834	249.64	91.01
253.00	0.000	101.353	4.826	-0.210	4.831	250.51	91.01
254.00	0.000	101.353	4.823	-0.221	4.828	251.38	91.01
255.00	0.000	101.353	4.819	-0.231	4.824	252.25	91.01
256.00	0.000	101.358	4.814	-0.235	4.820	253.21	90.90
257.00	0.000	101.400	4.810	-0.239	4.816	254.16	89.77
258.00	0.000	101.442	4.806	-0.237	4.812	255.17	88.65
259.00	0.000	101.483	4.802	-0.244	4.808	256.09	87.52
260.00	0.000	101.524	4.797	-0.245	4.804	257.07	86.39
261.00	0.000	101.564	4.793	-0.255	4.800	257.96	85.26
262.00	0.000	101.603	4.789	-0.259	4.796	258.90	84.13
263.00	0.000	101.641	4.784	-0.265	4.791	259.83	83.00
264.00	0.749	101.678	4.779	-0.278	4.787	260.67	81.87
265.00	0.749	101.715	4.774	-0.287	4.783	261.56	80.74
266.00	0.749	101.751	4.769	-0.303	4.779	262.36	79.61
267.00	0.749	101.813	4.764	-0.310	4.774	263.28	77.58
268.00	0.749	101.883	4.758	-0.314	4.768	264.23	75.19
269.00	0.749	101.950	4.752	-0.327	4.764	265.06	72.80
270.00	0.749	102.014	4.747	-0.344	4.759	265.86	70.42
271.00	0.749	102.060	4.740	-0.353	4.754	266.74	68.58
272.00	0.749	102.073	4.734	-0.372	4.749	267.51	68.06
273.00	0.749	102.045	4.727	-0.395	4.744	268.22	69.19
274.00	0.749	102.016	4.720	-0.424	4.739	268.87	70.32
275.00	0.749	101.987	4.713	-0.444	4.734	269.61	71.45
276.00	0.749	101.956	4.705	-0.470	4.728	270.30	72.58
277.00	0.749	101.925	4.696	-0.487	4.721	271.08	73.71
278.00	0.749	101.894	4.687	-0.509	4.715	271.80	74.84
279.00	0.749	101.861	4.678	-0.530	4.708	272.54	75.97
280.00	0.749	101.828	4.669	-0.541	4.700	273.39	77.10
281.00	0.749	101.769	4.659	-0.554	4.692	274.22	79.02
282.00	0.749	101.693	4.650	-0.550	4.682	275.26	81.40
283.00	0.749	101.614	4.640	-0.541	4.672	276.35	83.79
284.00	0.749	101.531	4.631	-0.542	4.662	277.32	86.18
285.00	0.749	101.445	4.621	-0.526	4.651	278.51	88.56
286.00	0.749	101.356	4.612	-0.506	4.640	279.74	90.94
287.00	0.749	101.353	4.603	-0.518	4.632	280.57	91.01
288.00	0.749	101.353	4.594	-0.525	4.624	281.48	91.01
289.00	0.749	101.353	4.585	-0.532	4.616	282.38	91.01
290.00	0.749	101.353	4.576	-0.538	4.607	283.29	91.01
291.00	0.749	101.353	4.566	-0.544	4.599	284.20	91.01
292.00	0.749	101.421	4.557	-0.530	4.587	285.37	89.23
293.00	0.000	101.508	4.548	-0.518	4.577	286.50	86.84
294.00	0.000	101.591	4.539	-0.503	4.566	287.67	84.46
295.00	0.000	101.671	4.530	-0.499	4.557	288.71	82.07
296.00	0.000	101.738	4.521	-0.498	4.548	289.72	80.02
297.00	0.000	101.772	4.512	-0.510	4.541	290.54	78.93
298.00	0.000	101.805	4.503	-0.519	4.533	291.43	77.84
299.00	0.000	101.838	4.494	-0.534	4.526	292.23	76.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	101.863	4.484	-0.545	4.517	293.08	75.88
301.00	0.000	101.863	4.475	-0.567	4.510	293.78	75.88
302.00	0.939	101.863	4.465	-0.589	4.503	294.49	75.88
303.00	0.939	101.863	4.454	-0.611	4.496	295.19	75.88
304.00	0.939	101.863	4.443	-0.632	4.488	295.90	75.88
305.00	0.000	101.863	4.432	-0.654	4.480	296.61	75.88
306.00	0.000	101.863	4.420	-0.675	4.471	297.31	75.88
307.00	0.000	101.846	4.408	-0.694	4.462	298.05	76.47
308.00	0.000	101.774	4.396	-0.701	4.451	298.94	78.86
309.00	0.000	101.698	4.384	-0.693	4.438	300.02	81.24
310.00	0.000	101.619	4.372	-0.680	4.424	301.16	83.63
311.00	0.000	101.537	4.360	-0.677	4.412	302.17	86.02
312.00	0.000	101.487	4.348	-0.667	4.399	303.27	87.42
313.00	0.000	101.447	4.337	-0.657	4.386	304.38	88.51
314.00	0.000	101.407	4.325	-0.656	4.375	305.38	89.60
315.00	0.000	101.366	4.314	-0.642	4.361	306.53	90.69
316.00	0.000	101.353	4.303	-0.644	4.350	307.49	91.01
317.00	0.000	101.353	4.291	-0.645	4.340	308.45	91.01
318.00	0.000	101.353	4.280	-0.646	4.329	309.41	91.01
319.00	0.000	101.353	4.269	-0.648	4.318	310.37	91.01
320.00	0.000	101.353	4.257	-0.649	4.307	311.34	91.01
321.00	0.000	101.353	4.246	-0.649	4.295	312.31	91.01
322.00	0.000	101.353	4.235	-0.650	4.284	313.28	91.01
323.00	0.000	101.353	4.223	-0.650	4.273	314.25	91.01
324.00	0.000	101.353	4.212	-0.650	4.262	315.22	91.01
325.00	0.000	101.353	4.201	-0.650	4.251	316.20	91.01
326.00	0.000	101.353	4.189	-0.650	4.239	317.18	91.01
327.00	0.000	101.353	4.178	-0.649	4.228	318.16	91.01
328.00	0.000	101.353	4.167	-0.649	4.217	319.15	91.01
329.00	0.000	101.353	4.155	-0.648	4.206	320.14	91.01
330.00	0.000	101.353	4.144	-0.647	4.194	321.13	91.01
331.00	0.000	101.353	4.133	-0.646	4.183	322.12	91.01
332.00	0.000	101.353	4.121	-0.644	4.172	323.12	91.01
333.00	0.000	101.353	4.110	-0.642	4.160	324.12	91.01
334.00	0.000	101.353	4.099	-0.641	4.149	325.12	91.01
335.00	0.000	101.353	4.088	-0.638	4.137	326.12	91.01
336.00	0.000	101.353	4.077	-0.636	4.126	327.13	91.01
337.00	0.000	101.353	4.066	-0.634	4.115	328.14	91.01
338.00	0.000	101.353	4.055	-0.631	4.103	329.15	91.01
339.00	0.000	101.353	4.044	-0.628	4.092	330.17	91.01
340.00	0.000	101.353	4.033	-0.625	4.081	331.18	91.01
341.00	0.000	101.353	4.022	-0.622	4.070	332.20	91.01
342.00	0.000	101.353	4.011	-0.619	4.058	333.23	91.01
343.00	0.000	101.353	4.000	-0.615	4.047	334.26	91.01
344.00	0.000	101.353	3.989	-0.611	4.036	335.29	91.01
345.00	0.000	101.353	3.979	-0.607	4.025	336.32	91.01
346.00	0.000	101.353	3.968	-0.603	4.014	337.35	91.01
347.00	0.000	101.353	3.958	-0.599	4.003	338.39	91.01
348.00	0.000	101.353	3.947	-0.594	3.992	339.43	91.01
349.00	0.000	101.353	3.937	-0.590	3.981	340.48	91.01

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 10:39:20

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	101.353	3.927	-0.585	3.970	341.53	91.01
351.00	0.000	101.353	3.916	-0.580	3.959	342.58	91.01
352.00	0.000	101.353	3.906	-0.575	3.948	343.63	91.01
353.00	0.000	101.353	3.896	-0.569	3.938	344.69	91.01
354.00	0.000	101.353	3.887	-0.564	3.927	345.75	91.01
355.00	0.000	101.353	3.877	-0.558	3.917	346.81	91.01
356.00	0.000	101.353	3.867	-0.552	3.906	347.87	91.01
357.00	0.000	101.353	3.857	-0.546	3.896	348.94	91.01
358.00	0.000	101.353	3.848	-0.540	3.886	350.01	91.01
359.00	0.000	101.353	3.839	-0.533	3.875	351.09	91.01

MINIMUM STRESS (Pb,x') = 3.560 AT 54.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 3.560 AT 53.98 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:02:21

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H4 -- 8 Years of Crack Growth -- Upset Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.356 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 9 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	78.4200	(DTHETA =	78.420)	DEPTH (IN) =	2.000
2 ANGLES:	84.8900 TO	91.7700	(DTHETA =	6.880)	DEPTH (IN) =	2.000
3 ANGLES:	94.7900 TO	100.0200	(DTHETA =	5.230)	DEPTH (IN) =	2.000
4 ANGLES:	103.1900 TO	122.1100	(DTHETA =	18.920)	DEPTH (IN) =	2.000
5 ANGLES:	124.5800 TO	199.2000	(DTHETA =	74.620)	DEPTH (IN) =	2.000
6 ANGLES:	201.5200 TO	211.0500	(DTHETA =	9.530)	DEPTH (IN) =	2.000
7 ANGLES:	218.0900 TO	265.0900	(DTHETA =	47.000)	DEPTH (IN) =	2.000
8 ANGLES:	278.4100 TO	284.9900	(DTHETA =	6.580)	DEPTH (IN) =	2.000
9 ANGLES:	292.6400 TO	360.0000	(DTHETA =	67.360)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1288.838

REMAINING DEGRADED SECTION AREA (IN2) = 162.7518

(APPROX. DEGRADED METAL AREA = 162.7521)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	96.027	8.450	-2.455	8.799	343.80	157.87
1.00	0.000	96.235	8.408	-2.385	8.739	345.16	155.48
2.00	0.000	96.324	8.366	-2.333	8.686	346.42	154.45
3.00	0.000	96.324	8.326	-2.314	8.641	347.47	154.45
4.00	0.000	96.324	8.285	-2.294	8.597	348.52	154.45
5.00	0.000	96.324	8.245	-2.273	8.553	349.58	154.45
6.00	0.000	96.324	8.205	-2.252	8.509	350.65	154.45
7.00	0.000	96.324	8.166	-2.230	8.465	351.72	154.45
8.00	0.000	96.324	8.127	-2.207	8.421	352.80	154.45
9.00	0.000	96.324	8.088	-2.184	8.378	353.89	154.45
10.00	0.000	96.324	8.050	-2.160	8.335	354.98	154.45
11.00	0.000	96.335	8.012	-2.135	8.292	356.08	154.32
12.00	0.000	96.535	7.976	-2.062	8.238	357.50	151.97
13.00	0.000	96.735	7.940	-1.992	8.186	358.91	149.58
14.00	0.000	96.931	7.906	-1.909	8.133	0.42	147.20
15.00	0.000	97.125	7.873	-1.845	8.086	1.81	144.81
16.00	0.000	97.315	7.841	-1.783	8.042	3.19	142.42
17.00	0.000	97.501	7.811	-1.710	7.996	4.65	140.04
18.00	0.000	97.685	7.781	-1.654	7.955	6.00	137.65
19.00	0.000	97.865	7.753	-1.601	7.917	7.33	135.26
20.00	0.000	98.042	7.725	-1.537	7.877	8.74	132.88
21.00	0.000	98.215	7.699	-1.491	7.842	10.04	130.49
22.00	0.000	98.305	7.673	-1.460	7.811	11.23	129.24
23.00	0.000	98.305	7.647	-1.457	7.785	12.21	129.24
24.00	0.000	98.305	7.622	-1.453	7.759	13.20	129.24
25.00	0.000	98.305	7.596	-1.449	7.733	14.20	129.24
26.00	0.000	98.305	7.571	-1.445	7.708	15.20	129.24
27.00	0.000	98.305	7.546	-1.440	7.682	16.20	129.24
28.00	0.000	98.305	7.520	-1.434	7.656	17.20	129.24
29.00	0.000	98.305	7.495	-1.429	7.630	18.21	129.24
30.00	0.000	98.305	7.470	-1.422	7.604	19.22	129.24
31.00	0.000	98.305	7.445	-1.416	7.579	20.23	129.24
32.00	0.000	98.305	7.421	-1.408	7.553	21.25	129.24
33.00	0.000	98.305	7.396	-1.401	7.527	22.27	129.24
34.00	0.000	98.305	7.371	-1.393	7.502	23.30	129.24
35.00	0.000	98.305	7.347	-1.384	7.476	24.33	129.24
36.00	0.000	98.265	7.323	-1.376	7.451	25.36	129.80
37.00	0.000	98.093	7.299	-1.309	7.416	26.83	132.19
38.00	0.000	97.917	7.277	-1.266	7.386	28.13	134.57
39.00	0.000	97.738	7.255	-1.191	7.353	29.67	136.96
40.00	0.000	97.693	7.235	-1.154	7.326	30.94	137.55
41.00	0.000	97.693	7.215	-1.134	7.304	32.07	137.55
42.00	0.000	97.693	7.195	-1.114	7.281	33.20	137.55
43.00	0.000	97.693	7.176	-1.093	7.259	34.34	137.55
44.00	0.000	97.693	7.157	-1.072	7.237	35.48	137.55
45.00	0.000	97.693	7.138	-1.050	7.215	36.63	137.55
46.00	0.000	97.693	7.120	-1.029	7.194	37.78	137.55
47.00	0.000	97.693	7.102	-1.007	7.173	38.93	137.55
48.00	0.000	97.693	7.085	-0.984	7.153	40.09	137.55
49.00	0.000	97.652	7.068	-0.969	7.134	41.19	138.08

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	97.468	7.052	-0.885	7.107	42.84	140.47
51.00	0.000	97.281	7.037	-0.797	7.082	44.54	142.85
52.00	0.000	97.090	7.024	-0.736	7.062	46.02	145.24
53.00	0.000	96.896	7.012	-0.640	7.041	47.78	147.63
54.00	0.000	96.699	7.002	-0.540	7.023	49.59	150.01
55.00	0.000	96.498	6.993	-0.469	7.009	51.16	152.40
56.00	0.000	96.295	6.986	-0.361	6.995	53.04	154.79
57.00	0.000	96.088	6.981	-0.250	6.985	54.95	157.17
58.00	0.000	95.877	6.977	-0.169	6.979	56.61	159.56
59.00	0.000	95.664	6.975	-0.051	6.975	58.58	161.95
60.00	0.000	95.591	6.975	0.034	6.975	60.28	162.75
61.00	0.000	95.591	6.976	0.087	6.977	61.71	162.75
62.00	0.000	95.591	6.978	0.139	6.979	63.14	162.75
63.00	0.000	95.591	6.981	0.191	6.983	64.57	162.75
64.00	0.000	95.625	6.984	0.260	6.989	66.13	162.38
65.00	0.000	95.839	6.990	0.362	6.999	67.97	159.99
66.00	0.000	96.050	6.997	0.460	7.012	69.77	157.60
67.00	0.000	96.258	7.005	0.572	7.029	71.67	155.22
68.00	0.000	96.462	7.016	0.663	7.047	73.40	152.83
69.00	0.000	96.663	7.028	0.751	7.068	75.10	150.44
70.00	0.000	96.861	7.042	0.850	7.093	76.89	148.06
71.00	0.000	97.055	7.057	0.931	7.119	78.51	145.67
72.00	0.000	97.247	7.074	1.007	7.146	80.10	143.28
73.00	0.000	97.435	7.092	1.095	7.176	81.78	140.90
74.00	0.000	97.619	7.112	1.164	7.207	83.30	138.51
75.00	0.000	97.801	7.133	1.229	7.238	84.78	136.12
76.00	0.000	97.979	7.155	1.305	7.273	86.34	133.74
77.00	0.000	98.153	7.178	1.363	7.306	87.75	131.35
78.00	0.000	98.325	7.202	1.416	7.340	89.12	128.96
79.00	2.000	98.493	7.227	1.479	7.377	90.57	126.58
80.00	2.000	98.658	7.253	1.525	7.412	91.87	124.19
81.00	2.000	98.819	7.280	1.567	7.447	93.15	121.80
82.00	2.000	98.977	7.308	1.617	7.484	94.48	119.42
83.00	2.000	99.132	7.336	1.651	7.520	95.69	117.03
84.00	2.000	99.257	7.365	1.681	7.554	96.86	115.06
85.00	0.000	99.257	7.394	1.673	7.581	97.75	115.06
86.00	0.000	99.257	7.423	1.665	7.607	98.64	115.06
87.00	0.000	99.257	7.452	1.656	7.634	99.53	115.06
88.00	0.000	99.257	7.480	1.647	7.659	100.41	115.06
89.00	0.000	99.257	7.509	1.637	7.685	101.30	115.06
90.00	0.000	99.257	7.537	1.626	7.711	102.18	115.06
91.00	0.000	99.346	7.565	1.639	7.741	103.22	113.64
92.00	2.000	99.492	7.594	1.660	7.773	104.33	111.25
93.00	2.000	99.636	7.623	1.676	7.805	105.40	108.87
94.00	2.000	99.775	7.652	1.700	7.839	106.53	106.48
95.00	0.000	99.912	7.682	1.709	7.870	107.54	104.09
96.00	0.000	100.045	7.712	1.714	7.900	108.53	101.71
97.00	0.000	100.175	7.742	1.725	7.932	109.56	99.32
98.00	0.000	100.220	7.772	1.764	7.970	110.79	98.46
99.00	0.000	100.220	7.803	1.832	8.016	112.21	98.46

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	100.220	7.836	1.900	8.063	113.63	98.46
101.00	2.000	100.140	7.869	1.927	8.102	114.76	99.96
102.00	2.000	100.009	7.903	1.915	8.132	115.62	102.35
103.00	2.000	99.875	7.936	1.928	8.167	116.65	104.74
104.00	0.000	99.738	7.970	1.944	8.204	117.70	107.12
105.00	0.000	99.597	8.004	1.940	8.236	118.62	109.51
106.00	0.000	99.453	8.038	1.962	8.274	119.72	111.90
107.00	0.000	99.306	8.073	1.988	8.314	120.83	114.28
108.00	0.000	99.155	8.107	1.992	8.349	121.81	116.67
109.00	0.000	99.001	8.143	2.024	8.390	122.96	119.06
110.00	0.000	98.843	8.178	2.059	8.433	124.13	121.44
111.00	0.000	98.682	8.214	2.071	8.471	125.15	123.83
112.00	0.000	98.518	8.251	2.112	8.517	126.36	126.22
113.00	0.000	98.350	8.288	2.157	8.564	127.59	128.61
114.00	0.000	98.179	8.326	2.177	8.606	128.65	130.99
115.00	0.000	98.005	8.364	2.227	8.656	129.91	133.38
116.00	0.000	97.858	8.404	2.268	8.704	131.10	135.36
117.00	0.000	97.858	8.443	2.265	8.742	132.02	135.36
118.00	0.000	97.858	8.483	2.261	8.779	132.92	135.36
119.00	0.000	97.858	8.522	2.256	8.816	133.83	135.36
120.00	0.000	97.858	8.561	2.251	8.852	134.73	135.36
121.00	0.000	97.858	8.600	2.245	8.889	135.63	135.36
122.00	0.000	97.858	8.639	2.238	8.925	136.52	135.36
123.00	2.000	97.752	8.679	2.247	8.965	137.51	136.77
124.00	2.000	97.570	8.718	2.300	9.017	138.78	139.15
125.00	0.000	97.384	8.759	2.357	9.070	140.06	141.54
126.00	0.000	97.195	8.800	2.386	9.118	141.17	143.93
127.00	0.000	97.003	8.843	2.448	9.175	142.48	146.32
128.00	0.000	96.808	8.886	2.514	9.234	143.80	148.70
129.00	0.000	96.609	8.930	2.550	9.287	144.94	151.09
130.00	0.000	96.407	8.975	2.621	9.350	146.28	153.48
131.00	0.000	96.202	9.021	2.695	9.415	147.63	155.86
132.00	0.000	95.993	9.069	2.739	9.473	148.80	158.25
133.00	0.000	95.782	9.117	2.818	9.543	150.18	160.64
134.00	0.000	95.591	9.167	2.891	9.612	151.50	162.75
135.00	0.000	95.591	9.218	2.904	9.664	152.49	162.75
136.00	0.000	95.591	9.268	2.917	9.716	153.47	162.75
137.00	0.000	95.591	9.319	2.928	9.768	154.44	162.75
138.00	0.000	95.591	9.370	2.939	9.820	155.42	162.75
139.00	0.000	95.591	9.421	2.949	9.872	156.38	162.75
140.00	0.000	95.591	9.473	2.958	9.924	157.34	162.75
141.00	0.000	95.591	9.524	2.966	9.976	158.30	162.75
142.00	0.000	95.591	9.576	2.974	10.027	159.25	162.75
143.00	0.000	95.591	9.628	2.980	10.079	160.20	162.75
144.00	0.000	95.591	9.680	2.986	10.130	161.14	162.75
145.00	0.000	95.591	9.732	2.990	10.181	162.08	162.75
146.00	0.000	95.591	9.784	2.994	10.232	163.01	162.75
147.00	0.000	95.591	9.836	2.996	10.282	163.94	162.75
148.00	0.000	95.591	9.888	2.998	10.333	164.87	162.75
149.00	0.000	95.591	9.940	2.999	10.383	165.79	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	95.591	9.993	2.999	10.433	166.71	162.75
151.00	0.000	95.591	10.045	2.998	10.483	167.62	162.75
152.00	0.000	95.591	10.097	2.996	10.532	168.53	162.75
153.00	0.000	95.591	10.149	2.994	10.581	169.43	162.75
154.00	0.000	95.591	10.201	2.990	10.630	170.34	162.75
155.00	0.000	95.591	10.253	2.985	10.679	171.23	162.75
156.00	0.000	95.591	10.305	2.980	10.727	172.13	162.75
157.00	0.000	95.591	10.357	2.974	10.775	173.02	162.75
158.00	0.000	95.591	10.409	2.966	10.823	173.91	162.75
159.00	0.000	95.591	10.460	2.958	10.870	174.79	162.75
160.00	0.000	95.591	10.512	2.949	10.918	175.67	162.75
161.00	0.000	95.591	10.563	2.939	10.964	176.55	162.75
162.00	0.000	95.591	10.614	2.928	11.010	177.42	162.75
163.00	0.000	95.591	10.665	2.917	11.056	178.30	162.75
164.00	0.000	95.591	10.715	2.904	11.102	179.16	162.75
165.00	0.000	95.591	10.766	2.890	11.147	180.03	162.75
166.00	0.000	95.591	10.816	2.876	11.192	180.89	162.75
167.00	0.000	95.591	10.866	2.861	11.236	181.75	162.75
168.00	0.000	95.591	10.916	2.845	11.280	182.61	162.75
169.00	0.000	95.591	10.965	2.828	11.324	183.46	162.75
170.00	0.000	95.591	11.014	2.810	11.367	184.31	162.75
171.00	0.000	95.591	11.063	2.791	11.409	185.16	162.75
172.00	0.000	95.591	11.111	2.772	11.452	186.01	162.75
173.00	0.000	95.591	11.159	2.751	11.493	186.85	162.75
174.00	0.000	95.591	11.207	2.730	11.535	187.69	162.75
175.00	0.000	95.591	11.254	2.708	11.575	188.53	162.75
176.00	0.000	95.591	11.301	2.685	11.616	189.36	162.75
177.00	0.000	95.591	11.348	2.661	11.656	190.20	162.75
178.00	0.000	95.591	11.394	2.637	11.695	191.03	162.75
179.00	0.000	95.591	11.439	2.611	11.734	191.86	162.75
180.00	0.000	95.591	11.485	2.585	11.772	192.69	162.75
181.00	0.000	95.591	11.529	2.558	11.810	193.51	162.75
182.00	0.000	95.591	11.574	2.531	11.847	194.33	162.75
183.00	0.000	95.591	11.617	2.502	11.884	195.16	162.75
184.00	0.000	95.591	11.661	2.473	11.920	195.97	162.75
185.00	0.000	95.591	11.703	2.443	11.956	196.79	162.75
186.00	0.000	95.591	11.746	2.412	11.991	197.61	162.75
187.00	0.000	95.591	11.787	2.381	12.025	198.42	162.75
188.00	0.000	95.591	11.829	2.349	12.059	199.23	162.75
189.00	0.000	95.591	11.869	2.316	12.093	200.04	162.75
190.00	0.000	95.591	11.909	2.282	12.126	200.85	162.75
191.00	0.000	95.591	11.948	2.248	12.158	201.66	162.75
192.00	0.000	95.591	11.987	2.213	12.190	202.46	162.75
193.00	0.000	95.591	12.025	2.178	12.221	203.26	162.75
194.00	0.000	95.591	12.063	2.141	12.252	204.07	162.75
195.00	0.000	95.591	12.100	2.104	12.282	204.87	162.75
196.00	0.000	95.591	12.136	2.067	12.311	205.67	162.75
197.00	0.000	95.591	12.172	2.029	12.340	206.46	162.75
198.00	0.000	95.591	12.207	1.990	12.368	207.26	162.75
199.00	0.000	95.591	12.241	1.951	12.395	208.05	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	95.591	12.275	1.911	12.422	208.85	162.75
201.00	2.000	95.591	12.307	1.870	12.449	209.64	162.75
202.00	0.000	95.591	12.339	1.829	12.474	210.43	162.75
203.00	0.000	95.591	12.371	1.787	12.499	211.22	162.75
204.00	0.000	95.591	12.402	1.745	12.524	212.01	162.75
205.00	0.000	95.591	12.432	1.702	12.548	212.80	162.75
206.00	0.000	95.591	12.461	1.659	12.571	213.58	162.75
207.00	0.000	95.591	12.489	1.615	12.593	214.37	162.75
208.00	0.000	95.591	12.517	1.571	12.615	215.15	162.75
209.00	0.000	95.591	12.544	1.526	12.636	215.94	162.75
210.00	0.000	95.591	12.570	1.481	12.657	216.72	162.75
211.00	0.000	95.591	12.595	1.435	12.677	217.50	162.75
212.00	2.000	95.591	12.620	1.389	12.696	218.28	162.75
213.00	2.000	95.591	12.643	1.343	12.714	219.06	162.75
214.00	2.000	95.591	12.666	1.296	12.732	219.84	162.75
215.00	2.000	95.591	12.688	1.248	12.749	220.62	162.75
216.00	2.000	95.591	12.709	1.201	12.766	221.40	162.75
217.00	2.000	95.591	12.730	1.153	12.782	222.17	162.75
218.00	2.000	95.591	12.749	1.104	12.797	222.95	162.75
219.00	0.000	95.591	12.768	1.055	12.812	223.73	162.75
220.00	0.000	95.591	12.786	1.006	12.826	224.50	162.75
221.00	0.000	95.591	12.803	0.957	12.839	225.27	162.75
222.00	0.000	95.591	12.819	0.907	12.851	226.05	162.75
223.00	0.000	95.591	12.834	0.857	12.863	226.82	162.75
224.00	0.000	95.591	12.849	0.807	12.874	227.59	162.75
225.00	0.000	95.591	12.862	0.757	12.884	228.37	162.75
226.00	0.000	95.591	12.875	0.706	12.894	229.14	162.75
227.00	0.000	95.591	12.887	0.655	12.903	229.91	162.75
228.00	0.000	95.591	12.897	0.604	12.912	230.68	162.75
229.00	0.000	95.591	12.907	0.553	12.919	231.45	162.75
230.00	0.000	95.591	12.916	0.502	12.926	232.22	162.75
231.00	0.000	95.591	12.925	0.450	12.932	232.99	162.75
232.00	0.000	95.591	12.932	0.398	12.938	233.76	162.75
233.00	0.000	95.591	12.938	0.346	12.943	234.53	162.75
234.00	0.000	95.591	12.944	0.295	12.947	235.30	162.75
235.00	0.000	95.591	12.948	0.243	12.951	236.07	162.75
236.00	0.000	95.591	12.952	0.190	12.953	236.84	162.75
237.00	0.000	95.591	12.955	0.138	12.955	237.61	162.75
238.00	0.000	95.769	12.957	0.137	12.957	238.61	160.78
239.00	0.000	95.981	12.959	0.132	12.960	239.59	158.39
240.00	0.000	96.189	12.961	0.124	12.962	240.55	156.01
241.00	0.000	96.395	12.963	0.129	12.964	241.57	153.62
242.00	0.000	96.597	12.965	0.114	12.966	242.51	151.23
243.00	0.000	96.796	12.967	0.096	12.967	243.42	148.85
244.00	0.000	96.992	12.969	0.090	12.969	244.40	146.46
245.00	0.000	97.184	12.970	0.065	12.970	245.29	144.07
246.00	0.000	97.373	12.971	0.036	12.971	246.16	141.68
247.00	0.000	97.536	12.971	0.004	12.971	247.02	139.59
248.00	0.000	97.536	12.970	-0.074	12.970	247.67	139.59
249.00	0.000	97.536	12.968	-0.152	12.969	248.33	139.59

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	97.536	12.965	-0.230	12.967	248.98	139.59
251.00	0.000	97.536	12.960	-0.308	12.964	249.64	139.59
252.00	0.000	97.536	12.954	-0.386	12.960	250.29	139.59
253.00	0.000	97.536	12.947	-0.463	12.955	250.95	139.59
254.00	0.000	97.581	12.938	-0.526	12.949	251.67	139.01
255.00	0.000	97.763	12.928	-0.547	12.940	252.58	136.62
256.00	0.000	97.942	12.918	-0.586	12.932	253.40	134.24
257.00	0.000	98.117	12.908	-0.628	12.923	254.21	131.85
258.00	0.000	98.289	12.896	-0.659	12.913	255.07	129.46
259.00	0.000	98.338	12.884	-0.748	12.906	255.68	128.78
260.00	0.000	98.338	12.870	-0.836	12.897	256.28	128.78
261.00	0.000	98.338	12.855	-0.924	12.888	256.89	128.78
262.00	0.000	98.338	12.838	-1.012	12.878	257.49	128.78
263.00	0.000	98.338	12.819	-1.100	12.866	258.09	128.78
264.00	0.000	98.419	12.799	-1.160	12.852	258.82	127.63
265.00	0.000	98.586	12.779	-1.210	12.836	259.59	125.24
266.00	2.000	98.748	12.757	-1.249	12.818	260.41	122.85
267.00	2.000	98.908	12.735	-1.305	12.801	261.15	120.47
268.00	2.000	99.064	12.711	-1.364	12.784	261.87	118.08
269.00	2.000	99.106	12.687	-1.449	12.769	262.48	117.43
270.00	2.000	99.106	12.661	-1.547	12.755	263.03	117.43
271.00	2.000	99.106	12.633	-1.644	12.739	263.58	117.43
272.00	2.000	99.106	12.603	-1.741	12.723	264.13	117.43
273.00	2.000	99.106	12.572	-1.837	12.706	264.69	117.43
274.00	2.000	99.004	12.539	-1.910	12.684	265.34	119.01
275.00	2.000	98.846	12.506	-1.951	12.657	266.13	121.40
276.00	2.000	98.685	12.471	-2.014	12.633	266.83	123.78
277.00	2.000	98.521	12.436	-2.046	12.603	267.65	126.17
278.00	2.000	98.354	12.400	-2.074	12.572	268.50	128.56
279.00	0.000	98.183	12.363	-2.125	12.545	269.24	130.94
280.00	0.000	98.009	12.326	-2.145	12.511	270.13	133.33
281.00	0.000	97.831	12.288	-2.160	12.477	271.03	135.72
282.00	0.000	97.650	12.250	-2.199	12.446	271.82	138.10
283.00	0.000	97.467	12.212	-2.206	12.410	272.76	140.48
284.00	0.000	97.467	12.173	-2.256	12.380	273.50	140.48
285.00	2.000	97.650	12.134	-2.275	12.345	274.38	138.10
286.00	2.000	97.831	12.094	-2.283	12.307	275.31	135.72
287.00	2.000	98.009	12.053	-2.308	12.273	276.16	133.33
288.00	2.000	98.125	12.013	-2.350	12.241	276.93	131.75
289.00	2.000	98.070	11.971	-2.415	12.212	277.59	132.50
290.00	2.000	97.894	11.929	-2.425	12.173	278.51	134.88
291.00	2.000	97.714	11.887	-2.431	12.133	279.44	137.27
292.00	2.000	97.531	11.844	-2.461	12.097	280.26	139.66
293.00	0.000	97.345	11.801	-2.458	12.054	281.23	142.04
294.00	0.000	97.304	11.758	-2.498	12.020	282.00	142.56
295.00	0.000	97.304	11.714	-2.551	11.988	282.71	142.56
296.00	0.000	97.304	11.669	-2.604	11.956	283.42	142.56
297.00	0.000	97.304	11.623	-2.655	11.922	284.13	142.56
298.00	0.000	97.304	11.576	-2.706	11.888	284.84	142.56
299.00	0.000	97.199	11.528	-2.743	11.850	285.61	143.88

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	97.007	11.481	-2.728	11.800	286.63	146.27
301.00	0.000	96.812	11.433	-2.708	11.749	287.67	148.65
302.00	0.000	96.613	11.386	-2.715	11.705	288.59	151.04
303.00	0.000	96.411	11.339	-2.686	11.653	289.67	153.43
304.00	0.000	96.370	11.292	-2.705	11.611	290.53	153.91
305.00	0.000	96.370	11.244	-2.737	11.573	291.32	153.91
306.00	0.000	96.370	11.196	-2.769	11.533	292.11	153.91
307.00	0.000	96.370	11.147	-2.799	11.494	292.90	153.91
308.00	0.000	96.370	11.098	-2.829	11.453	293.70	153.91
309.00	0.000	96.370	11.049	-2.858	11.412	294.49	153.91
310.00	0.000	96.370	10.999	-2.886	11.371	295.29	153.91
311.00	0.000	96.370	10.948	-2.914	11.329	296.10	153.91
312.00	0.000	96.370	10.897	-2.940	11.286	296.90	153.91
313.00	0.000	96.370	10.845	-2.966	11.243	297.71	153.91
314.00	0.000	96.370	10.793	-2.990	11.200	298.51	153.91
315.00	0.000	96.370	10.741	-3.014	11.156	299.32	153.91
316.00	0.000	96.370	10.688	-3.036	11.111	300.14	153.91
317.00	0.000	96.370	10.635	-3.058	11.066	300.95	153.91
318.00	0.000	96.370	10.581	-3.079	11.020	301.77	153.91
319.00	0.000	96.370	10.527	-3.099	10.974	302.59	153.91
320.00	0.000	96.370	10.473	-3.118	10.927	303.42	153.91
321.00	0.000	96.370	10.418	-3.136	10.880	304.25	153.91
322.00	0.000	96.370	10.363	-3.153	10.832	305.07	153.91
323.00	0.000	96.189	10.308	-3.137	10.775	306.07	156.01
324.00	0.000	95.981	10.254	-3.082	10.707	307.27	158.39
325.00	0.000	95.769	10.201	-3.021	10.639	308.50	160.78
326.00	0.000	95.591	10.149	-2.977	10.576	309.65	162.75
327.00	0.000	95.591	10.096	-2.980	10.527	310.55	162.75
328.00	0.000	95.591	10.044	-2.982	10.478	311.46	162.75
329.00	0.000	95.591	9.992	-2.983	10.428	312.38	162.75
330.00	0.000	95.591	9.940	-2.983	10.378	313.29	162.75
331.00	0.000	95.591	9.888	-2.982	10.328	314.22	162.75
332.00	0.000	95.591	9.836	-2.980	10.277	315.14	162.75
333.00	0.000	95.591	9.783	-2.977	10.226	316.07	162.75
334.00	0.000	95.591	9.731	-2.974	10.176	317.01	162.75
335.00	0.000	95.591	9.679	-2.969	10.125	317.94	162.75
336.00	0.000	95.591	9.627	-2.964	10.073	318.89	162.75
337.00	0.000	95.591	9.576	-2.957	10.022	319.84	162.75
338.00	0.000	95.591	9.524	-2.950	9.970	320.79	162.75
339.00	0.000	95.591	9.472	-2.942	9.919	321.74	162.75
340.00	0.000	95.591	9.421	-2.933	9.867	322.71	162.75
341.00	0.000	95.591	9.370	-2.923	9.815	323.67	162.75
342.00	0.000	95.591	9.319	-2.912	9.763	324.64	162.75
343.00	0.000	95.591	9.268	-2.900	9.711	325.62	162.75
344.00	0.000	95.591	9.217	-2.888	9.659	326.60	162.75
345.00	0.000	95.591	9.167	-2.874	9.607	327.59	162.75
346.00	0.000	95.591	9.117	-2.860	9.555	328.58	162.75
347.00	0.000	95.591	9.067	-2.845	9.502	329.58	162.75
348.00	0.000	95.591	9.017	-2.828	9.450	330.58	162.75
349.00	0.000	95.591	8.968	-2.811	9.398	331.59	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:03:14

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	95.591	8.919	-2.794	9.346	332.61	162.75
351.00	0.000	95.591	8.870	-2.775	9.294	333.63	162.75
352.00	0.000	95.591	8.821	-2.755	9.242	334.65	162.75
353.00	0.000	95.591	8.773	-2.735	9.190	335.69	162.75
354.00	0.000	95.591	8.726	-2.714	9.138	336.72	162.75
355.00	0.000	95.591	8.678	-2.692	9.086	337.77	162.75
356.00	0.000	95.591	8.631	-2.669	9.035	338.82	162.75
357.00	0.000	95.591	8.585	-2.645	8.983	339.88	162.75
358.00	0.000	95.601	8.539	-2.620	8.932	340.94	162.64
359.00	0.000	95.816	8.494	-2.528	8.862	342.43	160.25

MINIMUM STRESS (Pb,x')	=	6.975	AT	60.00	DEGREES
MINIMUM TOTAL STRESS (Pb,max)	=	6.975	AT	60.28	DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:08:18

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H4 -- 8 Years of Crack Growth -- Faulted Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.917 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 9 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	78.4200	(DTHETA =	78.420)	DEPTH (IN) =	2.000
2 ANGLES:	84.8900 TO	91.7700	(DTHETA =	6.880)	DEPTH (IN) =	2.000
3 ANGLES:	94.7900 TO	100.0200	(DTHETA =	5.230)	DEPTH (IN) =	2.000
4 ANGLES:	103.1900 TO	122.1100	(DTHETA =	18.920)	DEPTH (IN) =	2.000
5 ANGLES:	124.5800 TO	199.2000	(DTHETA =	74.620)	DEPTH (IN) =	2.000
6 ANGLES:	201.5200 TO	211.0500	(DTHETA =	9.530)	DEPTH (IN) =	2.000
7 ANGLES:	218.0900 TO	265.0900	(DTHETA =	47.000)	DEPTH (IN) =	2.000
8 ANGLES:	278.4100 TO	284.9900	(DTHETA =	6.580)	DEPTH (IN) =	2.000
9 ANGLES:	292.6400 TO	360.0000	(DTHETA =	67.360)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1288.838

REMAINING DEGRADED SECTION AREA (IN2) = 162.7518

(APPROX. DEGRADED METAL AREA = 162.7521)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:11

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	97.028	7.394	-2.576	7.830	340.79	162.75
1.00	0.000	97.164	7.350	-2.503	7.764	342.19	161.06
2.00	0.000	97.353	7.306	-2.433	7.701	343.58	158.67
3.00	0.000	97.539	7.265	-2.366	7.640	344.96	156.29
4.00	0.000	97.681	7.224	-2.301	7.581	346.33	154.45
5.00	0.000	97.681	7.184	-2.280	7.537	347.39	154.45
6.00	0.000	97.681	7.144	-2.259	7.493	348.45	154.45
7.00	0.000	97.681	7.105	-2.237	7.448	349.52	154.45
8.00	0.000	97.681	7.066	-2.214	7.404	350.60	154.45
9.00	0.000	97.681	7.027	-2.191	7.361	351.68	154.45
10.00	0.000	97.681	6.989	-2.167	7.317	352.77	154.45
11.00	0.000	97.681	6.951	-2.142	7.274	353.87	154.45
12.00	0.000	97.681	6.914	-2.117	7.231	354.97	154.45
13.00	0.000	97.681	6.877	-2.091	7.188	356.09	154.45
14.00	0.000	97.807	6.841	-2.036	7.137	357.42	152.78
15.00	0.000	97.985	6.806	-1.955	7.081	358.97	150.39
16.00	0.000	98.159	6.772	-1.891	7.031	0.40	148.00
17.00	0.000	98.331	6.740	-1.830	6.984	1.81	145.62
18.00	0.000	98.499	6.708	-1.758	6.935	3.31	143.23
19.00	0.000	98.663	6.678	-1.703	6.892	4.69	140.84
20.00	0.000	98.825	6.649	-1.651	6.850	6.06	138.46
21.00	0.000	98.983	6.620	-1.589	6.808	7.50	136.07
22.00	0.000	99.137	6.593	-1.542	6.771	8.83	133.68
23.00	0.000	99.288	6.566	-1.499	6.735	10.14	131.30
24.00	0.000	99.416	6.540	-1.459	6.701	11.42	129.24
25.00	0.000	99.416	6.515	-1.455	6.675	12.41	129.24
26.00	0.000	99.416	6.489	-1.450	6.649	13.40	129.24
27.00	0.000	99.416	6.464	-1.445	6.624	14.39	129.24
28.00	0.000	99.416	6.439	-1.440	6.598	15.39	129.24
29.00	0.000	99.416	6.414	-1.434	6.572	16.39	129.24
30.00	0.000	99.416	6.389	-1.428	6.546	17.40	129.24
31.00	0.000	99.416	6.364	-1.421	6.520	18.41	129.24
32.00	0.000	99.416	6.339	-1.414	6.495	19.42	129.24
33.00	0.000	99.416	6.314	-1.407	6.469	20.44	129.24
34.00	0.000	99.332	6.290	-1.386	6.441	21.57	130.60
35.00	0.000	99.181	6.266	-1.327	6.405	23.04	132.99
36.00	0.000	99.028	6.243	-1.263	6.370	24.56	135.38
37.00	0.000	98.885	6.222	-1.205	6.337	26.04	137.55
38.00	0.000	98.885	6.201	-1.186	6.313	27.17	137.55
39.00	0.000	98.885	6.180	-1.166	6.289	28.31	137.55
40.00	0.000	98.885	6.160	-1.147	6.265	29.45	137.55
41.00	0.000	98.885	6.140	-1.127	6.242	30.60	137.55
42.00	0.000	98.885	6.120	-1.106	6.219	31.75	137.55
43.00	0.000	98.885	6.101	-1.086	6.196	32.91	137.55
44.00	0.000	98.885	6.082	-1.064	6.174	34.07	137.55
45.00	0.000	98.885	6.063	-1.043	6.152	35.24	137.55
46.00	0.000	98.885	6.045	-1.021	6.130	36.41	137.55
47.00	0.000	98.796	6.027	-0.980	6.106	37.77	138.89
48.00	0.000	98.634	6.010	-0.928	6.082	39.22	141.27
49.00	0.000	98.469	5.995	-0.847	6.055	40.96	143.66

Arbitrary Net Section-Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:11

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	98.300	5.981	-0.762	6.029	42.74	146.05
51.00	0.000	98.128	5.968	-0.700	6.009	44.31	148.43
52.00	0.000	97.953	5.957	-0.607	5.988	46.18	150.82
53.00	0.000	97.775	5.947	-0.510	5.969	48.10	153.21
54.00	0.000	97.593	5.939	-0.438	5.955	49.78	155.59
55.00	0.000	97.408	5.932	-0.333	5.942	51.78	157.98
56.00	0.000	97.219	5.927	-0.224	5.932	53.83	160.37
57.00	0.000	97.029	5.924	-0.143	5.926	55.62	162.73
58.00	0.000	97.028	5.922	-0.077	5.923	57.26	162.75
59.00	0.000	97.028	5.922	-0.024	5.922	58.76	162.75
60.00	0.000	97.028	5.921	0.028	5.922	60.27	162.75
61.00	0.000	97.028	5.922	0.080	5.923	61.77	162.75
62.00	0.000	97.028	5.924	0.132	5.926	63.28	162.75
63.00	0.000	97.028	5.927	0.184	5.930	64.78	162.75
64.00	0.000	97.028	5.931	0.236	5.935	66.28	162.75
65.00	0.000	97.028	5.935	0.288	5.942	67.78	162.75
66.00	0.000	97.028	5.941	0.340	5.950	69.28	162.75
67.00	0.000	97.185	5.947	0.438	5.963	71.21	160.80
68.00	0.000	97.374	5.956	0.531	5.979	73.10	158.41
69.00	0.000	97.560	5.966	0.636	6.000	75.09	156.02
70.00	0.000	97.742	5.978	0.723	6.021	76.89	153.64
71.00	0.000	97.921	5.991	0.806	6.045	78.66	151.25
72.00	0.000	98.097	6.006	0.899	6.073	80.51	148.86
73.00	0.000	98.269	6.022	0.974	6.100	82.19	146.48
74.00	0.000	98.439	6.039	1.046	6.129	83.82	144.09
75.00	0.000	98.604	6.058	1.127	6.162	85.54	141.70
76.00	0.000	98.767	6.078	1.191	6.194	87.08	139.32
77.00	0.000	98.926	6.100	1.251	6.227	88.59	136.93
78.00	0.000	99.082	6.122	1.319	6.263	90.16	134.54
79.00	2.000	99.234	6.145	1.372	6.297	91.58	132.16
80.00	2.000	99.383	6.170	1.420	6.331	92.96	129.77
81.00	2.000	99.529	6.195	1.476	6.368	94.40	127.38
82.00	2.000	99.672	6.221	1.517	6.403	95.70	125.00
83.00	2.000	99.811	6.248	1.553	6.438	96.96	122.61
84.00	2.000	99.946	6.275	1.596	6.475	98.27	120.22
85.00	0.000	100.078	6.303	1.625	6.509	99.45	117.84
86.00	0.000	100.207	6.332	1.649	6.543	100.60	115.45
87.00	0.000	100.228	6.360	1.651	6.571	101.55	115.06
88.00	0.000	100.228	6.389	1.641	6.597	102.41	115.06
89.00	0.000	100.228	6.418	1.631	6.622	103.26	115.06
90.00	0.000	100.228	6.446	1.621	6.647	104.11	115.06
91.00	0.000	100.228	6.474	1.610	6.671	104.96	115.06
92.00	2.000	100.228	6.502	1.598	6.696	105.81	115.06
93.00	2.000	100.260	6.530	1.597	6.722	106.74	114.45
94.00	2.000	100.384	6.558	1.612	6.753	107.81	112.06
95.00	0.000	100.505	6.586	1.633	6.785	108.93	109.67
96.00	0.000	100.622	6.614	1.640	6.815	109.93	107.29
97.00	0.000	100.644	6.643	1.701	6.857	111.36	106.83
98.00	0.000	100.644	6.673	1.770	6.904	112.85	106.83
99.00	0.000	100.644	6.705	1.838	6.952	114.33	106.83

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:11

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.000	100.644	6.737	1.905	7.001	115.79	106.83
101.00	2.000	100.644	6.771	1.972	7.052	117.24	106.83
102.00	2.000	100.591	6.806	2.002	7.094	118.39	107.93
103.00	2.000	100.473	6.841	2.016	7.131	119.42	110.32
104.00	0.000	100.351	6.876	2.014	7.164	120.32	112.70
105.00	0.000	100.226	6.911	2.034	7.204	121.40	115.09
106.00	0.000	100.098	6.947	2.058	7.245	122.50	117.48
107.00	0.000	99.966	6.983	2.063	7.281	123.46	119.86
108.00	0.000	99.831	7.019	2.093	7.324	124.60	122.25
109.00	0.000	99.693	7.056	2.126	7.369	125.77	124.64
110.00	0.000	99.551	7.093	2.140	7.409	126.79	127.02
111.00	0.000	99.406	7.131	2.179	7.456	127.99	129.41
112.00	0.000	99.257	7.169	2.222	7.505	129.22	131.80
113.00	0.000	99.105	7.208	2.243	7.549	130.29	134.18
114.00	0.000	99.029	7.247	2.280	7.598	131.46	135.36
115.00	0.000	99.029	7.287	2.278	7.635	132.36	135.36
116.00	0.000	99.029	7.327	2.275	7.672	133.25	135.36
117.00	0.000	99.029	7.366	2.272	7.709	134.14	135.36
118.00	0.000	99.029	7.406	2.268	7.745	135.03	135.36
119.00	0.000	99.029	7.445	2.263	7.781	135.91	135.36
120.00	0.000	99.028	7.484	2.258	7.817	136.79	135.37
121.00	0.000	98.883	7.524	2.293	7.865	137.95	137.57
122.00	0.000	98.723	7.564	2.315	7.910	139.02	139.96
123.00	2.000	98.560	7.605	2.367	7.965	140.29	142.35
124.00	2.000	98.393	7.646	2.422	8.021	141.57	144.73
125.00	0.000	98.223	7.689	2.452	8.070	142.69	147.12
126.00	0.000	98.050	7.732	2.513	8.130	144.00	149.51
127.00	0.000	97.873	7.777	2.577	8.192	145.33	151.89
128.00	0.000	97.693	7.822	2.614	8.247	146.48	154.28
129.00	0.000	97.510	7.868	2.684	8.313	147.84	156.67
130.00	0.000	97.323	7.915	2.757	8.382	149.20	159.05
131.00	0.000	97.133	7.964	2.801	8.442	150.38	161.44
132.00	0.000	97.028	8.013	2.854	8.506	151.61	162.75
133.00	0.000	97.028	8.063	2.869	8.559	152.59	162.75
134.00	0.000	97.028	8.113	2.884	8.611	153.57	162.75
135.00	0.000	97.028	8.164	2.897	8.663	154.54	162.75
136.00	0.000	97.028	8.215	2.910	8.715	155.51	162.75
137.00	0.000	97.028	8.265	2.922	8.767	156.47	162.75
138.00	0.000	97.028	8.316	2.933	8.818	157.42	162.75
139.00	0.000	97.028	8.368	2.943	8.870	158.37	162.75
140.00	0.000	97.028	8.419	2.952	8.922	159.32	162.75
141.00	0.000	97.028	8.471	2.960	8.973	160.26	162.75
142.00	0.000	97.028	8.522	2.967	9.024	161.20	162.75
143.00	0.000	97.028	8.574	2.973	9.075	162.13	162.75
144.00	0.000	97.028	8.626	2.979	9.126	163.05	162.75
145.00	0.000	97.028	8.678	2.983	9.177	163.97	162.75
146.00	0.000	97.028	8.730	2.987	9.227	164.89	162.75
147.00	0.000	97.028	8.782	2.990	9.277	165.80	162.75
148.00	0.000	97.028	8.835	2.992	9.327	166.71	162.75
149.00	0.000	97.028	8.887	2.992	9.377	167.61	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:11

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	97.028	8.939	2.992	9.427	168.51	162.75
151.00	0.000	97.028	8.991	2.992	9.476	169.40	162.75
152.00	0.000	97.028	9.043	2.990	9.525	170.29	162.75
153.00	0.000	97.028	9.095	2.987	9.573	171.18	162.75
154.00	0.000	97.028	9.148	2.983	9.622	172.06	162.75
155.00	0.000	97.028	9.200	2.979	9.670	172.94	162.75
156.00	0.000	97.028	9.251	2.973	9.717	173.82	162.75
157.00	0.000	97.028	9.303	2.967	9.765	174.69	162.75
158.00	0.000	97.028	9.355	2.960	9.812	175.56	162.75
159.00	0.000	97.028	9.406	2.952	9.859	176.42	162.75
160.00	0.000	97.028	9.458	2.942	9.905	177.28	162.75
161.00	0.000	97.028	9.509	2.932	9.951	178.14	162.75
162.00	0.000	97.028	9.560	2.922	9.997	178.99	162.75
163.00	0.000	97.028	9.611	2.910	10.042	179.84	162.75
164.00	0.000	97.028	9.662	2.897	10.087	180.69	162.75
165.00	0.000	97.028	9.712	2.884	10.131	181.54	162.75
166.00	0.000	97.028	9.762	2.869	10.175	182.38	162.75
167.00	0.000	97.028	9.812	2.854	10.219	183.22	162.75
168.00	0.000	97.028	9.862	2.838	10.262	184.05	162.75
169.00	0.000	97.028	9.911	2.821	10.305	184.89	162.75
170.00	0.000	97.028	9.960	2.803	10.347	185.72	162.75
171.00	0.000	97.028	10.009	2.784	10.389	186.55	162.75
172.00	0.000	97.028	10.057	2.765	10.431	187.37	162.75
173.00	0.000	97.028	10.106	2.744	10.472	188.19	162.75
174.00	0.000	97.028	10.153	2.723	10.512	189.01	162.75
175.00	0.000	97.028	10.201	2.701	10.552	189.83	162.75
176.00	0.000	97.028	10.247	2.678	10.592	190.65	162.75
177.00	0.000	97.028	10.294	2.655	10.631	191.46	162.75
178.00	0.000	97.028	10.340	2.630	10.669	192.27	162.75
179.00	0.000	97.028	10.386	2.605	10.707	193.08	162.75
180.00	0.000	97.028	10.431	2.579	10.745	193.89	162.75
181.00	0.000	97.028	10.476	2.552	10.782	194.69	162.75
182.00	0.000	97.028	10.520	2.524	10.818	195.49	162.75
183.00	0.000	97.028	10.564	2.496	10.854	196.29	162.75
184.00	0.000	97.028	10.607	2.466	10.890	197.09	162.75
185.00	0.000	97.028	10.650	2.436	10.925	197.89	162.75
186.00	0.000	97.028	10.692	2.406	10.959	198.68	162.75
187.00	0.000	97.028	10.734	2.374	10.993	199.47	162.75
188.00	0.000	97.028	10.775	2.342	11.026	200.26	162.75
189.00	0.000	97.028	10.815	2.309	11.059	201.05	162.75
190.00	0.000	97.028	10.855	2.276	11.091	201.84	162.75
191.00	0.000	97.028	10.895	2.242	11.123	202.63	162.75
192.00	0.000	97.028	10.934	2.207	11.154	203.41	162.75
193.00	0.000	97.028	10.972	2.171	11.184	204.19	162.75
194.00	0.000	97.028	11.009	2.135	11.214	204.97	162.75
195.00	0.000	97.028	11.046	2.098	11.244	205.75	162.75
196.00	0.000	97.028	11.082	2.060	11.272	206.53	162.75
197.00	0.000	97.028	11.118	2.022	11.300	207.31	162.75
198.00	0.000	97.028	11.153	1.983	11.328	208.08	162.75
199.00	0.000	97.028	11.187	1.944	11.355	208.86	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:12

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	97.028	11.221	1.904	11.381	209.63	162.75
201.00	2.000	97.028	11.254	1.863	11.407	210.40	162.75
202.00	0.000	97.028	11.286	1.822	11.432	211.17	162.75
203.00	0.000	97.028	11.317	1.780	11.456	211.94	162.75
204.00	0.000	97.028	11.348	1.738	11.480	212.71	162.75
205.00	0.000	97.028	11.378	1.695	11.503	213.48	162.75
206.00	0.000	97.028	11.407	1.652	11.526	214.24	162.75
207.00	0.000	97.028	11.435	1.608	11.548	215.01	162.75
208.00	0.000	97.028	11.463	1.564	11.569	215.77	162.75
209.00	0.000	97.028	11.490	1.519	11.590	216.53	162.75
210.00	0.000	97.028	11.516	1.474	11.610	217.29	162.75
211.00	0.000	97.028	11.541	1.428	11.629	218.06	162.75
212.00	2.000	97.028	11.566	1.382	11.648	218.82	162.75
213.00	2.000	97.028	11.590	1.336	11.666	219.58	162.75
214.00	2.000	97.028	11.612	1.289	11.684	220.33	162.75
215.00	2.000	97.028	11.634	1.242	11.701	221.09	162.75
216.00	2.000	97.028	11.656	1.194	11.717	221.85	162.75
217.00	2.000	97.028	11.676	1.146	11.732	222.60	162.75
218.00	2.000	97.028	11.696	1.097	11.747	223.36	162.75
219.00	0.000	97.028	11.714	1.049	11.761	224.12	162.75
220.00	0.000	97.028	11.732	1.000	11.775	224.87	162.75
221.00	0.000	97.028	11.749	0.950	11.788	225.62	162.75
222.00	0.000	97.028	11.765	0.901	11.800	226.38	162.75
223.00	0.000	97.028	11.781	0.851	11.811	227.13	162.75
224.00	0.000	97.028	11.795	0.801	11.822	227.88	162.75
225.00	0.000	97.028	11.809	0.750	11.832	228.63	162.75
226.00	0.000	97.028	11.821	0.699	11.842	229.39	162.75
227.00	0.000	97.028	11.833	0.649	11.851	230.14	162.75
228.00	0.000	97.028	11.844	0.598	11.859	230.89	162.75
229.00	0.000	97.028	11.854	0.546	11.866	231.64	162.75
230.00	0.000	97.028	11.863	0.495	11.873	232.39	162.75
231.00	0.000	97.028	11.871	0.443	11.879	233.14	162.75
232.00	0.000	97.028	11.878	0.392	11.885	233.89	162.75
233.00	0.000	97.028	11.885	0.340	11.889	234.64	162.75
234.00	0.000	97.028	11.890	0.288	11.893	235.39	162.75
235.00	0.000	97.028	11.895	0.236	11.897	236.14	162.75
236.00	0.000	97.028	11.898	0.184	11.900	236.89	162.75
237.00	0.000	97.028	11.901	0.132	11.902	237.63	162.75
238.00	0.000	97.028	11.903	0.079	11.903	238.38	162.75
239.00	0.000	97.028	11.904	0.027	11.904	239.13	162.75
240.00	0.000	97.122	11.904	0.006	11.904	240.03	161.58
241.00	0.000	97.312	11.904	-0.003	11.904	240.98	159.20
242.00	0.000	97.499	11.904	-0.001	11.904	241.99	156.81
243.00	0.000	97.682	11.903	-0.017	11.903	242.92	154.42
244.00	0.000	97.862	11.903	-0.036	11.903	243.82	152.04
245.00	0.000	98.039	11.902	-0.045	11.902	244.78	149.65
246.00	0.000	98.213	11.901	-0.071	11.901	245.66	147.26
247.00	0.000	98.383	11.899	-0.101	11.900	246.51	144.88
248.00	0.000	98.550	11.897	-0.121	11.898	247.42	142.49
249.00	0.000	98.714	11.894	-0.157	11.896	248.24	140.10

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:12

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.000	98.749	11.891	-0.222	11.893	248.93	139.59
251.00	0.000	98.749	11.886	-0.300	11.890	249.55	139.59
252.00	0.000	98.749	11.880	-0.378	11.886	250.18	139.59
253.00	0.000	98.749	11.873	-0.455	11.882	250.80	139.59
254.00	0.000	98.749	11.864	-0.533	11.876	251.43	139.59
255.00	0.000	98.749	11.854	-0.610	11.870	252.05	139.59
256.00	0.000	98.749	11.842	-0.687	11.862	252.68	139.59
257.00	0.000	98.893	11.830	-0.727	11.852	253.48	137.43
258.00	0.000	99.049	11.817	-0.770	11.842	254.27	135.04
259.00	0.000	99.203	11.803	-0.816	11.831	255.04	132.66
260.00	0.000	99.352	11.788	-0.853	11.819	255.86	130.27
261.00	0.000	99.444	11.773	-0.917	11.808	256.54	128.78
262.00	0.000	99.444	11.756	-1.005	11.799	257.11	128.78
263.00	0.000	99.444	11.737	-1.093	11.788	257.68	128.78
264.00	0.000	99.444	11.717	-1.180	11.777	258.25	128.78
265.00	0.000	99.444	11.696	-1.267	11.764	258.82	128.78
266.00	2.000	99.465	11.673	-1.353	11.751	259.39	128.43
267.00	2.000	99.609	11.649	-1.395	11.732	260.17	126.05
268.00	2.000	99.750	11.624	-1.451	11.714	260.88	123.66
269.00	2.000	99.887	11.598	-1.511	11.696	261.58	121.27
270.00	2.000	100.021	11.571	-1.562	11.676	262.31	118.89
271.00	2.000	100.098	11.543	-1.638	11.659	262.92	117.47
272.00	2.000	99.969	11.514	-1.714	11.641	263.53	119.82
273.00	2.000	99.834	11.484	-1.763	11.618	264.27	122.20
274.00	2.000	99.695	11.452	-1.807	11.594	265.03	124.59
275.00	2.000	99.554	11.420	-1.870	11.572	265.70	126.98
276.00	2.000	99.408	11.387	-1.906	11.546	266.50	129.36
277.00	2.000	99.260	11.354	-1.937	11.518	267.32	131.75
278.00	2.000	99.108	11.320	-1.988	11.493	268.04	134.14
279.00	0.000	98.953	11.285	-2.011	11.462	268.90	136.52
280.00	0.000	98.794	11.249	-2.029	11.431	269.78	138.91
281.00	0.000	98.681	11.214	-2.070	11.403	270.54	140.59
282.00	0.000	98.681	11.177	-2.134	11.379	271.19	140.59
283.00	0.000	98.681	11.139	-2.198	11.354	271.84	140.59
284.00	0.000	98.681	11.100	-2.261	11.328	272.48	140.59
285.00	2.000	98.681	11.060	-2.324	11.302	273.13	140.59
286.00	2.000	98.681	11.019	-2.386	11.274	273.78	140.59
287.00	2.000	98.794	10.977	-2.409	11.238	274.62	138.91
288.00	2.000	98.836	10.935	-2.365	11.188	275.79	138.28
289.00	2.000	98.836	10.894	-2.299	11.134	277.08	138.28
290.00	2.000	98.689	10.854	-2.308	11.096	277.99	140.46
291.00	2.000	98.545	10.813	-2.327	11.061	278.86	142.56
292.00	2.000	98.545	10.772	-2.382	11.032	279.53	142.56
293.00	0.000	98.545	10.730	-2.437	11.003	280.20	142.56
294.00	0.000	98.545	10.686	-2.490	10.973	280.88	142.56
295.00	0.000	98.545	10.642	-2.544	10.942	281.56	142.56
296.00	0.000	98.545	10.597	-2.596	10.910	282.23	142.56
297.00	0.000	98.397	10.551	-2.609	10.869	283.11	144.69
298.00	0.000	98.227	10.506	-2.628	10.830	283.95	147.07
299.00	0.000	98.053	10.460	-2.616	10.782	284.96	149.46

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:12

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.000	97.877	10.414	-2.599	10.734	285.99	151.85
301.00	0.000	97.721	10.369	-2.594	10.688	286.95	153.91
302.00	0.000	97.721	10.323	-2.629	10.653	287.71	153.91
303.00	0.000	97.721	10.277	-2.663	10.616	288.47	153.91
304.00	0.000	97.721	10.230	-2.696	10.579	289.24	153.91
305.00	0.000	97.721	10.182	-2.728	10.542	290.00	153.91
306.00	0.000	97.721	10.134	-2.760	10.503	290.76	153.91
307.00	0.000	97.721	10.086	-2.791	10.465	291.53	153.91
308.00	0.000	97.721	10.037	-2.820	10.425	292.30	153.91
309.00	0.000	97.721	9.987	-2.849	10.385	293.07	153.91
310.00	0.000	97.721	9.937	-2.878	10.345	293.85	153.91
311.00	0.000	97.721	9.886	-2.905	10.304	294.62	153.91
312.00	0.000	97.721	9.835	-2.931	10.262	295.40	153.91
313.00	0.000	97.721	9.783	-2.957	10.220	296.18	153.91
314.00	0.000	97.721	9.731	-2.981	10.178	296.97	153.91
315.00	0.000	97.721	9.679	-3.005	10.135	297.75	153.91
316.00	0.000	97.721	9.626	-3.028	10.091	298.54	153.91
317.00	0.000	97.721	9.573	-3.049	10.047	299.33	153.91
318.00	0.000	97.721	9.519	-3.070	10.002	300.12	153.91
319.00	0.000	97.721	9.465	-3.090	9.957	300.92	153.91
320.00	0.000	97.682	9.411	-3.111	9.912	301.71	154.42
321.00	0.000	97.499	9.357	-3.068	9.847	302.85	156.81
322.00	0.000	97.312	9.304	-3.050	9.791	303.85	159.20
323.00	0.000	97.122	9.251	-2.998	9.725	305.04	161.58
324.00	0.000	97.028	9.199	-2.976	9.668	306.07	162.75
325.00	0.000	97.028	9.147	-2.981	9.620	306.95	162.75
326.00	0.000	97.028	9.095	-2.984	9.572	307.83	162.75
327.00	0.000	97.028	9.043	-2.987	9.523	308.72	162.75
328.00	0.000	97.028	8.991	-2.989	9.474	309.61	162.75
329.00	0.000	97.028	8.938	-2.990	9.425	310.51	162.75
330.00	0.000	97.028	8.886	-2.990	9.376	311.40	162.75
331.00	0.000	97.028	8.834	-2.989	9.326	312.31	162.75
332.00	0.000	97.028	8.782	-2.987	9.276	313.21	162.75
333.00	0.000	97.028	8.730	-2.984	9.226	314.13	162.75
334.00	0.000	97.028	8.678	-2.980	9.175	315.04	162.75
335.00	0.000	97.028	8.626	-2.976	9.125	315.96	162.75
336.00	0.000	97.028	8.574	-2.970	9.074	316.89	162.75
337.00	0.000	97.028	8.522	-2.964	9.023	317.82	162.75
338.00	0.000	97.028	8.470	-2.957	8.971	318.76	162.75
339.00	0.000	97.028	8.419	-2.949	8.920	319.70	162.75
340.00	0.000	97.028	8.367	-2.940	8.869	320.64	162.75
341.00	0.000	97.028	8.316	-2.930	8.817	321.59	162.75
342.00	0.000	97.028	8.265	-2.919	8.765	322.55	162.75
343.00	0.000	97.028	8.214	-2.907	8.713	323.51	162.75
344.00	0.000	97.028	8.163	-2.894	8.661	324.48	162.75
345.00	0.000	97.028	8.113	-2.881	8.609	325.45	162.75
346.00	0.000	97.028	8.063	-2.866	8.557	326.43	162.75
347.00	0.000	97.028	8.013	-2.851	8.505	327.41	162.75
348.00	0.000	97.028	7.963	-2.835	8.453	328.40	162.75
349.00	0.000	97.028	7.914	-2.818	8.401	329.40	162.75

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

08-27-2000 11:09:12

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	97.028	7.865	-2.800	8.348	330.40	162.75
351.00	0.000	97.028	7.816	-2.781	8.296	331.41	162.75
352.00	0.000	97.028	7.768	-2.762	8.244	332.42	162.75
353.00	0.000	97.028	7.720	-2.742	8.192	333.45	162.75
354.00	0.000	97.028	7.672	-2.720	8.140	334.48	162.75
355.00	0.000	97.028	7.625	-2.698	8.088	335.51	162.75
356.00	0.000	97.028	7.578	-2.675	8.036	336.55	162.75
357.00	0.000	97.028	7.531	-2.652	7.984	337.60	162.75
358.00	0.000	97.028	7.485	-2.627	7.933	338.66	162.75
359.00	0.000	97.028	7.439	-2.602	7.881	339.72	162.75

MINIMUM STRESS (Pb,x')	=	5.921	AT	60.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max)	=	5.922	AT	58.76 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:51:10

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H5 -- 10 Years of Crack Growth -- Upset Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.356 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 11 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	7.3000	(DTHETA =	7.300)	DEPTH (IN) =	2.000
2 ANGLES:	37.7100 TO	52.3000	(DTHETA =	14.590)	DEPTH (IN) =	2.000
3 ANGLES:	56.2100 TO	62.2000	(DTHETA =	5.990)	DEPTH (IN) =	1.941
4 ANGLES:	74.2800 TO	83.0400	(DTHETA =	8.760)	DEPTH (IN) =	2.000
5 ANGLES:	83.0400 TO	102.4900	(DTHETA =	19.450)	DEPTH (IN) =	1.941
6 ANGLES:	107.2600 TO	115.0500	(DTHETA =	7.790)	DEPTH (IN) =	1.941
7 ANGLES:	118.8900 TO	124.2900	(DTHETA =	5.400)	DEPTH (IN) =	1.941
8 ANGLES:	124.2900 TO	183.1100	(DTHETA =	58.820)	DEPTH (IN) =	2.000
9 ANGLES:	183.1100 TO	186.9400	(DTHETA =	3.830)	DEPTH (IN) =	1.941
10 ANGLES:	217.1000 TO	235.7200	(DTHETA =	18.620)	DEPTH (IN) =	2.000
11 ANGLES:	304.2900 TO	360.0000	(DTHETA =	55.710)	DEPTH (IN) =	2.000

TOTAL AREA (IN2) = 1288.838

REMAINING DEGRADED SECTION AREA (IN2) = 554.89

(APPROX. DEGRADED METAL AREA = 554.887)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:01

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	52.633	31.607	-6.421	32.252	348.52	433.96
1.00	0.000	53.125	31.495	-6.421	32.142	349.48	431.67
2.00	0.000	53.614	31.383	-6.379	32.024	350.51	429.37
3.00	0.000	54.111	31.271	-6.385	31.916	351.46	427.04
4.00	0.000	54.617	31.159	-6.401	31.809	352.39	424.65
5.00	0.000	55.121	31.047	-6.376	31.695	353.39	422.27
6.00	0.000	55.623	30.935	-6.392	31.588	354.32	419.88
7.00	0.000	56.123	30.823	-6.408	31.482	355.26	417.49
8.00	2.000	56.622	30.711	-6.383	31.367	356.26	415.11
9.00	2.000	57.118	30.599	-6.399	31.261	357.19	412.72
10.00	2.000	57.613	30.487	-6.415	31.154	358.12	410.33
11.00	2.000	58.105	30.375	-6.391	31.040	359.12	407.95
12.00	2.000	58.596	30.262	-6.407	30.933	0.04	405.56
13.00	2.000	59.085	30.150	-6.424	30.827	0.97	403.17
14.00	2.000	59.572	30.038	-6.401	30.712	1.97	400.79
15.00	2.000	60.056	29.926	-6.417	30.606	2.90	398.40
16.00	2.000	60.539	29.813	-6.434	30.499	3.82	396.01
17.00	2.000	61.020	29.701	-6.412	30.385	4.82	393.63
18.00	2.000	61.498	29.588	-6.429	30.278	5.74	391.24
19.00	2.000	61.975	29.475	-6.446	30.172	6.66	388.85
20.00	2.000	62.449	29.363	-6.426	30.058	7.65	386.47
21.00	2.000	62.921	29.250	-6.443	29.951	8.58	384.08
22.00	2.000	63.392	29.137	-6.461	29.845	9.49	381.69
23.00	2.000	63.860	29.024	-6.442	29.730	10.48	379.31
24.00	2.000	64.326	28.911	-6.461	29.624	11.40	376.92
25.00	2.000	64.789	28.798	-6.479	29.518	12.32	374.53
26.00	2.000	65.251	28.684	-6.461	29.403	13.30	372.15
27.00	2.000	65.710	28.571	-6.481	29.297	14.22	369.76
28.00	2.000	66.167	28.457	-6.501	29.191	15.13	367.37
29.00	2.000	66.622	28.344	-6.484	29.076	16.11	364.99
30.00	2.000	67.074	28.230	-6.505	28.970	17.02	362.60
31.00	2.000	67.524	28.116	-6.526	28.863	17.93	360.21
32.00	2.000	67.972	28.002	-6.511	28.749	18.91	357.83
33.00	2.000	68.418	27.888	-6.533	28.643	19.81	355.44
34.00	2.000	68.861	27.773	-6.555	28.536	20.72	353.05
35.00	2.000	69.302	27.658	-6.542	28.422	21.69	350.67
36.00	2.000	69.741	27.544	-6.565	28.315	22.59	348.28
37.00	2.000	70.177	27.429	-6.589	28.209	23.49	345.89
38.00	0.000	70.611	27.313	-6.578	28.094	24.46	343.51
39.00	0.000	71.043	27.198	-6.602	27.988	25.35	341.12
40.00	0.000	71.472	27.082	-6.627	27.881	26.25	338.73
41.00	0.000	71.899	26.966	-6.618	27.767	27.21	336.35
42.00	0.000	72.323	26.850	-6.645	27.660	28.10	333.96
43.00	0.000	72.745	26.734	-6.671	27.553	28.99	331.57
44.00	0.000	73.164	26.617	-6.664	27.439	29.94	329.19
45.00	0.000	73.581	26.500	-6.692	27.332	30.83	326.80
46.00	0.000	73.995	26.383	-6.720	27.225	31.71	324.41
47.00	0.000	74.403	26.265	-6.712	27.109	32.66	322.05
48.00	0.000	74.796	26.147	-6.729	26.999	33.57	319.76
49.00	0.000	75.187	26.029	-6.746	26.889	34.47	317.47

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:01

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	75.421	25.912	-6.683	26.760	35.54	316.09
51.00	0.000	75.421	25.797	-6.484	26.599	36.89	316.09
52.00	0.000	75.421	25.685	-6.283	26.442	38.25	316.09
53.00	2.000	75.421	25.577	-6.079	26.290	39.63	316.09
54.00	2.000	75.421	25.473	-5.874	26.141	41.01	316.09
55.00	2.000	75.421	25.372	-5.667	25.997	42.41	316.09
56.00	2.000	75.421	25.274	-5.459	25.857	43.81	316.09
57.00	0.059	75.421	25.181	-5.249	25.722	45.22	316.09
58.00	0.059	75.421	25.091	-5.037	25.592	46.65	316.09
59.00	0.059	75.421	25.005	-4.823	25.466	48.08	316.09
60.00	0.059	75.421	24.922	-4.608	25.345	49.52	316.09
61.00	0.059	75.421	24.844	-4.392	25.229	50.97	316.09
62.00	0.059	75.421	24.769	-4.175	25.118	52.43	316.09
63.00	2.000	75.421	24.698	-3.956	25.013	53.90	316.09
64.00	2.000	75.421	24.630	-3.736	24.912	55.37	316.09
65.00	2.000	75.421	24.567	-3.514	24.817	56.86	316.09
66.00	2.000	75.421	24.508	-3.292	24.728	58.35	316.09
67.00	2.000	75.421	24.452	-3.069	24.644	59.85	316.09
68.00	2.000	75.421	24.400	-2.844	24.565	61.35	316.09
69.00	2.000	75.421	24.352	-2.619	24.493	62.86	316.09
70.00	2.000	75.421	24.309	-2.393	24.426	64.38	316.09
71.00	2.000	75.421	24.269	-2.167	24.365	65.90	316.09
72.00	2.000	75.421	24.233	-1.939	24.310	67.42	316.09
73.00	2.000	75.421	24.201	-1.712	24.261	68.95	316.09
74.00	2.000	75.421	24.173	-1.483	24.218	70.49	316.09
75.00	0.000	75.421	24.149	-1.254	24.181	72.03	316.09
76.00	0.000	75.421	24.129	-1.025	24.150	73.57	316.09
77.00	0.000	75.421	24.113	-0.795	24.126	75.11	316.09
78.00	0.000	75.421	24.101	-0.566	24.107	76.65	316.09
79.00	0.000	75.421	24.093	-0.336	24.095	78.20	316.09
80.00	0.000	75.518	24.088	-0.138	24.089	79.67	315.52
81.00	0.000	75.920	24.086	-0.138	24.086	80.67	313.13
82.00	0.000	76.320	24.083	-0.140	24.083	81.67	310.74
83.00	0.000	76.544	24.080	-0.177	24.081	82.58	309.40
84.00	0.059	76.544	24.076	-0.277	24.078	83.34	309.40
85.00	0.059	76.544	24.070	-0.378	24.073	84.10	309.40
86.00	0.059	76.544	24.063	-0.479	24.068	84.86	309.40
87.00	0.059	76.544	24.053	-0.579	24.060	85.62	309.40
88.00	0.059	76.544	24.042	-0.679	24.052	86.38	309.40
89.00	0.059	76.544	24.029	-0.779	24.042	87.14	309.40
90.00	0.059	76.544	24.015	-0.879	24.031	87.90	309.40
91.00	0.059	76.544	23.998	-0.978	24.018	88.66	309.40
92.00	0.059	76.544	23.980	-1.078	24.004	89.43	309.40
93.00	0.059	76.544	23.960	-1.177	23.989	90.19	309.40
94.00	0.059	76.544	23.939	-1.275	23.973	90.95	309.40
95.00	0.059	76.544	23.916	-1.373	23.955	91.71	309.40
96.00	0.059	76.544	23.891	-1.471	23.936	92.48	309.40
97.00	0.059	76.544	23.864	-1.568	23.915	93.24	309.40
98.00	0.059	76.324	23.836	-1.639	23.892	94.06	310.72
99.00	0.059	75.924	23.808	-1.605	23.862	95.14	313.11

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:01

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.059	75.522	23.780	-1.567	23.831	96.23	315.49
101.00	0.059	75.117	23.752	-1.591	23.806	97.17	317.88
102.00	0.059	74.709	23.725	-1.546	23.776	98.27	320.27
103.00	2.000	74.299	23.699	-1.498	23.746	99.38	322.65
104.00	2.000	73.887	23.672	-1.513	23.721	100.34	325.04
105.00	2.000	73.472	23.647	-1.459	23.692	101.47	327.43
106.00	2.000	73.054	23.622	-1.401	23.663	102.60	329.81
107.00	2.000	72.634	23.597	-1.407	23.639	103.59	332.20
108.00	0.059	72.212	23.573	-1.343	23.612	104.74	334.59
109.00	0.059	71.787	23.550	-1.276	23.585	105.90	336.97
110.00	0.059	71.359	23.528	-1.274	23.563	106.90	339.36
111.00	0.059	70.930	23.507	-1.201	23.537	108.07	341.75
112.00	0.059	70.497	23.486	-1.124	23.513	109.26	344.13
113.00	0.059	70.063	23.467	-1.114	23.493	110.28	346.52
114.00	0.059	69.626	23.448	-1.032	23.471	111.48	348.91
115.00	0.059	69.187	23.431	-0.946	23.450	112.69	351.29
116.00	2.000	68.745	23.415	-0.928	23.433	113.73	353.68
117.00	2.000	68.301	23.400	-0.837	23.414	114.95	356.07
118.00	2.000	67.855	23.386	-0.743	23.397	116.18	358.45
119.00	0.059	67.406	23.373	-0.718	23.384	117.24	360.84
120.00	0.059	66.955	23.361	-0.618	23.370	118.48	363.23
121.00	0.059	66.502	23.351	-0.515	23.357	119.73	365.61
122.00	0.059	66.047	23.343	-0.483	23.348	120.81	368.00
123.00	0.059	65.589	23.336	-0.375	23.339	122.08	370.39
124.00	0.059	65.129	23.330	-0.264	23.331	123.35	372.77
125.00	0.000	64.667	23.326	-0.225	23.327	124.44	375.16
126.00	0.000	64.203	23.323	-0.110	23.323	125.73	377.55
127.00	0.000	63.736	23.322	0.009	23.322	127.02	379.94
128.00	0.000	63.268	23.323	0.054	23.323	128.13	382.32
129.00	0.000	62.797	23.325	0.177	23.326	129.43	384.71
130.00	0.000	62.324	23.329	0.302	23.331	130.74	387.10
131.00	0.000	61.849	23.335	0.353	23.338	131.87	389.48
132.00	0.000	61.372	23.342	0.483	23.347	133.19	391.87
133.00	0.000	60.893	23.352	0.615	23.360	134.51	394.26
134.00	0.000	60.633	23.364	0.827	23.378	136.03	395.55
135.00	0.000	60.633	23.381	1.193	23.412	137.92	395.55
136.00	0.000	60.633	23.405	1.559	23.457	139.81	395.55
137.00	0.000	60.633	23.435	1.925	23.514	141.70	395.55
138.00	0.000	60.633	23.472	2.290	23.583	143.57	395.55
139.00	0.000	60.633	23.515	2.654	23.664	145.44	395.55
140.00	0.000	60.633	23.564	3.017	23.757	147.30	395.55
141.00	0.000	60.633	23.620	3.380	23.861	149.14	395.55
142.00	0.000	60.633	23.682	3.741	23.976	150.98	395.55
143.00	0.000	60.633	23.750	4.102	24.102	152.80	395.55
144.00	0.000	60.633	23.825	4.461	24.239	154.61	395.55
145.00	0.000	60.633	23.906	4.819	24.387	156.40	395.55
146.00	0.000	60.633	23.993	5.175	24.545	158.17	395.55
147.00	0.000	60.633	24.086	5.530	24.713	159.93	395.55
148.00	0.000	60.633	24.186	5.883	24.891	161.67	395.55
149.00	0.000	60.633	24.291	6.234	25.078	163.39	395.55

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:01

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	60.633	24.403	6.583	25.275	165.10	395.55
151.00	0.000	60.633	24.521	6.931	25.481	166.78	395.55
152.00	0.000	60.633	24.645	7.276	25.696	168.45	395.55
153.00	0.000	60.633	24.774	7.619	25.919	170.09	395.55
154.00	0.000	60.633	24.910	7.959	26.151	171.72	395.55
155.00	0.000	60.633	25.052	8.298	26.390	173.33	395.55
156.00	0.000	60.633	25.200	8.633	26.638	174.91	395.55
157.00	0.000	60.633	25.353	8.967	26.892	176.48	395.55
158.00	0.000	60.633	25.512	9.297	27.154	178.02	395.55
159.00	0.000	60.633	25.677	9.625	27.422	179.55	395.55
160.00	0.000	60.633	25.848	9.949	27.697	181.05	395.55
161.00	0.000	60.633	26.024	10.271	27.978	182.54	395.55
162.00	0.000	60.633	26.206	10.589	28.265	184.00	395.55
163.00	0.000	60.633	26.394	10.905	28.558	185.45	395.55
164.00	0.000	60.609	26.587	11.216	28.856	186.87	395.67
165.00	0.000	60.127	26.783	11.216	29.036	187.72	398.05
166.00	0.000	59.643	26.979	11.293	29.247	188.71	400.44
167.00	0.000	59.156	27.177	11.368	29.459	189.70	402.82
168.00	0.000	58.668	27.376	11.363	29.640	190.54	405.21
169.00	0.000	58.177	27.575	11.436	29.852	191.53	407.60
170.00	0.000	57.685	27.775	11.508	30.065	192.51	409.98
171.00	0.000	57.191	27.976	11.498	30.247	193.34	412.37
172.00	0.000	56.694	28.178	11.567	30.459	194.32	414.76
173.00	0.000	56.196	28.380	11.635	30.672	195.29	417.14
174.00	0.000	55.696	28.583	11.620	30.855	196.12	419.53
175.00	0.000	55.248	28.787	11.685	31.068	197.09	421.66
176.00	0.000	55.248	28.994	11.990	31.375	198.47	421.66
177.00	0.000	55.248	29.206	12.290	31.687	199.82	421.66
178.00	0.000	55.248	29.424	12.588	32.003	201.16	421.66
179.00	0.000	55.153	29.647	12.881	32.324	202.48	422.11
180.00	0.000	54.669	29.872	12.929	32.550	203.40	424.41
181.00	0.000	54.183	30.097	12.894	32.743	204.19	426.70
182.00	0.000	53.695	30.323	12.938	32.968	205.11	428.99
183.00	0.000	53.208	30.549	12.981	33.193	206.02	431.28
184.00	0.059	53.472	30.775	12.974	33.398	206.86	430.04
185.00	0.059	53.981	31.001	12.967	33.604	207.70	427.65
186.00	0.059	54.487	31.227	12.953	33.807	208.53	425.27
187.00	2.000	54.992	31.453	12.975	34.024	209.42	422.88
188.00	2.000	55.494	31.679	12.949	34.223	210.23	420.49
189.00	2.000	55.995	31.904	12.918	34.421	211.04	418.11
190.00	2.000	56.494	32.130	12.921	34.631	211.91	415.72
191.00	2.000	56.991	32.354	12.878	34.823	212.70	413.33
192.00	2.000	57.486	32.579	12.829	35.014	213.49	410.95
193.00	2.000	57.979	32.802	12.814	35.216	214.34	408.56
194.00	2.000	58.471	33.025	12.753	35.402	215.12	406.17
195.00	2.000	58.960	33.247	12.687	35.585	215.89	403.79
196.00	2.000	59.447	33.468	12.653	35.780	216.71	401.40
197.00	2.000	59.932	33.687	12.574	35.958	217.47	399.01
198.00	2.000	60.415	33.906	12.490	36.133	218.22	396.63
199.00	2.000	60.896	34.123	12.438	36.319	219.03	394.24

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:01

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	61.376	34.339	12.341	36.489	219.77	391.85
201.00	2.000	61.853	34.553	12.239	36.657	220.50	389.47
202.00	2.000	62.117	34.766	12.093	36.809	221.18	388.14
203.00	2.000	62.117	34.975	11.866	36.933	221.74	388.14
204.00	2.000	62.117	35.180	11.636	37.054	222.30	388.14
205.00	2.000	62.117	35.381	11.402	37.172	222.86	388.14
206.00	2.000	62.117	35.577	11.165	37.288	223.42	388.14
207.00	2.000	62.117	35.770	10.924	37.401	223.98	388.14
208.00	2.000	62.117	35.958	10.680	37.511	224.54	388.14
209.00	2.000	62.117	36.142	10.433	37.618	225.10	388.14
210.00	2.000	62.117	36.322	10.182	37.722	225.66	388.14
211.00	2.000	62.131	36.497	9.929	37.824	226.22	388.07
212.00	2.000	62.152	36.668	9.710	37.932	226.83	387.96
213.00	2.000	62.173	36.835	9.451	38.028	227.39	387.86
214.00	2.000	62.193	36.997	9.188	38.121	227.95	387.75
215.00	2.000	62.214	37.155	8.923	38.211	228.50	387.65
216.00	2.000	62.235	37.308	8.654	38.298	229.06	387.55
217.00	2.000	62.255	37.456	8.383	38.383	229.62	387.44
218.00	0.000	62.276	37.600	8.110	38.465	230.17	387.34
219.00	0.000	62.297	37.739	7.872	38.551	230.78	387.23
220.00	0.000	62.317	37.874	7.593	38.627	231.34	387.13
221.00	0.000	62.338	38.003	7.312	38.700	231.89	387.03
222.00	0.000	62.359	38.128	7.029	38.770	232.45	386.92
223.00	0.000	62.380	38.248	6.743	38.838	233.00	386.82
224.00	0.000	62.400	38.363	6.456	38.902	233.55	386.71
225.00	0.000	62.421	38.473	6.166	38.964	234.11	386.61
226.00	0.000	62.442	38.578	5.913	39.028	234.71	386.50
227.00	0.000	62.462	38.678	5.619	39.084	235.27	386.40
228.00	0.000	62.483	38.773	5.324	39.137	235.82	386.30
229.00	0.000	62.504	38.863	5.027	39.187	236.37	386.19
230.00	0.000	62.527	38.948	4.729	39.234	236.92	386.08
231.00	0.000	62.972	39.028	4.542	39.292	237.64	383.82
232.00	0.000	63.442	39.106	4.389	39.351	238.40	381.43
233.00	0.000	63.910	39.180	4.195	39.404	239.11	379.05
234.00	0.000	64.376	39.251	3.997	39.455	239.81	376.66
235.00	0.000	64.839	39.320	3.833	39.506	240.57	374.28
236.00	2.000	65.300	39.384	3.629	39.551	241.26	371.89
237.00	2.000	65.759	39.445	3.421	39.594	241.96	369.50
238.00	2.000	65.571	39.503	3.211	39.633	242.65	370.48
239.00	2.000	65.129	39.557	3.039	39.674	243.39	372.78
240.00	2.000	64.685	39.609	2.869	39.712	244.14	375.07
241.00	2.000	64.239	39.656	2.625	39.743	244.79	377.36
242.00	2.000	63.791	39.701	2.457	39.777	245.54	379.66
243.00	2.000	63.340	39.742	2.292	39.808	246.30	381.95
244.00	2.000	63.276	39.782	2.277	39.847	247.28	382.28
245.00	2.000	63.276	39.823	2.338	39.892	248.36	382.28
246.00	2.000	63.276	39.865	2.398	39.937	249.44	382.28
247.00	2.000	63.268	39.908	2.458	39.984	250.52	382.32
248.00	2.000	62.816	39.950	2.291	40.015	251.28	384.61
249.00	2.000	62.362	39.988	2.126	40.045	252.04	386.91

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:02

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	2.000	61.906	40.024	1.962	40.072	252.81	389.20
251.00	2.000	61.447	40.056	1.800	40.097	253.57	391.49
252.00	2.000	60.970	40.086	1.563	40.116	254.23	393.87
253.00	2.000	60.489	40.112	1.405	40.136	255.01	396.26
254.00	2.000	60.006	40.134	1.248	40.154	255.78	398.65
255.00	2.000	59.521	40.154	1.016	40.167	256.45	401.03
256.00	2.000	59.035	40.170	0.863	40.180	257.23	403.42
257.00	2.000	58.546	40.184	0.713	40.190	258.02	405.81
258.00	2.000	58.055	40.194	0.485	40.197	258.69	408.19
259.00	2.000	57.562	40.201	0.338	40.203	259.48	410.58
260.00	2.000	57.067	40.206	0.194	40.206	260.28	412.97
261.00	2.000	56.570	40.207	-0.028	40.207	260.96	415.35
262.00	2.000	56.072	40.205	-0.168	40.206	261.76	417.74
263.00	2.000	55.571	40.201	-0.306	40.202	262.56	420.13
264.00	2.000	55.069	40.194	-0.523	40.197	263.25	422.51
265.00	2.000	54.565	40.183	-0.656	40.189	264.06	424.90
266.00	2.000	54.059	40.170	-0.787	40.178	264.88	427.29
267.00	2.000	53.551	40.155	-0.998	40.167	265.58	429.67
268.00	2.000	53.041	40.136	-1.124	40.152	266.39	432.06
269.00	2.000	52.529	40.115	-1.248	40.135	267.22	434.45
270.00	2.000	52.016	40.092	-1.453	40.118	267.92	436.83
271.00	2.000	51.501	40.065	-1.572	40.096	268.75	439.22
272.00	2.000	50.984	40.036	-1.689	40.072	269.58	441.61
273.00	2.000	50.465	40.005	-1.887	40.050	270.30	443.99
274.00	2.000	49.945	39.971	-1.999	40.021	271.14	446.38
275.00	2.000	49.423	39.935	-2.108	39.991	271.98	448.77
276.00	2.000	48.899	39.897	-2.299	39.963	272.70	451.15
277.00	2.000	48.374	39.856	-2.404	39.928	273.55	453.54
278.00	2.000	47.847	39.812	-2.505	39.891	274.40	455.93
279.00	2.000	47.318	39.767	-2.689	39.858	275.13	458.31
280.00	2.000	46.788	39.719	-2.786	39.817	275.99	460.70
281.00	2.000	46.334	39.670	-2.918	39.777	276.79	462.74
282.00	2.000	46.334	39.616	-3.182	39.744	277.41	462.74
283.00	2.000	46.334	39.558	-3.445	39.708	278.02	462.74
284.00	2.000	46.334	39.495	-3.706	39.669	278.64	462.74
285.00	2.000	46.334	39.428	-3.967	39.627	279.25	462.74
286.00	2.000	46.333	39.356	-4.226	39.582	279.87	462.74
287.00	2.000	46.333	39.280	-4.484	39.535	280.49	462.74
288.00	2.000	46.333	39.199	-4.741	39.485	281.10	462.74
289.00	2.000	46.333	39.114	-4.996	39.431	281.72	462.74
290.00	2.000	46.333	39.024	-5.249	39.375	282.34	462.74
291.00	2.000	46.333	38.930	-5.501	39.317	282.96	462.74
292.00	2.000	46.333	38.831	-5.752	39.255	283.57	462.74
293.00	2.000	46.333	38.728	-6.000	39.190	284.19	462.74
294.00	2.000	46.333	38.621	-6.247	39.123	284.81	462.74
295.00	2.000	46.333	38.510	-6.492	39.053	285.43	462.74
296.00	2.000	46.037	38.394	-6.692	38.973	286.11	464.07
297.00	2.000	45.503	38.277	-6.760	38.869	286.98	466.46
298.00	2.000	44.967	38.158	-6.824	38.763	287.86	468.84
299.00	2.000	44.434	38.037	-6.970	38.671	288.61	471.21

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:02

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	2.000	43.916	37.915	-7.026	38.561	289.50	473.51
301.00	2.000	43.398	37.792	-7.079	38.449	290.39	475.80
302.00	2.000	43.320	37.667	-7.246	38.358	291.11	476.15
303.00	2.000	43.839	37.540	-7.276	38.239	292.03	473.85
304.00	2.000	44.357	37.412	-7.350	38.127	292.88	471.56
305.00	0.000	44.873	37.282	-7.424	38.014	293.74	469.26
306.00	0.000	45.362	37.152	-7.496	37.900	294.59	467.08
307.00	0.000	45.362	37.023	-7.283	37.732	295.87	467.08
308.00	0.000	45.362	36.898	-7.067	37.568	297.16	467.08
309.00	0.000	45.362	36.776	-6.849	37.408	298.45	467.08
310.00	0.000	45.362	36.659	-6.628	37.253	299.75	467.08
311.00	0.000	45.362	36.545	-6.406	37.102	301.06	467.08
312.00	0.000	45.362	36.435	-6.182	36.956	302.37	467.08
313.00	0.000	45.362	36.329	-5.956	36.814	303.69	467.09
314.00	0.000	45.362	36.227	-5.728	36.677	305.01	467.09
315.00	0.000	45.362	36.129	-5.498	36.545	306.35	467.09
316.00	0.000	45.362	36.035	-5.267	36.418	307.68	467.09
317.00	0.000	45.362	35.945	-5.034	36.296	309.03	467.09
318.00	0.000	45.366	35.859	-4.800	36.179	310.37	467.07
319.00	0.000	45.880	35.775	-4.832	36.100	311.31	464.77
320.00	0.000	46.413	35.690	-4.856	36.019	312.25	462.38
321.00	0.000	46.945	35.604	-4.922	35.943	313.13	460.00
322.00	0.000	47.475	35.518	-4.989	35.866	314.00	457.61
323.00	0.000	48.003	35.430	-5.013	35.783	314.94	455.22
324.00	0.000	48.529	35.341	-5.081	35.704	315.82	452.83
325.00	0.000	49.046	35.252	-5.142	35.625	316.70	450.48
326.00	0.000	49.549	35.161	-5.193	35.543	317.60	448.19
327.00	0.000	50.050	35.070	-5.202	35.454	318.56	445.90
328.00	0.000	50.550	34.978	-5.253	35.371	319.46	443.60
329.00	0.000	51.048	34.886	-5.305	35.287	320.35	441.31
330.00	0.000	51.545	34.792	-5.357	35.202	321.25	439.02
331.00	0.000	52.040	34.698	-5.409	35.117	322.14	436.72
332.00	0.000	52.533	34.604	-5.418	35.025	323.10	434.43
333.00	0.000	53.025	34.508	-5.470	34.939	323.99	432.14
334.00	0.000	53.514	34.412	-5.523	34.852	324.88	429.84
335.00	0.000	54.003	34.315	-5.576	34.765	325.77	427.55
336.00	0.000	54.489	34.217	-5.629	34.677	326.66	425.26
337.00	0.000	54.974	34.118	-5.640	34.581	327.61	422.96
338.00	0.000	55.458	34.019	-5.693	34.492	328.50	420.67
339.00	0.000	55.939	33.918	-5.747	34.402	329.38	418.37
340.00	0.000	56.098	33.818	-5.645	34.286	330.52	417.61
341.00	0.000	55.728	33.721	-5.591	34.181	331.58	419.38
342.00	0.000	55.226	33.622	-5.694	34.101	332.39	421.77
343.00	0.000	54.722	33.523	-5.713	34.006	333.33	424.16
344.00	0.000	54.216	33.422	-5.727	33.910	334.27	426.54
345.00	0.000	53.709	33.322	-5.820	33.826	335.09	428.93
346.00	0.000	53.210	33.220	-5.827	33.727	336.05	431.27
347.00	0.000	53.167	33.117	-5.960	33.649	336.80	431.47
348.00	0.000	53.145	33.011	-6.114	33.572	337.51	431.57
349.00	0.000	53.123	32.902	-6.309	33.502	338.14	431.68

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 08:52:02

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	53.100	32.791	-6.459	33.421	338.85	431.78
351.00	0.000	53.078	32.677	-6.608	33.338	339.57	431.89
352.00	0.000	53.056	32.560	-6.754	33.253	340.28	431.99
353.00	0.000	53.034	32.440	-6.899	33.166	340.99	432.09
354.00	0.000	52.975	32.318	-7.083	33.085	341.64	432.37
355.00	0.000	52.464	32.195	-7.090	32.966	342.58	434.75
356.00	0.000	51.950	32.071	-7.072	32.841	343.56	437.14
357.00	0.000	51.891	31.949	-6.886	32.683	344.84	437.41
358.00	0.000	51.891	31.832	-6.614	32.512	346.26	437.41
359.00	0.000	52.140	31.719	-6.420	32.362	347.56	436.25

MINIMUM STRESS (Pb,x') = 23.322 AT 127.00 DEGREES

MINIMUM TOTAL STRESS (Pb,max) = 23.322 AT 127.02 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:58:34

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H5 -- 10 Years of Crack Growth -- Faulted Conditions

Crack assumed to take compression across face

RADIUS (IN) = 102.5625 WALL THICKNESS (IN) = 2

TENSION STRESS = 1.018 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 11 (AS FOLLOWS)

1	ANGLES:	0.0000	TO	7.3000	(DTHETA =	7.300)	DEPTH (IN) =	2.000
2	ANGLES:	37.7100	TO	52.3000	(DTHETA =	14.590)	DEPTH (IN) =	2.000
3	ANGLES:	56.2100	TO	62.2000	(DTHETA =	5.990)	DEPTH (IN) =	1.941
4	ANGLES:	74.2800	TO	83.0400	(DTHETA =	8.760)	DEPTH (IN) =	2.000
5	ANGLES:	83.0400	TO	102.4900	(DTHETA =	19.450)	DEPTH (IN) =	1.941
6	ANGLES:	107.2600	TO	115.0500	(DTHETA =	7.790)	DEPTH (IN) =	1.941
7	ANGLES:	118.8900	TO	124.2900	(DTHETA =	5.400)	DEPTH (IN) =	1.941
8	ANGLES:	124.2900	TO	183.1100	(DTHETA =	58.820)	DEPTH (IN) =	2.000
9	ANGLES:	183.1100	TO	186.9400	(DTHETA =	3.830)	DEPTH (IN) =	1.941
10	ANGLES:	217.1000	TO	235.7200	(DTHETA =	18.620)	DEPTH (IN) =	2.000
11	ANGLES:	304.2900	TO	360.0000	(DTHETA =	55.710)	DEPTH (IN) =	2.000

TOTAL AREA (IN²) = 1288.838REMAINING DEGRADED SECTION AREA (IN²) = 554.89

(APPROX. DEGRADED METAL AREA = 554.887)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.000	55.404	30.909	-6.790	31.646	347.61	440.67
1.00	0.000	55.886	30.791	-6.747	31.521	348.64	438.38
2.00	0.000	56.381	30.673	-6.758	31.408	349.57	436.01
3.00	0.000	56.879	30.554	-6.772	31.296	350.50	433.62
4.00	0.000	57.374	30.436	-6.747	31.175	351.50	431.24
5.00	0.000	57.868	30.318	-6.761	31.062	352.43	428.85
6.00	0.000	58.359	30.199	-6.775	30.950	353.35	426.46
7.00	0.000	58.849	30.081	-6.749	30.829	354.35	424.08
8.00	2.000	59.337	29.962	-6.763	30.716	355.28	421.69
9.00	2.000	59.822	29.844	-6.777	30.604	356.20	419.30
10.00	2.000	60.306	29.726	-6.753	30.483	357.20	416.92
11.00	2.000	60.788	29.607	-6.767	30.371	358.12	414.53
12.00	2.000	61.267	29.489	-6.781	30.258	359.05	412.14
13.00	2.000	61.745	29.370	-6.757	30.137	0.04	409.76
14.00	2.000	62.220	29.252	-6.772	30.025	0.96	407.37
15.00	2.000	62.693	29.133	-6.786	29.913	1.89	404.98
16.00	2.000	63.165	29.015	-6.763	29.792	2.88	402.60
17.00	2.000	63.634	28.896	-6.778	29.680	3.80	400.21
18.00	2.000	64.101	28.777	-6.793	29.568	4.72	397.82
19.00	2.000	64.565	28.659	-6.771	29.448	5.71	395.44
20.00	2.000	65.028	28.540	-6.787	29.336	6.62	393.05
21.00	2.000	65.488	28.421	-6.802	29.224	7.54	390.66
22.00	2.000	65.946	28.302	-6.782	29.103	8.52	388.28
23.00	2.000	66.402	28.183	-6.798	28.991	9.44	385.89
24.00	2.000	66.856	28.064	-6.815	28.880	10.35	383.50
25.00	2.000	67.307	27.945	-6.795	28.759	11.33	381.12
26.00	2.000	67.756	27.826	-6.812	28.648	12.24	378.73
27.00	2.000	68.203	27.707	-6.830	28.536	13.15	376.34
28.00	2.000	68.647	27.587	-6.812	28.416	14.13	373.96
29.00	2.000	69.090	27.468	-6.830	28.304	15.04	371.57
30.00	2.000	69.529	27.348	-6.848	28.193	15.94	369.18
31.00	2.000	69.967	27.228	-6.832	28.073	16.91	366.80
32.00	2.000	70.402	27.109	-6.851	27.961	17.82	364.41
33.00	2.000	70.835	26.989	-6.871	27.850	18.72	362.02
34.00	2.000	71.265	26.869	-6.856	27.730	19.68	359.64
35.00	2.000	71.693	26.748	-6.877	27.618	20.58	357.25
36.00	2.000	72.118	26.628	-6.898	27.507	21.48	354.86
37.00	2.000	72.541	26.507	-6.885	27.387	22.44	352.48
38.00	0.000	72.962	26.387	-6.907	27.276	23.33	350.09
39.00	0.000	73.380	26.266	-6.929	27.164	24.22	347.70
40.00	0.000	73.796	26.144	-6.919	27.044	25.18	345.32
41.00	0.000	74.209	26.023	-6.942	26.933	26.06	342.93
42.00	0.000	74.619	25.902	-6.966	26.822	26.95	340.54
43.00	0.000	75.027	25.780	-6.957	26.702	27.90	338.16
44.00	0.000	75.433	25.658	-6.982	26.591	28.78	335.77
45.00	0.000	75.836	25.535	-7.008	26.480	29.65	333.38
46.00	0.000	76.226	25.413	-6.993	26.358	30.61	331.06
47.00	0.000	76.608	25.290	-7.007	26.243	31.51	328.76
48.00	0.000	76.988	25.168	-7.022	26.129	32.41	326.47
49.00	0.000	77.072	25.046	-6.868	25.970	33.66	325.96

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.000	77.072	24.927	-6.670	25.804	35.02	325.96
51.00	0.000	77.072	24.812	-6.471	25.642	36.38	325.96
52.00	0.000	77.072	24.701	-6.270	25.484	37.76	325.96
53.00	2.000	77.072	24.593	-6.066	25.330	39.14	325.96
54.00	2.000	77.072	24.488	-5.861	25.180	40.54	325.96
55.00	2.000	77.072	24.387	-5.654	25.034	41.94	325.96
56.00	2.000	77.072	24.290	-5.446	24.893	43.36	325.96
57.00	0.059	77.072	24.197	-5.236	24.757	44.79	325.96
58.00	0.059	77.072	24.107	-5.024	24.625	46.23	325.96
59.00	0.059	77.072	24.021	-4.810	24.497	47.67	325.96
60.00	0.059	77.072	23.938	-4.595	24.375	49.13	325.96
61.00	0.059	77.072	23.859	-4.379	24.258	50.60	325.96
62.00	0.059	77.072	23.785	-4.162	24.146	52.07	325.96
63.00	2.000	77.072	23.713	-3.943	24.039	53.56	325.96
64.00	2.000	77.072	23.646	-3.723	23.937	55.05	325.96
65.00	2.000	77.072	23.583	-3.501	23.841	56.55	325.96
66.00	2.000	77.072	23.523	-3.279	23.751	58.06	325.96
67.00	2.000	77.072	23.468	-3.056	23.666	59.58	325.96
68.00	2.000	77.072	23.416	-2.831	23.586	61.10	325.96
69.00	2.000	77.072	23.368	-2.606	23.513	62.63	325.96
70.00	2.000	77.072	23.324	-2.380	23.445	64.17	325.96
71.00	2.000	77.072	23.284	-2.154	23.384	65.71	325.96
72.00	2.000	77.072	23.248	-1.926	23.328	67.26	325.96
73.00	2.000	77.072	23.216	-1.699	23.278	68.81	325.96
74.00	2.000	77.072	23.188	-1.470	23.235	70.37	325.96
75.00	0.000	77.072	23.164	-1.241	23.198	71.93	325.96
76.00	0.000	77.072	23.144	-1.012	23.166	73.49	325.96
77.00	0.000	77.072	23.128	-0.782	23.141	75.06	325.96
78.00	0.000	77.072	23.116	-0.553	23.123	76.63	325.96
79.00	0.000	77.315	23.107	-0.450	23.112	77.88	324.49
80.00	0.000	77.706	23.099	-0.445	23.104	78.90	322.10
81.00	0.000	78.094	23.091	-0.442	23.096	79.90	319.71
82.00	0.000	78.479	23.084	-0.411	23.087	80.98	317.33
83.00	0.000	78.862	23.076	-0.413	23.080	81.97	314.94
84.00	0.059	79.242	23.069	-0.419	23.073	82.96	312.55
85.00	0.059	79.620	23.062	-0.396	23.065	84.01	310.17
86.00	0.059	79.740	23.054	-0.466	23.059	84.84	309.40
87.00	0.059	79.740	23.044	-0.567	23.051	85.59	309.40
88.00	0.059	79.740	23.033	-0.667	23.043	86.34	309.40
89.00	0.059	79.740	23.020	-0.767	23.033	87.09	309.40
90.00	0.059	79.740	23.006	-0.867	23.022	87.84	309.40
91.00	0.059	79.740	22.989	-0.966	23.010	88.59	309.40
92.00	0.059	79.740	22.971	-1.066	22.996	89.34	309.40
93.00	0.059	79.740	22.952	-1.165	22.981	90.09	309.40
94.00	0.059	79.740	22.930	-1.263	22.965	90.85	309.40
95.00	0.059	79.624	22.907	-1.337	22.946	91.66	310.14
96.00	0.059	79.246	22.883	-1.372	22.924	92.57	312.53
97.00	0.059	78.866	22.860	-1.343	22.899	93.64	314.92
98.00	0.059	78.483	22.837	-1.311	22.874	94.71	317.30
99.00	0.059	78.098	22.814	-1.337	22.853	95.64	319.69

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.059	77.710	22.791	-1.298	22.828	96.74	322.08
101.00	0.059	77.319	22.768	-1.256	22.803	97.84	324.46
102.00	0.059	76.926	22.746	-1.273	22.782	98.79	326.85
103.00	2.000	76.530	22.725	-1.224	22.758	99.91	329.24
104.00	2.000	76.131	22.704	-1.172	22.734	101.04	331.62
105.00	2.000	75.730	22.683	-1.181	22.714	102.02	334.01
106.00	2.000	75.327	22.664	-1.122	22.691	103.16	336.40
107.00	2.000	74.920	22.645	-1.060	22.669	104.32	338.78
108.00	0.059	74.512	22.626	-1.061	22.651	105.32	341.17
109.00	0.059	74.100	22.609	-0.992	22.630	106.49	343.56
110.00	0.059	73.687	22.592	-0.921	22.611	107.67	345.94
111.00	0.059	73.270	22.576	-0.913	22.594	108.68	348.33
112.00	0.059	72.851	22.561	-0.835	22.577	109.88	350.72
113.00	0.059	72.430	22.547	-0.754	22.560	111.08	353.10
114.00	0.059	72.007	22.534	-0.739	22.546	112.12	355.49
115.00	0.059	71.580	22.522	-0.652	22.532	113.34	357.88
116.00	2.000	71.152	22.512	-0.563	22.519	114.57	360.26
117.00	2.000	70.721	22.502	-0.540	22.509	115.62	362.65
118.00	2.000	70.288	22.494	-0.444	22.498	116.87	365.04
119.00	0.059	69.852	22.487	-0.346	22.490	118.12	367.42
120.00	0.059	69.414	22.481	-0.316	22.483	119.19	369.81
121.00	0.059	68.974	22.477	-0.212	22.478	120.46	372.20
122.00	0.059	68.531	22.474	-0.106	22.474	121.73	374.58
123.00	0.059	68.086	22.473	-0.068	22.473	122.82	376.97
124.00	0.059	67.638	22.473	0.043	22.473	124.11	379.36
125.00	0.000	67.188	22.475	0.158	22.475	125.40	381.74
126.00	0.000	66.736	22.478	0.202	22.479	126.51	384.13
127.00	0.000	66.282	22.483	0.321	22.485	127.82	386.52
128.00	0.000	65.825	22.489	0.442	22.494	129.13	388.91
129.00	0.000	65.367	22.498	0.493	22.503	130.25	391.29
130.00	0.000	64.906	22.508	0.619	22.516	131.58	393.68
131.00	0.000	64.443	22.520	0.748	22.532	132.90	396.07
132.00	0.000	63.977	22.533	0.803	22.548	134.04	398.45
133.00	0.000	63.510	22.549	0.936	22.568	135.38	400.84
134.00	0.000	63.040	22.566	1.072	22.592	136.72	403.23
135.00	0.000	62.606	22.586	1.209	22.618	138.06	405.42
136.00	0.000	62.606	22.610	1.575	22.664	139.98	405.42
137.00	0.000	62.606	22.640	1.941	22.723	141.90	405.42
138.00	0.000	62.606	22.676	2.305	22.793	143.81	405.42
139.00	0.000	62.606	22.719	2.670	22.876	145.70	405.42
140.00	0.000	62.606	22.769	3.033	22.970	147.59	405.42
141.00	0.000	62.606	22.825	3.396	23.076	149.46	405.42
142.00	0.000	62.606	22.887	3.757	23.193	151.32	405.42
143.00	0.000	62.606	22.955	4.118	23.321	153.17	405.42
144.00	0.000	62.606	23.030	4.477	23.461	155.00	405.42
145.00	0.000	62.606	23.110	4.834	23.611	156.82	405.42
146.00	0.000	62.606	23.197	5.191	23.771	158.61	405.42
147.00	0.000	62.606	23.291	5.545	23.942	160.39	405.42
148.00	0.000	62.606	23.390	5.898	24.122	162.15	405.42
149.00	0.000	62.606	23.496	6.250	24.313	163.90	405.42

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.000	62.606	23.608	6.599	24.512	165.62	405.42
151.00	0.000	62.607	23.725	6.946	24.721	167.32	405.42
152.00	0.000	62.607	23.849	7.291	24.939	169.00	405.42
153.00	0.000	62.607	23.979	7.634	25.165	170.66	405.42
154.00	0.000	62.607	24.115	7.975	25.399	172.30	405.42
155.00	0.000	62.607	24.257	8.313	25.642	173.92	405.42
156.00	0.000	62.607	24.404	8.649	25.892	175.52	405.42
157.00	0.000	62.607	24.558	8.982	26.149	177.09	405.42
158.00	0.000	62.607	24.717	9.313	26.413	178.65	405.42
159.00	0.000	62.607	24.882	9.640	26.684	180.18	405.42
160.00	0.000	62.607	25.053	9.965	26.962	181.69	405.42
161.00	0.000	62.607	25.229	10.287	27.245	183.18	405.42
162.00	0.000	62.607	25.411	10.605	27.535	184.65	405.42
163.00	0.000	62.607	25.598	10.920	27.830	186.10	405.42
164.00	0.000	62.607	25.791	11.232	28.131	187.53	405.42
165.00	0.000	62.607	25.990	11.541	28.437	188.94	405.42
166.00	0.000	62.290	26.192	11.618	28.653	189.92	407.02
167.00	0.000	61.814	26.396	11.694	28.871	190.89	409.41
168.00	0.000	61.337	26.601	11.769	29.088	191.87	411.79
169.00	0.000	60.858	26.807	11.766	29.275	192.70	414.18
170.00	0.000	60.377	27.013	11.838	29.493	193.66	416.57
171.00	0.000	59.893	27.220	11.909	29.711	194.63	418.95
172.00	0.000	59.408	27.428	11.901	29.899	195.46	421.34
173.00	0.000	58.921	27.637	11.969	30.117	196.42	423.73
174.00	0.000	58.431	27.846	12.036	30.336	197.38	426.11
175.00	0.000	57.940	28.056	12.022	30.524	198.20	428.50
176.00	0.000	57.446	28.267	12.086	30.743	199.15	430.89
177.00	0.000	57.312	28.480	12.308	31.025	200.37	431.54
178.00	0.000	57.312	28.697	12.605	31.344	201.71	431.54
179.00	0.000	57.312	28.920	12.898	31.666	203.04	431.54
180.00	0.000	57.312	29.148	13.187	31.993	204.34	431.54
181.00	0.000	57.231	29.379	13.230	32.221	205.24	431.93
182.00	0.000	57.253	29.609	13.114	32.383	205.89	431.82
183.00	0.000	57.274	29.836	12.993	32.543	206.53	431.72
184.00	0.059	57.296	30.062	12.869	32.700	207.17	431.62
185.00	0.059	57.318	30.285	12.740	32.855	207.82	431.51
186.00	0.059	57.339	30.506	12.607	33.008	208.45	431.41
187.00	2.000	57.742	30.725	12.590	33.205	209.28	429.46
188.00	2.000	58.234	30.945	12.566	33.399	210.10	427.08
189.00	2.000	58.724	31.164	12.576	33.606	210.98	424.69
190.00	2.000	59.212	31.383	12.541	33.796	211.78	422.30
191.00	2.000	59.698	31.601	12.500	33.983	212.58	419.92
192.00	2.000	60.182	31.819	12.491	34.183	213.43	417.53
193.00	2.000	60.664	32.036	12.438	34.366	214.22	415.14
194.00	2.000	61.145	32.253	12.379	34.547	215.00	412.76
195.00	2.000	61.622	32.468	12.353	34.739	215.83	410.37
196.00	2.000	62.098	32.683	12.282	34.914	216.60	407.98
197.00	2.000	62.572	32.897	12.205	35.088	217.36	405.60
198.00	2.000	63.044	33.109	12.160	35.271	218.17	403.21
199.00	2.000	63.513	33.320	12.072	35.439	218.92	400.82

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	63.981	33.530	11.977	35.605	219.66	398.44
201.00	2.000	64.446	33.738	11.914	35.780	220.45	396.05
202.00	2.000	64.909	33.945	11.808	35.940	221.18	393.66
203.00	2.000	65.370	34.150	11.695	36.097	221.90	391.28
204.00	2.000	65.829	34.353	11.614	36.263	222.68	388.89
205.00	2.000	65.972	34.554	11.417	36.391	223.28	388.14
206.00	2.000	65.972	34.750	11.180	36.504	223.83	388.14
207.00	2.000	65.972	34.943	10.939	36.615	224.38	388.14
208.00	2.000	65.972	35.131	10.695	36.723	224.93	388.14
209.00	2.000	65.972	35.315	10.448	36.828	225.48	388.14
210.00	2.000	65.972	35.495	10.197	36.931	226.03	388.14
211.00	2.000	65.972	35.670	9.944	37.031	226.58	388.14
212.00	2.000	65.973	35.841	9.687	37.127	227.12	388.14
213.00	2.000	65.973	36.008	9.428	37.221	227.67	388.14
214.00	2.000	65.991	36.170	9.165	37.313	228.22	388.04
215.00	2.000	66.011	36.327	8.900	37.401	228.77	387.94
216.00	2.000	66.031	36.480	8.632	37.487	229.31	387.83
217.00	2.000	66.051	36.628	8.361	37.570	229.86	387.73
218.00	0.000	66.071	36.771	8.125	37.658	230.46	387.63
219.00	0.000	66.091	36.910	7.849	37.736	231.00	387.52
220.00	0.000	66.111	37.044	7.570	37.810	231.55	387.42
221.00	0.000	66.130	37.174	7.290	37.882	232.09	387.31
222.00	0.000	66.150	37.298	7.006	37.951	232.64	387.21
223.00	0.000	66.170	37.418	6.721	38.017	233.18	387.10
224.00	0.000	66.190	37.532	6.434	38.080	233.73	387.00
225.00	0.000	66.210	37.642	6.181	38.146	234.33	386.90
226.00	0.000	66.230	37.747	5.890	38.204	234.87	386.79
227.00	0.000	66.250	37.847	5.596	38.258	235.41	386.69
228.00	0.000	66.270	37.942	5.301	38.310	235.95	386.58
229.00	0.000	66.290	38.031	5.005	38.359	236.50	386.48
230.00	0.000	66.310	38.116	4.706	38.405	237.04	386.37
231.00	0.000	66.329	38.195	4.407	38.449	237.58	386.27
232.00	0.000	66.349	38.270	4.142	38.493	238.18	386.17
233.00	0.000	66.451	38.339	3.839	38.530	238.72	385.63
234.00	0.000	66.904	38.404	3.680	38.580	239.47	383.24
235.00	0.000	67.356	38.466	3.481	38.623	240.17	380.86
236.00	2.000	67.776	38.525	3.279	38.664	240.86	378.62
237.00	2.000	67.776	38.583	3.326	38.726	241.93	378.62
238.00	2.000	67.776	38.641	3.373	38.788	242.99	378.62
239.00	2.000	67.614	38.701	3.347	38.845	243.94	379.49
240.00	2.000	67.181	38.757	3.177	38.887	244.69	381.78
241.00	2.000	66.747	38.811	3.009	38.927	245.43	384.08
242.00	2.000	66.310	38.861	2.770	38.960	246.08	386.37
243.00	2.000	65.872	38.908	2.605	38.995	246.83	388.66
244.00	2.000	65.431	38.952	2.442	39.029	247.59	390.96
245.00	2.000	65.200	38.994	2.354	39.065	248.46	392.16
246.00	2.000	65.200	39.036	2.415	39.110	249.54	392.16
247.00	2.000	65.200	39.079	2.474	39.157	250.62	392.16
248.00	2.000	65.200	39.123	2.532	39.205	251.70	392.16
249.00	2.000	64.918	39.167	2.443	39.243	252.57	393.62

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	2.000	64.473	39.208	2.280	39.274	253.33	395.91
251.00	2.000	64.026	39.246	2.119	39.304	254.09	398.21
252.00	2.000	63.577	39.282	1.960	39.330	254.86	400.50
253.00	2.000	63.116	39.314	1.727	39.352	255.52	402.84
254.00	2.000	62.645	39.343	1.572	39.374	256.29	405.23
255.00	2.000	62.171	39.368	1.418	39.394	257.06	407.62
256.00	2.000	61.696	39.391	1.190	39.409	257.73	410.00
257.00	2.000	61.218	39.411	1.040	39.424	258.51	412.39
258.00	2.000	60.738	39.427	0.892	39.437	259.30	414.78
259.00	2.000	60.256	39.441	0.669	39.447	259.97	417.16
260.00	2.000	59.772	39.452	0.526	39.455	260.76	419.55
261.00	2.000	59.287	39.459	0.384	39.461	261.56	421.94
262.00	2.000	58.799	39.464	0.167	39.464	262.24	424.32
263.00	2.000	58.309	39.466	0.030	39.466	263.04	426.71
264.00	2.000	57.817	39.465	-0.105	39.465	263.85	429.10
265.00	2.000	57.323	39.461	-0.317	39.462	264.54	431.48
266.00	2.000	56.828	39.455	-0.448	39.457	265.35	433.87
267.00	2.000	56.330	39.445	-0.576	39.450	266.16	436.26
268.00	2.000	55.830	39.434	-0.782	39.441	266.86	438.64
269.00	2.000	55.329	39.419	-0.905	39.429	267.68	441.03
270.00	2.000	54.826	39.402	-1.026	39.415	268.51	443.42
271.00	2.000	54.320	39.382	-1.226	39.401	269.22	445.80
272.00	2.000	53.813	39.360	-1.342	39.383	270.05	448.19
273.00	2.000	53.304	39.335	-1.456	39.362	270.88	450.58
274.00	2.000	52.794	39.308	-1.649	39.343	271.60	452.96
275.00	2.000	52.281	39.279	-1.758	39.318	272.44	455.35
276.00	2.000	51.767	39.247	-1.864	39.291	273.28	457.74
277.00	2.000	51.251	39.213	-2.050	39.266	274.01	460.12
278.00	2.000	50.733	39.176	-2.151	39.235	274.86	462.51
279.00	2.000	50.684	39.136	-2.372	39.208	275.53	462.74
280.00	2.000	50.684	39.092	-2.637	39.181	276.14	462.74
281.00	2.000	50.684	39.043	-2.901	39.151	276.75	462.74
282.00	2.000	50.684	38.990	-3.165	39.118	277.36	462.74
283.00	2.000	50.684	38.932	-3.428	39.082	277.97	462.74
284.00	2.000	50.683	38.869	-3.689	39.044	278.58	462.74
285.00	2.000	50.683	38.802	-3.950	39.002	279.19	462.74
286.00	2.000	50.683	38.730	-4.209	38.958	279.80	462.74
287.00	2.000	50.683	38.653	-4.467	38.911	280.41	462.74
288.00	2.000	50.683	38.573	-4.724	38.861	281.02	462.74
289.00	2.000	50.683	38.487	-4.979	38.808	281.63	462.74
290.00	2.000	50.683	38.398	-5.232	38.753	282.24	462.74
291.00	2.000	50.682	38.304	-5.484	38.694	282.85	462.74
292.00	2.000	50.682	38.205	-5.735	38.633	283.46	462.74
293.00	2.000	50.519	38.102	-5.942	38.563	284.14	463.50
294.00	2.000	49.999	37.997	-6.104	38.484	284.87	465.88
295.00	2.000	49.477	37.890	-6.178	38.390	285.74	468.27
296.00	2.000	48.954	37.781	-6.249	38.294	286.61	470.65
297.00	2.000	48.429	37.671	-6.400	38.210	287.36	473.04
298.00	2.000	47.902	37.558	-6.464	38.111	288.23	475.43
299.00	2.000	47.602	37.445	-6.599	38.022	289.00	476.79

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	2.000	47.579	37.327	-6.814	37.944	289.65	476.89
301.00	2.000	47.562	37.206	-7.027	37.863	290.30	476.97
302.00	2.000	47.562	37.081	-7.237	37.780	290.95	476.97
303.00	2.000	47.562	36.952	-7.445	37.695	291.61	476.97
304.00	2.000	47.562	36.820	-7.651	37.606	292.26	476.96
305.00	0.000	47.563	36.685	-7.690	37.482	293.16	476.96
306.00	0.000	47.563	36.552	-7.479	37.309	294.44	476.96
307.00	0.000	47.563	36.423	-7.265	37.140	295.72	476.96
308.00	0.000	47.563	36.298	-7.049	36.976	297.01	476.96
309.00	0.000	47.563	36.176	-6.831	36.816	298.31	476.96
310.00	0.000	47.563	36.059	-6.611	36.660	299.61	476.96
311.00	0.000	47.563	35.945	-6.388	36.508	300.92	476.96
312.00	0.000	47.563	35.835	-6.164	36.361	302.24	476.96
313.00	0.000	47.563	35.729	-5.938	36.219	303.56	476.96
314.00	0.000	47.563	35.627	-5.710	36.082	304.89	476.96
315.00	0.000	47.563	35.529	-5.481	35.950	306.23	476.96
316.00	0.000	47.563	35.435	-5.250	35.822	307.57	476.96
317.00	0.000	47.747	35.345	-5.110	35.713	308.77	476.13
318.00	0.000	48.275	35.255	-5.175	35.633	309.65	473.74
319.00	0.000	48.800	35.164	-5.198	35.546	310.59	471.35
320.00	0.000	49.324	35.072	-5.263	35.465	311.46	468.97
321.00	0.000	49.847	34.980	-5.328	35.383	312.34	466.58
322.00	0.000	50.368	34.886	-5.352	35.294	313.28	464.19
323.00	0.000	50.887	34.791	-5.417	35.211	314.15	461.80
324.00	0.000	51.388	34.696	-5.471	35.125	315.04	459.49
325.00	0.000	51.884	34.600	-5.521	35.038	315.93	457.20
326.00	0.000	52.378	34.503	-5.528	34.943	316.90	454.90
327.00	0.000	52.870	34.406	-5.578	34.855	317.79	452.61
328.00	0.000	53.360	34.308	-5.628	34.766	318.68	450.31
329.00	0.000	53.849	34.209	-5.678	34.677	319.57	448.02
330.00	0.000	54.337	34.109	-5.729	34.587	320.46	445.73
331.00	0.000	54.822	34.009	-5.738	34.489	321.42	443.43
332.00	0.000	55.306	33.907	-5.788	34.398	322.31	441.14
333.00	0.000	55.788	33.806	-5.839	34.306	323.20	438.85
334.00	0.000	56.268	33.703	-5.890	34.214	324.09	436.55
335.00	0.000	56.746	33.600	-5.942	34.121	324.97	434.26
336.00	0.000	57.223	33.496	-5.952	34.020	325.92	431.97
337.00	0.000	57.698	33.391	-6.004	33.926	326.81	429.67
338.00	0.000	58.148	33.285	-6.052	33.831	327.69	427.49
339.00	0.000	58.148	33.181	-5.841	33.691	329.02	427.49
340.00	0.000	58.148	33.081	-5.628	33.556	330.34	427.49
341.00	0.000	58.148	32.984	-5.414	33.426	331.68	427.49
342.00	0.000	57.971	32.891	-5.277	33.312	332.88	428.35
343.00	0.000	57.477	32.798	-5.374	33.236	333.69	430.74
344.00	0.000	57.331	32.704	-5.477	33.159	334.49	431.44
345.00	0.000	57.310	32.607	-5.637	33.091	335.19	431.55
346.00	0.000	57.288	32.507	-5.795	33.019	335.89	431.65
347.00	0.000	57.267	32.404	-5.952	32.946	336.59	431.76
348.00	0.000	57.245	32.298	-6.106	32.871	337.29	431.86
349.00	0.000	57.224	32.190	-6.259	32.793	337.99	431.96

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 09:59:25

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.000	57.202	32.079	-6.451	32.721	338.63	432.07
351.00	0.000	57.180	31.965	-6.600	32.639	339.33	432.17
352.00	0.000	56.764	31.849	-6.615	32.529	340.27	434.17
353.00	0.000	56.266	31.733	-6.689	32.430	341.10	436.56
354.00	0.000	55.766	31.616	-6.679	32.314	342.07	438.95
355.00	0.000	55.265	31.499	-6.665	32.196	343.05	441.33
356.00	0.000	54.761	31.382	-6.727	32.095	343.90	443.72
357.00	0.000	54.291	31.265	-6.709	31.977	344.89	445.94
358.00	0.000	54.436	31.147	-6.792	31.879	345.70	445.26
359.00	0.000	54.921	31.028	-6.791	31.762	346.65	442.97

MINIMUM STRESS (Pb,x') = 22.473 AT 123.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 22.473 AT 122.82 DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:09:10

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H6 -- 8 Years of Crack Growth -- Upset Conditions

Crack assumed to take compression across face

RADIUS (IN) = 99.375 WALL THICKNESS (IN) = 2

TENSION STRESS = 0.634 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 15 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	6.0900	(DTHETA =	6.090)	DEPTH (IN) =	1.864
2 ANGLES:	6.0900 TO	39.3600	(DTHETA =	33.270)	DEPTH (IN) =	1.724
3 ANGLES:	39.3600 TO	51.0900	(DTHETA =	11.730)	DEPTH (IN) =	1.864
4 ANGLES:	51.0900 TO	65.4500	(DTHETA =	14.360)	DEPTH (IN) =	1.804
5 ANGLES:	65.4500 TO	88.7700	(DTHETA =	23.320)	DEPTH (IN) =	1.754
6 ANGLES:	88.7700 TO	124.6500	(DTHETA =	35.880)	DEPTH (IN) =	1.794
7 ANGLES:	124.6500 TO	195.5800	(DTHETA =	70.930)	DEPTH (IN) =	1.864
8 ANGLES:	202.5500 TO	207.0000	(DTHETA =	4.450)	DEPTH (IN) =	1.564
9 ANGLES:	207.0000 TO	219.3600	(DTHETA =	12.360)	DEPTH (IN) =	1.794
10 ANGLES:	219.3600 TO	238.5900	(DTHETA =	19.230)	DEPTH (IN) =	1.864
11 ANGLES:	238.5900 TO	252.1000	(DTHETA =	13.510)	DEPTH (IN) =	1.584
12 ANGLES:	260.6700 TO	267.1000	(DTHETA =	6.430)	DEPTH (IN) =	1.784
13 ANGLES:	273.4700 TO	278.8000	(DTHETA =	5.330)	DEPTH (IN) =	1.814
14 ANGLES:	281.5700 TO	304.2900	(DTHETA =	22.720)	DEPTH (IN) =	1.794
15 ANGLES:	304.2900 TO	360.0000	(DTHETA =	55.710)	DEPTH (IN) =	1.864

TOTAL AREA (IN2) = 1248.783

REMAINING DEGRADED SECTION AREA (IN2) = 197.575

(APPROX. DEGRADED METAL AREA = 197.5756)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.136	92.412	10.460	-3.885	11.158	339.62	168.01
1.00	0.136	92.604	10.393	-3.823	11.074	340.80	165.90
2.00	0.136	92.705	10.326	-3.801	11.003	341.79	164.79
3.00	0.136	92.746	10.260	-3.777	10.933	342.79	164.33
4.00	0.136	92.787	10.194	-3.754	10.863	343.78	163.88
5.00	0.136	92.828	10.128	-3.748	10.799	344.69	163.42
6.00	0.136	92.868	10.063	-3.723	10.730	345.70	162.97
7.00	0.276	92.883	9.998	-3.716	10.666	346.61	162.80
8.00	0.276	92.893	9.933	-3.708	10.603	347.53	162.69
9.00	0.276	92.903	9.869	-3.680	10.532	348.55	162.58
10.00	0.276	92.913	9.804	-3.670	10.468	349.48	162.46
11.00	0.276	92.923	9.740	-3.659	10.404	350.41	162.35
12.00	0.276	92.933	9.676	-3.646	10.340	351.35	162.24
13.00	0.276	92.943	9.612	-3.633	10.276	352.29	162.13
14.00	0.276	92.953	9.549	-3.619	10.212	353.24	162.02
15.00	0.276	92.963	9.486	-3.586	10.141	354.29	161.91
16.00	0.276	92.972	9.423	-3.570	10.077	355.25	161.79
17.00	0.276	92.982	9.361	-3.553	10.013	356.22	161.68
18.00	0.276	92.992	9.299	-3.535	9.948	357.19	161.57
19.00	0.276	92.999	9.237	-3.516	9.884	358.16	161.49
20.00	0.276	92.999	9.176	-3.496	9.820	359.14	161.49
21.00	0.276	92.999	9.115	-3.475	9.755	0.13	161.49
22.00	0.276	92.999	9.055	-3.453	9.691	1.13	161.49
23.00	0.276	92.999	8.995	-3.430	9.626	2.13	161.49
24.00	0.276	92.999	8.935	-3.405	9.562	3.13	161.49
25.00	0.276	92.999	8.875	-3.380	9.497	4.15	161.49
26.00	0.276	92.999	8.817	-3.354	9.433	5.17	161.49
27.00	0.276	92.999	8.758	-3.327	9.369	6.20	161.49
28.00	0.276	92.999	8.700	-3.298	9.305	7.24	161.49
29.00	0.276	92.999	8.643	-3.269	9.240	8.28	161.49
30.00	0.276	92.999	8.586	-3.239	9.177	9.33	161.49
31.00	0.276	92.999	8.530	-3.207	9.113	10.39	161.49
32.00	0.276	92.999	8.474	-3.175	9.049	11.46	161.49
33.00	0.276	92.999	8.419	-3.142	8.986	12.53	161.49
34.00	0.276	92.999	8.364	-3.108	8.923	13.62	161.49
35.00	0.276	92.999	8.310	-3.072	8.860	14.71	161.49
36.00	0.276	92.999	8.257	-3.036	8.797	15.81	161.49
37.00	0.276	92.853	8.204	-2.952	8.719	17.21	163.14
38.00	0.276	92.680	8.153	-2.854	8.638	18.71	165.07
39.00	0.276	92.524	8.105	-2.717	8.548	20.46	166.79
40.00	0.136	92.367	8.058	-2.611	8.471	22.04	168.50
41.00	0.136	92.208	8.014	-2.467	8.385	23.89	170.21
42.00	0.136	92.048	7.971	-2.354	8.312	25.54	171.92
43.00	0.136	91.886	7.932	-2.202	8.232	27.48	173.64
44.00	0.136	91.722	7.894	-2.083	8.164	29.22	175.35
45.00	0.136	91.556	7.859	-1.923	8.091	31.25	177.06
46.00	0.136	91.460	7.826	-1.812	8.033	32.97	178.05
47.00	0.136	91.457	7.796	-1.719	7.983	34.56	178.08
48.00	0.136	91.454	7.766	-1.626	7.935	36.17	178.11
49.00	0.136	91.451	7.739	-1.533	7.889	37.79	178.14

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.136	91.609	7.713	-1.397	7.839	39.74	176.51
51.00	0.136	91.802	7.690	-1.266	7.793	41.65	174.51
52.00	0.196	91.993	7.669	-1.138	7.753	43.56	172.50
53.00	0.196	92.182	7.650	-1.013	7.717	45.46	170.50
54.00	0.196	92.368	7.633	-0.891	7.685	47.34	168.49
55.00	0.196	92.552	7.619	-0.772	7.658	49.21	166.49
56.00	0.196	92.733	7.606	-0.656	7.634	51.07	164.48
57.00	0.196	92.912	7.595	-0.543	7.615	52.91	162.48
58.00	0.196	93.089	7.587	-0.433	7.599	54.73	160.47
59.00	0.196	93.263	7.580	-0.326	7.587	56.53	158.46
60.00	0.196	93.440	7.575	-0.245	7.579	58.15	156.40
61.00	0.196	93.618	7.571	-0.134	7.572	59.98	154.29
62.00	0.196	93.646	7.569	-0.095	7.570	61.28	153.96
63.00	0.196	93.656	7.568	-0.055	7.568	62.58	153.83
64.00	0.196	93.667	7.567	-0.016	7.567	63.88	153.71
65.00	0.196	93.678	7.567	0.040	7.567	65.30	153.58
66.00	0.246	93.688	7.568	0.079	7.568	66.60	153.45
67.00	0.246	93.699	7.569	0.118	7.570	67.89	153.32
68.00	0.246	93.767	7.572	0.173	7.574	69.31	152.51
69.00	0.246	93.940	7.575	0.260	7.580	70.96	150.40
70.00	0.246	94.110	7.580	0.343	7.588	72.59	148.29
71.00	0.246	94.278	7.587	0.423	7.599	74.19	146.19
72.00	0.246	94.443	7.595	0.500	7.612	75.76	144.08
73.00	0.246	94.606	7.604	0.573	7.626	77.31	141.97
74.00	0.246	94.766	7.615	0.642	7.642	78.82	139.86
75.00	0.246	94.923	7.627	0.708	7.660	80.30	137.76
76.00	0.246	95.067	7.640	0.778	7.679	81.82	135.80
77.00	0.246	95.148	7.654	0.846	7.701	83.31	134.68
78.00	0.246	95.123	7.669	0.863	7.717	84.42	135.03
79.00	0.246	95.098	7.684	0.897	7.736	85.66	135.37
80.00	0.246	95.073	7.700	0.915	7.754	86.78	135.72
81.00	0.246	95.048	7.716	0.949	7.774	88.01	136.07
82.00	0.246	95.054	7.733	0.984	7.795	89.25	135.98
83.00	0.246	95.178	7.750	1.050	7.821	90.72	134.27
84.00	0.246	95.300	7.769	1.130	7.851	92.28	132.55
85.00	0.246	95.421	7.789	1.190	7.880	93.69	130.84
86.00	0.246	95.465	7.811	1.231	7.907	94.96	130.21
87.00	0.246	95.443	7.832	1.256	7.932	96.11	130.52
88.00	0.246	95.421	7.854	1.265	7.955	97.15	130.84
89.00	0.206	95.319	7.877	1.300	7.983	98.37	132.28
90.00	0.206	95.176	7.900	1.354	8.015	99.73	134.29
91.00	0.206	95.031	7.924	1.411	8.049	101.09	136.29
92.00	0.206	94.883	7.950	1.498	8.090	102.67	138.30
93.00	0.206	94.733	7.976	1.561	8.127	104.07	140.30
94.00	0.206	94.580	8.004	1.626	8.167	105.49	142.31
95.00	0.206	94.425	8.033	1.694	8.209	106.91	144.31
96.00	0.206	94.268	8.063	1.765	8.254	108.35	146.32
97.00	0.206	94.108	8.094	1.838	8.300	109.79	148.33
98.00	0.206	93.946	8.127	1.914	8.349	111.25	150.33
99.00	0.206	93.781	8.161	1.992	8.401	112.72	152.34

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.206	93.614	8.197	2.073	8.455	114.19	154.34
101.00	0.206	93.548	8.234	2.145	8.509	115.60	155.13
102.00	0.206	93.546	8.272	2.180	8.554	116.76	155.14
103.00	0.206	93.545	8.310	2.215	8.600	117.92	155.16
104.00	0.206	93.544	8.349	2.249	8.647	119.08	155.17
105.00	0.206	93.538	8.388	2.282	8.693	120.22	155.24
106.00	0.206	93.528	8.428	2.315	8.741	121.36	155.37
107.00	0.206	93.495	8.469	2.330	8.784	122.38	155.75
108.00	0.206	93.315	8.511	2.411	8.845	123.81	157.86
109.00	0.206	93.133	8.554	2.494	8.910	125.26	159.97
110.00	0.206	92.947	8.598	2.581	8.977	126.71	162.08
111.00	0.206	92.760	8.644	2.669	9.047	128.16	164.18
112.00	0.206	92.569	8.692	2.761	9.120	129.62	166.29
113.00	0.206	92.376	8.741	2.855	9.195	131.09	168.40
114.00	0.206	92.181	8.791	2.951	9.274	132.55	170.51
115.00	0.206	91.983	8.844	3.050	9.355	134.03	172.61
116.00	0.206	91.786	8.898	3.151	9.439	135.50	174.68
117.00	0.206	91.771	8.954	3.208	9.511	136.71	174.84
118.00	0.206	91.763	9.010	3.252	9.579	137.85	174.92
119.00	0.206	91.755	9.067	3.296	9.647	138.98	175.00
120.00	0.206	91.748	9.124	3.339	9.716	140.10	175.08
121.00	0.206	91.740	9.183	3.361	9.778	141.10	175.16
122.00	0.206	91.617	9.242	3.449	9.864	142.47	176.44
123.00	0.206	91.412	9.303	3.549	9.957	143.88	178.54
124.00	0.206	91.204	9.365	3.652	10.052	145.30	180.65
125.00	0.136	90.993	9.429	3.718	10.136	146.52	182.76
126.00	0.136	90.904	9.495	3.809	10.231	147.86	183.65
127.00	0.136	90.892	9.562	3.857	10.311	148.97	183.76
128.00	0.136	90.881	9.630	3.904	10.391	150.07	183.87
129.00	0.136	90.870	9.698	3.949	10.471	151.16	183.98
130.00	0.136	90.858	9.767	3.994	10.552	152.24	184.09
131.00	0.136	90.847	9.837	4.016	10.625	153.21	184.21
132.00	0.136	90.836	9.907	4.058	10.706	154.27	184.32
133.00	0.136	90.824	9.978	4.099	10.788	155.33	184.43
134.00	0.136	90.813	10.050	4.139	10.869	156.39	184.54
135.00	0.136	90.802	10.122	4.178	10.951	157.43	184.65
136.00	0.136	90.790	10.195	4.216	11.033	158.47	184.76
137.00	0.136	90.779	10.269	4.232	11.107	159.40	184.88
138.00	0.136	90.768	10.343	4.267	11.189	160.42	184.99
139.00	0.136	90.756	10.418	4.302	11.271	161.44	185.10
140.00	0.136	90.745	10.493	4.335	11.353	162.45	185.21
141.00	0.136	90.733	10.569	4.367	11.435	163.45	185.32
142.00	0.136	90.722	10.645	4.398	11.518	164.45	185.44
143.00	0.136	90.711	10.722	4.406	11.592	165.34	185.55
144.00	0.136	90.699	10.799	4.434	11.674	166.33	185.66
145.00	0.136	90.688	10.876	4.462	11.756	167.30	185.77
146.00	0.136	90.676	10.954	4.488	11.838	168.28	185.88
147.00	0.136	90.665	11.033	4.513	11.920	169.25	186.00
148.00	0.136	90.653	11.111	4.536	12.002	170.21	186.11
149.00	0.136	90.648	11.191	4.555	12.082	171.15	186.16

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.136	90.648	11.270	4.569	12.161	172.07	186.16
151.00	0.136	90.648	11.349	4.582	12.239	172.98	186.16
152.00	0.136	90.648	11.429	4.593	12.318	173.89	186.16
153.00	0.136	90.648	11.509	4.603	12.395	174.80	186.16
154.00	0.136	90.648	11.589	4.611	12.473	175.70	186.16
155.00	0.136	90.648	11.669	4.619	12.550	176.59	186.16
156.00	0.136	90.648	11.750	4.624	12.627	177.48	186.16
157.00	0.136	90.648	11.830	4.629	12.704	178.37	186.16
158.00	0.136	90.648	11.911	4.632	12.780	179.25	186.16
159.00	0.136	90.648	11.991	4.633	12.855	180.12	186.16
160.00	0.136	90.648	12.072	4.633	12.930	181.00	186.16
161.00	0.136	90.648	12.152	4.632	13.005	181.86	186.16
162.00	0.136	90.650	12.233	4.629	13.079	182.73	186.14
163.00	0.136	90.673	12.313	4.625	13.153	183.59	185.92
164.00	0.136	90.695	12.394	4.619	13.227	184.44	185.70
165.00	0.136	90.718	12.474	4.632	13.307	185.37	185.48
166.00	0.136	90.740	12.555	4.623	13.379	186.21	185.26
167.00	0.136	90.763	12.635	4.612	13.451	187.05	185.04
168.00	0.136	90.785	12.716	4.620	13.529	187.97	184.82
169.00	0.136	90.807	12.796	4.606	13.600	188.80	184.60
170.00	0.136	90.830	12.876	4.590	13.670	189.62	184.38
171.00	0.136	90.852	12.956	4.572	13.739	190.44	184.16
172.00	0.136	90.874	13.036	4.574	13.815	191.33	183.94
173.00	0.136	90.897	13.115	4.553	13.883	192.14	183.72
174.00	0.136	90.919	13.194	4.530	13.950	192.95	183.50
175.00	0.136	90.941	13.273	4.527	14.024	193.83	183.28
176.00	0.136	90.963	13.352	4.501	14.090	194.63	183.06
177.00	0.136	90.985	13.430	4.474	14.156	195.42	182.84
178.00	0.136	91.007	13.508	4.465	14.227	196.29	182.62
179.00	0.136	91.029	13.585	4.434	14.291	197.08	182.40
180.00	0.136	91.051	13.662	4.402	14.354	197.86	182.18
181.00	0.136	91.073	13.739	4.389	14.423	198.72	181.96
182.00	0.136	91.095	13.815	4.353	14.485	199.49	181.74
183.00	0.136	91.117	13.891	4.316	14.546	200.26	181.52
184.00	0.136	91.139	13.966	4.298	14.612	201.11	181.30
185.00	0.136	91.161	14.040	4.258	14.672	201.87	181.08
186.00	0.136	91.183	14.114	4.216	14.730	202.63	180.86
187.00	0.136	91.205	14.187	4.193	14.794	203.47	180.64
188.00	0.136	91.227	14.260	4.148	14.851	204.22	180.42
189.00	0.136	91.249	14.332	4.102	14.907	204.97	180.20
190.00	0.136	91.270	14.403	4.054	14.962	205.72	179.98
191.00	0.136	91.292	14.473	4.025	15.022	206.54	179.76
192.00	0.136	91.314	14.543	3.974	15.076	207.28	179.54
193.00	0.136	91.336	14.612	3.922	15.129	208.02	179.32
194.00	0.136	91.357	14.680	3.888	15.186	208.84	179.10
195.00	0.136	91.379	14.747	3.833	15.237	209.57	178.88
196.00	2.000	91.401	14.813	3.777	15.287	210.30	178.66
197.00	2.000	91.406	14.879	3.719	15.336	211.03	178.60
198.00	2.000	91.406	14.943	3.659	15.385	211.76	178.60
199.00	2.000	91.406	15.006	3.599	15.432	212.49	178.60

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	91.406	15.069	3.538	15.478	213.21	178.60
201.00	2.000	91.406	15.130	3.476	15.524	213.94	178.60
202.00	2.000	91.406	15.190	3.412	15.568	214.66	178.60
203.00	0.436	91.406	15.249	3.348	15.612	215.38	178.60
204.00	0.436	91.406	15.307	3.282	15.655	216.10	178.60
205.00	0.436	91.406	15.363	3.216	15.696	216.82	178.60
206.00	0.436	91.406	15.419	3.148	15.737	217.54	178.60
207.00	0.321	91.406	15.473	3.080	15.777	218.26	178.60
208.00	0.206	91.406	15.527	3.010	15.816	218.97	178.60
209.00	0.206	91.416	15.578	2.960	15.857	219.76	178.50
210.00	0.206	91.408	15.629	2.899	15.896	220.51	178.58
211.00	0.206	91.395	15.679	2.819	15.930	221.19	178.71
212.00	0.206	91.383	15.728	2.760	15.968	221.95	178.83
213.00	0.206	91.371	15.775	2.699	16.004	222.71	178.96
214.00	0.206	91.359	15.821	2.638	16.040	223.47	179.08
215.00	0.206	91.347	15.867	2.577	16.075	224.22	179.20
216.00	0.206	91.334	15.911	2.493	16.105	224.91	179.33
217.00	0.206	91.322	15.954	2.431	16.138	225.66	179.45
218.00	0.206	91.310	15.996	2.367	16.170	226.42	179.58
219.00	0.206	91.298	16.036	2.303	16.201	227.17	179.70
220.00	0.136	91.285	16.076	2.239	16.231	227.93	179.83
221.00	0.136	91.273	16.114	2.174	16.260	228.68	179.95
222.00	0.136	91.261	16.151	2.087	16.285	229.36	180.07
223.00	0.136	91.255	16.187	2.021	16.312	230.12	180.13
224.00	0.136	91.251	16.221	1.954	16.339	230.87	180.18
225.00	0.136	91.246	16.255	1.887	16.364	231.62	180.22
226.00	0.136	91.242	16.287	1.820	16.388	232.38	180.27
227.00	0.136	91.237	16.318	1.752	16.412	233.13	180.31
228.00	0.136	91.232	16.348	1.683	16.434	233.88	180.36
229.00	0.136	91.228	16.377	1.614	16.456	234.63	180.41
230.00	0.136	91.223	16.404	1.545	16.477	235.38	180.45
231.00	0.136	91.219	16.430	1.475	16.496	236.13	180.50
232.00	0.136	91.214	16.455	1.405	16.515	236.88	180.55
233.00	0.136	91.209	16.479	1.334	16.533	237.63	180.59
234.00	0.136	91.205	16.501	1.263	16.549	238.38	180.64
235.00	0.136	91.200	16.522	1.170	16.564	239.05	180.68
236.00	0.136	91.196	16.542	1.099	16.578	239.80	180.73
237.00	0.136	91.191	16.561	1.027	16.592	240.55	180.78
238.00	0.136	91.186	16.578	0.955	16.605	241.30	180.82
239.00	0.416	91.182	16.594	0.883	16.617	242.04	180.87
240.00	0.416	91.177	16.609	0.810	16.628	242.79	180.92
241.00	0.416	91.173	16.622	0.737	16.638	243.54	180.96
242.00	0.416	91.168	16.634	0.664	16.647	244.29	181.01
243.00	0.416	91.168	16.645	0.590	16.655	245.03	181.01
244.00	0.416	91.185	16.654	0.503	16.662	245.73	180.84
245.00	0.416	91.202	16.662	0.436	16.668	246.50	180.67
246.00	0.416	91.216	16.669	0.349	16.673	247.20	180.53
247.00	0.416	91.227	16.674	0.261	16.676	247.90	180.42
248.00	0.416	91.238	16.678	0.173	16.678	248.60	180.31
249.00	0.416	91.249	16.680	0.085	16.680	249.29	180.19

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.416	91.260	16.680	-0.003	16.680	249.99	180.08
251.00	0.416	91.271	16.679	-0.071	16.680	250.75	179.97
252.00	0.416	91.282	16.677	-0.159	16.678	251.45	179.86
253.00	2.000	91.293	16.673	-0.248	16.675	252.15	179.75
254.00	2.000	91.304	16.668	-0.336	16.671	252.84	179.63
255.00	2.000	91.309	16.661	-0.421	16.667	253.55	179.59
256.00	2.000	91.311	16.653	-0.504	16.661	254.26	179.57
257.00	2.000	91.312	16.643	-0.587	16.654	254.98	179.55
258.00	2.000	91.314	16.632	-0.669	16.646	255.69	179.54
259.00	2.000	91.315	16.620	-0.751	16.637	256.41	179.52
260.00	2.000	91.317	16.606	-0.834	16.627	257.13	179.51
261.00	0.216	91.318	16.591	-0.915	16.616	257.84	179.49
262.00	0.216	91.320	16.574	-0.997	16.604	258.56	179.47
263.00	0.216	91.322	16.556	-1.078	16.591	259.27	179.46
264.00	0.216	91.323	16.536	-1.159	16.577	259.99	179.44
265.00	0.216	91.325	16.515	-1.240	16.562	260.71	179.43
266.00	0.216	91.326	16.493	-1.320	16.545	261.42	179.41
267.00	0.216	91.328	16.469	-1.400	16.528	262.14	179.40
268.00	2.000	91.329	16.444	-1.479	16.510	262.86	179.38
269.00	2.000	91.328	16.417	-1.557	16.491	263.58	179.39
270.00	2.000	91.322	16.389	-1.631	16.470	264.32	179.45
271.00	2.000	91.316	16.360	-1.704	16.449	265.05	179.52
272.00	2.000	91.310	16.330	-1.777	16.426	265.79	179.58
273.00	2.000	91.304	16.298	-1.849	16.403	266.53	179.64
274.00	0.186	91.297	16.265	-1.920	16.378	267.27	179.70
275.00	0.186	91.291	16.231	-1.991	16.352	268.01	179.77
276.00	0.186	91.285	16.195	-2.061	16.326	268.75	179.83
277.00	0.186	91.279	16.158	-2.130	16.298	269.49	179.89
278.00	0.186	91.273	16.120	-2.198	16.269	270.23	179.95
279.00	2.000	91.267	16.081	-2.288	16.243	270.90	180.01
280.00	2.000	91.261	16.040	-2.355	16.212	271.65	180.08
281.00	2.000	91.254	15.999	-2.421	16.181	272.39	180.14
282.00	0.206	91.241	15.956	-2.486	16.148	273.14	180.28
283.00	0.206	91.223	15.912	-2.551	16.115	273.89	180.45
284.00	0.206	91.206	15.866	-2.614	16.080	274.64	180.63
285.00	0.206	91.189	15.820	-2.698	16.048	275.32	180.80
286.00	0.206	91.172	15.772	-2.759	16.012	276.08	180.97
287.00	0.206	91.154	15.723	-2.819	15.974	276.83	181.15
288.00	0.206	91.137	15.673	-2.878	15.935	277.59	181.32
289.00	0.206	91.120	15.622	-2.958	15.900	278.28	181.50
290.00	0.206	91.102	15.570	-3.015	15.859	279.04	181.67
291.00	0.206	91.085	15.517	-3.071	15.818	279.80	181.84
292.00	0.206	91.067	15.462	-3.126	15.775	280.57	182.02
293.00	0.206	91.054	15.407	-3.203	15.736	281.26	182.15
294.00	0.206	91.043	15.350	-3.259	15.693	282.01	182.27
295.00	0.206	91.031	15.293	-3.314	15.648	282.77	182.38
296.00	0.206	91.020	15.235	-3.368	15.602	283.53	182.49
297.00	0.206	91.009	15.175	-3.421	15.556	284.29	182.60
298.00	0.206	90.998	15.115	-3.473	15.508	285.06	182.71
299.00	0.206	90.986	15.053	-3.544	15.465	285.75	182.83

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.206	90.975	14.991	-3.593	15.416	286.52	182.94
301.00	0.206	90.964	14.928	-3.641	15.365	287.29	183.05
302.00	0.206	90.953	14.863	-3.688	15.314	288.06	183.16
303.00	0.206	90.941	14.798	-3.734	15.262	288.84	183.27
304.00	0.206	90.930	14.733	-3.778	15.209	289.62	183.38
305.00	0.136	90.919	14.666	-3.842	15.161	290.32	183.50
306.00	0.136	90.908	14.599	-3.884	15.106	291.10	183.61
307.00	0.136	90.896	14.530	-3.924	15.051	291.89	183.72
308.00	0.136	90.885	14.461	-3.963	14.995	292.67	183.83
309.00	0.136	90.874	14.392	-4.001	14.937	293.46	183.94
310.00	0.136	90.862	14.321	-4.037	14.879	294.26	184.05
311.00	0.136	90.851	14.250	-4.093	14.826	294.97	184.17
312.00	0.136	90.840	14.178	-4.127	14.767	295.77	184.28
313.00	0.136	90.828	14.106	-4.159	14.706	296.57	184.39
314.00	0.136	90.817	14.033	-4.189	14.645	297.38	184.50
315.00	0.136	90.806	13.959	-4.219	14.583	298.18	184.61
316.00	0.136	90.794	13.885	-4.246	14.520	298.99	184.72
317.00	0.136	90.783	13.811	-4.294	14.463	299.73	184.84
318.00	0.136	90.772	13.735	-4.319	14.399	300.54	184.95
319.00	0.136	90.760	13.660	-4.343	14.334	301.36	185.06
320.00	0.136	90.749	13.584	-4.365	14.268	302.18	185.17
321.00	0.136	90.738	13.507	-4.385	14.201	303.01	185.28
322.00	0.136	90.726	13.430	-4.405	14.134	303.84	185.40
323.00	0.136	90.715	13.353	-4.422	14.066	304.67	185.51
324.00	0.136	90.703	13.275	-4.460	14.004	305.43	185.62
325.00	0.136	90.692	13.197	-4.475	13.935	306.27	185.73
326.00	0.136	90.680	13.119	-4.488	13.865	307.11	185.84
327.00	0.136	90.669	13.040	-4.499	13.795	307.96	185.95
328.00	0.136	90.658	12.961	-4.510	13.723	308.81	186.07
329.00	0.136	90.648	12.882	-4.519	13.652	309.67	186.16
330.00	0.136	90.648	12.803	-4.533	13.582	310.50	186.16
331.00	0.136	90.648	12.724	-4.546	13.511	311.34	186.16
332.00	0.136	90.648	12.644	-4.557	13.440	312.18	186.16
333.00	0.136	90.648	12.564	-4.567	13.368	313.02	186.16
334.00	0.136	90.648	12.484	-4.576	13.296	313.87	186.16
335.00	0.136	90.648	12.404	-4.583	13.223	314.72	186.16
336.00	0.136	90.648	12.323	-4.588	13.150	315.58	186.16
337.00	0.136	90.648	12.243	-4.593	13.076	316.44	186.16
338.00	0.136	90.648	12.162	-4.596	13.002	317.30	186.16
339.00	0.136	90.648	12.082	-4.597	12.927	318.17	186.16
340.00	0.136	90.648	12.001	-4.597	12.852	319.04	186.16
341.00	0.136	90.648	11.921	-4.596	12.776	319.91	186.16
342.00	0.136	90.648	11.840	-4.593	12.700	320.80	186.16
343.00	0.136	90.648	11.760	-4.589	12.623	321.68	186.16
344.00	0.136	90.648	11.679	-4.584	12.546	322.57	186.16
345.00	0.136	90.648	11.599	-4.577	12.469	323.47	186.16
346.00	0.136	90.648	11.519	-4.568	12.392	324.37	186.16
347.00	0.136	90.648	11.439	-4.559	12.314	325.27	186.16
348.00	0.136	90.648	11.359	-4.547	12.236	326.18	186.16
349.00	0.136	90.648	11.280	-4.535	12.157	327.10	186.16

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:10:03

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.136	90.648	11.200	-4.521	12.078	328.02	186.16
351.00	0.136	90.648	11.121	-4.506	11.999	328.94	186.16
352.00	0.136	90.780	11.042	-4.469	11.912	329.97	184.87
353.00	0.136	90.993	10.965	-4.391	11.812	331.17	182.76
354.00	0.136	91.203	10.889	-4.295	11.706	332.47	180.66
355.00	0.136	91.411	10.815	-4.222	11.610	333.67	178.55
356.00	0.136	91.616	10.741	-4.150	11.515	334.87	176.44
357.00	0.136	91.819	10.669	-4.081	11.423	336.07	174.33
358.00	0.136	92.019	10.598	-4.013	11.333	337.26	172.23
359.00	0.136	92.217	10.529	-3.948	11.244	338.44	170.12

MINIMUM STRESS (Pb,x')	=	7.567	AT	64.00	DEGREES
MINIMUM TOTAL STRESS (Pb,max)	=	7.567	AT	63.88	DEGREES

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:21:35

Page 1

DESCRIPTION:

Limerick, Unit 2 1999 Outage

Weld H6 -- 8 Years of Crack Growth -- Faulted Conditions

Crack assumed to take compression across face

RADIUS (IN) = 99.375 WALL THICKNESS (IN) = 2

TENSION STRESS = 1.324 KSI

MATERIAL FLOW STRESS = 43.200 KSI

ANGLE FOR MOMENT ITERATION = 1

FLAWS DEFINED = 15 (AS FOLLOWS)

1 ANGLES:	0.0000 TO	6.0900	(DTHETA =	6.090)	DEPTH (IN) =	1.864
2 ANGLES:	6.0900 TO	39.3600	(DTHETA =	33.270)	DEPTH (IN) =	1.724
3 ANGLES:	39.3600 TO	51.0900	(DTHETA =	11.730)	DEPTH (IN) =	1.864
4 ANGLES:	51.0900 TO	65.4500	(DTHETA =	14.360)	DEPTH (IN) =	1.804
5 ANGLES:	65.4500 TO	88.7700	(DTHETA =	23.320)	DEPTH (IN) =	1.754
6 ANGLES:	88.7700 TO	124.6500	(DTHETA =	35.880)	DEPTH (IN) =	1.794
7 ANGLES:	124.6500 TO	195.5800	(DTHETA =	70.930)	DEPTH (IN) =	1.864
8 ANGLES:	202.5500 TO	207.0000	(DTHETA =	4.450)	DEPTH (IN) =	1.564
9 ANGLES:	207.0000 TO	219.3600	(DTHETA =	12.360)	DEPTH (IN) =	1.794
10 ANGLES:	219.3600 TO	238.5900	(DTHETA =	19.230)	DEPTH (IN) =	1.864
11 ANGLES:	238.5900 TO	252.1000	(DTHETA =	13.510)	DEPTH (IN) =	1.584
12 ANGLES:	260.6700 TO	267.1000	(DTHETA =	6.430)	DEPTH (IN) =	1.784
13 ANGLES:	273.4700 TO	278.8000	(DTHETA =	5.330)	DEPTH (IN) =	1.814
14 ANGLES:	281.5700 TO	304.2900	(DTHETA =	22.720)	DEPTH (IN) =	1.794
15 ANGLES:	304.2900 TO	360.0000	(DTHETA =	55.710)	DEPTH (IN) =	1.864

TOTAL AREA (IN2) = 1248.783

REMAINING DEGRADED SECTION AREA (IN2) = 197.575

(APPROX. DEGRADED METAL AREA = 197.5756)

Program Output:

Angle = Angle that tension-to-compression axis x' is rotated

t = Thickness in wall at position corresponding to angle

delta = Distance from center to tension-to-compression axis

Pb,x' = Bending stress due to moment about tension-to-compression axis

Pb,y' = Bending stress due to moment perpendicular to tens./comp. axis

Pb,max = Maximum bending stress due to total limit moment

Anglemax = Angle for total limit moment relative to original Y axis

Atension = Area of metal in tension for Case 2

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 2

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
0.00	0.136	93.558	9.169	-4.046	10.022	336.19	174.96
1.00	0.136	93.734	9.099	-3.966	9.925	337.45	172.85
2.00	0.136	93.908	9.030	-3.904	9.838	338.61	170.74
3.00	0.136	94.079	8.962	-3.845	9.752	339.78	168.63
4.00	0.136	94.247	8.895	-3.788	9.668	340.93	166.53
5.00	0.136	94.295	8.829	-3.765	9.598	341.90	165.92
6.00	0.136	94.331	8.763	-3.757	9.534	342.79	165.46
7.00	0.276	94.367	8.697	-3.732	9.464	343.77	165.01
8.00	0.276	94.402	8.632	-3.723	9.401	344.67	164.55
9.00	0.276	94.434	8.568	-3.697	9.331	345.66	164.15
10.00	0.276	94.443	8.503	-3.687	9.268	346.56	164.04
11.00	0.276	94.451	8.439	-3.675	9.204	347.47	163.92
12.00	0.276	94.460	8.375	-3.647	9.134	348.47	163.81
13.00	0.276	94.469	8.311	-3.633	9.070	349.39	163.70
14.00	0.276	94.477	8.247	-3.618	9.006	350.31	163.59
15.00	0.276	94.486	8.184	-3.603	8.942	351.24	163.48
16.00	0.276	94.495	8.122	-3.587	8.878	352.17	163.36
17.00	0.276	94.503	8.059	-3.569	8.814	353.11	163.25
18.00	0.276	94.512	7.997	-3.535	8.743	354.15	163.14
19.00	0.276	94.521	7.935	-3.516	8.679	355.10	163.03
20.00	0.276	94.529	7.874	-3.495	8.615	356.06	162.92
21.00	0.276	94.538	7.813	-3.474	8.550	357.02	162.81
22.00	0.276	94.541	7.752	-3.452	8.486	357.99	162.76
23.00	0.276	94.541	7.692	-3.429	8.422	358.97	162.76
24.00	0.276	94.541	7.632	-3.405	8.357	359.96	162.76
25.00	0.276	94.541	7.573	-3.380	8.293	0.95	162.76
26.00	0.276	94.541	7.514	-3.353	8.228	1.95	162.76
27.00	0.276	94.541	7.456	-3.326	8.164	2.96	162.76
28.00	0.276	94.541	7.398	-3.298	8.100	3.97	162.76
29.00	0.276	94.541	7.341	-3.268	8.035	5.00	162.76
30.00	0.276	94.541	7.284	-3.238	7.971	6.03	162.76
31.00	0.276	94.541	7.227	-3.207	7.907	7.07	162.76
32.00	0.276	94.541	7.172	-3.174	7.843	8.12	162.76
33.00	0.276	94.541	7.116	-3.141	7.779	9.18	162.76
34.00	0.276	94.464	7.062	-3.078	7.704	10.45	163.76
35.00	0.276	94.299	7.009	-2.990	7.620	11.89	165.87
36.00	0.276	94.131	6.957	-2.898	7.537	13.38	167.98
37.00	0.276	93.961	6.907	-2.802	7.454	14.92	170.09
38.00	0.276	93.788	6.859	-2.733	7.383	16.27	172.19
39.00	0.276	93.613	6.812	-2.629	7.302	17.90	174.30
40.00	0.136	93.469	6.768	-2.488	7.210	19.81	176.01
41.00	0.136	93.322	6.725	-2.376	7.133	21.54	177.72
42.00	0.136	93.174	6.685	-2.228	7.047	23.57	179.44
43.00	0.136	93.025	6.648	-2.076	6.964	25.66	181.15
44.00	0.136	92.994	6.612	-1.986	6.904	27.28	181.50
45.00	0.136	92.991	6.578	-1.895	6.846	28.93	181.53
46.00	0.136	92.989	6.546	-1.803	6.789	30.59	181.56
47.00	0.136	92.986	6.515	-1.711	6.736	32.28	181.58
48.00	0.136	92.994	6.486	-1.624	6.686	33.94	181.50
49.00	0.136	93.022	6.458	-1.532	6.637	35.65	181.18

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 3

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
50.00	0.136	93.049	6.432	-1.459	6.595	37.22	180.87
51.00	0.136	93.077	6.407	-1.385	6.555	38.80	180.55
52.00	0.196	93.161	6.383	-1.274	6.509	40.71	179.59
53.00	0.196	93.334	6.362	-1.148	6.465	42.77	177.59
54.00	0.196	93.505	6.343	-1.024	6.425	44.83	175.58
55.00	0.196	93.673	6.326	-0.921	6.392	46.71	173.58
56.00	0.196	93.840	6.311	-0.803	6.361	48.74	171.57
57.00	0.196	94.003	6.297	-0.689	6.335	50.76	169.57
58.00	0.196	94.165	6.286	-0.577	6.313	52.76	167.56
59.00	0.196	94.332	6.277	-0.475	6.295	54.67	165.45
60.00	0.196	94.496	6.270	-0.377	6.281	56.56	163.34
61.00	0.196	94.658	6.264	-0.281	6.270	58.43	161.24
62.00	0.196	94.817	6.260	-0.190	6.263	60.26	159.13
63.00	0.196	94.974	6.257	-0.101	6.258	62.07	157.02
64.00	0.196	95.098	6.256	-0.016	6.256	63.85	155.32
65.00	0.196	95.107	6.256	0.024	6.256	65.22	155.19
66.00	0.246	95.116	6.257	0.063	6.257	66.58	155.06
67.00	0.246	95.126	6.258	0.102	6.259	67.94	154.94
68.00	0.246	95.135	6.260	0.156	6.262	69.43	154.81
69.00	0.246	95.144	6.263	0.195	6.266	70.78	154.68
70.00	0.246	95.153	6.267	0.233	6.271	72.13	154.55
71.00	0.246	95.255	6.271	0.301	6.278	73.74	153.13
72.00	0.246	95.404	6.277	0.379	6.288	75.46	151.02
73.00	0.246	95.550	6.284	0.454	6.300	77.13	148.92
74.00	0.246	95.694	6.292	0.526	6.314	78.78	146.81
75.00	0.246	95.813	6.302	0.612	6.332	80.55	145.02
76.00	0.246	95.926	6.313	0.685	6.351	82.19	143.31
77.00	0.246	96.037	6.326	0.770	6.373	83.94	141.60
78.00	0.246	96.146	6.340	0.837	6.395	85.52	139.89
79.00	0.246	96.253	6.355	0.915	6.421	87.19	138.17
80.00	0.246	96.243	6.371	0.934	6.439	88.34	138.33
81.00	0.246	96.222	6.388	0.967	6.460	89.61	138.68
82.00	0.246	96.200	6.405	0.986	6.480	90.75	139.02
83.00	0.246	96.178	6.422	1.020	6.502	92.02	139.37
84.00	0.246	96.157	6.440	1.039	6.523	93.16	139.72
85.00	0.246	96.242	6.459	1.101	6.552	94.67	138.35
86.00	0.246	96.348	6.478	1.174	6.584	96.27	136.64
87.00	0.246	96.371	6.499	1.267	6.622	98.03	136.26
88.00	0.246	96.303	6.523	1.365	6.664	99.82	137.37
89.00	0.206	96.178	6.547	1.419	6.699	101.23	139.37
90.00	0.206	96.051	6.572	1.475	6.735	102.65	141.38
91.00	0.206	95.921	6.598	1.534	6.774	104.09	143.38
92.00	0.206	95.789	6.625	1.596	6.815	105.54	145.39
93.00	0.206	95.654	6.654	1.661	6.858	107.01	147.39
94.00	0.206	95.517	6.684	1.728	6.903	108.49	149.40
95.00	0.206	95.377	6.715	1.798	6.951	109.99	151.40
96.00	0.206	95.235	6.747	1.898	7.009	111.71	153.41
97.00	0.206	95.091	6.780	1.974	7.062	113.23	155.42
98.00	0.206	94.976	6.815	2.035	7.113	114.63	156.98
99.00	0.206	94.975	6.851	2.073	7.158	115.83	157.00

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 4

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
100.00	0.206	94.974	6.888	2.109	7.204	117.03	157.02
101.00	0.206	94.973	6.925	2.145	7.250	118.21	157.03
102.00	0.206	94.972	6.963	2.181	7.296	119.39	157.05
103.00	0.206	94.970	7.001	2.215	7.343	120.56	157.06
104.00	0.206	94.969	7.040	2.249	7.390	121.72	157.08
105.00	0.206	94.854	7.080	2.315	7.449	123.11	158.64
106.00	0.206	94.703	7.121	2.394	7.512	124.58	160.64
107.00	0.206	94.546	7.163	2.474	7.578	126.05	162.70
108.00	0.206	94.383	7.207	2.557	7.647	127.54	164.80
109.00	0.206	94.216	7.253	2.643	7.719	129.02	166.91
110.00	0.206	94.048	7.300	2.731	7.794	130.51	169.02
111.00	0.206	93.876	7.348	2.822	7.871	132.01	171.13
112.00	0.206	93.702	7.398	2.916	7.952	133.51	173.24
113.00	0.206	93.525	7.450	3.012	8.036	135.01	175.34
114.00	0.206	93.462	7.503	3.081	8.111	136.33	176.09
115.00	0.206	93.455	7.557	3.128	8.179	137.49	176.17
116.00	0.206	93.449	7.612	3.174	8.247	138.64	176.25
117.00	0.206	93.442	7.667	3.219	8.316	139.78	176.33
118.00	0.206	93.435	7.724	3.246	8.378	140.80	176.41
119.00	0.206	93.379	7.781	3.286	8.446	141.90	177.06
120.00	0.206	93.198	7.839	3.381	8.537	143.33	179.16
121.00	0.206	93.014	7.899	3.479	8.631	144.77	181.27
122.00	0.206	92.827	7.961	3.578	8.728	146.20	183.38
123.00	0.206	92.692	8.024	3.679	8.828	147.63	184.88
124.00	0.206	92.682	8.089	3.730	8.907	148.75	185.00
125.00	0.136	92.672	8.154	3.779	8.987	149.86	185.11
126.00	0.136	92.662	8.221	3.827	9.068	150.97	185.22
127.00	0.136	92.652	8.288	3.875	9.148	152.06	185.33
128.00	0.136	92.642	8.355	3.902	9.221	153.03	185.44
129.00	0.136	92.631	8.424	3.947	9.302	154.11	185.55
130.00	0.136	92.621	8.493	3.991	9.384	155.17	185.67
131.00	0.136	92.611	8.563	4.034	9.465	156.23	185.78
132.00	0.136	92.601	8.633	4.076	9.547	157.27	185.89
133.00	0.136	92.591	8.705	4.117	9.629	158.31	186.00
134.00	0.136	92.581	8.776	4.138	9.703	159.24	186.11
135.00	0.136	92.571	8.849	4.176	9.785	160.27	186.22
136.00	0.136	92.560	8.922	4.214	9.867	161.28	186.34
137.00	0.136	92.550	8.996	4.250	9.949	162.29	186.45
138.00	0.136	92.540	9.070	4.285	10.031	163.29	186.56
139.00	0.136	92.530	9.145	4.319	10.114	164.28	186.67
140.00	0.136	92.520	9.220	4.333	10.188	165.17	186.78
141.00	0.136	92.510	9.296	4.365	10.270	166.15	186.89
142.00	0.136	92.499	9.372	4.395	10.352	167.12	187.01
143.00	0.136	92.489	9.449	4.425	10.434	168.09	187.12
144.00	0.136	92.479	9.527	4.453	10.516	169.05	187.23
145.00	0.136	92.469	9.604	4.480	10.598	170.01	187.34
146.00	0.136	92.460	9.682	4.504	10.679	170.95	187.43
147.00	0.136	92.460	9.761	4.522	10.758	171.86	187.43
148.00	0.136	92.460	9.840	4.539	10.836	172.76	187.43
149.00	0.136	92.460	9.919	4.555	10.915	173.66	187.43

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 5

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
150.00	0.136	92.460	9.998	4.569	10.993	174.56	187.43
151.00	0.136	92.460	10.078	4.581	11.070	175.45	187.43
152.00	0.136	92.460	10.158	4.593	11.148	176.33	187.43
153.00	0.136	92.460	10.238	4.584	11.217	177.12	187.43
154.00	0.136	92.460	10.318	4.592	11.294	177.99	187.43
155.00	0.136	92.460	10.398	4.599	11.370	178.86	187.43
156.00	0.136	92.460	10.478	4.605	11.446	179.73	187.43
157.00	0.136	92.460	10.559	4.609	11.521	180.58	187.43
158.00	0.136	92.460	10.639	4.612	11.596	181.44	187.43
159.00	0.136	92.460	10.720	4.614	11.670	182.29	187.43
160.00	0.136	92.460	10.800	4.614	11.745	183.13	187.43
161.00	0.136	92.460	10.881	4.613	11.818	183.97	187.43
162.00	0.136	92.460	10.961	4.629	11.898	184.89	187.43
163.00	0.136	92.460	11.042	4.625	11.971	185.73	187.43
164.00	0.136	92.460	11.122	4.619	12.043	186.55	187.43
165.00	0.136	92.469	11.202	4.612	12.115	187.38	187.34
166.00	0.136	92.489	11.282	4.603	12.185	188.20	187.12
167.00	0.136	92.509	11.363	4.593	12.256	189.01	186.90
168.00	0.136	92.529	11.443	4.600	12.333	189.90	186.68
169.00	0.136	92.549	11.523	4.586	12.402	190.70	186.46
170.00	0.136	92.569	11.602	4.571	12.470	191.50	186.24
171.00	0.136	92.589	11.682	4.573	12.545	192.38	186.02
172.00	0.136	92.609	11.761	4.554	12.612	193.17	185.80
173.00	0.136	92.629	11.841	4.534	12.679	193.95	185.58
174.00	0.136	92.649	11.919	4.512	12.745	194.74	185.36
175.00	0.136	92.669	11.998	4.507	12.817	195.59	185.14
176.00	0.136	92.689	12.076	4.482	12.881	196.36	184.92
177.00	0.136	92.709	12.154	4.456	12.945	197.13	184.70
178.00	0.136	92.728	12.232	4.446	13.015	197.97	184.48
179.00	0.136	92.748	12.309	4.416	13.077	198.73	184.26
180.00	0.136	92.768	12.386	4.384	13.139	199.49	184.04
181.00	0.136	92.787	12.462	4.369	13.206	200.32	183.82
182.00	0.136	92.807	12.538	4.335	13.266	201.07	183.60
183.00	0.136	92.827	12.613	4.298	13.326	201.82	183.38
184.00	0.136	92.846	12.688	4.279	13.390	202.63	183.16
185.00	0.136	92.866	12.762	4.239	13.448	203.37	182.94
186.00	0.136	92.886	12.836	4.198	13.505	204.11	182.72
187.00	0.136	92.905	12.909	4.174	13.567	204.92	182.50
188.00	0.136	92.925	12.981	4.130	13.622	205.65	182.28
189.00	0.136	92.944	13.052	4.084	13.676	206.37	182.06
190.00	0.136	92.964	13.123	4.055	13.735	207.17	181.84
191.00	0.136	92.983	13.193	4.006	13.788	207.89	181.62
192.00	0.136	93.002	13.263	3.956	13.840	208.61	181.40
193.00	0.136	93.022	13.331	3.922	13.896	209.40	181.18
194.00	0.136	93.041	13.399	3.869	13.947	210.11	180.96
195.00	0.136	93.060	13.466	3.815	13.996	210.82	180.74
196.00	2.000	93.080	13.532	3.759	14.044	211.52	180.52
197.00	2.000	93.099	13.597	3.720	14.097	212.30	180.30
198.00	2.000	93.118	13.661	3.661	14.143	213.00	180.08
199.00	2.000	93.137	13.725	3.601	14.189	213.70	179.87

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 6

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
200.00	2.000	93.137	13.787	3.539	14.234	214.40	179.87
201.00	2.000	93.137	13.848	3.477	14.278	215.09	179.87
202.00	2.000	93.137	13.908	3.414	14.321	215.79	179.87
203.00	0.436	93.137	13.967	3.349	14.363	216.48	179.87
204.00	0.436	93.137	14.025	3.284	14.404	217.18	179.87
205.00	0.436	93.137	14.082	3.217	14.445	217.87	179.87
206.00	0.436	93.137	14.137	3.150	14.484	218.56	179.87
207.00	0.321	93.127	14.192	3.086	14.523	219.27	179.98
208.00	0.206	93.108	14.245	3.029	14.563	220.00	180.20
209.00	0.206	93.089	14.297	2.971	14.603	220.74	180.42
210.00	0.206	93.069	14.348	2.893	14.637	221.40	180.64
211.00	0.206	93.054	14.398	2.834	14.674	222.13	180.81
212.00	0.206	93.043	14.447	2.774	14.711	222.87	180.94
213.00	0.206	93.032	14.494	2.713	14.746	223.60	181.06
214.00	0.206	93.021	14.541	2.652	14.781	224.33	181.19
215.00	0.206	93.010	14.586	2.571	14.811	224.99	181.31
216.00	0.206	92.999	14.631	2.508	14.844	225.73	181.43
217.00	0.206	92.988	14.674	2.445	14.876	226.46	181.56
218.00	0.206	92.978	14.716	2.381	14.907	227.19	181.68
219.00	0.206	92.967	14.757	2.317	14.937	227.92	181.81
220.00	0.136	92.956	14.796	2.233	14.964	228.58	181.93
221.00	0.136	92.945	14.835	2.167	14.992	229.31	182.05
222.00	0.136	92.934	14.872	2.102	15.019	230.04	182.18
223.00	0.136	92.923	14.908	2.035	15.046	230.77	182.30
224.00	0.136	92.912	14.942	1.968	15.072	231.50	182.43
225.00	0.136	92.903	14.976	1.901	15.096	232.24	182.52
226.00	0.136	92.899	15.008	1.833	15.120	232.97	182.57
227.00	0.136	92.895	15.039	1.746	15.140	233.62	182.62
228.00	0.136	92.891	15.069	1.677	15.162	234.35	182.66
229.00	0.136	92.887	15.098	1.608	15.183	235.08	182.71
230.00	0.136	92.882	15.125	1.539	15.203	235.81	182.76
231.00	0.136	92.878	15.152	1.469	15.223	236.54	182.80
232.00	0.136	92.874	15.177	1.398	15.241	237.26	182.85
233.00	0.136	92.870	15.200	1.327	15.258	237.99	182.89
234.00	0.136	92.866	15.223	1.256	15.274	238.72	182.94
235.00	0.136	92.862	15.244	1.185	15.290	239.44	182.99
236.00	0.136	92.858	15.264	1.113	15.304	240.17	183.03
237.00	0.136	92.854	15.282	1.041	15.318	240.90	183.08
238.00	0.136	92.849	15.300	0.969	15.330	241.62	183.13
239.00	0.416	92.845	15.316	0.897	15.342	242.35	183.17
240.00	0.416	92.841	15.331	0.824	15.353	243.08	183.22
241.00	0.416	92.852	15.344	0.742	15.362	243.77	183.10
242.00	0.416	92.867	15.356	0.657	15.370	244.45	182.93
243.00	0.416	92.883	15.367	0.571	15.377	245.13	182.75
244.00	0.416	92.898	15.376	0.485	15.384	245.81	182.58
245.00	0.416	92.914	15.384	0.417	15.389	246.55	182.40
246.00	0.416	92.929	15.390	0.330	15.394	247.23	182.23
247.00	0.416	92.944	15.395	0.243	15.397	247.90	182.06
248.00	0.416	92.960	15.398	0.173	15.399	248.64	181.88
249.00	0.416	92.970	15.400	0.086	15.401	249.32	181.76

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 7

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
250.00	0.416	92.980	15.401	-0.002	15.401	249.99	181.65
251.00	0.416	92.990	15.400	-0.090	15.400	250.66	181.54
252.00	0.416	92.998	15.397	-0.177	15.398	251.34	181.45
253.00	2.000	92.999	15.393	-0.260	15.396	252.03	181.44
254.00	2.000	93.000	15.388	-0.343	15.392	252.72	181.42
255.00	2.000	93.002	15.381	-0.426	15.387	253.41	181.41
256.00	2.000	93.003	15.373	-0.508	15.382	254.10	181.39
257.00	2.000	93.005	15.363	-0.591	15.375	254.80	181.38
258.00	2.000	93.006	15.352	-0.673	15.367	255.49	181.36
259.00	2.000	93.007	15.340	-0.756	15.358	256.18	181.34
260.00	2.000	93.009	15.326	-0.838	15.349	256.87	181.33
261.00	0.216	93.010	15.311	-0.919	15.338	257.56	181.31
262.00	0.216	93.011	15.294	-1.001	15.326	258.25	181.30
263.00	0.216	93.013	15.276	-1.082	15.314	258.95	181.28
264.00	0.216	93.014	15.256	-1.163	15.300	259.64	181.26
265.00	0.216	93.016	15.235	-1.243	15.286	260.33	181.25
266.00	0.216	93.017	15.213	-1.324	15.270	261.03	181.23
267.00	0.216	93.012	15.189	-1.400	15.253	261.73	181.29
268.00	2.000	93.006	15.164	-1.475	15.235	262.44	181.35
269.00	2.000	93.001	15.137	-1.549	15.216	263.15	181.42
270.00	2.000	92.995	15.109	-1.623	15.196	263.87	181.48
271.00	2.000	92.990	15.080	-1.697	15.176	264.58	181.54
272.00	2.000	92.984	15.050	-1.770	15.154	265.29	181.60
273.00	2.000	92.979	15.018	-1.842	15.131	266.01	181.67
274.00	0.186	92.973	14.985	-1.913	15.107	266.72	181.73
275.00	0.186	92.968	14.951	-1.984	15.082	267.44	181.79
276.00	0.186	92.962	14.916	-2.054	15.056	268.16	181.85
277.00	0.186	92.957	14.879	-2.143	15.032	268.80	181.92
278.00	0.186	92.951	14.841	-2.212	15.005	269.52	181.98
279.00	2.000	92.946	14.802	-2.280	14.976	270.24	182.04
280.00	2.000	92.940	14.761	-2.347	14.947	270.97	182.10
281.00	2.000	92.935	14.720	-2.413	14.916	271.69	182.16
282.00	0.206	92.929	14.677	-2.479	14.885	272.41	182.23
283.00	0.206	92.924	14.633	-2.544	14.852	273.14	182.29
284.00	0.206	92.917	14.588	-2.607	14.819	273.86	182.36
285.00	0.206	92.902	14.541	-2.670	14.784	274.59	182.54
286.00	0.206	92.886	14.494	-2.751	14.753	275.25	182.71
287.00	0.206	92.871	14.445	-2.812	14.716	275.98	182.89
288.00	0.206	92.855	14.395	-2.872	14.679	276.72	183.06
289.00	0.206	92.840	14.345	-2.931	14.641	277.45	183.23
290.00	0.206	92.826	14.293	-3.008	14.606	278.11	183.39
291.00	0.206	92.816	14.240	-3.068	14.566	278.84	183.50
292.00	0.206	92.806	14.185	-3.127	14.526	279.57	183.61
293.00	0.206	92.796	14.130	-3.185	14.485	280.30	183.73
294.00	0.206	92.786	14.074	-3.241	14.442	281.03	183.84
295.00	0.206	92.776	14.017	-3.297	14.399	281.76	183.95
296.00	0.206	92.766	13.958	-3.370	14.359	282.42	184.06
297.00	0.206	92.756	13.899	-3.423	14.314	283.16	184.17
298.00	0.206	92.746	13.839	-3.475	14.268	283.90	184.28
299.00	0.206	92.736	13.777	-3.526	14.221	284.64	184.40

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 8

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
300.00	0.206	92.726	13.715	-3.576	14.174	285.39	184.51
301.00	0.206	92.716	13.652	-3.624	14.125	286.13	184.62
302.00	0.206	92.706	13.588	-3.690	14.080	286.81	184.73
303.00	0.206	92.696	13.523	-3.736	14.030	287.56	184.84
304.00	0.206	92.686	13.458	-3.780	13.978	288.31	184.95
305.00	0.136	92.675	13.391	-3.824	13.926	289.06	185.07
306.00	0.136	92.665	13.324	-3.866	13.873	289.82	185.18
307.00	0.136	92.655	13.256	-3.906	13.819	290.58	185.29
308.00	0.136	92.645	13.187	-3.965	13.770	291.26	185.40
309.00	0.136	92.635	13.117	-4.003	13.714	292.03	185.51
310.00	0.136	92.625	13.047	-4.039	13.658	292.80	185.62
311.00	0.136	92.615	12.976	-4.075	13.601	293.57	185.74
312.00	0.136	92.605	12.904	-4.108	13.543	294.34	185.85
313.00	0.136	92.595	12.832	-4.141	13.484	295.11	185.96
314.00	0.136	92.584	12.759	-4.191	13.430	295.81	186.07
315.00	0.136	92.574	12.686	-4.221	13.370	296.60	186.18
316.00	0.136	92.564	12.612	-4.249	13.308	297.38	186.30
317.00	0.136	92.554	12.537	-4.276	13.246	298.17	186.41
318.00	0.136	92.544	12.462	-4.301	13.184	298.96	186.52
319.00	0.136	92.534	12.387	-4.325	13.120	299.75	186.63
320.00	0.136	92.523	12.311	-4.367	13.062	300.47	186.74
321.00	0.136	92.513	12.235	-4.388	12.997	301.27	186.85
322.00	0.136	92.503	12.158	-4.407	12.932	302.07	186.97
323.00	0.136	92.493	12.081	-4.425	12.865	302.88	187.08
324.00	0.136	92.482	12.003	-4.441	12.798	303.69	187.19
325.00	0.136	92.472	11.925	-4.457	12.731	304.51	187.30
326.00	0.136	92.462	11.847	-4.470	12.662	305.33	187.41
327.00	0.136	92.460	11.769	-4.487	12.595	306.13	187.43
328.00	0.136	92.460	11.690	-4.504	12.527	306.93	187.43
329.00	0.136	92.460	11.611	-4.520	12.459	307.73	187.43
330.00	0.136	92.460	11.531	-4.534	12.391	308.54	187.43
331.00	0.136	92.460	11.452	-4.546	12.321	309.35	187.43
332.00	0.136	92.460	11.372	-4.558	12.251	310.16	187.43
333.00	0.136	92.460	11.292	-4.568	12.181	310.98	187.43
334.00	0.136	92.460	11.212	-4.576	12.110	311.80	187.43
335.00	0.136	92.460	11.132	-4.583	12.038	312.62	187.43
336.00	0.136	92.460	11.052	-4.589	11.966	313.45	187.43
337.00	0.136	92.460	10.971	-4.593	11.894	314.28	187.43
338.00	0.136	92.460	10.891	-4.596	11.821	315.12	187.43
339.00	0.136	92.460	10.810	-4.598	11.747	315.96	187.43
340.00	0.136	92.460	10.730	-4.598	11.673	316.80	187.43
341.00	0.136	92.460	10.649	-4.596	11.599	317.65	187.43
342.00	0.136	92.460	10.568	-4.594	11.524	318.51	187.43
343.00	0.136	92.460	10.488	-4.589	11.448	319.36	187.43
344.00	0.136	92.460	10.408	-4.584	11.372	320.23	187.43
345.00	0.136	92.460	10.327	-4.577	11.296	321.10	187.43
346.00	0.136	92.460	10.247	-4.569	11.220	321.97	187.43
347.00	0.136	92.460	10.167	-4.559	11.143	322.85	187.43
348.00	0.136	92.460	10.088	-4.548	11.065	323.73	187.43
349.00	0.136	92.460	10.008	-4.535	10.988	324.62	187.43

Arbitrary Net Section Collapse ANSC 2.0 (4/26/94)

09-07-2000 10:22:28

Page 9

Angle	Wall t	Delta	Pb,x'	Pb,y'	Pb,max	AngleMax	A tension
350.00	0.136	92.460	9.929	-4.521	10.910	325.51	187.43
351.00	0.136	92.460	9.849	-4.506	10.831	326.41	187.43
352.00	0.136	92.460	9.771	-4.489	10.753	327.32	187.43
353.00	0.136	92.460	9.692	-4.471	10.674	328.23	187.43
354.00	0.136	92.460	9.614	-4.452	10.595	329.15	187.43
355.00	0.136	92.637	9.537	-4.395	10.501	330.26	185.49
356.00	0.136	92.826	9.461	-4.321	10.401	331.45	183.39
357.00	0.136	93.013	9.386	-4.250	10.303	332.64	181.28
358.00	0.136	93.197	9.312	-4.180	10.207	333.83	179.17
359.00	0.136	93.379	9.240	-4.112	10.113	335.01	177.06

MINIMUM STRESS (Pb,x') = 6.256 AT 65.00 DEGREES
MINIMUM TOTAL STRESS (Pb,max) = 6.256 AT 65.22 DEGREES

APPENDIX C

Linear Elastic Fracture Mechanics Evaluation



Based upon fluence estimates provided by PECO [10], only two welds in the Limerick, Unit 2 core shroud are projected to reach the 3×10^{20} n/cm² fluence threshold in the near term, which will require evaluation using linear elastic fracture mechanics (LEFM) techniques. Weld H4 has already exceeded this threshold.

For weld H3 at end-of-cycle 8 (EOC 8), the fluence is projected to be 3.1×10^{20} n/cm² [10]. Utilizing a crack growth rate of 2.2×10^{-5} inches/hour for the current cycle, and 1.1×10^{-5} inches/hour for the next two, the total crack growth and NDE uncertainty would be 0.835 inches. For cracking from both the inside and outside surfaces, a number of indications, as well as the uninspected regions, would be projected to be flawed through-wall. Since it has been shown previously that long through-wall flaws are typically unacceptable in the Limerick, Unit 2 core shroud when performing LEFM evaluations, it is considered prudent to require reinspection of weld H3 at EOC 7, where the projected fluence is less than the 3.0×10^{20} n/cm² threshold.

For weld H4, utilizing a crack growth rate of 5×10^{-5} inches/hour for the current cycle, and 2.5×10^{-5} inches/hour for each additional cycle when considering NMCA, the depth of the deepest reported indication in weld H4, when also considering NDE uncertainty, would be 1.44 inches after two cycles of operation, and 1.84 inches after three cycles of operation.

The Reference 11 letter provides applied stress intensity factors for various part through-wall flaws in a core shroud. This information is graphically depicted in Figure 4 [11]. The basis for the values shown in this figure includes a maximum operating membrane stress in the shroud of 1.6 ksi, which bounds the Limerick, Unit 2 total applied upset stress at weld H4 of 1.51 ksi. For the Limerick, Unit 2 core shroud R/t ratio of 51, and normalized flaw depths of 0.72 and 0.92 for two or three cycles of operation, the applied stress intensity factor is $6 \text{ ksi}\sqrt{\text{in}}$ for two cycles of operation and an indeterminate value for three cycles, since the Figure 4 curves extend only to a flaw depth of 90% through-wall. Since the upset allowable stress intensity is equal to the material fracture toughness ($150 \text{ ksi}\sqrt{\text{in}}$) [1] divided by the factor-of-safety (2.77), it is clear that for two cycles of operation, the projected flaws are acceptable. The same conclusion can be drawn for the faulted condition if the applied stress intensity factor is doubled, since the factor-of-safety for the faulted condition is half of that for the upset condition. Therefore, it is recommended that weld H4 be reinspected at EOC 7.



APPENDIX D

Evaluation of Irradiated Type 304L Stainless Steel Crack Growth Rates For the Limerick, Unit 2 Core Shroud Operating With Low HWC or NMCA



1.0 INTRODUCTION

This data evaluation is designed to determine the crack growth rate of Type 304L stainless steel in the irradiated BWR core shroud region for Limerick, Unit 2 (Limerick-2) during two distinct periods of water chemistry operation. The primary concern is for an apparent flaw on the outside surface of shroud weld H4. The inside surface of weld H4 is characterized by a fluence of 8.9×10^{20} n/cm² at end-of-cycle 7.

Limerick-2 is currently operating (from Spring 1999 through Spring 2001) with a low level hydrogen water chemistry (L-HWC) environment. Although the current level of hydrogen injection, i.e., ~16 SCFM, is not sufficient to reduce the corrosion potential of stainless steel to below the threshold level for the initiation of intergranular stress corrosion cracking (IGSCC), it will reduce the crack growth rate. The current L-HWC will be enhanced with noble metal chemical application (NMCA, commercially known as NobleChemTM) during the next Limerick-2 fuel cycle (from Spring 2001 to Spring 2003). Based on Limerick-1's present experience with NMCA, the application of NMCA is expected to lower the corrosion potential of stainless steel substantially below the threshold level for IGSCC, such that crack initiation will be completely mitigated and crack growth of any existing flaws will be extremely low.

It is well documented that radiation can exacerbate specific aspects of cracking susceptibility via its effect on the material's microstructure (e.g., radiation-induced segregation [RIS]), water chemistry (e.g., radiolysis), and stress (e.g., radiation-induced creep and hardening). However, Limerick-2's recent implementation of L-HWC and subsequent implementation of NMCA during the next fuel cycle will dramatically mitigate the highly oxidizing power of the irradiated BWR environment despite the presence of a high radiation field. This chemical control of the BWR environment mitigates one of the required parameters for not only IGSCC, but also irradiation assisted stress corrosion cracking (IASCC).

Since furnace sensitized stainless steel metallurgically bounds welded and RIS material, in-reactor and laboratory crack growth data obtained from furnace sensitized stainless steel fracture mechanics specimen studies can be conservatively used to evaluate less susceptible irradiated welded material crack growth behavior. Crack initiation data from constant extension rate tests (CERTs) and crack growth modeling can also be used to support the contention that Limerick-2's planned NMCA environment will further mitigate crack growth and prevent crack initiation.

The Limerick-2 core shroud is constructed of Type 304L material, while the studies documented herein are based upon Type 304 material. Use of Type 304 data, however, is conservative for Type 304L material.



2.0 LOW HYDROGEN WATER CHEMISTRY EVALUATION - CURRENT CYCLE

2.1 In-Reactor and Laboratory Crack Growth Rate Data in L-HWC Environments

Figure 1 presents the dissolved oxygen content of the reactor water in Limerick-2 during the current L-HWC fuel cycle [1]. The plant is operating at essentially 100% power during the current cycle. The average dissolved oxygen content of Limerick-2 is 27 ppb as compared to the nominal content of 200 ppb for a BWR operating on normal water chemistry (NWC). This 200 ppb to 27 ppb reduction in dissolved oxygen content results in a reduction in the corrosion potential of stainless steel from approximately 200 mV(SHE) to approximately -100 mV(SHE). Although the suppression of the stainless steel corrosion potential (ECP) from 200 mV(SHE) to approximately -100 mV(SHE) does not create an environment that would completely mitigate IGSCC initiation, i.e., -230 mV(SHE), -100 mV(SHE) does approach the IASCC initiation threshold of -140 mV(SHE) [2].

Fortunately, there are some real-time crack growth rate data obtained by the electrical potential monitoring (EPM) technique [3] from both in-reactor and laboratory L-HWC environments that can be correlated with this level of dissolved oxygen content. This data can be used for a Limerick-2 L-HWC crack growth rate evaluation, Table 1 [4]. The results indicate very low crack growth ($\leq 9.0 \times 10^{-6}$ in/h) even in an environment characterized by a very high conductivity, i.e., 0.294 $\mu\text{S}/\text{cm}$. (The lack of a good correlation between the corrosion potential and dissolved oxygen content are due to the presence of other oxidizing species, such as hydrogen peroxide [in-reactor], BWR system location, age of the specimen, flow rate, heat of material, etc.)

Table 1

Furnace Sensitized Type 304 Stainless Steel EPM Crack Growth Rates
in L-HWC Environments [4]

EPM Test Location	Measured Dissolved Oxygen Content, ppb	Measured Corrosion Potential, mV(SHE)	Conductivity, $\mu\text{S}/\text{cm}$	Stress Intensity, ksi $\sqrt{\text{in}}$	Measured Crack Growth Rate, in/h
Dresden-2	20	-230	0.100	25.0	5.5×10^{-7}
Peach Bottom-2 (RWCU)	20	-130	0.080	22.0	9.0×10^{-6}
Garōna	20	-40	0.074	19.2	0
Garōna	20	-40	0.074	19.9	5.7×10^{-7}
Laboratory	25	-116	0.060	26.0	1.0×10^{-7}
Peach Bottom-2 (Feedwater)	25	0	0.058	32.0	0
Laboratory	31	-77	0.294	26.0	1.7×10^{-6}

2.2 Crack Growth Rate Modeling in L-HWC Environments

Since susceptibility to IASCC in annealed austenitic stainless steels may occur at fluences of approximately 5×10^{20} n/cm² or higher in a BWR environment [5], there is concern for the weld H4 location. Conversely, a higher fluence ($\sim 2 \times 10^{21}$ n/cm²) is required for cracking in low corrosion potential environments, e.g., pressurized water reactors (PWRs) or BWRs with moderate HWC (M-HWC) or L-HWC/NMCA. This IASCC "threshold" fluence range is where many radiation-induced variables change dramatically, so that it has been difficult to isolate individual contributions to the cracking process.

2.2.1 BWRVIP-14 Crack Growth Rate Modeling – L-HWC

To quantify the benefit of Limerick-2's current L-HWC environment, a comparison was made between the crack growth rates predicted by the BWRVIP-14 crack growth model [5] in an irradiated BWR environment with a stainless steel corrosion potential of 200 mV(SHE) and the present Limerick-2 L-HWC environment with an estimated stainless steel corrosion potential of -100 mV(SHE). This comparison results in a factor of improvement (FOI) calculation, a technique that has been submitted to the U.S. NRC to obtain inspection relief for BWR internals operating with M-HWC or L-HWC/NMCA [6].

The BWRVIP-14 crack growth model is a statistically based correlation of crack growth rate and key mechanical and environmental parameters, with the notable exception of the degree of sensitization, Figure 2. The empirical model is designed to predict the crack propagation rate of stainless steels in the BWR environment. The model equation has the following form:

$$\ln \text{ of crack growth rate (mm/s)} = a \ln K - b C^c + d \text{ ECP} + e/T - f$$

where:

a, b, c, d, e, f = empirically fit constants

K = stress intensity, MPa√m

C = conductivity at 25 °C, μS/cm

ECP = "electrochemical" corrosion potential, mV(SHE)

T = absolute temperature, °K

The best fit model for the Type 304 stainless steel data is:

$$\ln (da/dt) = 2.181 \ln (K) - 0.787 C^{-0.586} + 0.00362 \text{ ECP} + 6730/T - 35.567$$

The model is a multivariable least squares fit to documented fracture mechanics specimen crack growth rate data available to the BWRVIP in 1995. The 95th percentile residuals about the model, which are equal to the crack propagation rate from the best fit model multiplied by 10.3, has been recommended as a conservative representation of the data. The calibration data set included only sensitized, unirradiated, non-cold worked Type 304 stainless steel test results that were characterized by measured values of corrosion potential, conductivity, stress intensity and temperature. The 95th percentile model is conservative for non-sensitized material, and other stainless steels including Types 347, 316L and 316NG. Most of the earlier data used in NUREG/CR-0313, Revision 2 [7], for which measured corrosion potential and conductivity are



not available, are also bounded by the 95th percentile model under credible assumptions of corrosion potential and conductivity.

Table 2 presents the results of crack growth rate calculations for Limerick-2 for both 200 and -100 mV(SHE) at a temperature of 288 °C (561 °K) and a conductivity of 0.1 μS/cm as a function of stress intensity using the best fit BWRVIP-14 model and the 95th percentile BWRVIP-14 model. The L-HWC/NMCA FOI between the two corrosion potentials is also presented. The crack growth rate FOI is essentially constant at approximately three.

Table 2
Calculated Crack Growth Rates for Type 304 Stainless Steel
at 200 and -100 mV(SHE) Using BWRVIP-14

Stress Intensity ksi√in	Crack Growth Rate 200 mV(SHE), in/h	Crack Growth Rate 200 mV(SHE), in/h 95 th percentile	Crack Growth Rate -100 mV(SHE), in/h	Crack Growth Rate -100 mV(SHE), in/h 95 th percentile	FOI
5	3.33×10^{-8}	3.43×10^{-7}	1.12×10^{-8}	1.15×10^{-7}	2.97
10	1.51×10^{-7}	1.56×10^{-6}	5.09×10^{-8}	5.24×10^{-7}	2.97
15	3.65×10^{-7}	3.76×10^{-6}	1.23×10^{-7}	1.27×10^{-6}	2.97
20	6.84×10^{-7}	7.04×10^{-6}	2.31×10^{-7}	2.38×10^{-6}	2.96
25	1.11×10^{-6}	1.14×10^{-5}	3.76×10^{-7}	3.87×10^{-6}	2.95
30	1.66×10^{-6}	1.71×10^{-5}	5.59×10^{-7}	5.77×10^{-6}	2.97

Figure 3 presents Type 304 stainless steel crack growth rates as a function of stress intensity using the U.S. NRC disposition curve for the metallurgically bounding furnace sensitized (FS) material [7], and 95th percentile BWRVIP-14 model calculations for sensitized material in the NWC environment (200 mV[SHE]) and the estimated present Limerick-2 L-HWC environment (-100 mV[SHE]). An FOI on the U.S. NRC disposition curve for Limerick-2 has been developed based on the FOI of three ratio between the two 95th percentile BWRVIP-14 calculated crack growth rate curves.

The comparison of this bounding furnace sensitized U.S. NRC disposition crack growth line and the BWRVIP-14 FOI analysis of Figure 3 reflects this FOI of three reduction in crack growth rate. The crack growth rate at 30 ksi√in is less than 6.7×10^{-5} in/h. This model value is very conservative relative to the actually measured crack growth rate data presented in Table 1, where the highest furnace sensitized Type 304 stainless steel crack growth rate was $\leq 9.0 \times 10^{-6}$ in/h. The BWRVIP-14 model itself predicts a 95th percentile crack growth rate of 5.77×10^{-6} in/h at 30 ksi√in.



2.2.2 SKI Crack Growth Rate Modeling – L-HWC

The Swedish State Nuclear Inspectorate (SKI) also has disposition equations for stainless steel crack growth rates in NWC and HWC environments, as shown in Table 3 [8]. However, the SKI model is based on either NWC or HWC, with no consideration for decreasing corrosion potential, and, thus, decreasing crack growth rate. This black or white approach is valid for crack initiation but certainly not crack propagation. Also, as was the case for the BWRVIP-14 model, there is no effect of the degree of sensitization on crack growth rate for the SKI model.

Table 3

SKI Crack Growth Rate for Type 304 Stainless Steel [8]

BWR Environment	Environmental Definition	Crack Growth Rate Equation*
NWC	$\leq 0.3 \mu\text{S/cm}$ and $\text{ECP} > -230 \text{ mV(SHE)}$	$da/dt = 9.5 \times 10^{-12} K^3 \text{ mm/s}$
HWC	$\leq 0.3 \mu\text{S/cm}$ and $\text{ECP} \leq -230 \text{ mV(SHE)}$	$da/dt = 2.5 \times 10^{-13} K^3 \text{ mm/s}$

*K in $\text{MPa}\sqrt{\text{m}}$ (K in $\text{ksi}\sqrt{\text{in}}$ x 1.095)

Since no credit is granted for conductivities less than $0.3 \mu\text{S/cm}$ or corrosion potentials slightly above -230 mV(SHE) , no FOI can be developed for L-HWC for Limerick-2 using this SKI model. That is, the SKI model considers L-HWC to be NWC. However, as will be shown in Section 3.0, the FOI of HWC versus NWC is significantly higher than that obtained with the BWRVIP-14 model. This suggests that if SKI had equations for L-HWC type environments, a higher FOI would be anticipated than is obtained with the BWRVIP-14 model. The SKI NWC equation indicates that a stress intensity of $30 \text{ ksi}\sqrt{\text{in}}$ would result in a crack growth rate of $4.84 \times 10^{-5} \text{ in/h}$.

2.2.3 GE PLEDGE Crack Growth Rate Modeling – L-HWC

Unlike the BWRVIP-14 or SKI models, PLEDGE is a deterministic model, based on the film rupture/slip oxidation mechanism of IGSCC that was developed by GE CR&D. It is based on laboratory studies and field data reported in numerous EPRI reports [9 through 12]. It was reviewed and accepted by the BWRVIP for use in evaluating the impact of water chemistry variables on crack growth rate in stainless steels over the ECP range of -500 to 50 mV (SHE) , and for conductivities up to $1 \mu\text{S/cm}$.

The PLEDGE crack propagation rate/crack tip strain rate relationship may be generalized by:

$$\bar{V}_t = A \dot{\epsilon}_{ct}^n$$

where $\bar{V}_t$ is the average environmentally controlled crack propagation rate, $\dot{\epsilon}_{ct}$ is the crack tip strain rate, and A and n are constants depending on the material and environment compositions at



the crack tip. There are limits to the validity of this relationship, however, which are observed at high and low crack tip strain rates. At low crack tip strain rates, the ultimate criterion is that sharp cracks cannot be maintained when the average crack tip propagation rate, $\bar{V}_t$, approaches the oxidation rate on the crack sides, V_s . Under these conditions, therefore, the crack propagation rate will slow down with exposure time and crack arrest will eventually occur due to blunting. At high crack tip strain rates ($\sim 10^{-2}/s$), a bare surface is continuously maintained at the crack tip, and the environmentally controlled crack propagation rates becomes independent of $\dot{\epsilon}_{ct}$, since it cannot exceed the Faradic equivalent of the bare surface dissolution rate.

Variables in the PLEDGE crack growth model include material type, degree of sensitization, stress intensity, ECP, conductivity and irradiation. PLEDGE predicts the expected rate of actively growing cracks; it is not a mean or a bound of SCC data. A comparison of highly accurate laboratory crack growth rate measurements and PLEDGE predictions indicates that the PLEDGE model is conservative. As intended, PLEDGE calculations represent the high end of the crack growth data within a factor of two for approximately 95% of the data. For the subset of data measured under HWC and near HWC conditions, there is also excellent agreement between PLEDGE predictions and the observed crack growth rates.

Studies using the PLEDGE model for developing crack growth rate FOIs as a function of HWC availability and corrosion potential as part of the BWRVIP-62 [6] inspection relief study have demonstrated FOIs for HWC that are significantly higher than obtained from both the BWRVIP-14 and SKI models.



3.0 NOBLE METAL CHEMICAL APPLICATION EVALUATION – SPRING 2001

3.1 Noble Metal Chemical Application Process

General Electric Company (GE) has developed a novel concept of applying noble metal on all wetted in-reactor structural material surfaces by employing the reactor coolant water as the medium of transport [13, 14]. The NMCA technology has successfully decreased the corrosion potential of surfaces well below the IGSCC threshold corrosion potential of -230 mV(SHE) and mitigated crack growth in stoichiometrically excess hydrogen in BWR environments. This technology has minimized the hydrogen demand necessary to achieve the HWC specification potential of in-reactor components. The approach of achieving HWC specification potential with NMCA relies on decreasing the oxygen concentration on the metal surface, while conventional HWC relies on decreasing the bulk oxygen concentration in the water to very low levels, typically less than 2 ppb.

Thus, with NMCA, the bulk oxygen concentration could still be high while the surface oxygen concentration remains close to zero due to the remarkable ability of noble metals, such as Pt, Rh, Ir, Os, Pd, etc., to catalytically recombine reactor water oxidants (O_2 and $\frac{1}{2} H_2O_2$) with low levels of hydrogen added into the feedwater. When the molar ratio of hydrogen to oxidants is greater than two, the corrosion potential of a noble metal decreases well below the IGSCC threshold corrosion potential. In the BWR, the H_2 /oxidant molar ratio reaches the value of two at fairly low hydrogen concentrations, usually less than 0.4 ppm in the feedwater. Thus, if the surfaces of BWR structural materials could be treated with noble metal, the component's corrosion potential would behave more like that of a noble metal, not the underlying stainless steel. NMCA is the method of taking advantage of this behavior. Hence, under NMCA L-HWC conditions, the bulk oxygen need not be lowered to zero, and in fact the reactor water oxygen could be in the range of 40 to 60 ppb for most BWRs [14].

Limerick-1 has achieved stainless steel corrosion potentials of -400 mV(SHE) with L-HWC/NMCA that are significantly below both the IGSCC threshold for corrosion potential of -230 mV(SHE), and the IASCC threshold potential of -140 mV(SHE) [2], Figure 4. This same level of protection, i.e., -400 mV(SHE), would be expected for Limerick-1's sister BWR, Limerick-2.

3.2 In-reactor and Laboratory Crack Growth Rate Data in HWC Environments

Figure 5 presents a plot of the real-time crack growth rate data obtained by the EPM technique in both in-reactor and laboratory HWC environments. The crack growth data reveals extremely low crack growth rates of $\leq 1.0 \times 10^{-6}$ in/h for numerous heats of furnace sensitized Type 304 stainless steel material. The data is based on the results of 48 compact tension (CT), wedge-open-load (WOL) and double cantilever beam (DCB) specimens exposed to HWC environments at various corrosion potentials below -230 mV(SHE).

The data is roughly grouped by corrosion potential ranges. The coolant conductivity ranged in these studies from 0.08 to 0.18 $\mu S/cm$. Although there is significant crack growth rate data scatter due to variation in test location, heats of materials, heat treatments, specimen geometry,



conductivity, etc., the highest crack growth rate identified in this plot is still 50 times lower than the BWRVIP-01 value of the stress intensity independent 5.0×10^{-5} inches/hour [15].

The five points shown in Figure 5 with a crack growth rate of 1.0×10^{-8} inches/hour with a descending arrow are, in fact, zero growth rates that could not be represented on a logarithmic plot. Many of the measured EPM crack growth rate values presented in the figure were confirmed by metallography.

It is clear that the IGSCC growth rate of furnace sensitized Type 304 stainless steel with a corrosion potential below -230 mV(SHE) in HWC environments is extremely low.

It is important to emphasize that it does not matter if HWC alone or L-HWC/NMCA produces the low corrosion potential. That is, regardless of the process utilized, a metal surface characterized with a low corrosion potential will exhibit very low (or no) IGSCC growth.

3.3 In-Reactor Irradiated CERT Studies in HWC

A series of week-long (168 hour) CERTs were performed on U-notched Types 304 and 316 stainless steel that were irradiated in the Barsebäck, Unit 1 (B-1) BWR to fast neutron fluences ranging from 3×10^{20} to 5×10^{21} n/cm² ($E > 1$ MeV) [16]. Tests were performed in a test loop using reactor water at a high flow rate in HWC environments. Based on the current BWR fleet average of 0.1 μ S/cm, the conductivity of the coolant was a relatively high 0.2 μ S/cm.

Although the CERT test is an IGSCC **initiation test** and not designed for crack growth evaluations, it is often used to inexpensively obtain pseudo crack growth rates for comparison purposes, i.e., ranking of various materials' IGSCC resistance, ranking of the effects of ionic impurities in the environment on IGSCC, etc.

Due to the nature and design of the test (the constant straining and subsequent rupture of the passive film on the specimen surface), CERT calculated crack growth rates, simply obtained by dividing the depth of the deepest crack by the test time, are extremely high. As discussed in Section 2.0, the proper technique for measuring (not calculating) crack growth involves pre-cracked fracture mechanics specimens using the very accurate, real time EPM technique. Direct one-to-one comparisons between calculated CERT and measured EPM crack growth rates have sometimes revealed two orders of magnitude higher crack growth rates calculated from CERT [17].

With this caveat in mind, the CERT "crack growth rate" results obtained from the B-1 study are presented in Table 4 for HWC test conditions. Despite the aggressive nature of the CERT test and high coolant conductivity, there was no crack growth in the HWC environment at B-1, i.e., there was only ductile behavior. This result is completely consistent with furnace sensitized material IGSCC test results and both the -230 mV(SHE) and -140 mV(SHE) threshold IGSCC/IASCC corrosion potentials, Figure 4. It further reinforces the negligible or zero crack growth rate in low ECP environments, representative of the HWC or NobleChemTM environments.



Table 4

**Barsebäck, Unit 1 Type 304 Stainless Steel CERT
Crack Growth Rates at -500 mV(SHE) – Representative of HWC/NMCA [16]**

Fluence, n/cm ²	CERT Calculated Crack Growth Rate, in/h
1.25 x 10 ²¹	<1.00 x 10 ⁻⁶ *
2.50 x 10 ²¹	<1.00 x 10 ⁻⁶ *
2.90 x 10 ²¹	<1.00 x 10 ⁻⁶ *
3.00 x 10 ²¹	<1.00 x 10 ⁻⁶ *
3.25 x 10 ²¹	<1.00 x 10 ⁻⁶ *

* No crack growth, ductile behavior

3.4 Halden Test Studies

The U.S. NRC/ANL/EPRI co-managed Halden test reactor BWR studies are designed to generate crack initiation and growth data applicable to the core shroud and top guide residual life assessment. Although no data from this program has been published, the crack growth rate results obtained in this study in HWC-type environments have been extremely low.

3.5 Irradiation Crack Growth Rate in L-HWC/NMCA

3.5.1 BWRVIP-14 Crack Growth Rate Modeling - NMCA

Table 5 presents the results of crack growth rate calculations for Limerick-2 for both 200 and -400 mV(SHE) at a temperature of 288 °C (561 °K) and a conductivity of 0.1 μS/cm as a function of stress intensity using the 95th percentile BWRVIP-14 model. As was the case for L-HWC, an L-HWC/NMCA FOI between the two corrosion potentials is calculated. The crack growth rate FOI is essentially constant at 8.77, or approximately an order of magnitude decrease in crack growth rate.



Table 5

**Calculated Crack Growth Rates for Type 304 Stainless Steel
at 200 and -400 mV(SHE) Using BWRVIP-14**

Stress Intensity ksi√in	Crack Growth Rate 200 mV(SHE), in/h	Crack Growth Rate 200 mV(SHE), in/h 95 th percentile	Crack Growth Rate -400 mV(SHE), in/h	Crack Growth Rate -400 mV(SHE), in/h 95 th percentile	FOI
5	3.33×10^{-8}	3.43×10^{-7}	3.79×10^{-9}	3.90×10^{-8}	8.79
10	1.51×10^{-7}	1.56×10^{-6}	1.72×10^{-8}	1.77×10^{-7}	8.78
15	3.65×10^{-7}	3.76×10^{-6}	4.16×10^{-8}	4.28×10^{-7}	8.77
20	6.84×10^{-7}	7.04×10^{-6}	7.80×10^{-8}	8.03×10^{-7}	8.77
25	1.11×10^{-6}	1.14×10^{-5}	1.27×10^{-7}	1.31×10^{-6}	8.74
30	1.66×10^{-6}	1.71×10^{-5}	1.89×10^{-7}	1.95×10^{-6}	8.78

This calculated FOI can then be applied to the conservative NUREG/CR-0313, Revision 2 bounding furnace sensitized Type 304 stainless steel disposition curve to account for the L-HWC/NMCA induced lower corrosion potential.

Figure 6 presents Type 304 stainless steel crack growth rates as a function of stress intensity using the U.S. NRC disposition curve for furnace sensitized material, and 95th percentile BWRVIP-14 model calculations for sensitized material in the NWC irradiated environment (200 mV[SHE]) and the anticipated Limerick-2 HWC/NMCA environment (-400 mV[SHE]). An FOI on the U.S. NRC disposition curve for Limerick-2 has been developed based on the FOI 8.77 ratio between the two 95th percentile BWRVIP-14 calculated curves.

The comparison of this bounding furnace sensitized U.S. NRC disposition crack growth line and the 95th percentile BWRVIP-14 FOI analysis of Figure 6 reflects this FOI of 8.77, i.e., reduction in crack growth rate. The crack growth rate at 30 ksi√in is less than 2.3×10^{-5} inches/hour. This value is very conservative relative to the data presented in Figure 5, where the actually measured furnace sensitized crack growth rate at 31 ksi√in was less than 1.0×10^{-6} inches/hour.

Based on the available in-reactor and laboratory crack growth evaluations and 95th percentile BWRVIP-14 modeling, it appears that the limiting crack growth rate for Limerick-2's future environment is certainly significantly less than 2.5×10^{-5} inches/hour at stress intensities at or below 30 ksi√in.

3.5.2 SKI Crack Growth Rate Modeling - NMCA

Although the SKI model does not provide any credit for conductivities or corrosion potentials significantly less than 0.3 μS/cm or -230 mV(SHE), respectively, the FOI of HWC versus NWC is significantly higher than that obtained with the 95th percentile BWRVIP-14 model. The ratio of



NWC to HWC crack growth rates is a constant 38 for the anticipated Limerick-2 NMCA environment. Table 6 presents crack growth rate calculations using the SKI model.

Table 6
Calculated Crack Growth Rates for Type 304 Stainless Steel
in NWC and HWC Using the SKI Model

Stress Intensity ksi√in	Crack Growth Rate NWC, in/h	Crack Growth Rate HWC, in/h	Factor of Improvement
5	2.21×10^{-7}	5.82×10^{-9}	38
10	1.77×10^{-6}	4.65×10^{-8}	38
15	5.97×10^{-6}	1.57×10^{-7}	38
20	1.41×10^{-5}	3.72×10^{-7}	38
25	2.76×10^{-5}	7.27×10^{-7}	38
30	4.77×10^{-5}	1.26×10^{-6}	38

3.5.3 GE PLEDGE Crack Growth Rate Modeling - NMCA

Studies using the PLEDGE model for developing crack growth rate FOIs as a function of HWC availability and corrosion potential as part of the BWRVIP-62 [6] inspection relief study have demonstrated FOIs for HWC that are significantly higher than obtained for both the BWRVIP-14 and SKI models.

3.5.4 Crack Growth Rate Model Comparisons

As presented in Figure 7, the crack growth models predict extremely low crack growth rates under L-HWC/NMCA conditions, even at 30 ksi√in, i.e., 95th percentile BWRVIP-14 = 1.95×10^{-6} inches/hour and SKI = 1.26×10^{-6} inches/hour compared to the BWRVIP-01 value of 5×10^{-5} inches/hour in NWC. The 95th percentile BWRVIP-14 and SKI predictions were based on measured crack growth rate data.

The 95th percentile BWRVIP-14 and SKI crack growth rate models are consistent with the U.S. NRC weld sensitized disposition line. As expected, both the statistically developed BWRVIP-14 and SKI crack growth rate models are consistent with the actually measured open literature crack growth rate data.

It is important to note the additional conservative assumptions utilized in this crack growth rate analysis:

1. It was assumed that the outside surface of weld H4 was characterized by the same fluence as the inside surface, i.e., 8.9×10^{20} n/cm². However, the outside surface fluence would actually be attenuated by the 2 inch thickness of the stainless steel shroud by a factor of $e^{(-0.24t)}$, where t is the thickness of the H4 weld [18].

2. The degree of sensitization due to irradiation, i.e., chromium depletion at the grain boundaries, is less severe than thermal sensitization [2]. (The Limerick-2 FOI evaluation was based on a metallurgically worst-case furnace sensitized material that metallurgically bounds the weld sensitized data even at elevated fluences.)
3. The strong possibility of crack branching that results in a decrease in stress intensity and, subsequently, decreased crack growth rate was ignored.
4. No credit was taken for irradiation-induced stress relaxation.
5. The anticipated Limerick-2 HWC/NMCA FOI utilized in this evaluation was based on the 95th percentile BWRVIP-14 model value of 8.77. The dramatically higher SKI model FOI was not used.



4.0 SUMMARY

4.1 Limerick-2 Currently Operating with L-HWC

The real-time crack growth rate test data in similar environments to the present L-HWC Limerick-2 injection ratios indicates very low crack growth rates for furnace sensitized Type 304 stainless steel. Measured real-time crack growth rates were $\leq 9.0 \times 10^{-6}$ inches/hour in environments similar to the Limerick-2 current cycle environment. BWRVIP-14 model calculations suggest a FOI of three reduction in crack growth rate with L-HWC. The 95th percentile BWRVIP-14 model predicts a crack growth rate of 5.77×10^{-6} inches/hour in L-HWC at an applied stress intensity factor of 30 ksi $\sqrt{\text{in}}$. Therefore, it is conservative to use the BWRVIP-01 bounding crack growth rate of 5×10^{-5} inches/hour for the current cycle of operation.

4.2 Limerick-2 Future Operation with NMCA

The real-time crack growth rate test data and crack growth modeling results plus CERT initiation results based on Limerick-1 operation clearly indicate that the anticipated Limerick-2 HWC/NMCA environment will essentially eliminate crack growth. In fact, the actual measured crack growth rates in the anticipated Limerick-2 type environment are typically 50 times lower, i.e., $\sim 1 \times 10^{-6}$ inches/hour, than the BWRVIP-01 value of 5.0×10^{-5} inches/hour. The 95th percentile BWRVIP-14 and SKI models predicts a crack growth rate of 1.95×10^{-6} inches/hour and 1.26×10^{-6} inches/hour, respectively, in L-HWC/NMCA at an applied stress intensity factor of 30 ksi $\sqrt{\text{in}}$.

Therefore, it is conservative to use a bounding crack growth rate of 2.5×10^{-5} inches/hour for the next cycle of operation.



5.0 REFERENCES

1. K. M. McGinniss, "Limerick Unit 2 - Hydrogen Water Chemistry Data," e-mail to R. Mattson et al., August 16, 2000.
2. M. E. Indig, J. L. Nelson and G. P. Wozadlo, "Investigation of Protection Potential Against IASCC," paper presented at the Fifth International Symposium on the Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors, Monterey, CA, August 25-29, 1991, published in proceedings of same, ANS, La Grange, IL, p. 941, 1992.
3. R. P. Gangloff, "Electrical Potential Monitoring of Fatigue Crack Formation and Growth From Surface Defects," ASTM Symposium on Fatigue Crack Growth Measurement and Data Analysis, Pittsburgh, PA, October 20-30, 1979.
4. S. M. Bruemmer, et al., "Critical Issues Reviews for the Understanding and Evaluation of Irradiation Assisted Stress Corrosion Cracking," EPRI Report TR-107159, Palo Alto, CA, November 1996.
5. BWR Vessel and Internals Project, "Evaluation of Crack Growth in BWR Stainless Steel RPV Internals (BWRVIP-14)," EPRI Report TR-105873, Palo Alto, CA, March 1996.
6. BWR Vessel and Internals Project, "Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection (BWRVIP-62)," EPRI Report TR-108705, Palo Alto, CA, December 1998.
7. W. S. Hazelton and W. H. Koo, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," NUREG-0313, Revision 2, U.S. NRC, January 1988.
8. A. Jenssen fax to B. M. Gordon, "SKI Lines for Crack Propagation," April 24, 1997.
9. F. P. Ford, "Mechanisms of Environmental Cracking in Systems Peculiar to the Power Generation Industry," EPRI Report NP-2589, Palo Alto, CA, September 1982.
10. F. P. Ford, et al., "Environmentally-Controlled Cracking of Stainless and Low-Alloy Steels in Light-Water Reactors," EPRI Report NP-5064S, Palo Alto, CA, February 1987.
11. F. P. Ford and D. Weinstein, "The Effect of Improved Water Chemistry on Corrosion Cracking of BWR Piping," EPRI Report NP-6585, Palo Alto, CA, December 1989.
12. P. L. Andresen, "Stress Corrosion Monitoring and Component Life Prediction in BWRs," EPRI Report TR-1000399, Palo Alto, CA, March 1992.



13. S. Hettiarachchi, G. P. Wozadlo and T. P. Diaz, "A Novel Approach for Noble Metal Deposition on Surfaces for IGSCC Mitigation of Boiling Water Reactor Internals," paper 413 presented at Corrosion 95, NACE, Orlando, Florida, March 1995.
14. S. Hettiarachchi, W. D. Miller, R. L. Cowan and T. P. Diaz, "Noble Metal Chemical Addition for IGSCC Mitigation of BWRs – Field Successes," paper 184 presented at Corrosion 2000, NACE, Orlando, Florida, March 2000.
15. BWR Vessel and Internals Project, "BWR Core Shroud Inspection and Evaluation Guideline, Revision 2 (BWRVIP-01)," EPRI Report TR-107079, Palo Alto, CA, October 1996.
16. A. Jenssen, L. G. Ljungberg and J. Elkert, "Irradiation Assisted Stress Corrosion Cracking, a Life Limiting Factor for Internal Parts. Research and Experience," paper presented at "Plant Life Extension," Zurich, Switzerland, November 30, 1993.
17. B. M. Gordon, Structural Integrity, unpublished data.
18. U. S. Nuclear Regulatory Commission, Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988.



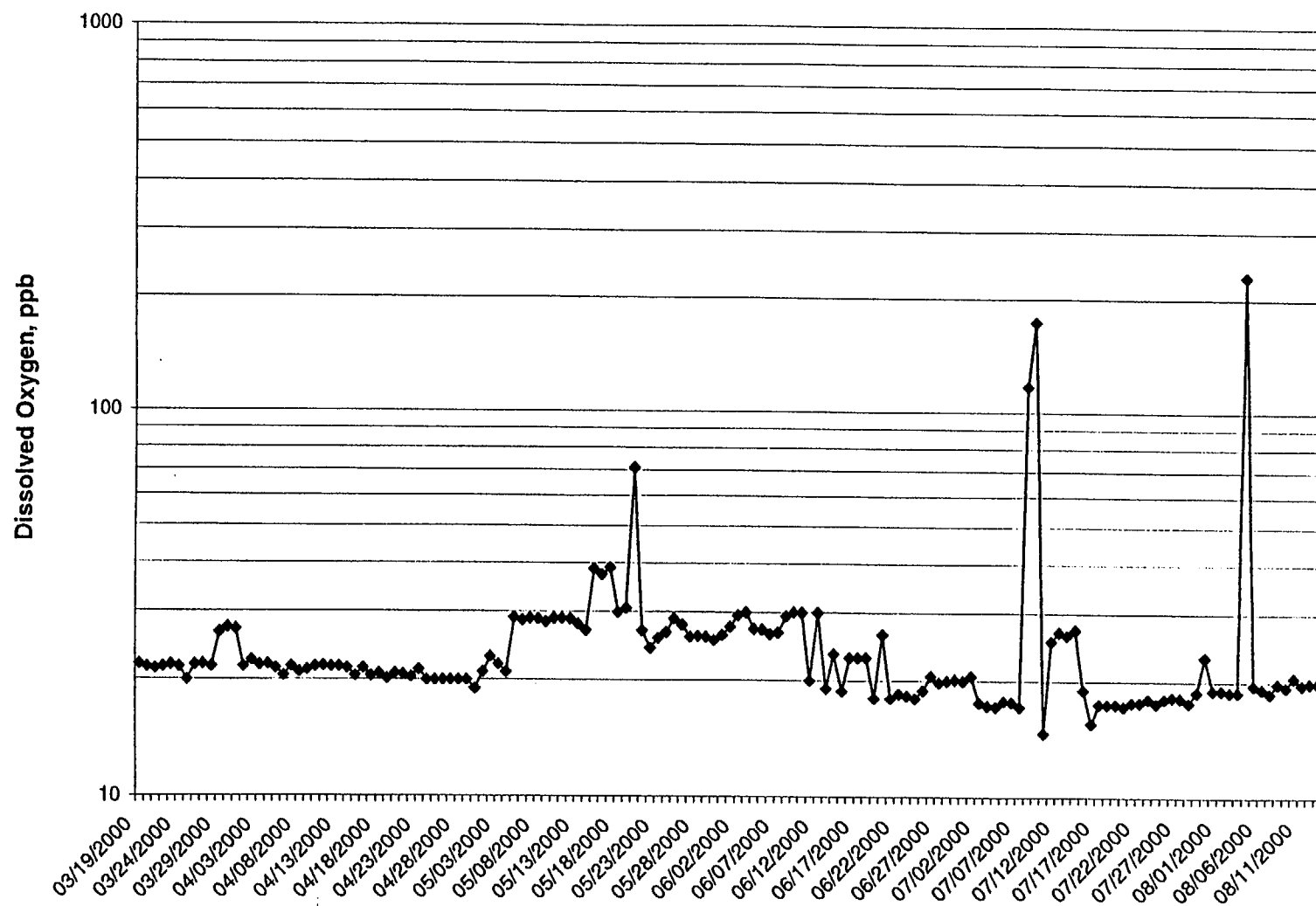


Figure 1. Limerick-2 Reactor Water Dissolved Oxygen Content [1]

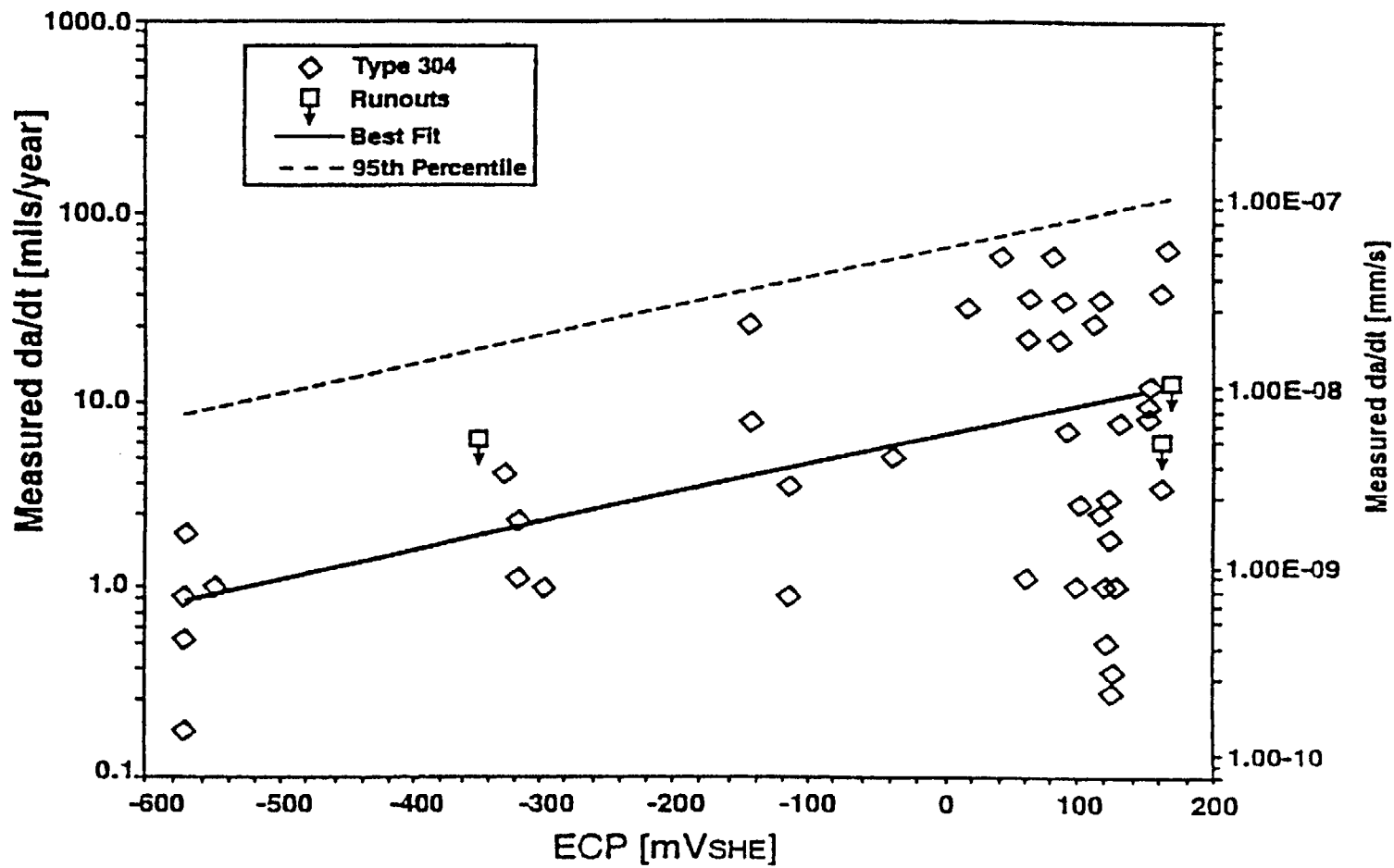


Figure 2. Type 304 Stainless Steel Crack Growth Rate vs. Corrosion Potential for BWRVIP Model [5]

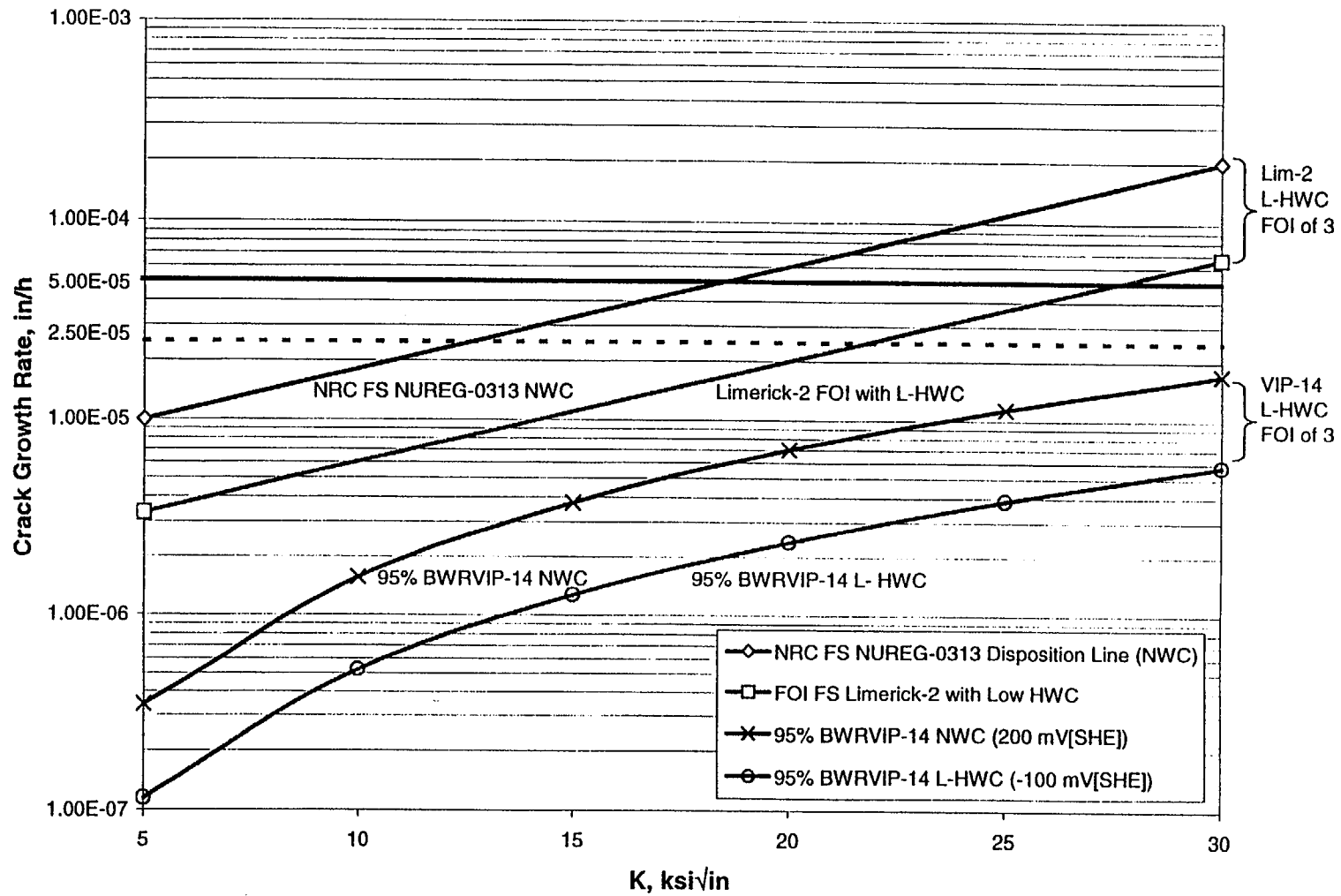
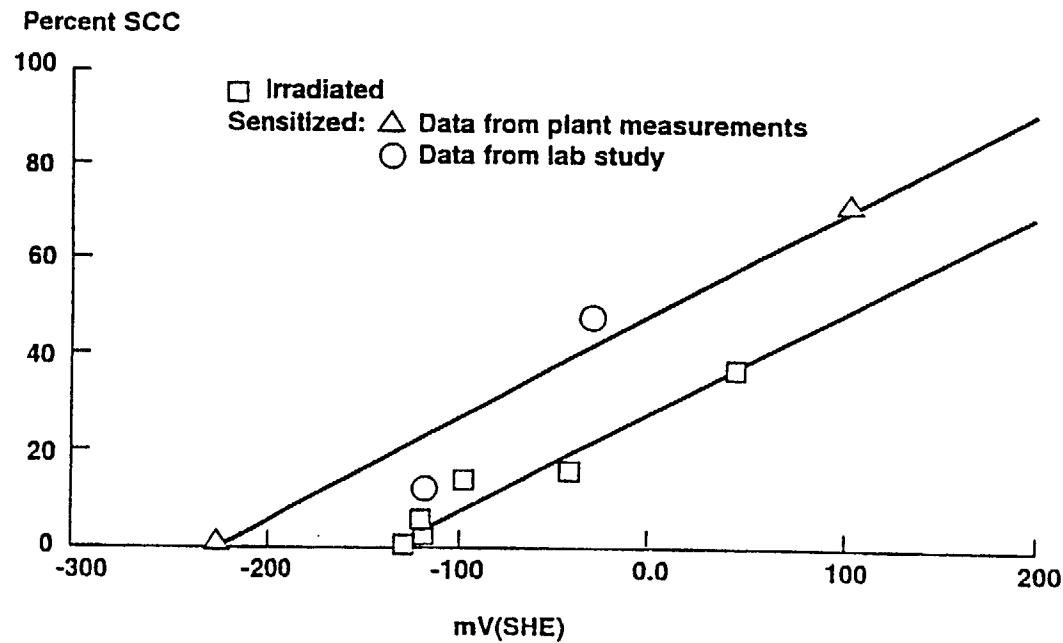


Figure 3. Effect of Stress Intensity on Furnace Sensitized Type 304 Stainless Steel IGSCC Rate
NRC Disposition Lines and 95% BWRVIP-14 Model for L-HWC

Notes: Percent SCC is % Intergranular Fracture
 Irradiated is solution annealed + irradiated to 1.9×10^{21} n/cm²
 Sensitized = Thermally sensitized



Test Environment
 Conductivity <0.1 μ S/cm
 T=274° C
 ECP controlled by addition of oxygen

Figure 4. Initiation of IGSCC/IASCC of Type 304 Stainless Steel as a Function of Corrosion Potential [2]

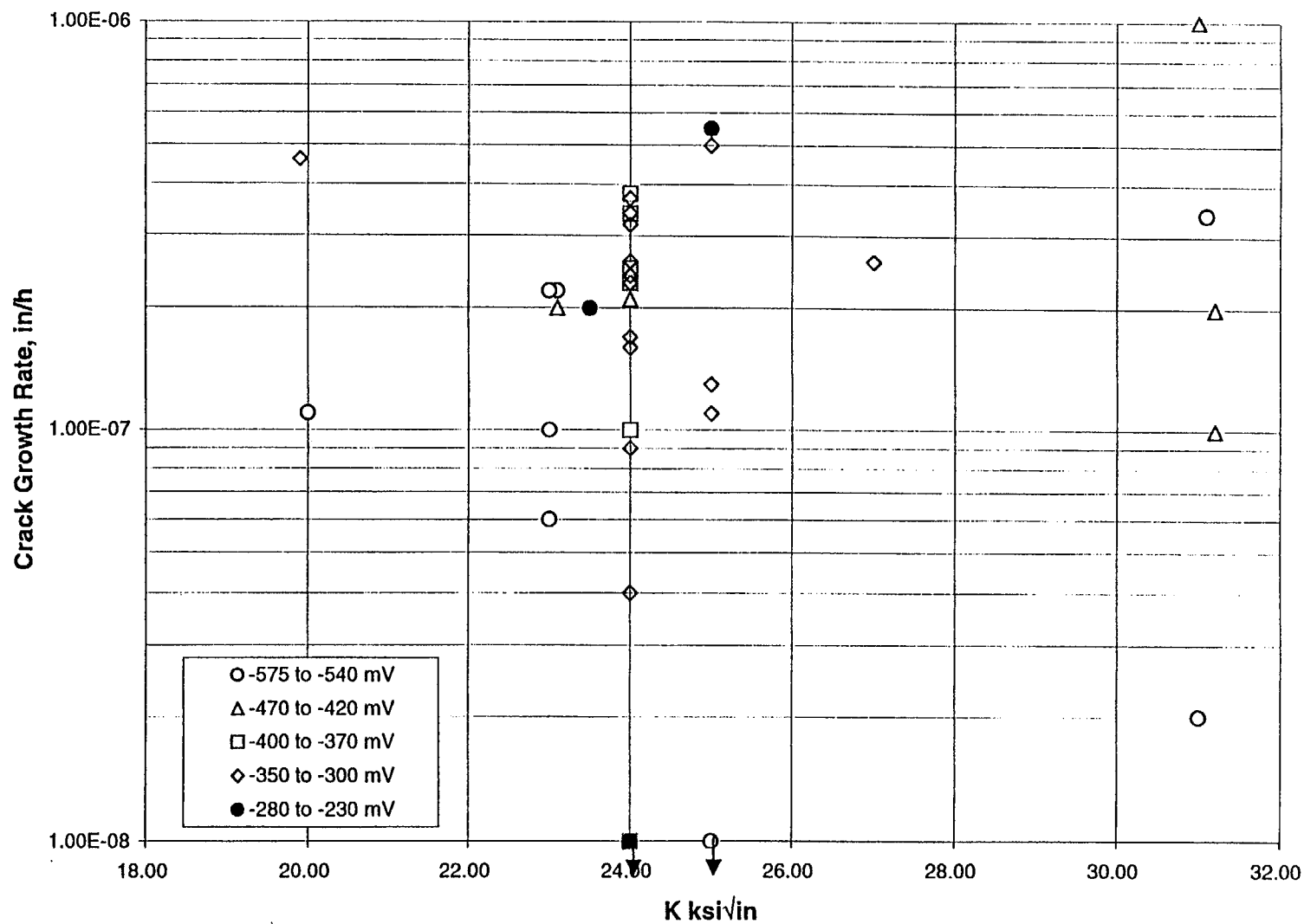


Figure 5. Effect of Stress Intensity on IGSCC Growth of Type 304 Stainless Steel at Low Corrosion Potentials [4]

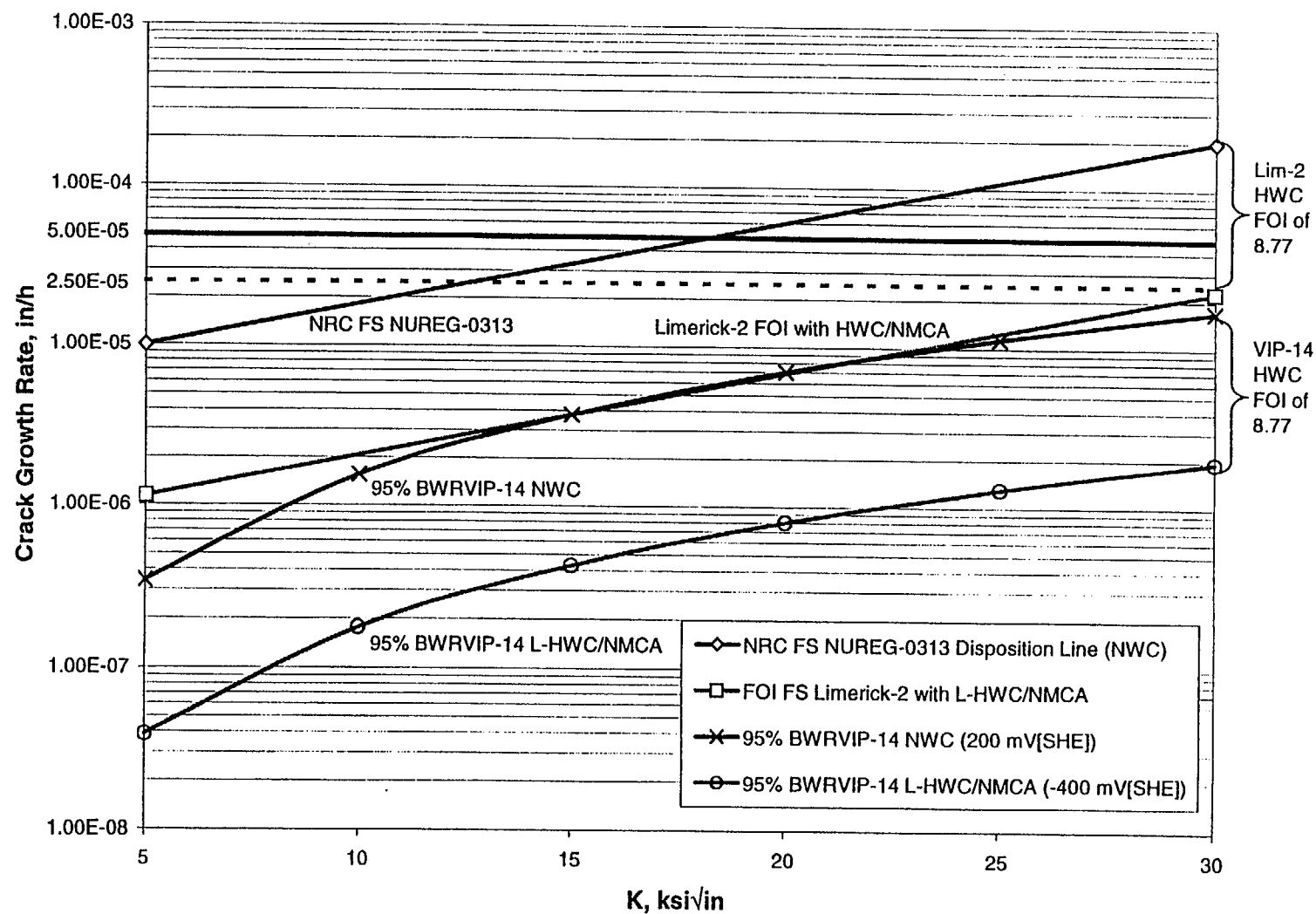


Figure 6. Effect of Stress Intensity on Furnace Sensitized Type 304 Stainless Steel IGSCC Rate
NRC Disposition Lines and 95% BWRVIP-14 Model for L-HWC/NMCA

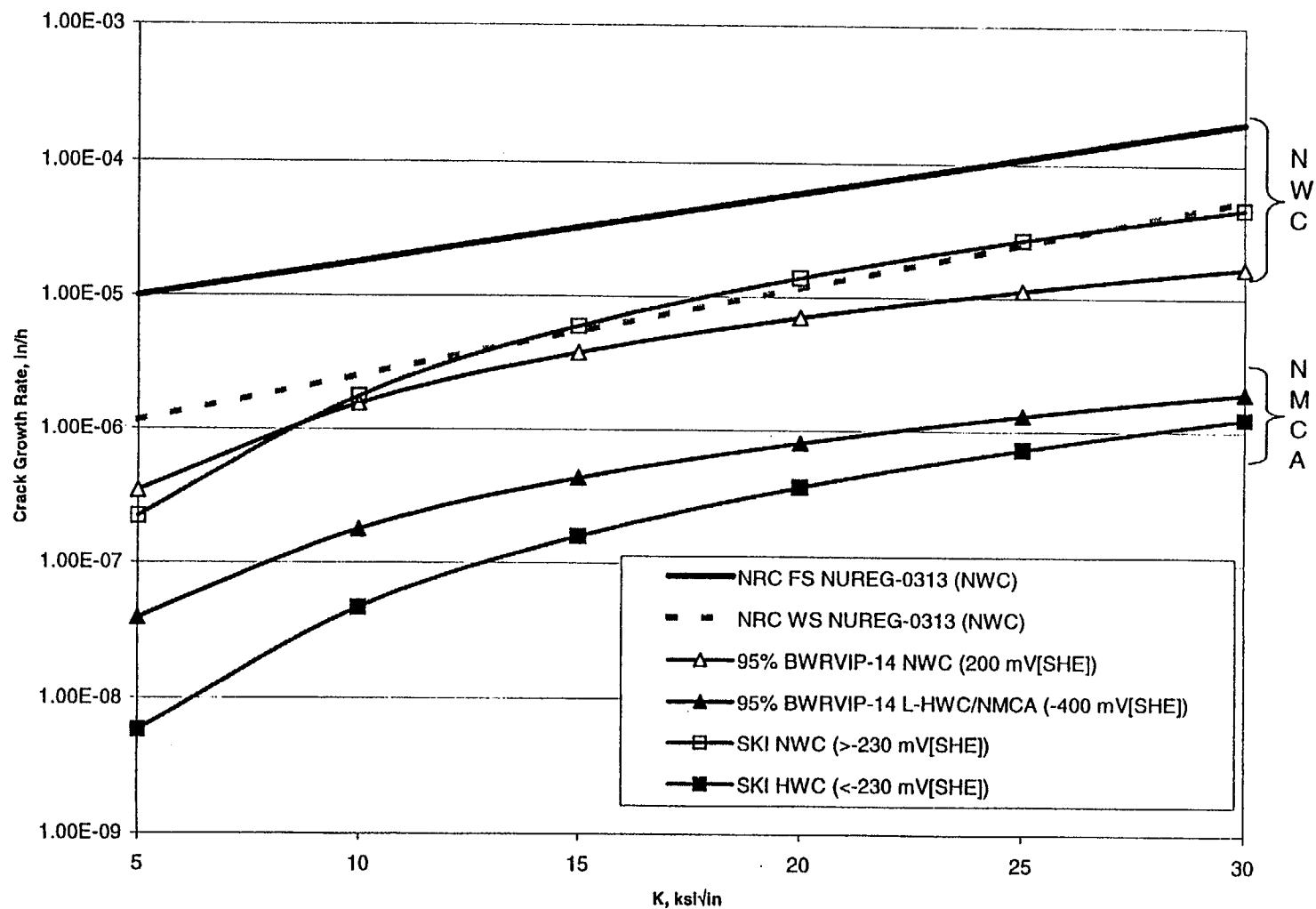


Figure 7. Comparison of NRC Disposition Lines, 95% BWRVIP-14 and SKI Crack Growth Rate Models for Sensitized Type 304 Stainless Steel