APS

Palo Verde Nuclear Generating Station

David Mauldin
Vice President
Nuclear Engineering
and Support

Tel: 623-393-5553
Fax: 623-393-6077

Mail Station 7605
PO Box 52034
Phoenix, Arizona 85072-2034

10 CFR 50.55a(a)(3)(i)

102-05247-CDM/SAB/RJR
April 14, 2005

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Reference: APS letter, "10 CFR 50.55a(a)(3)(i) Alternative Repair Request for Reactor Coolant System Hot Leg Alloy 600 Small-Bore Nozzles (Relief Request 31)," dated March 25, 2005.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
Response to Request for Information Related to Relief Request 31.

On April 6, 2005 the NRC requested, via e-mail, a copy of Westinghouse letter CEVR-05-11, "Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth." The original electronic copy of this letter was Revision 0 and was identified as "Proprietary." Revision 1 contains no technical changes and was changed to a Non-Proprietary, Class-3 Westinghouse document. The enclosure contains an electronically signed copy of the requested letter.

There are no new commitments being made in this letter. If you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

David Mauldin

CDM/SAB/RJR

Enclosure: Westinghouse letter CEVR-05-11, Revision 1, "Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth," dated April 12, 2005

A047

cc:	B. S. Mallett	NRC Region IV Regional Administrator
	M. B. Fields	NRC NRR Project Manager
	G. G. Warnick	NRC Senior Resident Inspector for PVNGS

Enclosure

Westinghouse Letter CEVR-05-11, Revision 1, "Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth," dated April 12, 2005

Westinghouse

Westinghouse Electric Company
Nuclear Services
4350 Northern Pike Road
Monroeville, PA 15146

USA

Mr. Mike Melton
Arizona Public Service
Palo Verde Nuclear Generating Station
5801 South Wintersburg Road
Tonopah, AZ 85354-7529

Direct tel: (412) 374-4403
Direct fax: (412) 374-5408
e-mail: olszewjs@westinghouse.com

Our ref: CVER-05-11, Rev. 1

April 12, 2005

Subject: Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth

Enclosure: LTR-CI-05-16, Rev. 1, "Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth"

Dear Mr. Melton:

The enclosed document justifies the extension of the generic crack growth evaluations used in previous Westinghouse reports to the specific Palo Verde plant dimensions for the hot leg case. This document re-evaluates the crack growths for the APSC specific hot leg borehole geometry and concludes that the final crack sizes computed with the Palo Verde specific dimensions do not impact the previous conclusions.

Should you have any questions or require additional information, please contact me (412-374-4403) or Reddy Ganta (860-731-6425).

Sincerely,

James S. Olszewski
Customer Projects Manager
Nuclear Services

CC: R. Ganta
J. Molkenthin
D. Baisley
J. Compas
A. Dietrich
F. Kiraly

Westinghouse

To: James S. Olszewski
Customer Projects Manager
Nuclear Services
cc: J.P. Molkenthin

From: Reddy Ganta
Ext: 860-731-6425
Fax: 860-731-6709

Date: April 12, 2005

Your ref:
Our ref: LTR-CI-05-16, Rev. 1

Subject: Hot Leg Alloy 600 Small Borehole Fatigue Crack Growth

1. References:

    1) Westinghouse Report CN-CI-02-71, Rev.1, "Summary of Fatigue Crack Growth Evaluation Associated with Small Diameter Nozzles in CEOG Plants", dated 3/31/04.

    2) Westinghouse Report WCAP-15973-P, Rev.1, "Low-Alloy Steel Component Corrosion Analysis Supporting Small-Diameter Alloy 600/690 Nozzle Repair/Replacement Programs", dated May 2004.

    3) Palo Verde drawing 78473-771-004 Rev.4 Primary Pipe Assembly

    4) Verbal communication from Mike Melton (APSC) to Jim Olszewski (WE) on the bore hole diameter to be 1.120"

Attachments: None

Westinghouse Electric (WE) has performed an evaluation of Alloy 600 small bore nozzle J-weld flaws as a part of the repair/replacement programs. This was sponsored by the Westinghouse Owners Group (WOG) and the results were reported in References 1 and 2. These calculations include all the Combustion Engineering (CE fleet) design plants with several bounding cases used in the evaluation. This evaluation is generic in nature and demonstrates the WE methodology to address the J-weld cracking problems in the small boreholes in the hot leg piping and the pressurizer heater sleeve/instrumentation nozzles. These reports have been submitted to NRC and a Safety Evaluation Report (SER) has been already issued accepting the WE methodology.

The original WE work performed in References 1 and 2 is for a generic plant with assumed geometry, transients and the material properties for the fracture toughness. The purpose of this letter is to extend the crack growth procedure used in References 1 and 2 to the specific Palo Verde plant dimensions for the hot leg case. Generic evaluation in References 1 and 2 used the dimensions in Figure 1 which resulted in the final flaw sizes listed in Table 1. As an effort to compute the crack growths for the APSC specific hot leg borehole geometry reported in Figures 2 and 3, dimensions in Figure 4 per APSC's request (Reference 4) are assumed and the crack growth is re-evaluated here. The new crack growth dimensions are given in Table 2.

It can be seen by comparing the final crack sizes in Tables 2 with those in Table 1 and those reported in References 1 and 2 that the effect of the change in the initial flaw depth from 0.938" to 0.950" and in the borehole diameter from 0.997" to 1.120" on the final crack sizes is very small and considered insignificant. Final crack sizes computed with the Palo Verde specific dimensions differ in the second or third significant digits only and do not impact the conclusions made in References 1 and 2.

Table 1: Hot Leg Piping Crack Dimensions from Reference 1

(Bore Hole Diameter Used Is 0.997")

Depth Or Length	Initial (in)	Axial Final (in)	Axial Allowable (in)	Circumferential Final (in)	Circumferential Allowable (in)
Depth	0.938	0.984	> 1.3	1.001	> 1.3
Length	0.762	0.791	> 1.1	0.802	> 1.1

Table 2: Hot Leg Piping Crack Dimensions using ANPP Dimensions

(Bore Hole Diameter Used Is 1.120")

Depth Or Length	Initial (in)	Axial Final (in)	Axial Allowable (in)	Circumferential Final (in)	Circumferential Allowable (in)
Depth	0.950	0.999	> 1.3	1.017	> 1.3
Length	0.762	0.793	> 1.1	0.805	> 1.1

The maximum allowable final crack sizes shown in the above tables are included in the WCAP report per NRC request and only meant to be for qualitative assessment. The purpose of these maximum sizes is only to assess how close the actual end-of-life calculated final crack sizes are to the maximum allowable ones. These maximum crack sizes were obtained by increasing the crack size dimensions until the applied crack tip stress intensity factors are close to the limiting material values. The J-weld is in the predominantly thermal bending stress region (especially at low pressures) and the applied thermal crack tip stress intensity factors (SIFs) decrease after certain depths which makes even the larger crack sizes stable. The symbol > used under the maximum allowable crack sizes in the above tables is to be interpreted as the crack sizes which are still stable under the hot leg applied loading have at least these dimensions.

WCAP-15973 assumed and used the transient cycles for the full design life described in the original Design Specifications. Details of this assumption are described in the WCAP. However, actual cycles of operation occurred to date can be obtained from the Palo Verde plant operating records. There will be additional margins available if the APSC plant specific reference nil-ductility temperature RT_{NDT} is used. As to the time when to start counting the cycles, it would be conservative to count them from the beginning of operation. Cycle counting may start from the beginning of the leakage as the crack sizes assumed in the WCAP analyses have same size as the J-weld dimensions and leakages may occur only after the full J-weld has cracked. This does not include the case where the tube has cracked below the J-weld in which case leakage is due to the tube crack and the J-weld may or may not have cracked.

Prepared by:	Reddy Ganta	Official record electronically approved in EDMS 2000
	Randy Schmidt	Official record electronically approved in EDMS 2000
Reviewed by:	Robert Watson	Official record electronically approved in EDMS 2000
Approved by:	Dave Baisley	Official record electronically approved in EDMS 2000

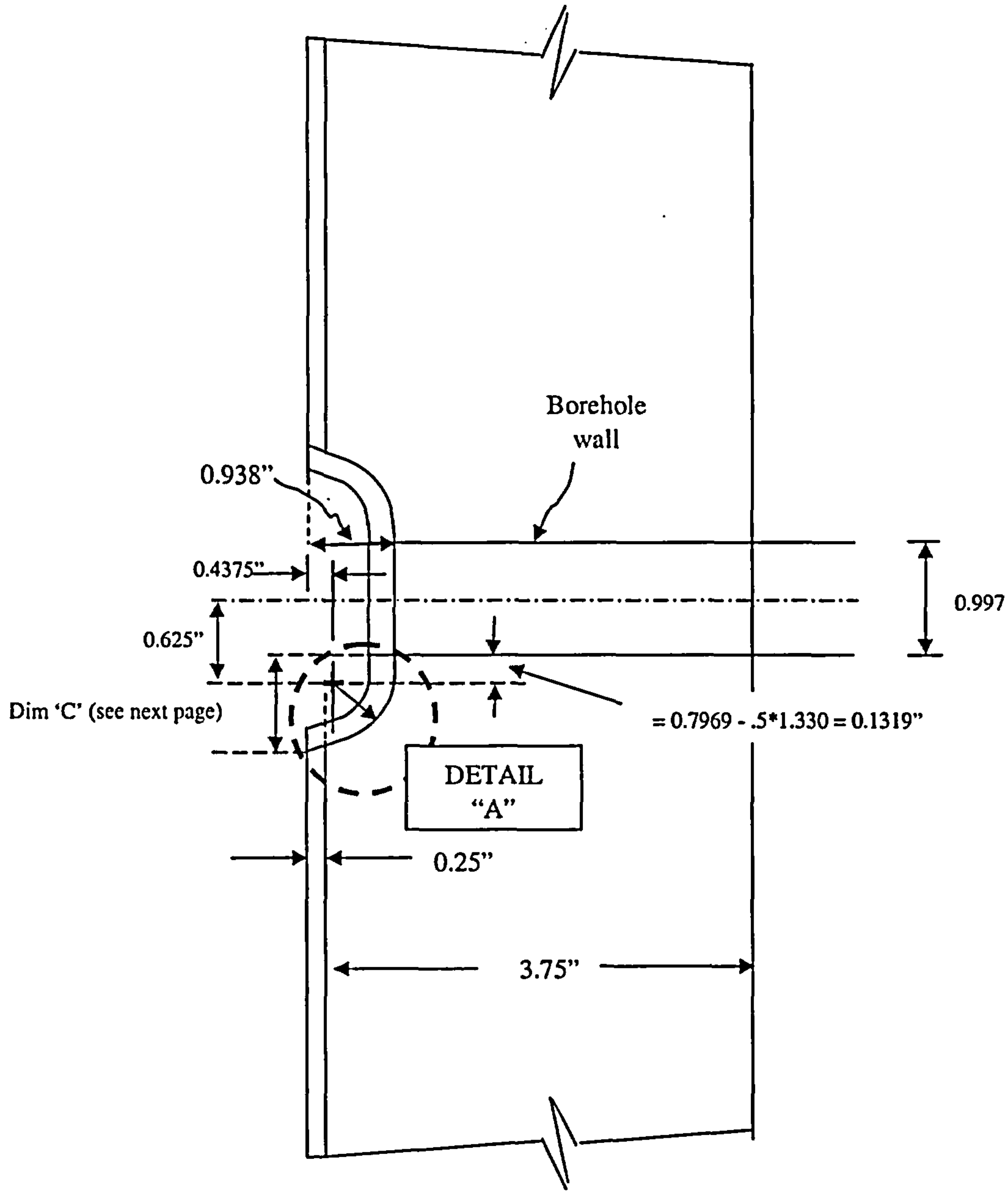
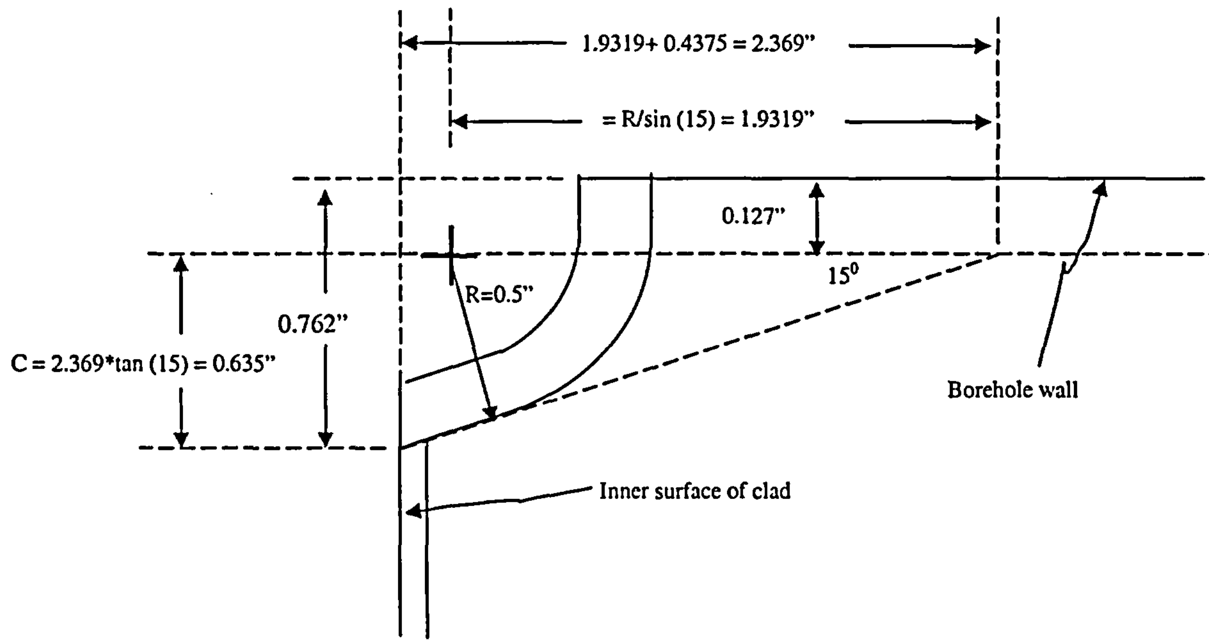


Figure 1: Small Bore Nozzle Bounding Plant Geometry
a) Hot Leg Piping, Sheet 1 of 2 (Figure 6-1 from Ref.1)



Detail "A"

Figure 1: Small Bore Nozzle Bounding Plant Geometry
b) Hot Leg Piping, Sheet 2 of 2 (Figure 6-1 from Ref.1)

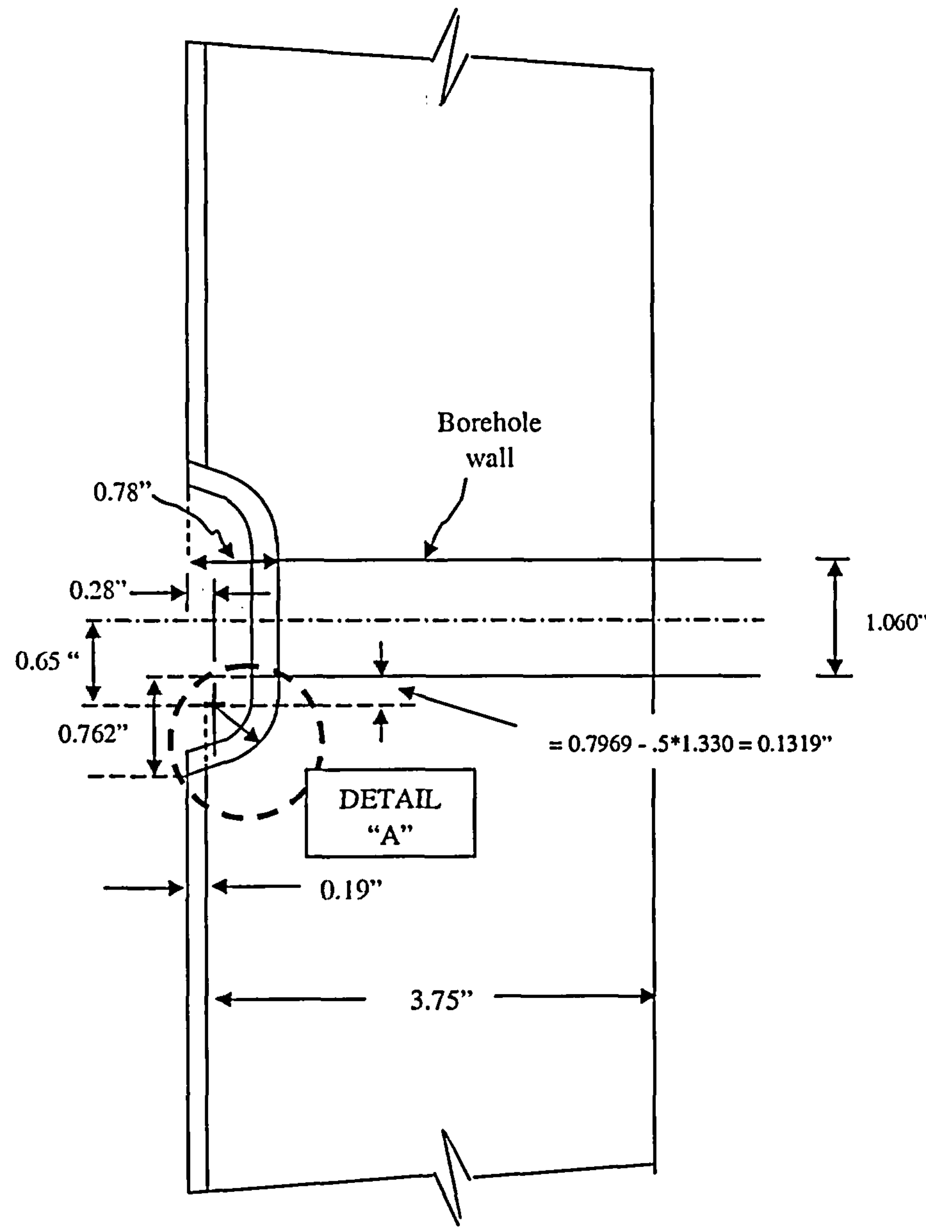


Figure 2: ANPP Hot Leg Piping Small Bore Nozzle Geometry, Cut E In Reference 2

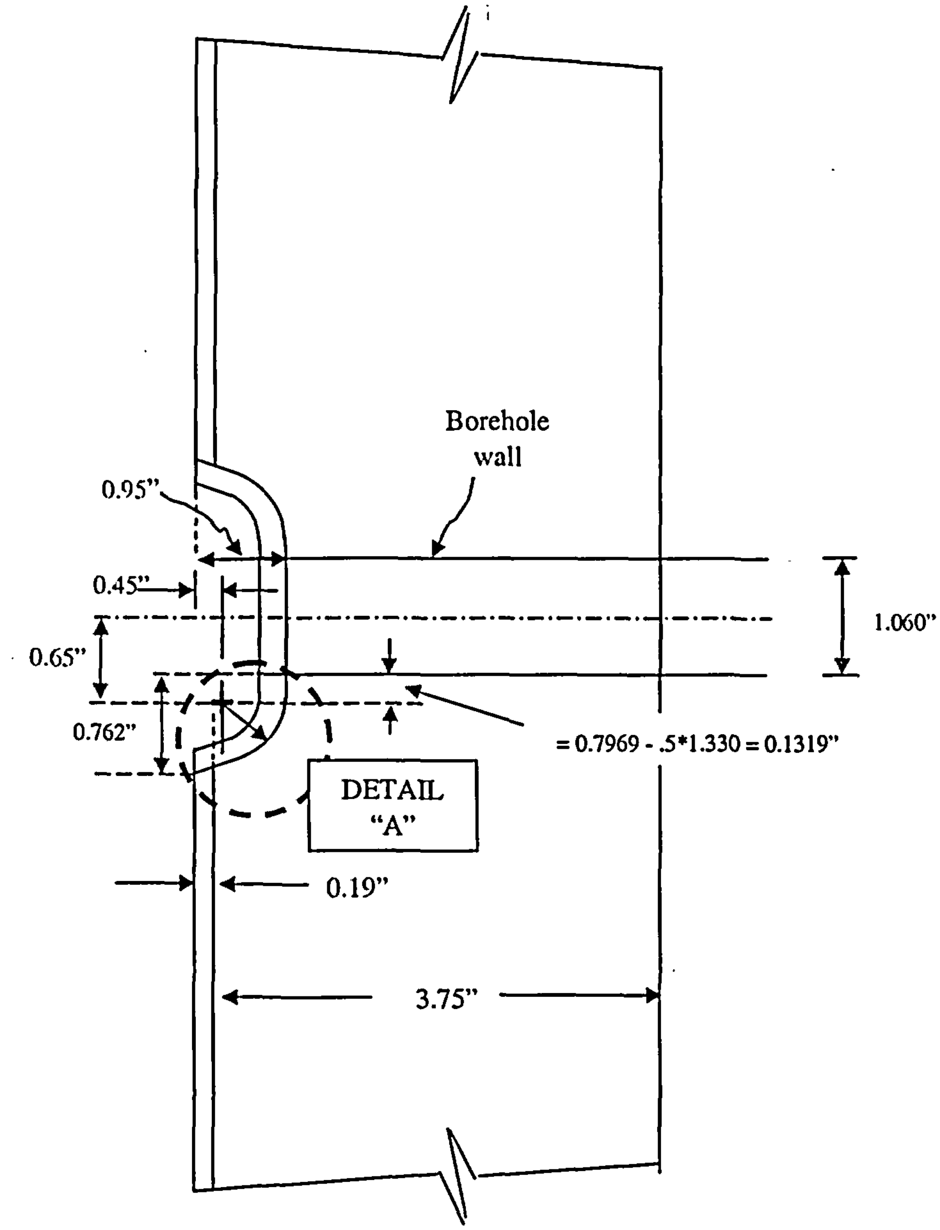


Figure 3: ANPP Hot Leg Piping Small Bore Nozzle Geometry, Cut F in Reference 2

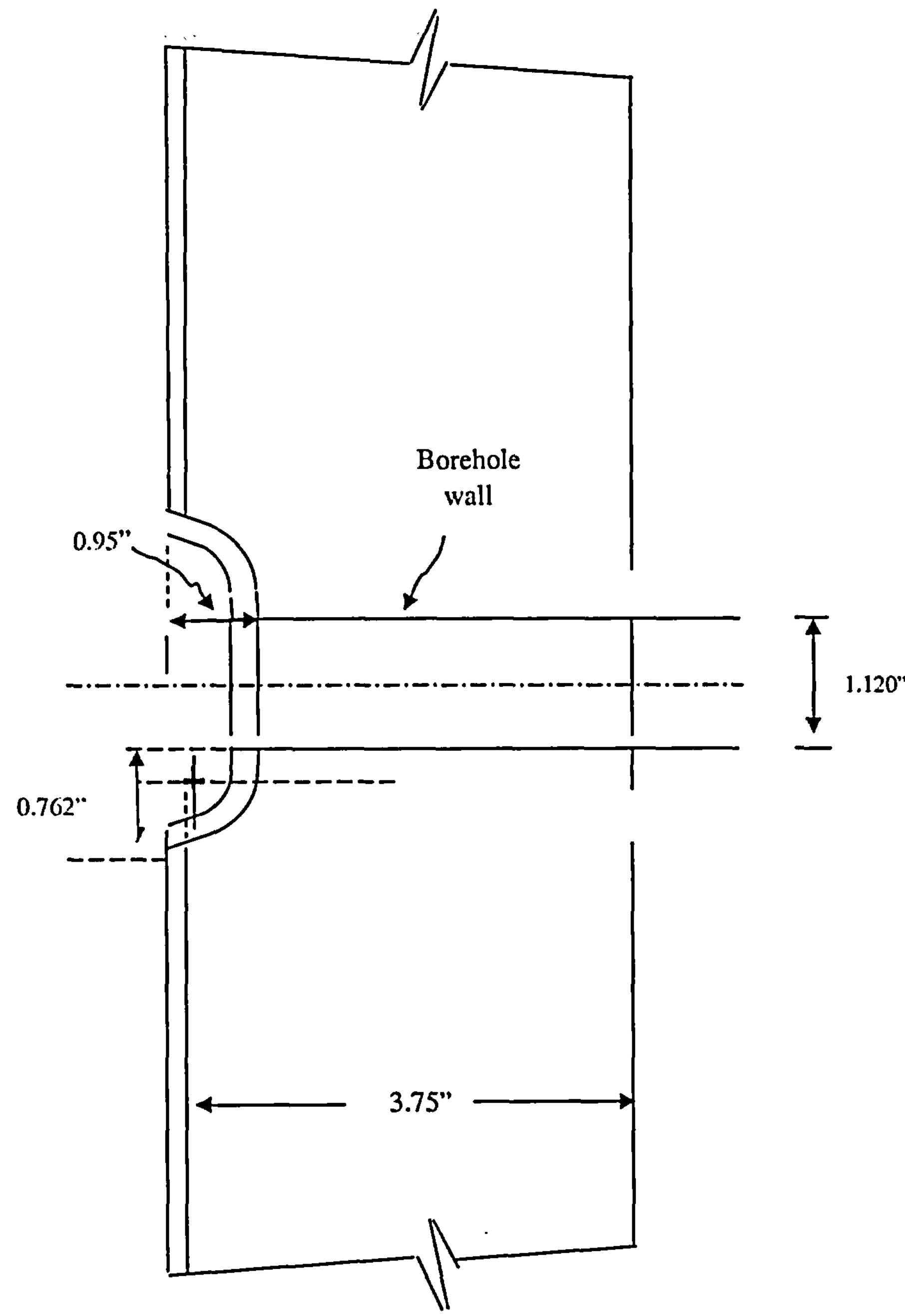


Figure 4: ANPP Hot Leg Piping Small Bore Nozzle Geometry per Reference 3