Comments on Proposed 10CFR50.55a Ruling
Section III, Appendix XXVI
Discussion

10 CFR 50.55a(b)(1)(xi)(A) Mandatory Appendix XXVI: First Provision

The NRC proposes to add a new paragraph (b)(1)(xi)(A), which specifies the essential variables to be used in qualifying fusing procedures for butt fusion joints in polyethylene piping. This includes four (4) variables in addition to those stated in Section IX that are pertinent to the fusing verification testing of XXVI-2300. These are diameter, cross-sectional area, ambient temperature [range specified in XXVI-4412(b)], and fusing machine carriage model. This 10CFR50.55a provision will be resolved after publication of the 2019 edition of ASME Section III, Appendix XXVI.

Comment: Previous discussions with the Regulator involving development and incorporation of Tables identifying all procedure variables applicable to testing required by Section IX and Appendix XXVI addressed only fusing procedure qualification and testing – not fusing operator performance qualification testing. The provision relating to fusing procedure variables will be resolved by publication of the 2019 edition of ASME Section III, Appendix XXVI.

Fusing operator performance qualification testing is performed in accordance with XXVI-4341 and XXVI-4342 using fusing procedures tested in accordance with XXVI-2300. Such fusing procedures define the fusing machine make and model(s) to be used in production of each joint, so the fusing operator is required to qualify on the same machines and models. However, fusing operators are qualified to use those machines over ranges of diameters and thicknesses, not on each diameter to be fused. This is the approach that was approved by the USNRC as recently as two years ago for the Plant Hatch HDPE Project (ML 15337A414). To require each fusing operator to perform qualification testing on each diameter, thickness and lot of material would entail significant added expense and hardship without a commensurate improvement in quality or safety. Therefore, the proposed wording of the paragraph (see Summary, below) involving performance qualification testing and reference to XXVI–4340 should be removed from that 10CFR50.55a paragraph.

10 CFR 50.55a(b)(1)(xi)(B) Mandatory Appendix XXVI: Second Provision

The NRC proposes to add a new paragraph (b)(1)(xi)(B), which will require both bend tests and high speed tensile impact testing (HSTIT) to qualify fusing procedures <u>and</u> to qualify fusing operators, for fusing joints in polyethylene piping…. The explanation of the proposed ruling states: "The NRC has performed limited confirmatory research on the ability of short-term mechanical tests to predict the in-service behavior of HDPE butt fusion joints. Based on this research as well as research results from the Welding Institute in the UK, the NRC lacks conclusive evidence that either of the two tests proposed in XXVI–4342(d) and XXVI–4342(e) is always a reliable predictor of joint quality. As a result, the NRC has determined that the combination of both test results provides increased and sufficient indication of butt fusion joint quality…."

Comment:

<u>A. Fusing Procedure Testing</u>: Relative to joint testing for procedure qualification or XXVI-2300 fusing verification testing, the testing performed by The Welding Institute of UK indicated that the HSTI test may not detect joints fused with fine sand or talcum powder sized particles placed within the joint. As a result of that testing, Paragraph XXVI-4412(a)(1) and XXVI-4412(a)(2) of Appendix XXVI specifically require that joint surfaces coming in contact with heaters must be protected and kept free of fine particulates, as well as other deleterious material. Also, EPRI Report 3002005434 "Advanced Nuclear Technology: Literature Review of Mechanical Testing Methods to Evaluate the Integrity of HDPE Butt-Fusion Joints," was developed to assist the NRC with evaluation of mechanical testing methods. This report provides the results of limited studies on the comparison of the high speed tensile impact test to the guided side bend and waisted tensile test methods. This report identifies that situations can occur with the HSTI test where the specimen ruptures outside of the fusion zone while using the HSTI test method. If this

occurs, a recommendation is provided for nuclear applications that the cause be evaluated by assessing the amount of increased fusion interface resulting from the fusion beads, and/or presence of out-of-roundness of the joined parts. (If there is indication of minimal or no increased fusion interface, or that mismatch exists between the parts being joined, the test should be re-performed with beads and mismatch removed.) Therefore, this provision should be revised to instead require retests for any HSTI ruptures occurring away from the fusion zone.

B. Fusing Operator Testing: Bend testing has been used extensively and successfully for decades for the qualification of fusing operators in the U.S. for joining polyethylene water and gas piping. It is endorsed by DOT for performance qualification for the fusing of interstate gas transmission pipelines as well as for local gas distribution pipelines. Government acceptance for use of only visual inspection of the test joint plus bend testing for performance qualification on volatile gas pipelines certainly supports its use for nuclear applications - where, in addition to the visual inspection and bend testing, the joint parameters are also required to be recorded and verified during preparation of the qualification test coupons as well as for each installed fusion joints. This is the approach that was approved by the USNRC as recently as two years ago for the Plant Hatch HDPE Project (ML 15337A414). In addition, all installed nuclear fusion joints receive ultrasonic volumetric examination plus a hydrostatic test at 1.5 times maximum design pressure, validating the integrity of each joint fused by each operator. The additional requirement to perform HSTI test in addition to bend testing during performance qualification imposes additional hardship and increased cost without commensurate improvement in quality or safety.

Paragraph 7.4 of EPRI Report 3002005434 provides reasons why the reverse bend test might be considered unacceptable for nuclear applications. The stated reasons are inaccurate based on the following explanations:

a.) Although ASTM F2620 lacks complete requirements for how to perform the reverse bend test including temperature range, Appendix XXVI-4342 invokes Section IX QF-143.1 which does provide explicit directions, including required temperature range.

b.) Although ASTM F2620 may lack clarity on how to perform the test, Section IX, QF-143.1 which is invoked by Appendix XXVI does provide specific instructions on how to perform the test.

c.) Although ASTM F2620 may lack clarity on test radii or coupon thickness, Section IX, QF-143.1.3 and QF-463 provide explicit direction on how to cut the specimens and perform the test. The specimen thickness, t, is the thickness of the joint per QF-463, and the bend radius is defined by the 15t dimension either side of the joint with the requirement to bend back until both 15t ends touch. This defines the ratio of thickness to bending length, which is a direct proportion regardless of what thickness is bent, and always results in a defined bending radius or arc at the apex of the tested joint of approximately 3t. A 3t arc at the apex of the bend results in at least a 15% strain, which exceeds the 10-12% yield strain of HDPE material.

d.) One test report identified by EPRI stated that Reverse Bend testing of 1.33 in. thick 12 NPS PE pipe did not identify defects that were detected by HSTI testing and Guided Side Bend testing. With the advent of the GSB test, most fusing organizations are now using guided side bend tests in lieu of reverse bend tests for qualifying fusing operators on thick sections over 1.25 in. for personnel safety reasons. We suggest that the provision be reworded to address this specific concern when using reverse bend tests for thick sections as indicated in the Summary, below. Note: HSTI testing machines are quite scarce and expensive. For fusing procedure verification testing (XXVI-2300) the test specimens are typically sent to a laboratory or shop to have the HSTI testing performed. To require this be done for performance qualification purposes would add extra non-productive days for fusing operators, plus it would require sending quality control personnel for witnessing the off-site testing. Since the only technical issue seems to be an anomaly with one test performed on 1.33 in. thick material, a reasonable resolution would be to reword the provision to mandate use of side bend tests (i.e., prohibit use of reverse bend tests) for performance qualification on all piping thicknesses over 1.25 in.

e.) Based on the above inaccuracies, the EPRI report suggested that other tests be used in place of or in addition to the Reverse Bend Test. In actual fact, considering the scarcity and expense of using HSTI test machines, imposing the condition to require HSTI test in addition to Reverse Bend or Guided Side Bend testing for all performance qualification imposes excessive cost and additional hardship without a commensurate improvement in quality or safety.

10 CFR 50.55a(b)(1)(xi)(C) Mandatory Appendix XXVI: Third Provision

The NRC is proposing to add a new paragraph (b)(1)(xi)(C), which specifies the essential variables to be used in qualifying fusing procedures for electrofusion of fusion joints in polyethylene piping that is to be installed in accordance with ASME BPV Code, Section III, Mandatory Appendix XXVI. This includes four (4) variables in addition to those stated in Section IX that are pertinent to the fusing verification testing of XXVI-2300. These are: fitting polyethylene material, pipe wall thickness, power supply, and processor.

This 10CFR50.55a provision will be resolved for electrofusion fusing procedures after publication of the 2019 edition of ASME Section III, Appendix XXVI.

Comment: Previous discussions with the Regulator involving development and incorporation of Tables identifying all electrofusion procedure variables applicable to testing required by Section IX and Appendix XXVI addressed only fusing procedure qualification and testing – not fusing operator performance qualification testing. Fusing operator performance qualification testing is performed in accordance with XXVI-4341 and XXVI-4342 using fusing procedures tested in accordance with XXVI-2300. Such fusing procedures define the electrofusion fitting material, pipe wall thickness, power supply and processor, to be used in production of each joint, so the fusing operator is already required to qualify using the same material and equipment. Therefore, the proposed wording of the paragraph (see Summary, below) involving performance qualification testing and reference to XXVI–4340 should be removed from that 10CFR50.55a paragraph.

10 CFR 50.55a(b)(1)(xi)(D) Mandatory Appendix XXVI: Fourth Provision

The NRC is proposing to add a new paragraph (b)(1)(xi)(D), which will require both crush tests and electrofusion bend tests to qualify fusing procedures for electrofusion joints in polyethylene piping…. The operating experience data on electrofusion joints is extremely limited and also indicates some failures…. the NRC is also proposing to add a condition that requires that both tests (crush test and electrofusion bend test) specified in in XXVI–2332(a) and XXVI–2332(b) be performed as part of performance qualification tests, instead of only one or the other.

Comment: Crush testing is designed for smaller fittings 8 NPS and less. Such tests are impractical and unsafe for sizes larger than 8 NPS due to the large hydraulic equipment that would be required. For this reason, ASTM F1055 provides the electrofusion bend test (FET) as a means of verifying fusion integrity for sizes over 8 NPS. There is no evidence that either of these tests are inadequate for their intended purpose.

Every electrofusion socket joint installed in a nuclear system also requires producing and testing an identical coupon using the same lot, size and thickness of material and fitting, the same equipment, the same power supply and the same fusing procedure under -2300 of Appendix XXVI. In addition, every electrofusion joint installed in a nuclear system requires data recording to verify the operator used the correct procedure, each joint receives full visual inspection, receives full volumetric examination of the fused joint plus hydrostatic testing at 1.5 times the design pressure. This proposed condition imposes significant cost, hardship and personnel safety issues without any improvement in quality.

10 CFR 50.55a(b)(1)(xi)(E) Mandatory Appendix XXVI: Fifth Provision

The NRC is proposing to add a new paragraph (b)(1)(xi)(E), which prohibits the use of electrofusion saddle fittings and electrofusion saddle joints…. some Department of Energy operational experience indicates that failures have occurred in electrofusion joints. The NRC has determined that the failure of a saddle type electrofusion joint could result in structural separation of the electrofusion saddle coupling from the HDPE pipe it is attached to, resulting in a potential loss of flow and loss of safety function in the system.

Comment: Unlike the failures identified by DOE - every electrofusion saddle joint installed in a nuclear system requires producing and testing an identical coupon using the same equipment and power supply under -2300 of Appendix XXVI. In addition, each installed saddle joint receives visual verification of fit-up gaps, alignment and out-of-roundness, plus recording and verification of the actual fusing variables, plus full volumetric examination of the fused joint, plus a hydrostatic pressure test at 1.5 times the design pressure. Without the capability of using electrofusion saddle connections, necessary modifications to or repairs of existing installations could be cost prohibitive, imposing significant hardship without any improvement in quality or safety.

Summary
Proposed 10CFR50.55a Provisions
ASME Section III, Appendix XXVI, 2015 and 2017 Editions

(xi) Section III condition: Mandatory Appendix XXVI. When applying the 2015 and 2017 Editions of Section III, Mandatory Appendix XXVI, ‘‘Rules for Construction of Class 3 Buried Polyethylene Pressure Piping,’’ applicants or licensees must meet the following conditions:
(A) Mandatory Appendix XXVI: First provision. When performing fusing procedure qualification tests and operator performance qualification tests in accordance with XXVI–4330 and XXVI–4340 the following essential variables shall be used for the performance qualification tests of butt fusion joints:
(1) Joint Type….
Requested change: Delete proposed requirement to impose this added testing for Fusing Operator performance qualification. Revise First Provision to read: <u>When performing fusing procedure qualification testing in accordance with XXVI-2300 and XXVI–4330 the following essential variables shall be used for the testing of butt fusion joints:
(1) Joint Type….</u>
(This provision will be resolved for procedure testing with publication of the 2019 Edition of ASME Section III, Appendix XXVI.)

(B) Mandatory Appendix XXVI: Second provision. When performing qualification tests of butt fusion joints in accordance with XXVI–4342, both the bend test and the high speed tensile impact test shall be successfully completed.
Requested change: Second Provision. <u>When performing procedure qualification HSTT testing of butt fusion joints in accordance with XXVI-2300 or XXVI-4330, specimen breaks away from the fusion zone shall require retesting. When performing fusing operator qualification bend tests of butt fusion joints in accordance with XXVI-4342, guided side bend testing shall be used for all thicknesses greater than 1.25 inches.</u>

(C) Mandatory Appendix XXVI: Third provision. When performing fusing procedure qualification tests and operator performance qualification tests in accordance with 2017 Edition of BPV Code Section III XXVI–4330 and XXVI–4340, the following essential variables shall be used for the performance qualification tests of electrofusion joints:
(1) Joint Design….
First provision will be resolved with publication of the 2019 Edition of Appendix XXVI.
Requested change: Second provision. <u>When performing fusing procedure qualification tests in accordance with 2017 Edition of BPV Code Section III XXVI–2300 and XXVI-4330, the following essential variables shall be used for the testing of electrofusion joints:
(1) Joint Design….</u>
(This provision will be resolved for procedure testing with publication of the 2019 Edition of Appendix XXVI.)

(D) Mandatory Appendix XXVI: Fourth provision. Performance of crush tests in accordance with 2017 BPV Code Section III XXVI–2332(a) and XXVI–2332(b) and electrofusion bend tests in accordance with 2017 BPV Code Section III XXVI–2332(b) are required to qualify fusing procedures for electrofusion joints in polyethylene piping installed in accordance with 2017 Edition of ASME BPV Code Section III, Mandatory Appendix XXVI.
Requested change: <u>Delete this provision.</u>

(E) Mandatory Appendix XXVI: Fifth provision. Electrofusion saddle fittings and electrofusion saddle joints are not permitted for use. Only full 360-degree seamless sleeve electrofusion couplings and full 360-degree electrofusion socket joints are permitted.
Requested change: <u>Delete this provision</u>.

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To:	RulemakingComments Resource
Cc:	Reichelt, Eric; Manoly, Kamal
Subject:	[External_Sender] NRC Proposed 50.55a Ruling
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Attachments:	Comments on Proposed Ruling Appendix XXVI (12-07-18).docx

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Attached please find a discussion, summary and suggested revisions on the proposed provisions to be imposed by the NRC on the 2015 and 2017 editions of ASME Section III, Appendix XXVI, Rules for Construction of Class III Buried Polyethylene Pressure Piping.

Contingent upon NRC agreement with these suggested revisions, the undersigned will commit to initiating and promoting changes to incorporate them into future editions of Appendix XXVI.

Please advise if you have any questions.

Thank you very much,

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