Attachment 1
to ULNRC-05542

Calculation 2007-13241 (Rev. 1)
Minimum Wall Thickness for ESW Buried HDPE Piping

ISSUE SUMMARY
Form SOP-0402-07, Revision 7B

DESIGN CONTROL SUMMARY

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PROJECT NO.:	11504-025	☒ NUCLEAR SAFETY- RELATED	
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TITLE:	Minimum Wall Thickness for ESW Buried HDPE Piping		
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INITIAL ISSUE

See Limitations in Section 6.3

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Revision 1:
Revised to incorporate updated design pressures, updated design code, and add results (for information only) considering a Design Factor value of 0.56. Revised pages 1 – 14 and added pages 15 – 17. Deleted Attachments 1 and 2 from Rev 0, and added Attachment 1 for AmerenUE Owner's Review Comments.

INPUTS/ ASSUMPTIONS
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TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE 3
2.0 DESIGN INPUTS 4
3.0 ASSUMPTIONS 6
4.0 METHODOLOGY AND ACCEPTANCE CRITERIA 7
5.0 CALCULATIONS 10
6.0 RESULTS 14
7.0 REFERENCES 17
8.0 ATTACHMENTS 17

1.0 PURPOSE AND SCOPE

The purpose of this calculation is to determine the minimum required wall thickness for the Callaway Nuclear Plant ESW buried High Density Polyethylene (HDPE) supply, return, and strainer backwash straight piping that is to replace the currently existing buried carbon steel piping under modification number MP 07-0066 [Ref. 7.2.1]. This calculation does not apply to fittings and components.

Specifically, this calculation applies to the following line numbers:

EF-002-AZC-4" - ESW Train 'A' Strainer Backwash Line
EF-003-AZC-36" - ESW Train 'A' Supply from ESW Pumphouse
EF-006-AZC-4" - ESW Train 'B' Strainer Backwash Line
EF-007-AZC-36" - ESW Train 'B' Supply from ESW Pumphouse
EF-083-AZC-36" - ESW Train 'A' Return to UHS Cooling Tower
EF-140-AZC-36" - ESW Train 'B' Return to UHS Cooling Tower

2.0 DESIGN INPUTS

2.1 ESW HDPE Supply Lines

Internal design pressure (P_D) = 161 psig [Ref. 7.2.1]

Design temperature (T_D) = 95°F [Ref. 7.2.1]

Outside diameter of pipe (D) = 36″ [Ref. 7.2.1]

Piping Material: PE 4710 with material properties not less than those for cell classification 445574C as defined by ASTM D3350 [Ref. 7.2.1]

2.2 ESW HDPE Return Lines

Internal design pressure (P_D) = 45 psig [Ref. 7.2.1]

Design temperature (T_D) = 175°F [Ref. 7.2.1]

Normal Operating Temperature (T_o) = 105°F [Ref. 7.2.8]

Outside diameter of pipe (D) = 36″ [Ref. 7.2.1]

Piping Material: PE 4710 with material properties not less than those for cell classification 445574C as defined by ASTM D3350 [Ref. 7.2.1]

2.3 ESW HDPE Backwash Lines

Internal design pressure (P_D) = 160 psig [Ref. 7.2.1]

Design temperature (T_D) = 95°F [Ref. 7.2.1]

Outside diameter of pipe (D) = 4.5″ [Ref. 7.2.1]

Piping Material: PE 4710 with material properties not less than those for cell classification 445574C as defined by ASTM D3350 [Ref. 7.2.1]

2.4 Design Code

The design is in accordance with procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1] per Design Specification M-2017 [Ref 7.2.2].

2.5 Mechanical and Erosion Allowance

No mechanical or erosion allowance (C) is considered in the minimum wall thickness calculation (See Assumption 3.1) [Ref. 7.2.4, p. 8].

2.6 Normal Service Life

The replacement buried piping shall be designed for a service life of 40 years under normal system operating conditions as stated in Reference 7.2.2, Section 6.1.1.

2.7 Post-Accident Service Life

The replacement buried piping shall be designed for a service life of 30 days at peak post-accident system operating conditions. The design shall assume that the peak post-accident conditions occur continuously for the entire 30 day period and that the accident occurs at the end of the 40 year normal service life as stated in Reference 7.2.2, Section 6.1.2.

2.8 Allowable Stress

Allowable stress values for HDPE for Design Factors 0.50 and 0.56 are taken from procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1] and are listed below in Table 2.8-1 and Table 2.8-2 below respectively. In accordance with -3016 of procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1], a Design Factor of 0.50 shall be utilized. A Design Factor of 0.56 is used in this calculation for information only. The use of these values for Callaway Nuclear Plant still requires formal acceptance by the NRC (Limitation 6.3.1).

Table 2.8-1 – Allowable Stress for Design Factor of 0.50

Service Temp. (°F)	Load Duration (yrs)	Allowable Stress (psi)
95°F	≤ 50	695
104°F	≤ 50	653
113°F	≤ 50	613
176°F	2	340

Table 2.8-2 – Allowable Stress for Design Factor of 0.56 (For Information Only)

Service Temp. (°F)	Load Duration (yrs)	Allowable Stress (psi)
95°F	≤ 50	778
104°F	≤ 50	732
113°F	≤ 50	687
176°F	2	382

Note: While Reference 7.1.1 only provides values for a load duration of 50 years, these values can conservatively be used for load durations of less than 50 years.

3.0 ASSUMPTIONS

3.1 Assumption: No mechanical or erosion allowance (C) is considered in the minimum wall thickness calculation.

Justification:
HDPE pipe will not rust, rot, pit, corrode, tuberculate or support biological growth. It has superb chemical resistance and is the material of choice for many harsh chemical environments [Ref. 7.2.4, p. 8]. Therefore, no mechanical or erosion allowance is required. This is consistent with Reference 7.2.2, Section 6.2.

3.2 Assumption: The allowable stress value for the HDPE Return Lines for a post-accident condition service life of 30 days is 340 psi at 175°F for a Design Factor of 0.50.

Justification:
The only allowable stress value data available near 175°F is 340 psi at 176°F for a load duration of 2 years in Reference 7.1.1 [Design Input 2.8]. The allowable stress for 2 years is lower than the allowable stress for 30 days and the allowable stress at 176°F is lower than the allowable stress at 175°F. This will result in a larger minimum wall thickness for the 30 day post-accident condition service life case at 175°F for the HDPE Return Lines. Therefore, it is conservative to use 340 psi.

<u>For Information Only:</u>

3.3 Assumption: The allowable stress value for the HDPE Return Lines for a post-accident condition service life of 30 days is 382 psi at 175°F for a Design Factor of 0.56.

Justification:
The only allowable stress value data available near 175°F is 382 psi at 176°F for a load duration of 2 years in Reference 7.1.1 [Design Input 2.8]. The allowable stress for 2 years is lower than the allowable stress for 30 days and the allowable stress at 176°F is lower than the allowable stress at 175°F. This will result in a larger minimum wall thickness for the 30 day post-accident condition service life case at 175°F for the HDPE Return Lines. Therefore, it is conservative to use 382 psi.

4.0 METHODOLOGY AND ACCEPTANCE CRITERIA

4.1 Methodology

4.2 Allowable Stress for HDPE Return Lines

Since the allowable stress value at a design temperature of 175°F for the HDPE Return Lines has only been provided for a maximum load duration of 2 years in Reference 7.1.1, an allowable stress value is calculated for the Normal Operating Condition case as defined by Miner's Rule using the methodology in Sections 4.2.1 and 4.2.2 and 340 psi for the 30 day Post-Accident Condition case (See Assumption 3.2) for a Design Factor of 0.50, and 382 psi for the 30 day Post-Accident Condition case (See Assumption 3.3) for a Design Factor of 0.56. A minimum wall thickness will be calculated for both the Normal Operating Condition and the 30 day Post-Accident Condition and the larger of the two shall be conservatively used for the HDPE Return Lines.

4.2.1 Miner's Rule to Calculate Load Duration

Miner's Rule takes into consideration the damages done to the pipe under different operating conditions to calculate the cumulative maximum permissible time of use under all varying conditions of the pipe. For the HDPE return lines, Normal Operating Conditions and Post-Accident Operating Conditions are considered. The cumulative maximum permissible time of use is the design service life of 40 years.

To calculate the allowable stress value for Normal Operating Conditions, Miner's Rule for plastic pipe [Ref. 7.2.6] is used, as specified in Reference 7.1.1, to find the load duration for the pipe under normal operating conditions that will ensure a cumulative maximum permissible time of use of 40 years when considering the 30 day load duration at Post-Accident Operating Conditions. This load duration can then be used to interpolate a corresponding allowable stress value using the values in Reference 7.1.1 at the normal operating temperature of 105°F. The allowable stress value for a load duration of ≤ 50 years at 105°F is provided in Reference 7.1.1 [Design Input 2.8]. The following variables are used by Miner's Rule:

T_o = normal operating temperature (°F)
T_{max} = maximum operating temperature (post-accident temperature) (°F)
A_i = percent of total service life of pipe under condition "i" (i=1, 2, 3, etc.) (%)
t_i = lifetime of pipe if placed under condition "i" (yrs)
t_{max} = lifetime of pipe if placed under maximum operating temperature T_{max} (yrs)
t_o = lifetime of pipe if placed under normal operating temperature T_o (yrs)
t_x = maximum permissible time of use under all varying conditions (yrs)
TYD = total yearly damage (%)

The percent of total service life of the pipe under each condition "i" is calculated for i=1, 2, 3, etc.

$$A_i = \frac{\text{Time Under Condition "i" (yrs)}}{\text{Total Service Life of Pipe (yrs)}}$$

Each condition which the pipe is exposed to generates a yearly damage percentage on the pipe.

$$\text{Yearly Damage} = \frac{A_i}{t_i} = \frac{\text{Percent of Total Service Life of Pipe Under Condition "i" (\%)}}{\text{Lifetime of Pipe Under Condition "i" (yrs)}}$$

The summation of these yearly damages is the total yearly damage.

$$TYD = \sum \frac{A_i}{t_i}$$

The total yearly damage (TYD) is used to find the maximum permissible time of use under all varying conditions.

$$t_x = \frac{100}{TYD}$$

To find the load duration for the pipe under normal operation, Miner's Rule is rearranged to solve for t_o, the lifetime of pipe if placed under only the normal operating temperature T_o = 105°F. This duration will be longer than t_x, the maximum permissible time of use under all varying conditions, and will provide a lower allowable stress value. Therefore, the minimum wall thickness calculated using this value for allowable stress for Normal Operating Conditions will result in a larger minimum wall thickness which is conservative.

First, solve for the percent of the total service life of the pipe that is exposed to the normal operating temperature and the post-accident temperature to obtain A_o and A_{max} respectively. Then calculate the yearly damage percentages on the pipe from the Normal Operating and Post-Accident Condition where t_o is the unknown variable to solve for and t_{max} is 2 years as stated in Assumption 3.2 and 3.3.

$$\text{yearly damage from post-accident condition} = \frac{A_{max}}{t_{max}}$$

$$\text{yearly damage from normal operating condition} = \frac{A_o}{t_o}$$

Summate the yearly damages to obtain the total yearly damage as a function of t_o.

$$TYD = \sum \frac{A_i}{t_i} = \frac{A_o}{t_o} + \frac{A_{max}}{t_{max}}$$

With the maximum permissible time of use under all varying conditions set as 40 years, t_x = 40 years, substitute the TYD and solve for t_o.

$$t_x = \frac{100}{TYD} \rightarrow 40 = \frac{100}{\frac{A_o}{t_o} + \frac{A_{max}}{t_{max}}}$$

4.2.2 Interpolation for Allowable Stress Values for Normal Operating Condition Case of the HDPE Return Lines Using the Calculated Load Duration (t_o)

To determine the allowable stress values for the Normal Operating Condition case, interpolate between the load durations of 50 years and the calculated t_o load duration.

4.3 Minimum Wall Thickness

The required minimum wall thickness is determined for the pipe lines identified in Section 1.0 of this calculation. The required minimum wall thickness (t_{design}) is calculated in accordance with procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1] per Design Specification M-2017 [Ref 7.2.2] as follows:

$$t_{design} = \underbrace{\frac{P_D D}{2S + P_D}}_{t_{min}} + C$$

where:

t_{design} = minimum required wall thickness (in)
t_{min} = pressure design thickness (in)
C = the sum of mechanical allowances and erosion allowance (in)
P_D = piping system internal Design Pressure (gage) at the corresponding Design Temperature T_D. This pressure does not include the consideration of pressure spikes due to transients (psig)
D = pipe outside diameter at the pipe section where the evaluation is conducted (in)
S = allowable stress (psi)

4.4 Acceptance Criteria

None

5.0 CALCULATIONS

5.1 Calculation of Normal and Post-Accident Condition Allowable Stresses Values for HDPE Return Lines

5.1.1 Percent of total service life of the pipe under each condition.

$$A_o = \frac{40\text{years} - 30\text{days(post-accident)} = 39.92\text{years}}{40\text{years}} \text{x}100\% = 99.8\%$$

$$A_{max} = \frac{30\text{days(post-accident)} = 0.08\text{years}}{40\text{years}} \text{x}100\% = 0.2\%$$

5.1.2 Summate the yearly damages to obtain the total yearly damage as a function of t_o.

$$\text{TYD}=\sum \frac{A_i}{t_i} = \frac{99.8\%}{t_o} + \frac{0.2\%}{2\text{years}}$$

5.1.3 Substitute the TYD and solve for t_o.

$$t_x = \frac{100}{\text{TYD}} \rightarrow 40\text{years} = \frac{100}{\frac{99.8\%}{t_o} + \frac{0.2\%}{2\text{years}}} \Rightarrow t_o = 41.58 \text{ years}$$

5.1.4 Interpolate between temperatures of 113°F and 104°F to find the allowable stress value $S_{105°F}$ at 105°F and 50 years from Design Input 2.8 for a Design Factor of 0.50.

$$S_{105^\circ F} = \frac{(613 \text{ psi} - 653 \text{ psi})}{(113^\circ F - 104^\circ F)}(105^\circ F - 104^\circ F) + 653 \text{ psi} = 648.6 \text{ psi}$$

<u>For Information Only:</u>

Interpolate between temperatures of 113°F and 104°F to find the allowable stress value $S_{105°F}$ at 105°F and 50 years from Design Input 2.8 for a Design Factor of 0.56.

$$S_{105^\circ F} = \frac{(687 \text{ psi} - 732 \text{ psi})}{(113^\circ F - 104^\circ F)}(105^\circ F - 104^\circ F) + 732 \text{ psi} = 727 \text{ psi}$$

5.1.5 Interpolate between the load durations of 50 and 40 years to find the correlating t_o load duration allowable stress at 105°F [Design Input 2.8] for a Design Factor of 0.50.

$$S_{t_o,105^\circ F} = \frac{(648.6\,\text{psi} - 648.6\,\text{psi})}{(50\text{yrs} - 40\text{yrs})}(41.58\text{yrs} - 40\text{yrs}) + 648.6\,\text{psi} = 648.6\,\text{psi}$$

Table 5.1.5-1 – HDPE Return Line Normal Operation Allowable Stress for Design Factor of 0.50

	Load Duration		
	40 yrs	t_o = 41.58 yrs	50 yrs
Allowable Stress (S) (psi)	$S_{t_x,105^oF}$ = 648.6	$S_{t_o,105^oF}$ = 648.6	S_{105^oF} = 648.6

Table 5.1.5-2 – HDPE Return Line Post-Accident Allowable Stress for Design Factor of 0.50

(See Assumption 3.2)	**Load Duration**
	30 days
Allowable Stress (S) (psi)	$S_{175^\circ F}$ = 340

<u>For Information Only:</u>

Interpolate between the load durations of 50 and 40 years to find the correlating t_o load duration allowable stress at 105°F [Design Input 2.8] for a Design Factor of 0.56.

$$S_{t_o,105^\circ F} = \frac{(727\,\text{psi} - 727\,\text{psi})}{(50\text{yrs} - 40\text{yrs})}(41.58\text{yrs} - 40\text{yrs}) + 727\,\text{psi} = 727\,\text{psi}$$

Table 5.1.5-3 – HDPE Return Line Normal Operation Allowable Stress for Design Factor of 0.56

	Load Duration		
	40 yrs	t_o = 41.58 yrs	50 yrs
Allowable Stress (S) (psi)	$S_{t_x,105^oF}$ = 727	$S_{t_o,105^oF}$ = 727	S_{105^oF} = 727

Table 5.1.5-4 – HDPE Return Line Post-Accident Allowable Stress for Design Factor of 0.56

(See Assumption 3.3)	**Load Duration**
	30 days
Allowable Stress (S) (psi)	$S_{175^\circ F}$ = 382

5.2 Minimum Calculated Wall Thicknesses

5.2.1 Supply Lines

Under an internal design pressure of 161 psig (Design Input 2.1), design temperature of 95°F (Design Input 2.1), mechanical and erosion allowance of 0" (Design Input 2.5), allowable stress of 695 psi (Table 2.8-1) for both supply lines at a Design Factor of 0.50, and an allowable stress of 778 psi (Table 2.8-2) for both supply lines at a Design Factor of 0.56 (for information only), the PE 4710 36″ diameter ESW HDPE supply line piping minimum required wall thickness is:

Design Factor of 0.50:

$$t_{\text{design, supply}} = \frac{(161\text{psig})(36'')}{2(695\text{psi}) + 161\text{psig}} + 0 = 3.737''$$

Design Factor of 0.56 (For Information Only):

$$t_{\text{design, supply}} = \frac{(161\text{psig})(36'')}{2(778\text{psi}) + 161\text{psig}} + 0 = 3.376''$$

5.2.2 Return Lines

5.2.2.1 For the Normal Operating Conditions case, an internal design pressure of 45 psig (Design Input 2.2), design temperature of 105°F (Design Input 2.2), mechanical and erosion allowance of 0" (Design Input 2.5), allowable stress of 648.6 psi (Table 5.1.5-1) for both return lines at a Design Factor of 0.50, and an allowable stress of 727 psi (Table 5.1.5-3) for both return lines at a Design Factor of 0.56 (for information only), the PE 4710 36″ diameter ESW HDPE return line piping minimum required wall thickness is:

Design Factor of 0.50:

$$t_{\text{design, return, normal op.}} = \frac{(45\text{psig})(36'')}{2(648.6\text{psi}) + 45\text{psig}} + 0 = 1.21''$$

Design Factor of 0.56 (For Information Only):

$$t_{\text{design, return, normal op.}} = \frac{(45\text{psig})(36'')}{2(727\text{psi}) + 45\text{psig}} + 0 = 1.081''$$

5.2.2.2 For the Post-Accident Conditions case, an internal design pressure of 45 psig (Design Input 2.2), design temperature of 175°F (Design Input 2.2), mechanical and erosion allowance of 0" (Design Input 2.5), allowable stress of 340 psi (Table 5.1.5-2) for both return lines at a Design Factor of 0.50, and an allowable stress of 382 psi (Table 5.1.5-4) for both return lines at a Design Factor of 0.56 (for information only), the PE 4710 36" diameter ESW HDPE return line piping minimum required wall thickness is:

Design Factor of 0.50:

$$t_{\text{design, return, post-accident}} = \frac{(45\text{psig})(36'')}{2(340\text{psi}) + 45\text{psig}} + 0 = 2.235'' = \text{bounding minimum wall value}$$

Design Factor of 0.56 (For Information Only):

$$t_{\text{design, return, post-accident}} = \frac{(45\text{psig})(36'')}{2(382\text{psi}) + 45\text{psig}} + 0 = 2.003'' = \text{bounding minimum wall value}$$

5.2.3 **Backwash Lines**

Under an internal design pressure of 160 psig (Design Input 2.3) and design temperature of 95°F (Design Input 2.3), mechanical and erosion allowance of 0" (Design Input 2.5), allowable stress of 695 psi (Table 2.8-1) for both backwash lines at a Design Factor of 0.50, and an allowable stress of 778 psi (Table 2.8-2) for both backwash lines at a Design Factor of 0.56 (for information only), the PE 4710 4.5" diameter ESW HDPE backwash line piping minimum required wall thickness is:

Design Factor of 0.50:

$$t_{\text{design, backwash}} = \frac{(160\text{psig})(4.5'')}{2(695\text{psi}) + 160\text{psig}} + 0 = 0.465''$$

Design Factor of 0.56 (For Information Only):

$$t_{\text{design, backwash}} = \frac{(160\text{psig})(4.5'')}{2(778\text{psi}) + 160\text{psig}} + 0 = 0.420''$$

6.0 RESULTS

6.1 Results

The required minimum wall thicknesses for the ESW buried HDPE pipes at a Design Factor of 0.50 are shown below in Table 6.1-1:

Table 6.1-1 - Summary of Results for Design Factor of 0.50

Line No.	Min. Wall Thickness (in)
EF-003-AZC-36" - ESW Train 'A' Supply from ESW Pumphouse	3.737"
EF-007-AZC-36" - ESW Train 'B' Supply from ESW Pumphouse	3.737"
EF-083-AZC-36" - ESW Train 'A' Return to UHS Cooling Tower	2.235"
EF-140-AZC-36" - ESW Train 'B' Return to UHS Cooling Tower	2.235"
EF-002-AZC-4" - ESW Train 'A' Strainer Backwash Line	0.465"
EF-006-AZC-4" - ESW Train 'B' Strainer Backwash Line	0.465"

For Information Only:
The required minimum wall thicknesses for the ESW buried HDPE pipes at a Design Factor of 0.56 are shown below in Table 6.1-2:

Table 6.1-2 - Summary of Results for Design Factor of 0.56

Line No.	Min. Wall Thickness (in)
EF-003-AZC-36" - ESW Train 'A' Supply from ESW Pumphouse	3.376"
EF-007-AZC-36" - ESW Train 'B' Supply from ESW Pumphouse	3.376"
EF-083-AZC-36" - ESW Train 'A' Return to UHS Cooling Tower	2.003"
EF-140-AZC-36" - ESW Train 'B' Return to UHS Cooling Tower	2.003"
EF-002-AZC-4" - ESW Train 'A' Strainer Backwash Line	0.420"
EF-006-AZC-4" - ESW Train 'B' Strainer Backwash Line	0.420"

6.2 Conclusions

The required minimum calculated wall thickness values provided in Section 6.1 of this calculation apply to straight pipe only and include 0.0" mechanical and erosion allowance. Nominal wall thickness values for the applicable lines must account for manufacturing tolerances such that the as-manufactured minimum wall thickness values for the piping are greater than or equal to the required values.

6.3 Limitations

6.3.1 The required minimum wall thickness calculated within this calculation is based on the methodology and allowable stress values provided within procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1]. The use of procedure APA-ZZ-00662, Appendix F [Ref. 7.1.1], still requires formal acceptance by the NRC.

6.3.2 The values based on a Design Factor of 0.56 within this calculation are provided for information only and are not to be used in the design of the piping system.

6.4 Impact Assessment

The following sections identify the documents reviewed for impact by this calculation and summarize the results of the impact assessments. Impacts as a result of the piping replacement being performed under MP 07-0066 are identified and evaluated as part of MP 07-0066.

6.4.1 FSAR / Site Addendum

The following sections of the standard plant FSAR and site addendum were reviewed for impact by this calculation:

3.9(B) (SP): Minimum wall thickness is not discussed in the FSAR for the design of non-NSSS piping. (NOT IMPACTED)

9.2 (SP and SA): This calculation does not change the design basis functions of the ESW system, design conditions of the ESW piping or design heat loads acting on the ESW system. (NOT IMPACTED)

6.4.2 Technical Specifications / Technical Specification Bases

The following sections of the technical specifications and technical specification bases were reviewed for impact by this calculation:

3.7.8 / B 3.7.8: This calculation does not change any surveillance requirements for the ESW system. None of the bases for the surveillance requirements are impacted. (NOT IMPACTED)

6.4.3 Other Documents

MS-02: A new material designation must be added to MS-02 for HDPE. This material designation must ensure that the nominal wall thickness values of installed HDPE piping will provide actual minimum wall thickness values greater than or equal to the required minimum wall thickness values determined in this calculation. (IMPACTED)

6.4.4 Design and Operating Margins

This calculation determines required minimum wall thickness for the subject replacement ESW piping. The nominal wall thickness of the installed piping, and hence the margin between the as-manufactured minimum wall thickness and the required minimum wall thickness, will be identified in Section 2.3.8 of the Engineering Disposition for MP 07-0066.

7.0 REFERENCES

7.1 Codes

7.1.1 Callaway Nuclear Plant Procedure APA-ZZ-00662, Appendix F, Rev. 4, "Requirements for High Density Polyethylene (HDPE) Piping for Nuclear Service."

7.2 Miscellaneous

7.2.1 Callaway Nuclear Plant Modification No. MP 07-0066, "Replace Buried ESW Piping with HDPE Material" including FCN 09.

7.2.2 Callaway Nuclear Plant Design Specification No. M-2017, Rev.1, "Design Specification for Replacement ASME Section III Buried Essential Service Water System Piping"

7.2.3 Not Used

7.2.4 The Plastics Pipe Institute, Inc. "Handbook of Polyethylene Pipe", First Edition

7.2.5 Not Used

7.2.6 The International Organization for Standardization, ISO 13760:1998(E), "Plastics Pipes for the Conveyance of Fluids Under Pressure – Miner's Rule – Calculation Method for Cumulative Damage" **(See Limitation 6.3.1)**

7.2.7 Not Used

7.2.8 Callaway Nuclear Plant Document MS-01, Rev. 96, "Piping Class Summary"

8.0 ATTACHMENTS

1. Revision 1 AmerenUE Owner's Review Comments 2 Pages

Attachment 1

Revision 1 AmerenUE Owner's Review Comments"

Callaway Comments
on
Minimum Wall Thickness for ESW Buried HDPE Piping,
S&L Calculation 2007-13241 Rev 1 (DRAFT) (received 8/19/08))

Callaway comments dated 09/03/08

Comment	Calc. Section	Comment	Proposed Resolution
1.	6.4.4	Specify where the margin between the as-manufactured minimum wall thickness and the required minimum wall thickness will be provided within MP 07-0066.	Comment Incorporated.