APPENDIX A

COMPILATION OF THE STATUS OF DATA USED IN AND GENERATED FROM THE ANALYSES PRESENTED IN THIS CHAPTER

98Ø918ØØ57 - Part 2

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-11	Model prediction of general corrosion rates of CAM in humid-air as a function of relative humidity at T = 75°C and different exposure times.	Humacd2.xls; worksheet XLReg; calculations performed in MathCad and exported to a SigmaPlot graph; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory[1]	MathCad 7.0, SigmaPlot 4.0; fig5.5-6.mcd, fig5.5-6.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-12	Model prediction of general corrosion rates of CAM in humid-air as a function of relative humidity at a 1 year exposure time and different exposure temperatures.	Humacd2.xls; worksheet XLReg; calculations performed in MathCad and exported to a SigmaPlot graph; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory[1]	MathCad 7.0, SigmaPlot 4.0; fig5.5-7.mcd, fig5.5-7.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-13	Model prediction of general corrosion rates of CAM in humid-air as a function of temperature at a relative humidity of 60% and different exposure times.	Humacd2.xls; worksheet XLReg; calculations performed in MathCad and exported to a SigmaPlot graph; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory[1]	MathCad 7.0, SigmaPlot 4.0; fig5.5-8.mcd, fig5.5-8.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-14	The aqueous CAM roughness factor from the Waste Package Degradation Expert Elicitation (Pendleton, 1998).	Expert elicitations Dm-a.cd, Pa-a.cd, Dm-a.mcd, C-pf-a.scd, Dm-a.scd, Pa-a.scd [TBV-311][2]	Data is imported to a SigmaPlot data sheet to be graphed fig5.6-1.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5.-15	General corrosion data of CAM in tropical lake water and polluted river water, and the model prediction with the uncertainty.	fig5.6-2.mcd; exported to a SigmaPlot data sheet to be graphed	AQDepth.txt = lines on Fig 5.6-2; fig5.6-2.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-15		Camaqua.xls; worksheet Aquadata columns A and C; rows 1-37 for lake water and rows 38-64 for river water; exported to a SigmaPlot data sheet to be graphed; Data has been previously submitted - MI: 30048-M04-001[1]	points on Fig 5.6-2; fig5.6-2.jnb	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-16	Temperature-dependent general corrosion data of mild steel in distilled water, and the model prediction with the uncertainty.	fig5.6-3.mcd; exported to a SigmaPlot data sheet to be graphed	5.6-3.txt = lines on Fig 5.6-3; fig5.6-3.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-16		Camaqua.xls; worksheet Aquadata; columns B and C, rows 65-71; exported to a SigmaPlot data sheet to be graphed; Data has been previously submitted - MI: 30048-M04-001[1]	points on Fig 5.6-3; fig5.6-3.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-17	Model prediction of aqueous general corrosion rates of CAM as a function of exposure temperature for different exposure times.	Humacd2.xls; worksheet XLReg; calculations performed in MathCad and exported to a SigmaPlot graph; Data has been previously submitted - MI: 30048-M04-001[1]	MathCad 7.0, SigmaPlot 4.0; fig5.6-4.mcd, fig5.6-4.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-18	Model prediction of aqueous general corrosion rates of CAM as a function of exposure time for different exposure temperatures.	Humacd2.xls; worksheet XLReg; calculations performed in MathCad and exported to a SigmaPlot graph; Data has been previously submitted - MI: 30048-M04-001[1]	MathCad 7.0, SigmaPlot 4.0; fig5.6-5.mcd, fig5.6-5.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-19	Comparison of model prediction of aqueous general corrosion of CAM to 0.5 and 1.0 year CAM general corrosion data from the Long-Term Corrosion Testing Facility (LTCTF) at Lawrence Livermore National Laboratory.	fig5.6-6.mcd; exported to a SigmaPlot data sheet to be graphed	5.6-6.txt = lines on Fig 5.6-6; fig6.6-6.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-19		Data from Pasupathi, V. 1998. Waste package Containment Barrier Materials Corrosion Data (LV.WP.VP.05/98-103)	points on Fig 5.6-6; fig5.6-6.jnb	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-20	Cumulative Distribution Function (CDF) of corrosion rate term in high pH CAM localized corrosion model.	Expert elicitations Ds-k.cd, Jf-k.cd, Js-k.cd, Pa-k.cd, Js-k.mcd, Pa-k.mcd, C-cam-k.scd, Ds-k.scd, Jf-k.scd, Js-k.scd, Pa-k.scd [TBV-311][2]	Data is imported to a SigmaPlot data sheet to be graphed; fig5.6-7.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-21	CDF of corrosion rate term in high pH CAM localized corrosion model.	Expert elicitations Ds-n.cd, Js-n.cd, Pa-n.cd, Ds-n.mcd, Js-n.mcd, C-cam-n.scd, Ds-n.scd, Jf-n.scd, Js-n.scd, Pa-n.scd [TBV-311][2]	Data is imported to a SigmaPlot data sheet to be graphed fig5.6-8.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-22	CAM localized corrosion depth versus exposure time for n = 0.3 and 0^{th}, 50^{th}, and 100^{th} percentiles of the B distribution.	Calculation done in MathCad; fig5.6-9.mcd; uses the B and n distributions in Figs 5.6-7,8.	Text file np3.dat results from fig5.6-9.mcd and is imported to a SigmaPlot 4.0 data sheet to be graphed	Non-Q	MO9807MWDWAPDG.000
Fig. 5-23	The CDFs[3] for the general corrosion rate of Alloy C-22 at 100°C in the absence of dripping from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.7-all.mcd) and exported to a SigmaPlot datasheet to be graphed; Data is originally from [TBV-323][4]	SigmaPlot 4.0; fig5.7-1.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-24	The CDFs[3] for the general corrosion rate of Alloy C-22 at 50°C in the absence of dripping from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.7-all.mcd) and exported to a SigmaPlot datasheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.7-2.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-25	The CDFs[3] for the general corrosion rate of Alloy C-22 at 25°C in the absence of dripping from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.7-all.mcd) and exported to a SigmaPlot datasheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.7-3.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-26	The variability CDFs[3] for the general corrosion rate of Alloy C-22 at 25, 50, and 100°C in the absence of dripping utilizing a 75%/25% uncertainty/variability partition ratio and the 50^{th} uncertainty percentile.	Calculations performed in MathCad (fig5.7-all.mcd) producing an output text file which is then exported to a SigmaPlot datasheet [TBV-323][4]	Output text file is a CDF and is imported (gnd17550.cdf, gnd27550.cdf, gnd37550.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.7-4.jnb)	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-27	The variability CDFs[3] for the general corrosion rate of Alloy C-22 at 100°C in the absence of dripping utilizing 25%/75%, 50%/50%, and 75%/25% uncertainty/variability partition ratios and the 50^{th} uncertainty percentile.	Calculations performed in MathCad (fig5.7-all.mcd) producing an output text file which is then exported to a SigmaPlot datasheet [TBV-323][4]	Output text file is a CDF and is imported (gnd32550.cdf, gnd35050.cdf, gnd37550.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.7-5.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-28	The CDFs[3] for the general corrosion rate of Alloy C-22 at 100°C in the absence of dripping utilizing a 75%/25% uncertainty/variability partition ratio and the 5^{th}, 50^{th}, and 95^{th} uncertainty percentiles.	Calculations performed in MathCad (fig5.7-all.mcd) producing an output text file which is then exported to a SigmaPlot datasheet [TBV-323][4]	Output text file is a CDF and is imported (gnd37505.cdf, gnd37550.cdf, gnd37595.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.7-6.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-29	Alloy C-22 CRM general corrosion depth variation with time at 100°C in the absence of dripping utilizing a 75%/25% uncertainty/variability partition ratio, the 50^{th} uncertainty percentile, and the 0^{th}, 50^{th}, and 100^{th} variability percentile corrosion rates.	Calculations performed in MathCad (fig5.7-all.mcd) producing an output text file which is then exported to a SigmaPlot datasheet [TBV-323][34]	Output text file is imported (Fig57) into a SigmaPlot 4.0 data sheet to be graphed (fig5.7-7.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-30	The CDFs[5] for the general corrosion rate of Alloy C-22 at 100°C in the pH = 3 to 10, 340mV dripping environment from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-1.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-31	The CDFs[5] for the general corrosion rate of Alloy C-22 at 100°C in the pH = 2.5, 340mV dripping environment from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-2.jnb	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-32	The CDFs[5] for the general corrosion rate of Alloy C-22 at 100°C in the pH = 2.5, 640mV dripping environment from the Waste Package Degradation Expert Elicitation.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-3.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-33	The CDFs[5] for the general corrosion rate of aggregate Alloy C-22 at 100°C in all dripping environments and the resultant composite CDF.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-4.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-34	The CDFs[5] for the general corrosion rate of aggregate Alloy C-22 at 50°C in all dripping environments and the resultant composite CDF.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-5.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-35	The CDFs[5] for the general corrosion rate of aggregate Alloy C-22 at 25°C in all dripping environments and the resultant composite CDF.	Calculations performed in MathCad (fig5.8.mcd) and exported to a SigmaPlot data sheet to be graphed [TBV-323][4]	SigmaPlot 4.0; fig5.8-6.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-36	Comparison of WPDEE results with Project and literature data on Alloy C-22 general corrosion rates in various testing conditions.	CRM5.8,9.xls, worksheet Composite Data for C-22, exported to a SigmaPlot data sheet to be graphed[6]	SigmaPlot 4.0; fig5.8-7.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-37	The variability CDFs[5] for the general corrosion rate of Alloy C-22 at 25, 50, and 100°C in presence of dripping utilizing a 50%/50% uncertainty/variability partition ratio and the 50th uncertainty percentile.	Calculations performed in MathCad (fig5.8.mcd) producing an output text file which is then exported to a SigmaPlot data sheet [TBV-323][4]	Output text file is a CDF and is imported (g8415050.cdf, g8425050.cdf, g8435050.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.8-8.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-38	The CDFs[5] for the general corrosion rate of Alloy C-22 at 100°C in the presence of dripping utilizing 25%/75%, 50%/50%, and 75%/25% uncertainty/variability partition ratios and the 50th uncertainty percentile.	Calculations performed in MathCad (fig5.8.mcd) producing an output text file which is then exported to a SigmaPlot data sheet [TBV-323][4]	Output text file is a CDF and is imported (g8432550.cdf, g8435050.cdf, g8437550.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.8-9.jnb)	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-39	The CDFs[5] for the general corrosion rate of Alloy C-22 at 100°C in the presence of dripping utilizing a 50%/50% uncertainty/variability	Calculations performed in MathCad (fig5.8.mcd) producing an output text file which is then exported to a SigmaPlot data sheet [TBV-323][4]	Output text file is a CDF and is imported (g8435005.cdf, g8435050.cdf, g8435095.cdf) into SigmaPlot 4.0 data sheet to be graphed (fig5.8-10.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-40	Alloy C-22 CRM general corrosion depth variation with time up to 10,000 years at 100°C in the presence of dripping utilizing a 50%/50% uncertainty/variability partition ratio, the 50th uncertainty percentile, and the 0th, 50th, and 100th variability percentile corrosion rates.	Calculations performed in MathCad (fig5.8.mcd) producing an output text file which is then exported to a SigmaPlot data sheet [TBV-323][4]	Output text file is imported (Fig511) into a SigmaPlot 4.0 data sheet to be graphed (fig5.8-11.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-41	Alloy C-22 CRM general corrosion depth variation with time up to 1,000,000 years at 100°C in the presence of dripping utilizing a 50%/50% uncertainty/variability partition ratio, the 50th uncertainty percentile, and the 0th, 50th, and 100th variability percentile corrosion rates.	Calculations performed in MathCad (fig5.8.mcd) producing an output text file which is then exported to a SigmaPlot data sheet [TBV-323][4]	Output text file is imported (Fig511) into a SigmaPlot 4.0 data sheet to be graphed (fig5.8-11.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-42	Localized corrosion rate of the inner barrier as a function of temperature predicted by the CRM localized corrosion model at 1,000 year exposure time. The mean of the model and 2 and 3 standard deviations of the mean are shown.	Calculations performed in MathCad (fig5.9.mcd) producing an output text file which is then exported to a SigmaPlot data sheet	Output text file is imported (59rate.dat) into a SigmaPlot 4.0 data sheet to be graphed; Columns 1, 2,3,4,5,6 (fig5.9-1.jnb)	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-43	Localized corrosion rate of the inner barrier as a function of temperature predicted by the CRM localized corrosion model at 100,000 year exposure time. The mean of the model and 2 and 3 standard deviations of the mean are shown.	Calculations performed in MathCad (fig5.9.mcd) producing an output text file which is then exported to a SigmaPlot data sheet	Output text file is imported (59rate.dat) into a SigmaPlot 4.0 data sheet to be graphed; Columns 1,12,13,14,15,16 (fig5.9-2.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-44	Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 90°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.	Calculations performed in MathCad (fig5.9.mcd) producing an output text file which is then exported to a SigmaPlot data sheet	Output text file is imported (LLNLPitR01.dat) into a SigmaPlot 4.0 data sheet to be graphed; Columns 1,2,3,4,5,6,17,18 (fig5.9-3.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-45	Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 60°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.	Calculations performed in MathCad (fig5.9.mcd) producing an output text file which is then exported to a SigmaPlot data sheet	Output text file is imported (LLNLPitR01.dat) into a SigmaPlot 4.0 data sheet to be graphed,; Columns 1,7,8,9,10,11,17,18 (fig5.9-4.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-46	Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 30°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.	Calculations performed in MathCad (fig5.9.mcd) producing an output text file which is then exported to a SigmaPlot data sheet	Output text file is imported (LLNLPitR01.dat) into a SigmaPlot 4.0 data sheet to be graphed; Columns 1,12,13,14,15,16,17,18 (fig5.9-5.jnb)	Non-Q	MO9807MWDWAPDG.000
Fig. 5-47	CDF[7] for the temperature threshold for CAM corrosion initiation from the WPDEE[2].	Expert elicitations Ds.cd, Ds.scd, Jf.cd, Jf.scd, Js.cd, Js.scd, Pa.cd, Pa.scd, T-ns.scd [TBV-323][4]	Data is imported to a SigmaPlot data sheet to be graphed Lines are the *.scd files and points are the *.cd files; fig5.10-1.jnb	Non-Q	MO9807MWDWAPDG.000

Table A-1. (continued).

Figure	Description	Source	Associated Files	Q Status	Data Tracking Number
Fig. 5-48	CDF[8] for the relative humidity threshold for CAM humid-air corrosion initiation including the effects of salts from the WPDEE[2].	Expert elicitations Chacrh-s.scd, Dm-s.cd, Dm-s.scd, Ds.cd, Ds.scd, Jf.cd, Jf.scd, Js.cd, Js-comb.scd, Pa.cd, Pa.scd [TBV-323][4]	Data is imported to a SigmaPlot data sheet to be graphed Lines are the *.scd files and points are the *.cd files; fig5.10-2.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-49	CDF[8] for the relative humidity threshold for CAM humid-air corrosion initiation from the WPDEE[2].	Expert elicitations C-hac-rh.scd, Dm.cd, Dm.scd, Ds.cd, Ds.scd, Jf.cd, Jf.scd, Js.cd, Js-comb.scd, Pa.cd, Pa.scd [TBV-323][4]	Data is imported to a SigmaPlot data sheet to be graphed Lines are the *.scd files and points are the *.cd files; fig5.10-3.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-50	CDF[8] for the relative humidity threshold for CAM aqueous corrosion initiation including the effects of salts from the WPDEE[2]	Expert elicitations Caqrh-s.scd, Dm-s.cd, Dm-s.scd, Ds.cd, Ds.scd, Jf.cd, Jf.scd, Js.cd, Js.scd, Pa.cd, Pa.scd [TBV-323][4]	Data is imported to a SigmaPlot data sheet to be graphed Lines are the *.scd files and points are the *.cd files; fig5.10-4.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-51	CDF[8] for the relative humidity threshold for CAM aqueous corrosion initiation from the WPDEE[2]	Expert elicitations C-aq-rh.scd, Dm.cd, Dm.scd, Ds.cd, Ds.scd, Jf.cd, Jf.scd, Js.cd, Js.scd, Pa.cd, Pa.scd [TBV-323][4]	Data is imported to a SigmaPlot data sheet to be graphed Lines are the *.scd files and points are the *.cd files; fig5.10-1.jnb	Non-Q	MO9807MWDWAPDG.000

1 WAPDEG 3.07 Software Routine Report, 30048-2999, Rev. 00, Appendix A and B
2 CRWMS M&O. 1997e. *Final Report on Waste Package Degradation Expert Elicitation Project, Rev. 0.* Las Vegas, Nevada: TRW Environmental Safety Systems. MOL.19980218.0231.
3 *Cumulative Distribution Functions for No Drip Corrosion Resistant Material General Corrosion Model,* B00000000-01717-0210-00012 REV 01
4 Pendleton, M. W. 1998. *Waste Package Degradation Expert Elicitation Revised Preliminary Inputs Received by March 31, 1998.* CRWMS M&O Interoffice Correspondence, LV.EI.MWP.04/98-017, April 13.
5 *Cumulative Distribution Functions for Dripping Corrosion Resistant Material General Corrosion Model,* B00000000-01717-0210-00014 REV 01A
6 Pasupathi, V. 1997. *CRM Degradation Models-Update.* CRWMS M&O (Civilian Radioactive Waste Management System, Management and Operating Contractor) Interoffice Correspondence. LV.WP.VP.12/97-268, December 22. MOY-971231-11.
7 *Cumulative Distribution Functions for the Temperature Threshold for the Onset of Carbon Steel Corrosion,* B00000000-01717-0210-00015 REV 00
8 *Cumulative Distribution Functions for the Relative Humidity Thresholds for the Onset of Carbon Steel Corrosion,* B00000000-01717-0210-00016 REV 00

Table A- 2 Input and Output Data for the Figures Reporting the Waste Package Degradation Analysis Results.

Figure	Code	Description	Input File	Output File	Q Status	Data Tracking Number
Fig. 5-57	NA	Temperature versus time history for waste package groups in the NE region, spent nuclear fuel, long term average, nominal infiltration, α_{mean}, and no backfill.	NEsnf00noBFj2204.hst NEsnf01noBFj2204.hst NEsnf10noBFj2204.hst NEsnf11noBFj2204.hst NEsnf12noBFj2204.hst NEsnf21noBFj2204.hst NEsnf22noBFj2204.hst NEsnf31noBFj2204.hst NEsnf32noBFj2204.hst NEsnf42noBFj2204.hst NEsnf52noBFj2204.hst NEsnf62noBFj2204.hst[1]	Columns 1 and 2 fig5.11-1.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-58	NA	Relative humidity versus time history of waste package groups in the NE region, spent nuclear fuel, long term average, nominal infiltration, α_{mean}, and no backfill.	Same as above	Columns 1 and 3 fig5.11-1.jnb	Non-Q	MO9807MWDWAPDG.000
Fig. 5-59 through 5-61	3.07[2]	Base case waste package degradation.	NE1a5set5.inp NE0a5set6.inp	NE1a5set5.out NE0a5set6.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-62 through 5-64	3.09[3]	Waste package degradation for six repository regions (i.e., CC, NE, NW, SC, SE, SW)	CC1a5set5.inp NE1a5set5.inp NW1a5set5.inp SC1a5set5.inp SE1a5set5.inp SW1a5set5.inp	CC1a5set5.out NE1a5set5.out NW1a5set5.out SC1a5set5.out SE1a5set5.out SW1a5set5.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-65 through 5-69	3.09	Waste package degradation for different surface fractions of the waste package surface wetted by drips	NE1-1a5set5.inp NE1-10a5set5.inp NE1-100a5set5.inp	NE1-1a5set5.out NE1-10a5set5.out NE1-100a5set5.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-70 through 5-74	3.09	Waste package degradation for different patch sizes	NE1a5s5p310.inp NE1a5s5p3100.inp NE1a5s5p31k.inp	NE1a5s5p310.out NE1a5s5p3100.out NE1a5s5p31k.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-75 and 5-76	3.09	Waste package degradation for high aspect-ratio pitting corrosion of the CAM under alkaline dripping	NE1a5s5phcdf.inp	NE1a5s5phcdf.out	Non-Q	MO9807MWDWAPDG.000

Table A-2. (continued).

Figure	Code	Description	Input File	Output File	Q Status	Data Tracking Number
		condition				
Fig. 5-77 through 5-79	3.09	Waste package degradation for enhanced general corrosion rates of the CAM under an assumed condition of sustained microbiologically influenced corrosion	NE1a5s5mic.inp	NE1a5s5mic.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-80 through 5-83	3.09	Waste package degradation for alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates	NE1a5set1.inp NE1a5set2.inp NE1a5set3.inp NE1a5set4.inp NE1a5set5.inp NE1a5set6.inp NE1a5set7.inp NE1a5set8.inp NE1a5set9.inp	NE1a5set1.out NE1a5set2.out NE1a5set3.out NE1a5set4.out NE1a5set5.out NE1a5set6.out NE1a5set7.out NE1a5set8.out NE1a5set9.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-84 through 5-85	NA	Cumulative distribution functions (CDFs)[4] for the composite CRM general corrosion rates	gPA15050.cdf gPA25050.cdf gPA35050.cdf gJF15050.cdf gJF25050.cdf gJF35050.cdf	NA	Non-Q	MO9807MWDWAPDG.000
Fig. 5-86 through 5-88	3.09	Waste package degradation for two end members of the expert elicitation for CRM general corrosion rate distribution under dripping condition	NE1a5s5jf.inp NE1a5s5pa.inp	NE1a5s5jf.out NE1a5s5pa.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-89 and 5-90	NA	Temperature and relative humidity histories of different waste package groups in the NE region in the presence of backfill emplaced at 100 years after waste emplacement	NEsnf00BFj2204.hst NEsnf01BFj2204.hst NEsnf02BFj2204.hst NEsnf11BFj2204.hst NEsnf12BFj2204.hst NEsnf20BFj2204.hst NEsnf21BFj2204.hst NEsnf22BFj2204.hst NEsnf81BFj2204.hst NEsnf82BFj2204.hst	fig5.12-9.jnb Columns 1, 2, and 3	Non-Q	MO9807MWDWAPDG.000
Fig. 5-91 through 5-93	3.09	Waste package degradation for different relative humidity and	CC1a5set5bf.inp NE1a5set5bf.inp NW1a5set5bf.inp	CC1a5set5bf.out NE1a5set5bf.out NW1a5set5bf.out	Non-Q	MO9807MWDWAPDG.000

Table A-2. (continued).

Figure	Code	Description	Input File	Output File	Q Status	Data Tracking Number
		temperature conditions at the waste package surface in the presence of backfill in six different repository regions	SC1a5set5bf.inp SE1a5set5bf.inp SW1a5set5bf.inp	SC1a5set5bf.out SE1a5set5bf.out SW1a5set5bf.out		
Fig. 5-94	3.09	Waste package degradation for varying drip shield thickness	NE1a5s5wpds1-1.inp NE1a5s5wpds1-2.inp NE1a5s5wpds1-4.inp NE1a5s5wpds2-1.inp NE1a5s5wpds2-2.inp NE1a5s5wpds2-4.inp	NE1a5s5wpds1-1.out NE1a5s5wpds1-2.out NE1a5s5wpds1-4.out NE1a5s5wpds2-1.out NE1a5s5wpds2-2.out NE1a5s5wpds2-4.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-95	3.09	Waste package degradation for ceramic coating	NE1a5s5c1aq1.inp NE1a5s5c1aq2.inp	NE1a5s5c1aq1.out NE1a5s5c1aq2.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-96 through 5-98	3.09	Waste package degradation for varying CAM thickness	NE1a5set5-10.inp NE1a5set5-15.inp NE1a5set5-30.inp	NE1a5set5-10.out NE1a5set5-15.out NE1a5set5-30.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-99 through 5-101	3.09	Waste package degradation for varying CRM thickness	NE1a5set5-1.inp NE1a5set5-2.inp NE1a5set5-4.inp NE1a5set5-6.inp	NE1a5set5-1.out NE1a5set5-2.out NE1a5set5-4.out NE1a5set5-6.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-102	SATOOL	Scatter plot of first-patch breach times versus CRM corrosion rate under dripping conditions resulting from sensitivity analysis Case WPSA1	NE1a5s5.inp	NE1a5s5.out	Non-Q	MO9807MWDWAPDG.000
Fig. 5-103 and 5-104	SATOOL	Salient input variables resulting from sensitivity study Case WPSA2	NE1a5s5sa3.inp NE1a5s5sa3s.inp	NE1a5s5sa3.out NE1a5s5sa3s.out NE1a5s5sa3t.SAT NE1a5s5sa3t.TBL	Non-Q	MO9807MWDWAPDG.000

[1] Thermal Hydrology, B00000000-01717-4301-00003 Rev 01, § 3.5.5, DTN - LL980709604242.041
[2] WAPDEG 3.07 Software Routine Report, 30048-2999, Rev. 00
[3] WAPDEG 3.09 Software Routine Report, 30048-2999, Rev. 02
[4] *Cumulative Distribution Functions for Dripping Corrosion Resistant Material General Corrosion Model*, B00000000-01717-0210-00014 REV 01

Table A- 3 Compilation of the Status of the Data Listed in the Tables of this Report.

Table	Description	Source	Q Status	Data Tracking Number
Table 5-2	Humid-Air Corrosion Data Used in the Model Development	Humacd2.xls; worksheet Data; Columns from left to right A,G,B,C,F,H,I,D,J,L,K,M,N; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory; discussed in the WAPDEG 3.07 Software Routine Report (App. A)	Non-Q	MO9807MWDWAPDG.000
Table 5-3	Humid-Air Corrosion Roughness Factor Data at 16-Year Exposure Time for Different Types of Steels	Humacd2.xls; worksheet Data (2); Columns from left to right M,H,N,P,N,P; Rows 59,64; 66,71; 73,78; 80,85; 87,92; 94,99; 101,106; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory; discussed in the WAPDEG 3.07 Software Routine Report (App. A); Data is originally from Southwell, et al., 1976; Southwell and Bultman, 1982	Non-Q	MO9807MWDWAPDG.000
Table 5-4	Aqueous General Corrosion Data Used in the Model Development	Camaqua.xls; worksheet Aquadata; Columns A,B, and C; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory; discussed in the WAPDEG 3.07 Software Routine Report (App. B)	Non-Q	MO9807MWDWAPDG.000
Table 5-5	Aqueous Corrosion Roughness Factor Data at 16-Year Exposure Time	Camaqua.xls; worksheet Aquadata (2); Columns from left to right M,N,Q,W,T,AC,Z; Rows 29-33; Data has been previously submitted - MI: 30048-M04-001; Contents of HumidCAM subdirectory; discussed in the WAPDEG 3.07 Software Routine Report (App. B)	Non-Q	MO9807MWDWAPDG.000
Table 5-6	Local Corrosion Environment Scenarios on the CRM and the Probabilities of Occurrence from the WPDEE	Data is originally from Pendleton, M. W. 1998. *Waste Package Degradation Expert Elicitation Revised Preliminary Inputs Received by March 31, 1998.* CRWMS M&O Interoffice Correspondence, LV.EI.MWP.04/98-017, April 13. [TBV-323]. The data used for the table is calculated in *Cumulative Distribution Functions for Dripping Corrosion Resistant Material General Corrosion Model*, B00000000-01717-0210-00014 REV 00, 01A	Non-Q	MO9807MWDWAPDG.000

Table A-3. (continued).

Table	Description	Source	Q Status	Data Tracking Number
Table 5-7	All the Corrosion Data for Alloy 22 Used in the Development of the Correlation of the Corrosion Rate	CRM5.8,9.xls; worksheet Composite Data for C-22; Columns from left to right F,G,I,J,K,L,M,O,R; Pasupathi, V. 1997. *CRM Degradation Models-Update.* CRWMS M&O (Civilian Radioactive Waste Management System, Management and Operating Contractor) Interoffice Correspondence. LV.WP.VP.12/97-268, December 22. MOY-971231-11.	Non-Q	MO9807MWDWAPDG.000
Table 5-18	Importance Ranking of Input Variables on First Patch-Breach Output Variable ($R^2 = 0.8492$)	NE1a5s5sa3.tbl; output from SATOOL.	Non-Q	MO9807MWDWAPDG.000

Chapter 5
Figures

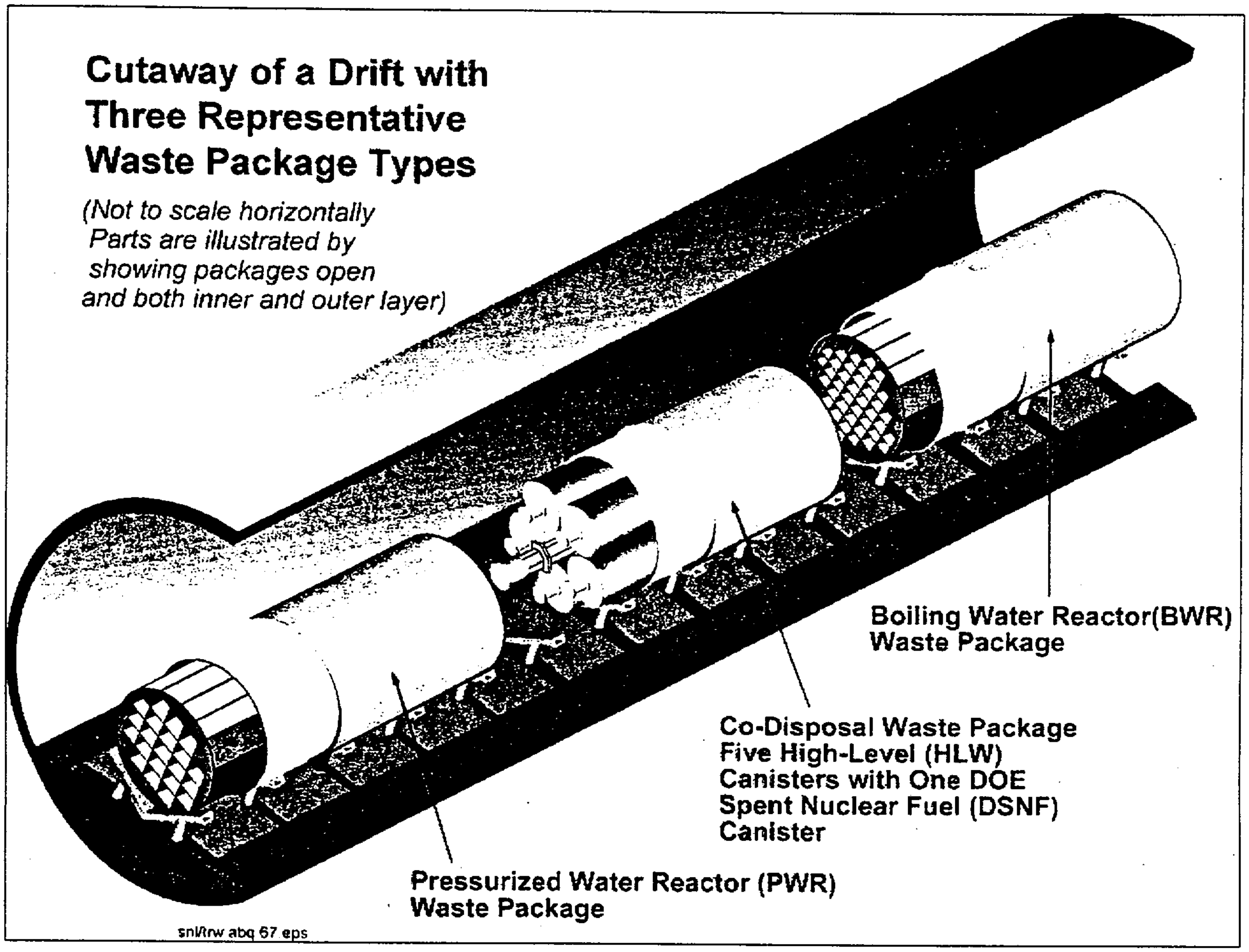

Figure 5-1. Cutaway of a drift with three representative waste package types.

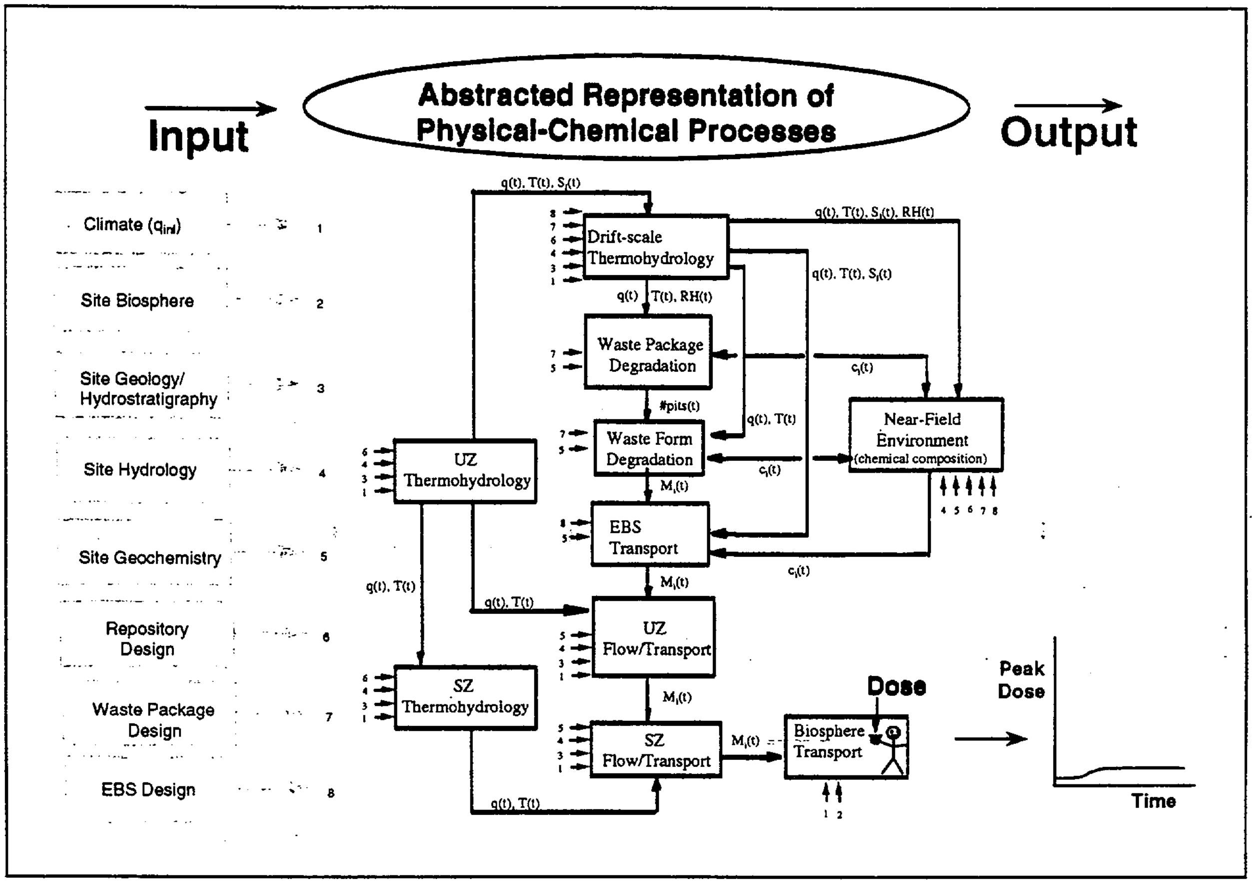

Figure 5-2. Information flow in TSPA model.

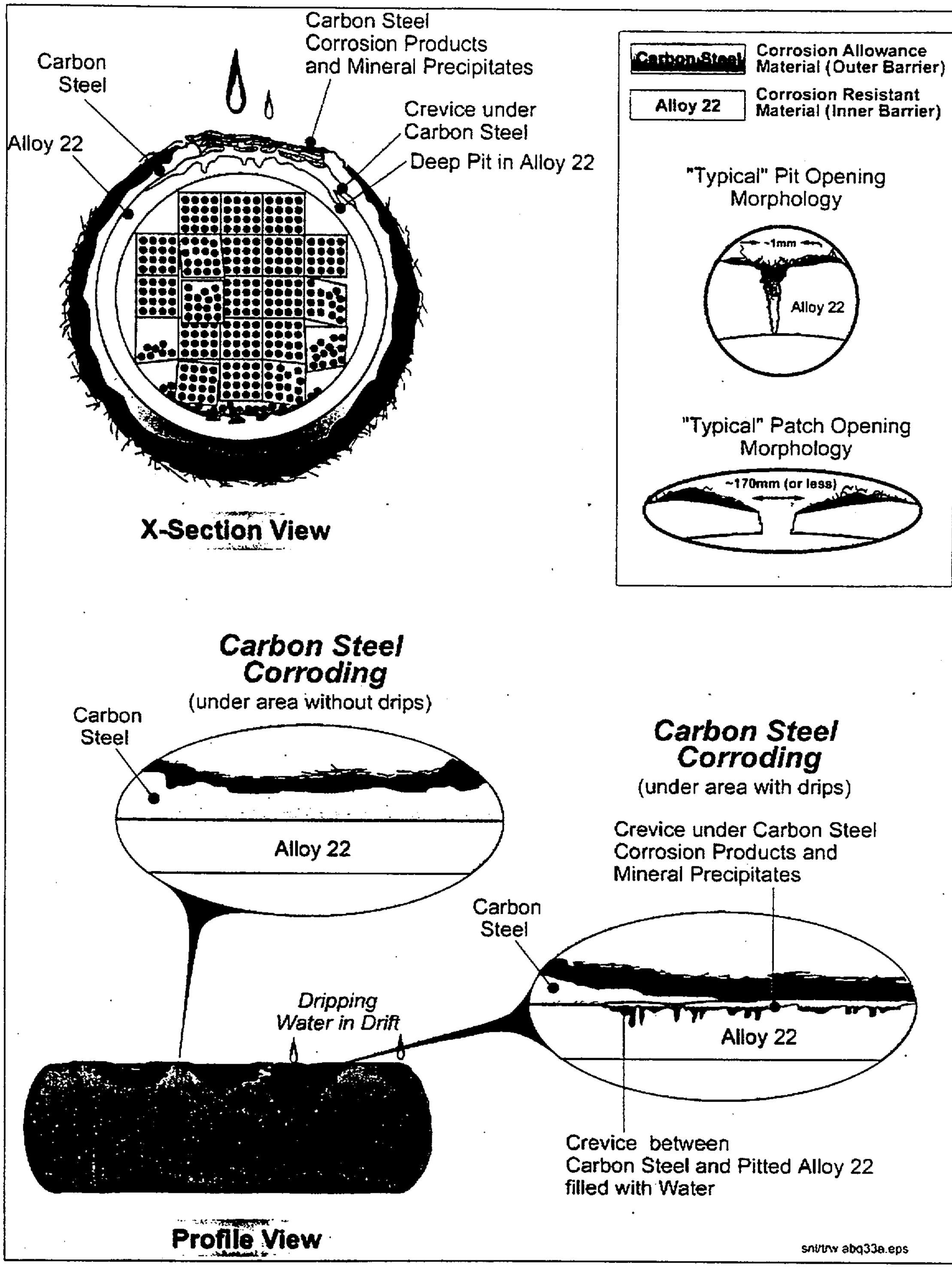

Figure 5-3. Drawings to illustrate the conceptual representation of waste package degradation by general and localized corrosion under dripping and no-drip conditions.

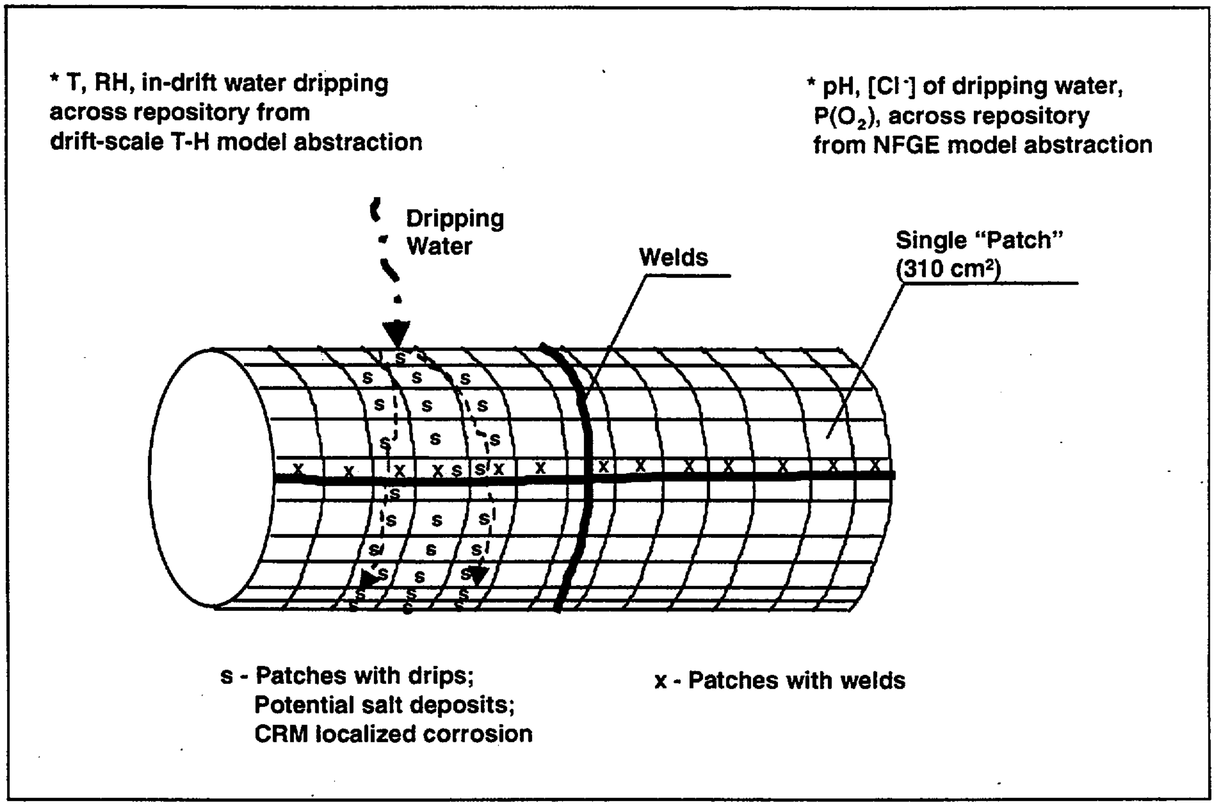

Figure 5-4. A schematic illustrating the conceptual model for the waste package degradation modeling with the "patches" approach.

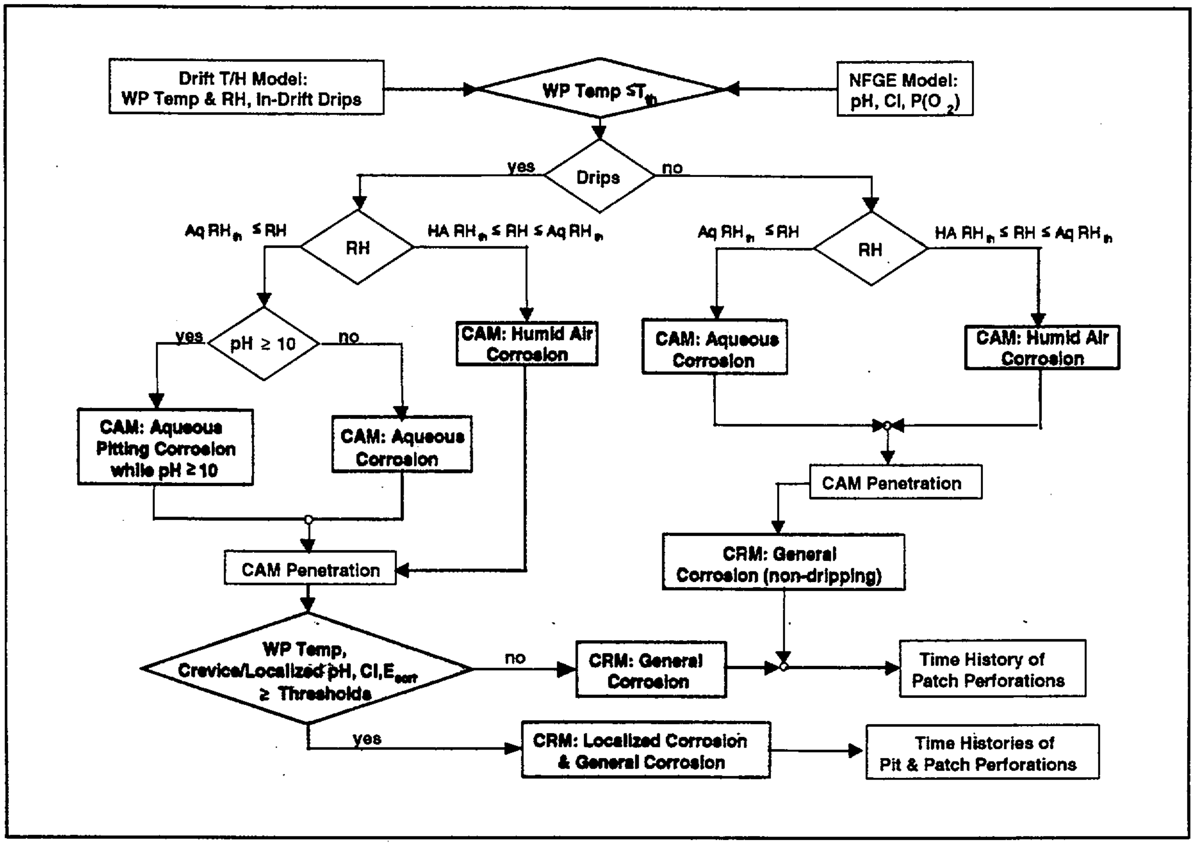

Figure 5-5. Logic diagram for the base case waste package degradation model. T_{th} = temperature threshold for CAM corrosion initiation; HA RH_{th} = relative humidity threshold for CAM humid-air corrosion initiation; Aq RH_{th} = relative humidity threshold for CAM aqueous corrosion initiation; E_{corr} = corrosion potential.

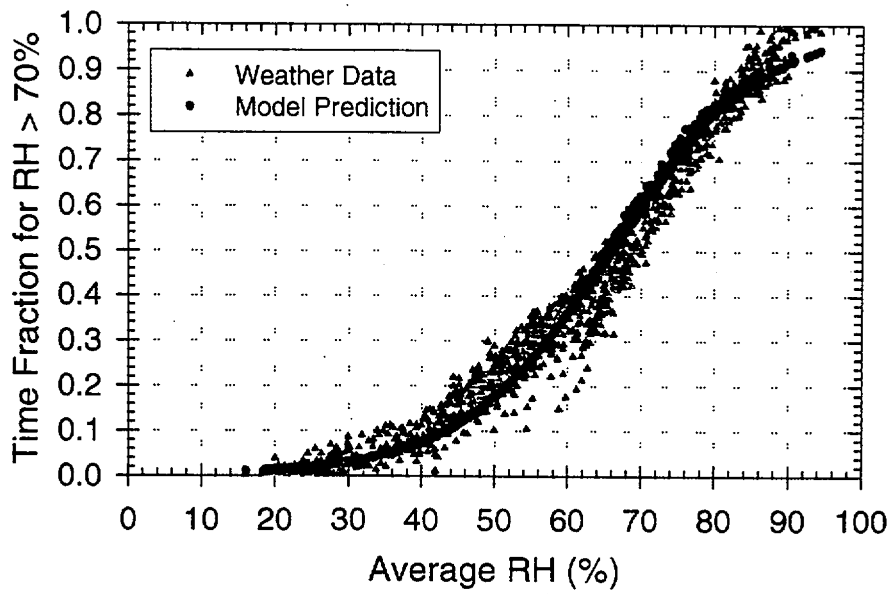

Figure 5-6. Weather data and model predictions of the fraction of time for RH ≥ 70 percent as a function of average relative humidity.

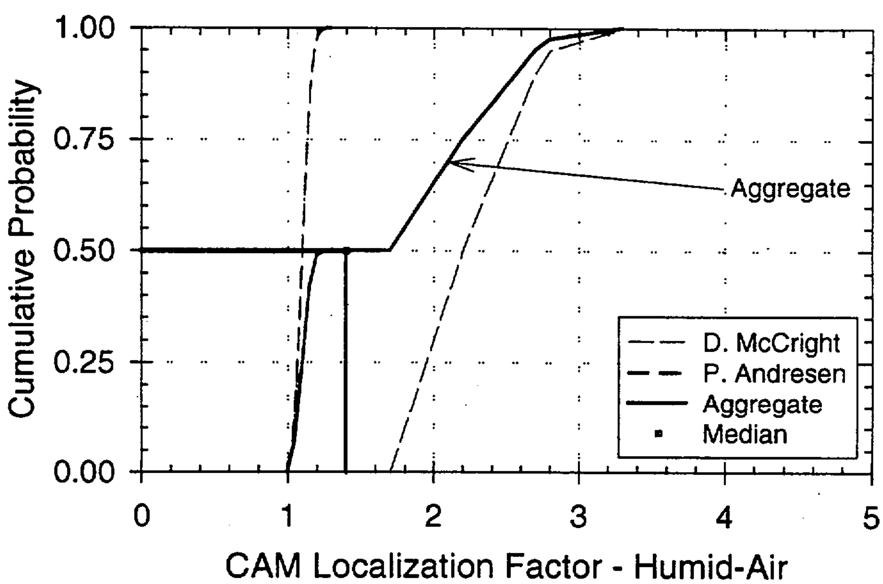

Figure 5-7. The humid-air CAM roughness factor from the Waste Package Degradation Expert Elicitation (CRWMS M&O 1997e).

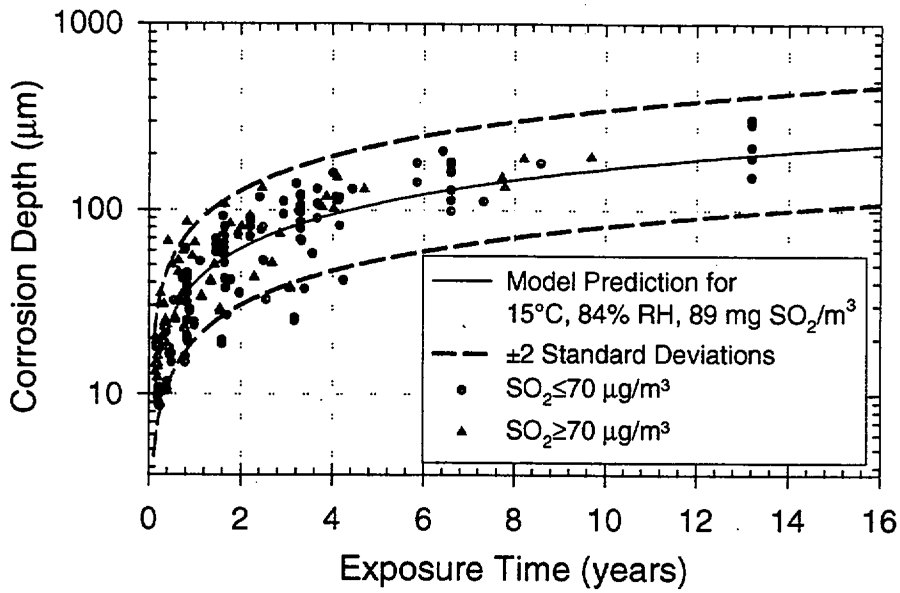

Figure 5-8. Humid-air general corrosion data and the model prediction for corrosion allowance materials.

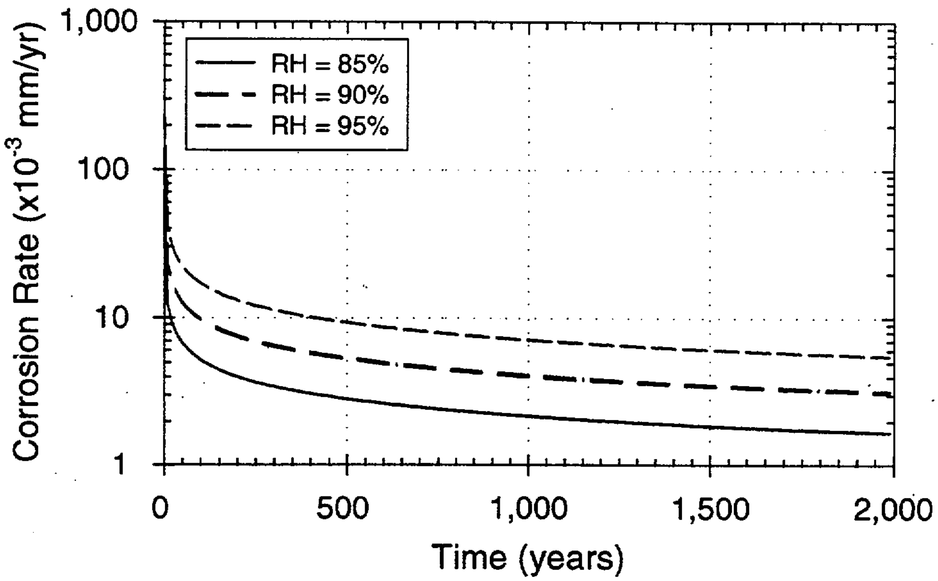

Figure 5-9. Model prediction of general corrosion rates of CAM in humid air as a function of exposure time at T = 60°C and different relative humidities.

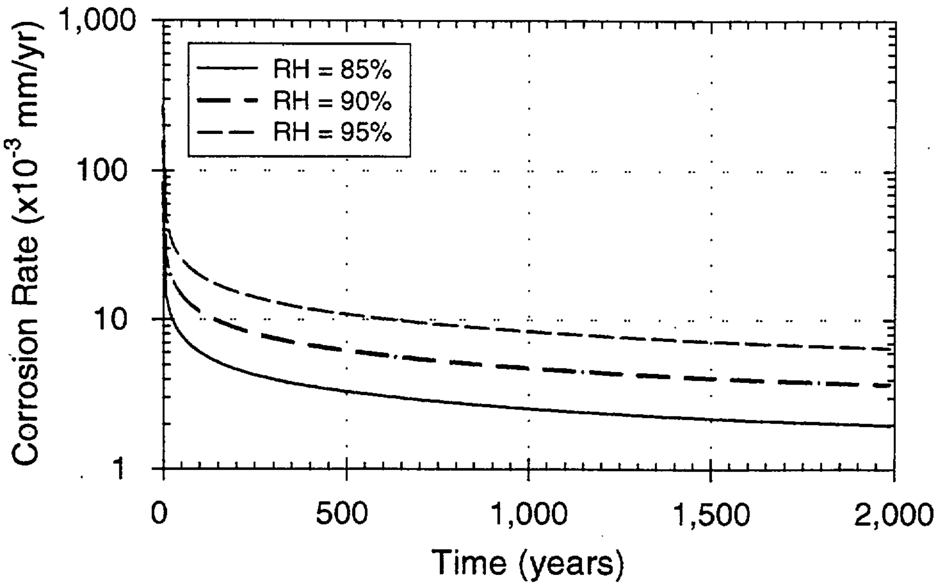

Figure 5-10. Model prediction of general corrosion rates of CAM in humid air as a function of exposure time at T = 90°C and different relative humidities.

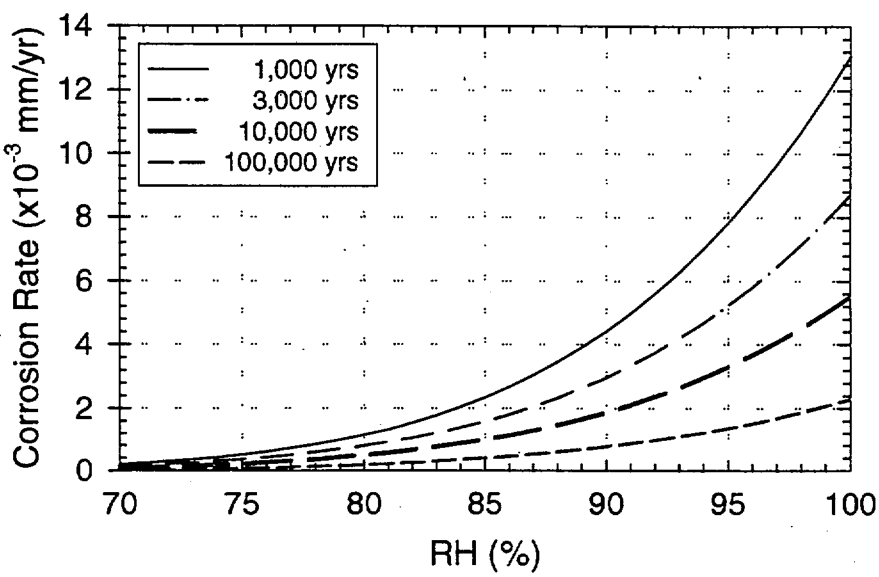

Figure 5-11. Model prediction of general corrosion rates of CAM in humid air as a function of relative humidity at T = 75°C and different exposure times.

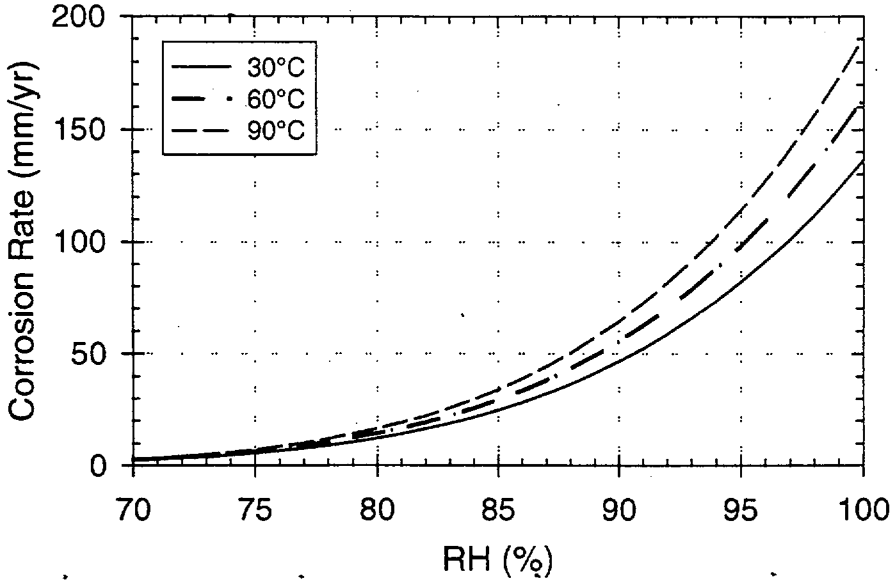

Figure 5-12. Model prediction of general corrosion rates of CAM in humid air as a function of relative humidity at a 1 year exposure time and different exposure temperatures.

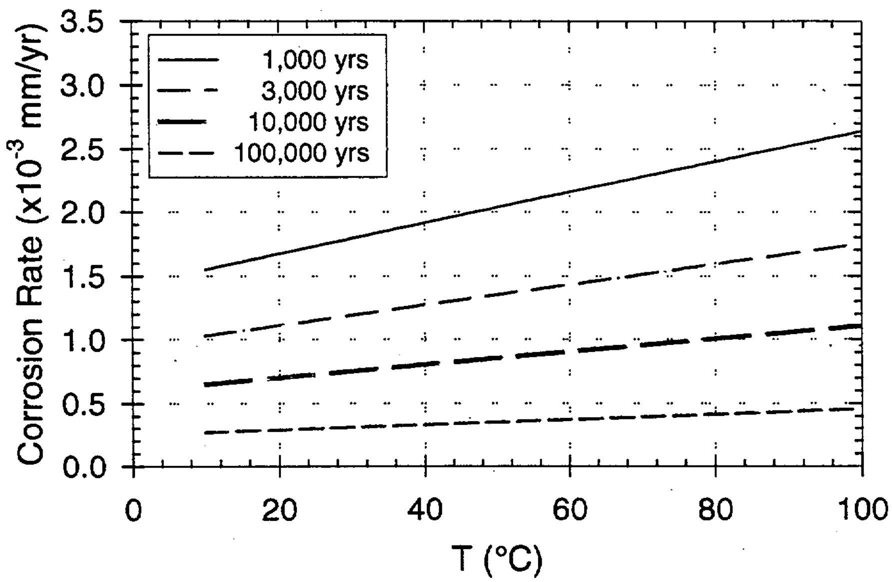

Figure 5-13. Model prediction of general corrosion rates of CAM in humid air as a function of temperature at a relative humidity of 60 percent and different exposure times.

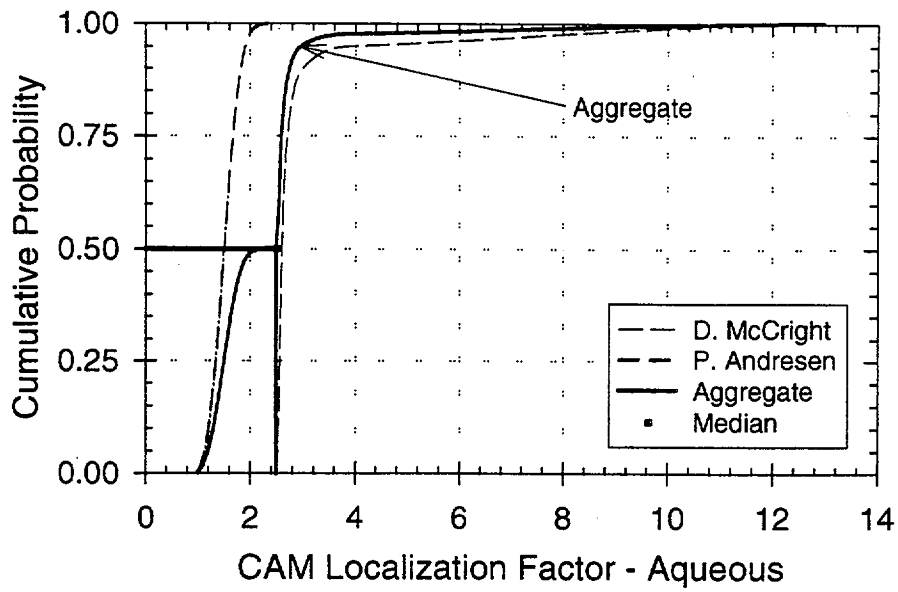

Figure 5-14. The aqueous CAM roughness factor from the Waste Package Degradation Expert Elicitation (CRWMS M&O 1997e).

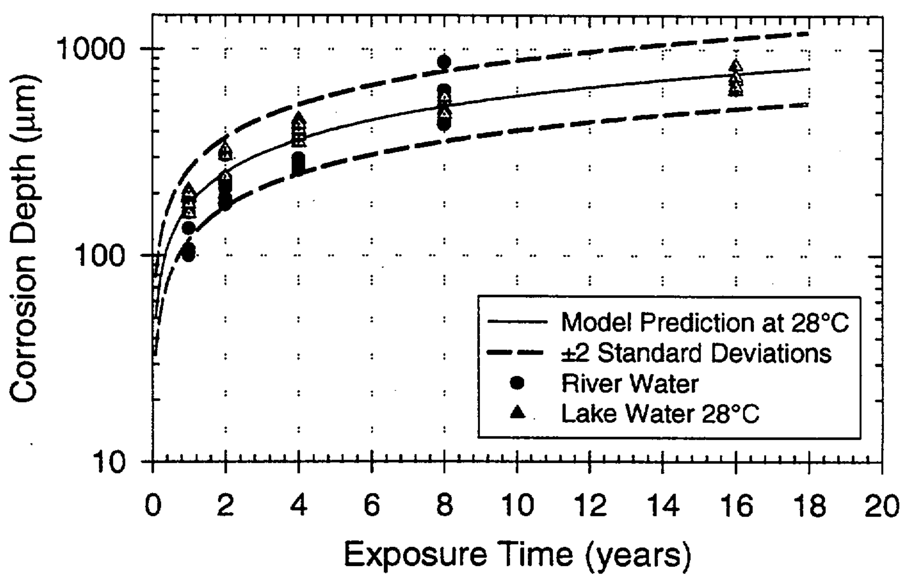

Figure 5-15. General corrosion data of CAM in tropical lake water and polluted river water, and the model prediction with the uncertainty.

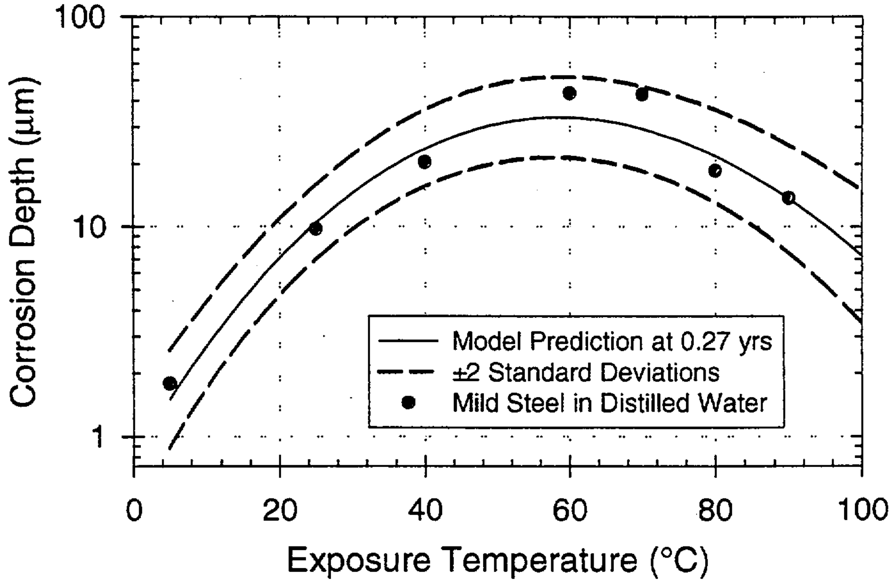

Figure 5-16. Temperature-dependent general corrosion data of mild steel in distilled water, and the model prediction with the uncertainty.

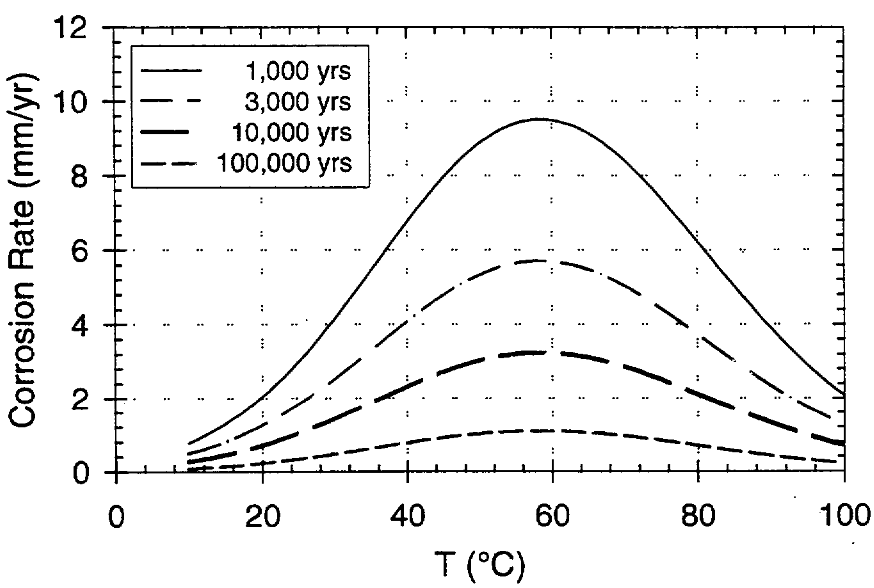

Figure 5-17. Model prediction of aqueous general corrosion rates of CAM as a function of exposure temperature for different exposure times.

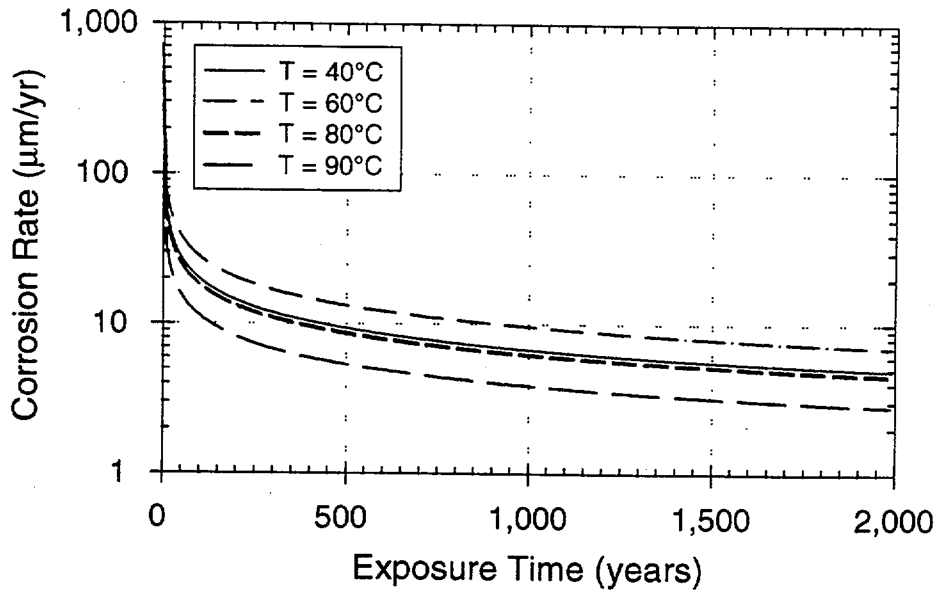

Figure 5-18. Model prediction of aqueous general corrosion rates of CAM as a function of exposure time for different exposure temperatures.

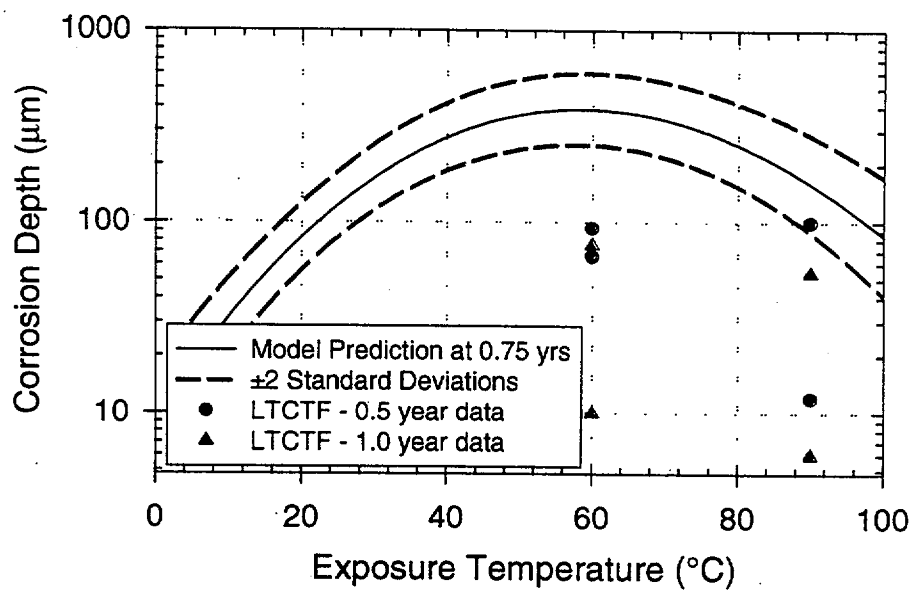

Figure 5-19. Comparison of model prediction of aqueous general corrosion of CAM to 0.5 and 1.0 year CAM general corrosion data from the Long-Term Corrosion Testing Facility (LTCTF) at Lawrence Livermore National Laboratory.

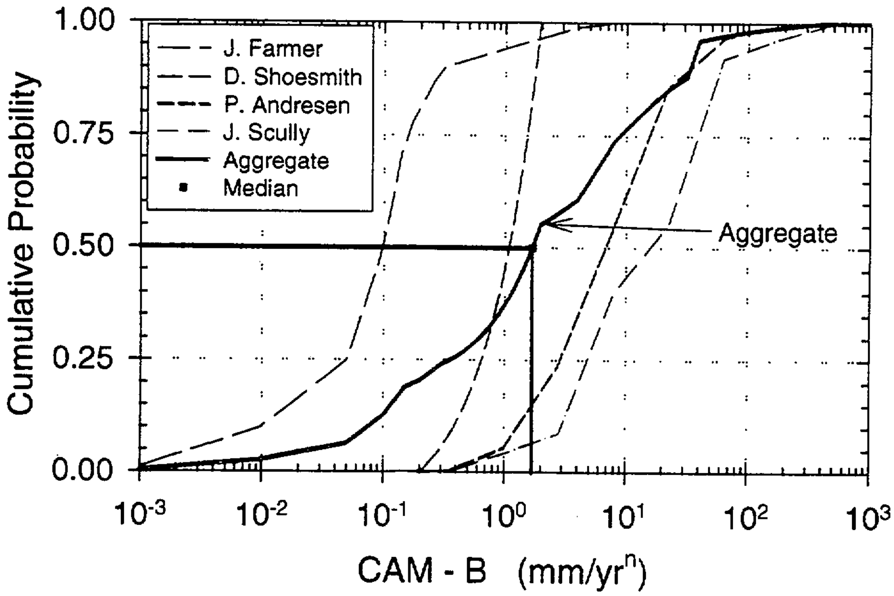

Figure 5-20. Cumulative distribution function of corrosion rate term in high pH CAM localized corrosion model.

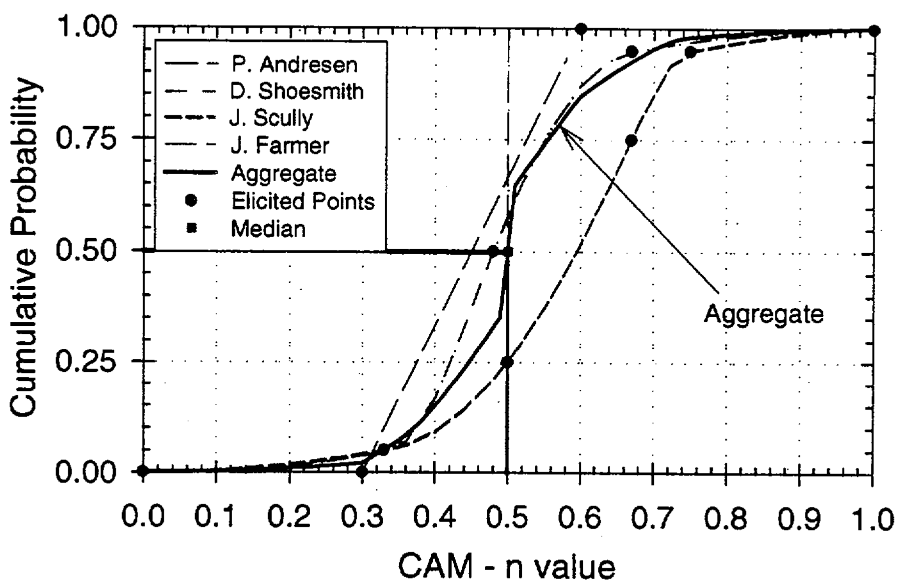

Figure 5-21. Cumulative distribution function of time exponent term in high pH CAM localized corrosion model.

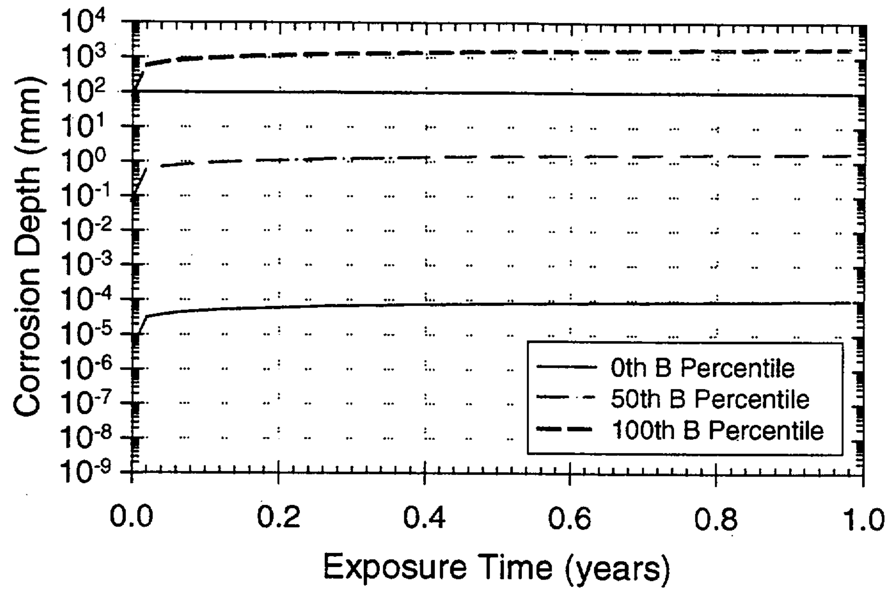

Figure 5-22. CAM localized corrosion depth versus exposure time for n = 0.3 and 0, 50th, and 100th percentiles of the B distribution.

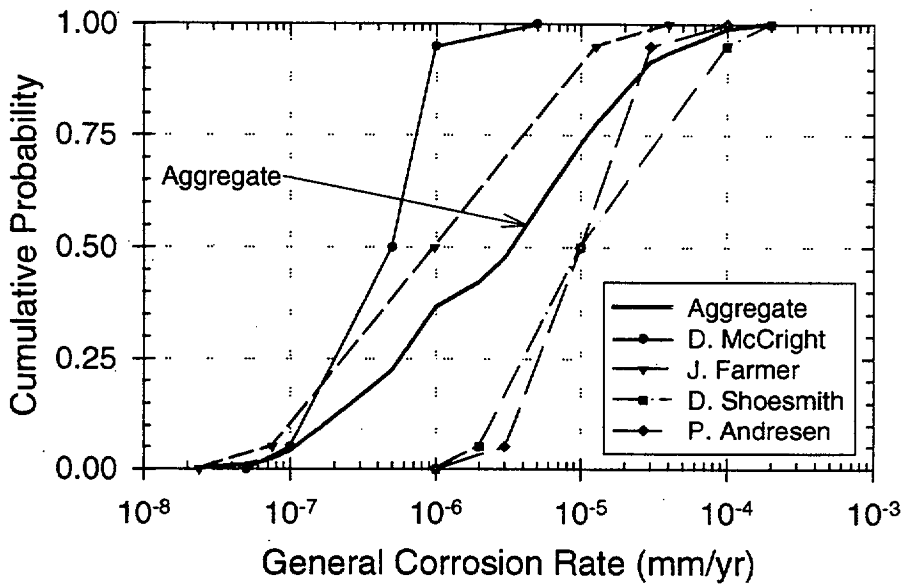

Figure 5-23. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the absence of dripping from the Waste Package Degradation Expert Elicitation (Pendleton 1998).

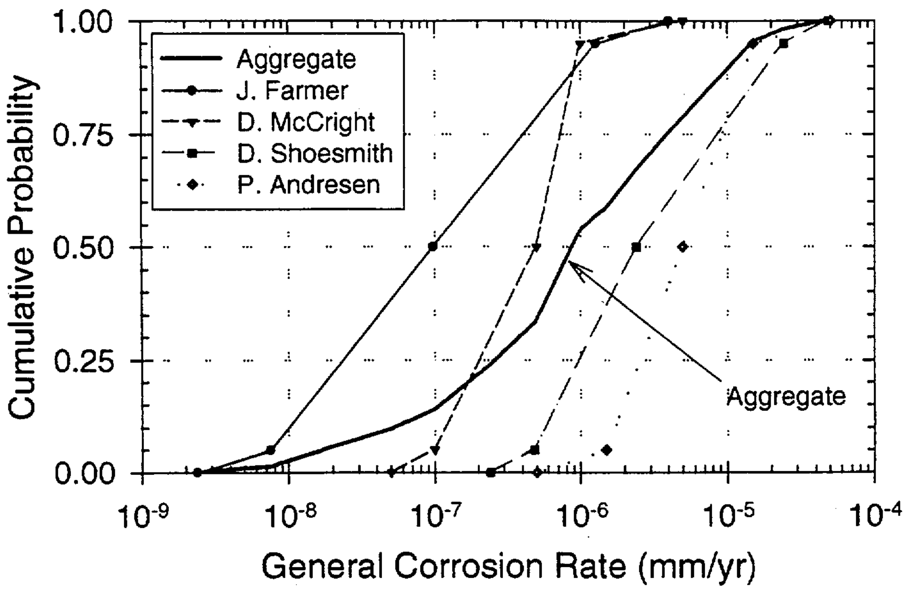

Figure 5-24. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 50°C in the absence of dripping from the Waste Package Degradation Expert Elicitation (Pendleton 1988).

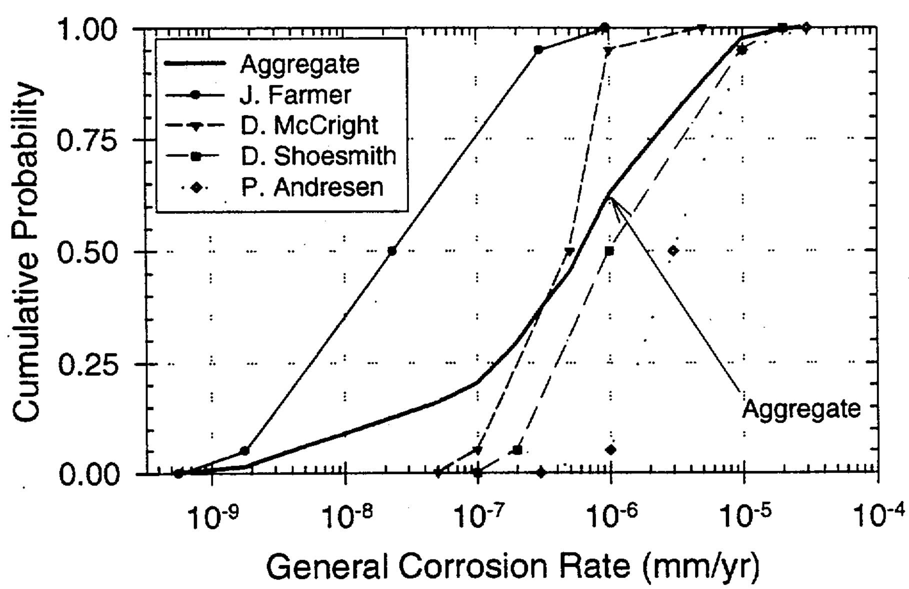

Figure 5-25. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 25°C in the absence of dripping from the Waste Package Degradation Expert Elicitation (Pendleton 1988).

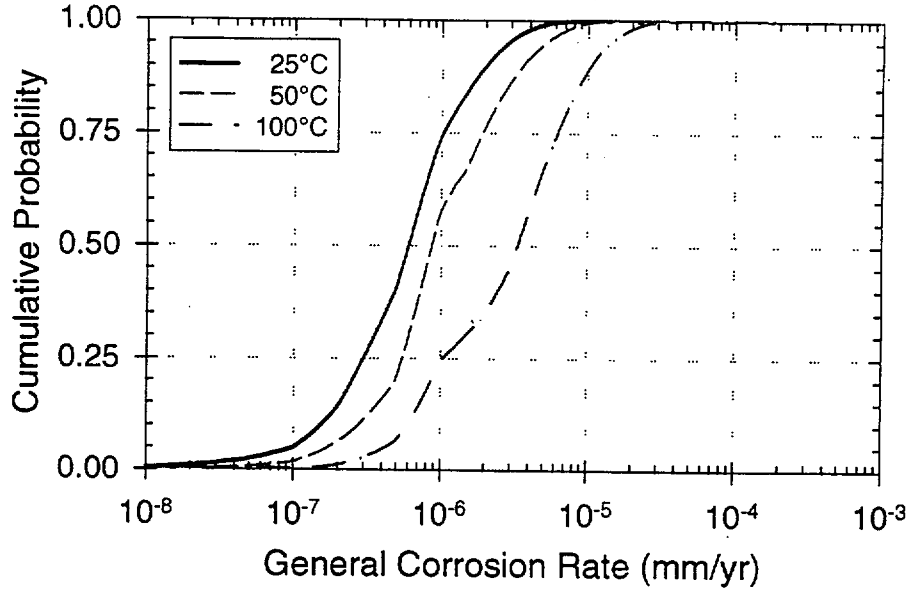

Figure 5-26. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 25, 50, and 100°C in the absence of dripping using a 75 percent/25 percent uncertainty/variability partition ratio and the 50th uncertainty percentile.

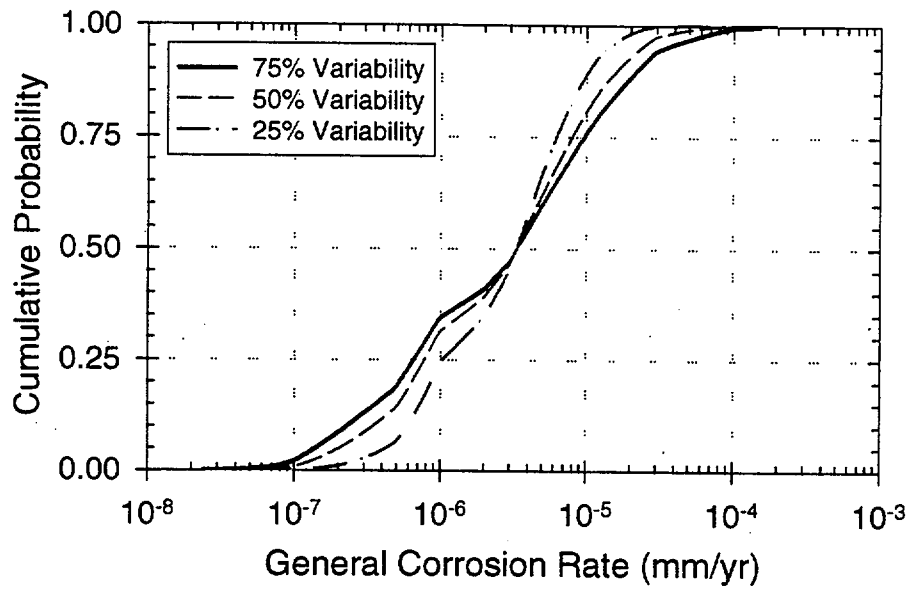

Figure 5-27. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the absence of dripping using 25 percent/75 percent, 50 percent/50 percent, and 75 percent/25 percent uncertainty/variability partition ratios and the 50th uncertainty percentile.

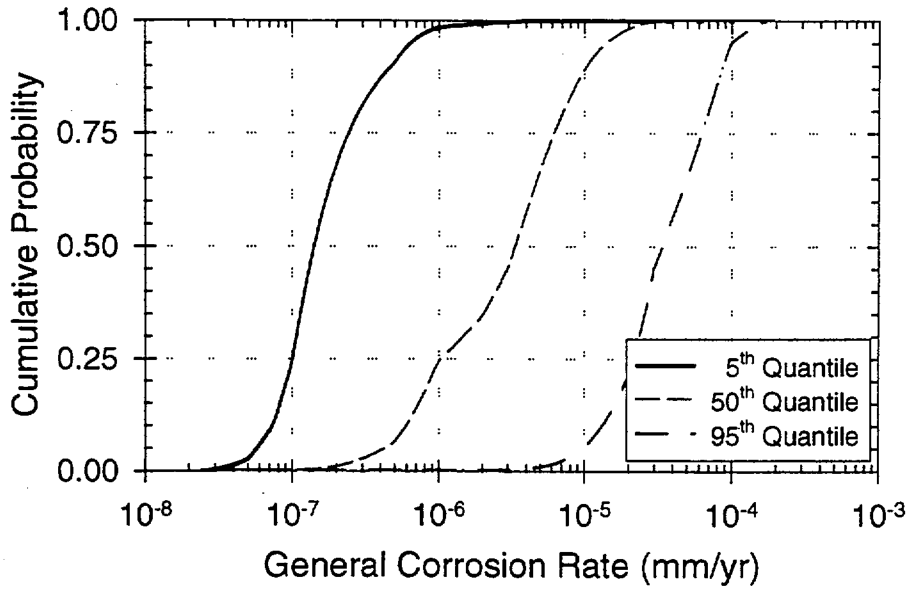

Figure 5-28. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the absence of dripping using a 75 percent/25 percent uncertainty/variability partition ratio and the 5th, 50th, and 95th uncertainty percentiles.

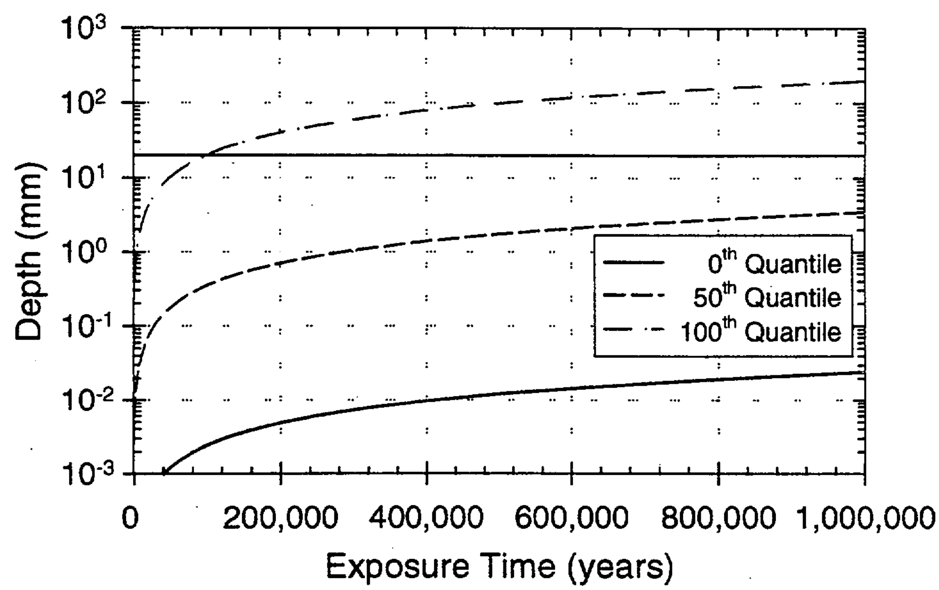

Figure 5-29. Alloy 22 CRM general corrosion depth variation with time at 100°C in the absence of dripping using a 75 percent/25 percent uncertainty/variability partition ratio, the 50th uncertainty percentile, and the 0, 50th, and 100th variability percentile corrosion rates.

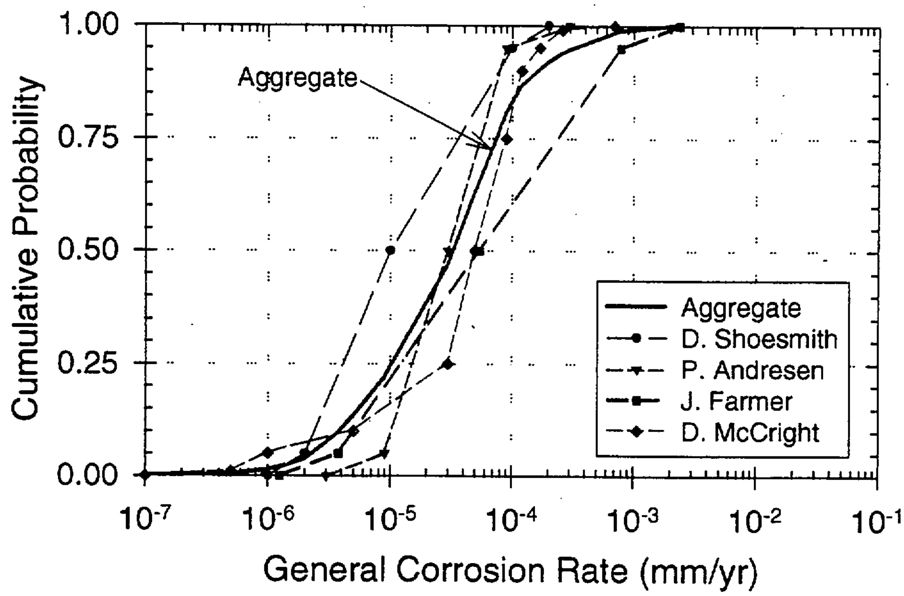

Figure 5-30. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the pH = 3 to 10, 340mV SHE dripping environment from the Waste Package Degradation Expert Elicitation (Pendleton 1998).

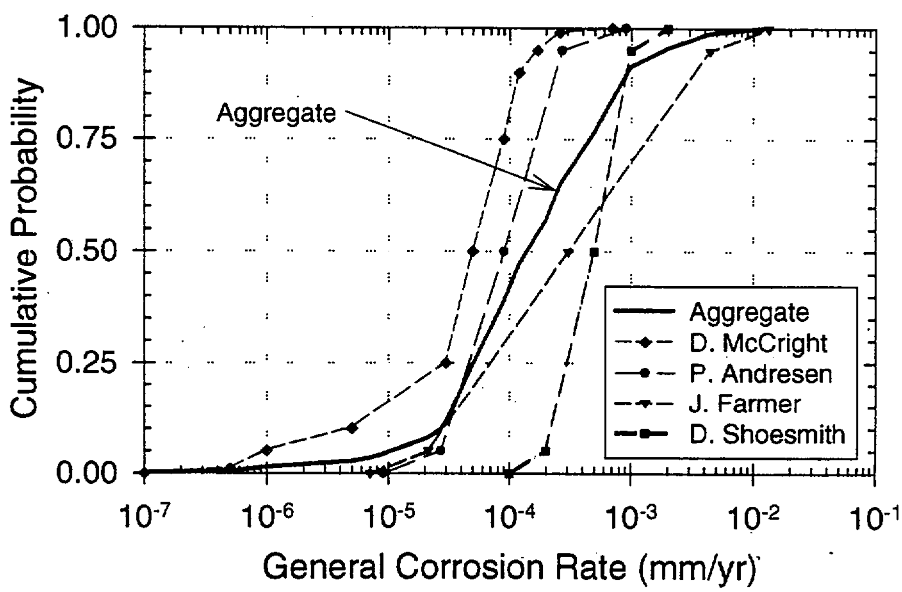

Figure 5-31. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the pH = 2.5, 340mV SHE dripping environment from the Waste Package Degradation Expert Elicitation (Pendleton 1998).

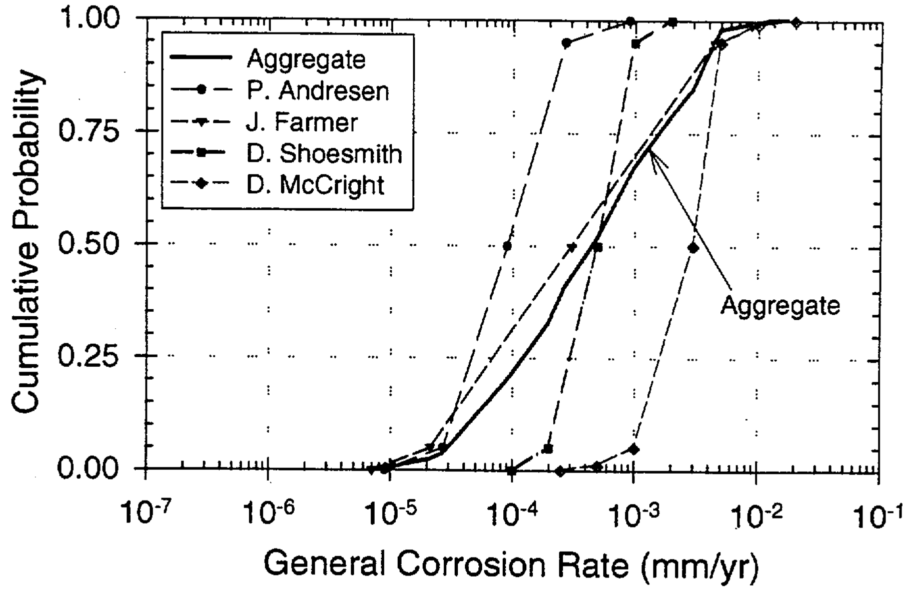

Figure 5-32. The cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the pH = 2.5, 640mV SHE dripping environment from the Waste Package Degradation Expert Elicitation (Pendleton 1988).

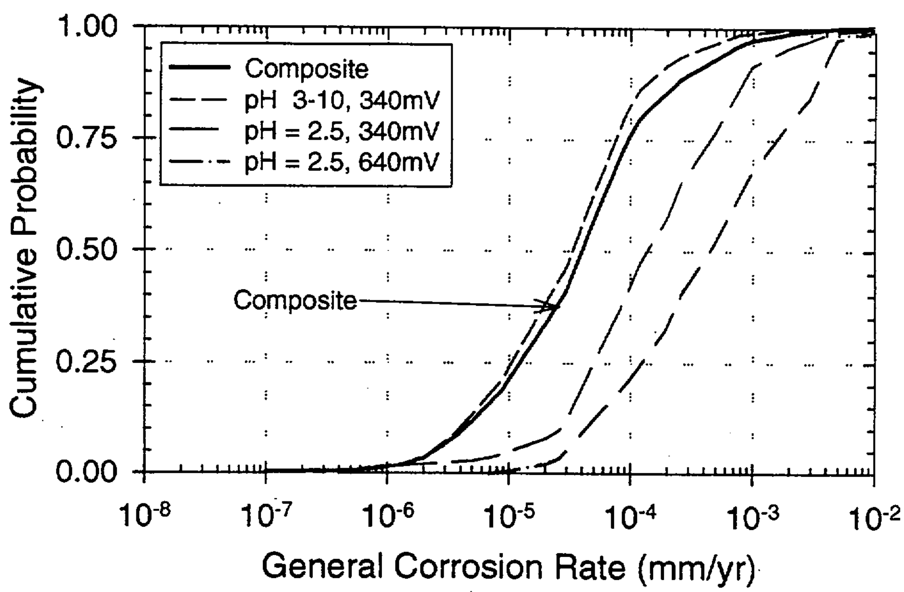

Figure 5-33. The cumulative distribution functions for the aggregate general corrosion rate of Alloy 22 at 100°C in all dripping environments and the resultant composite CDF. The corrosion potentials are with respect to standard hydrogen electrode (SHE) scale.

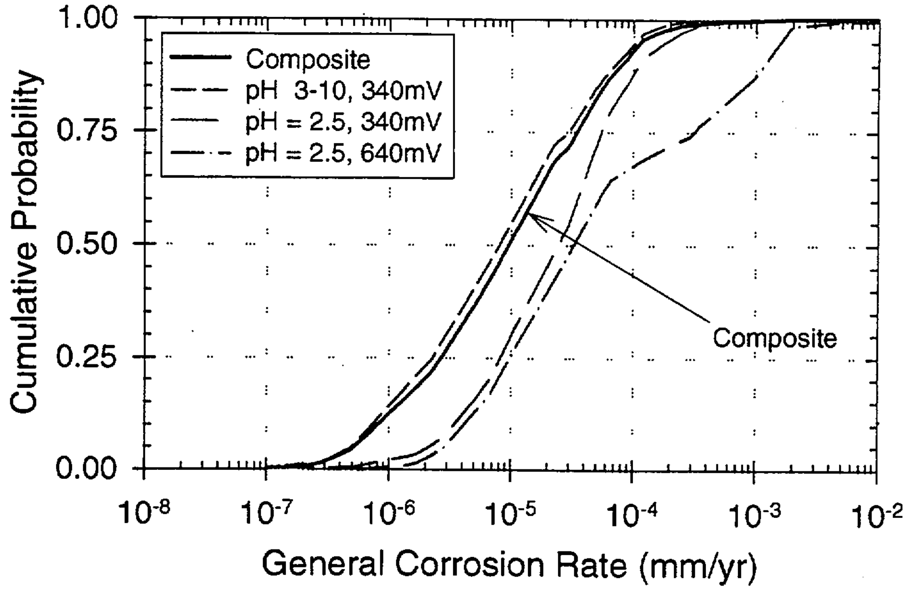

Figure 5-34. The cumulative distribution functions for the aggregate general corrosion rate of Alloy 22 at 50°C in all dripping environments and the resultant composite CDF. The corrosion potentials are with respect to standard hydrogen electrode (SHE) scale.

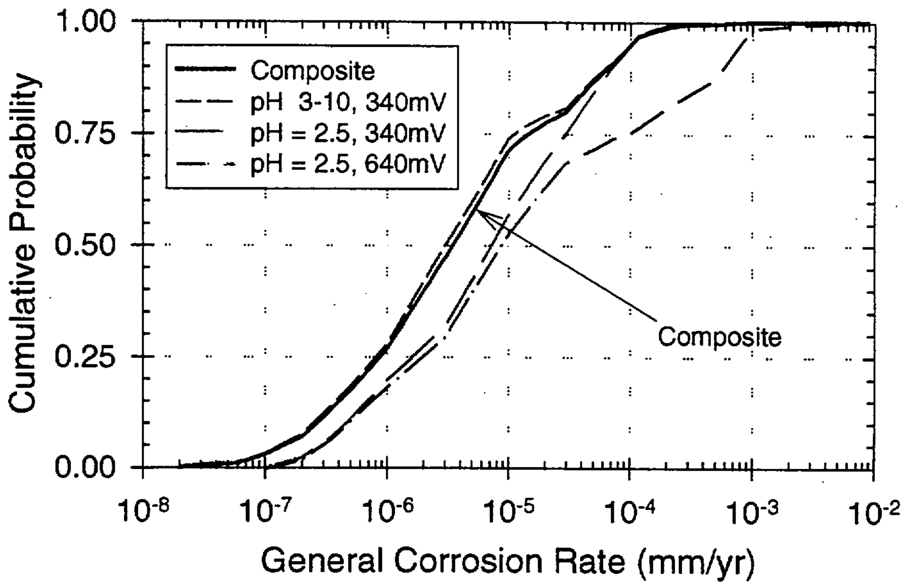

Figure 5-35. The cumulative distribution functions for the aggregate general corrosion rate of Alloy 22 at 25°C in all dripping environments and the resultant composite CDF. The corrosion potentials are with respect to standard hydrogen electrode (SHE) scale.

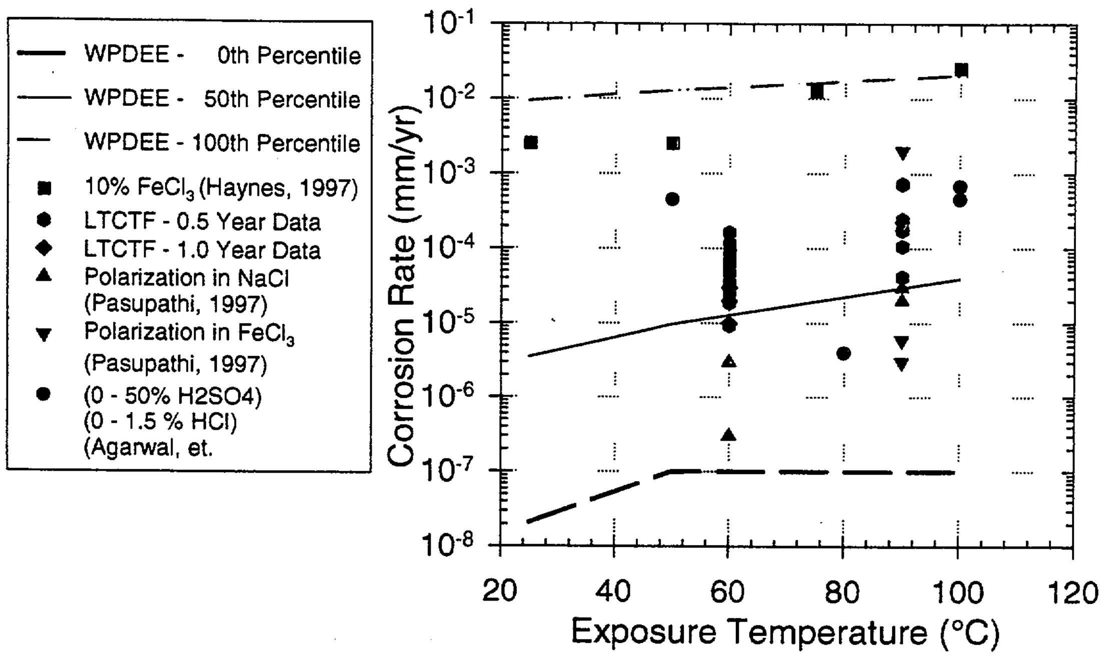

Figure 5-36. Comparison of WPDEE results with project and literature data on Alloy 22 general corrosion rates in various testing conditions.

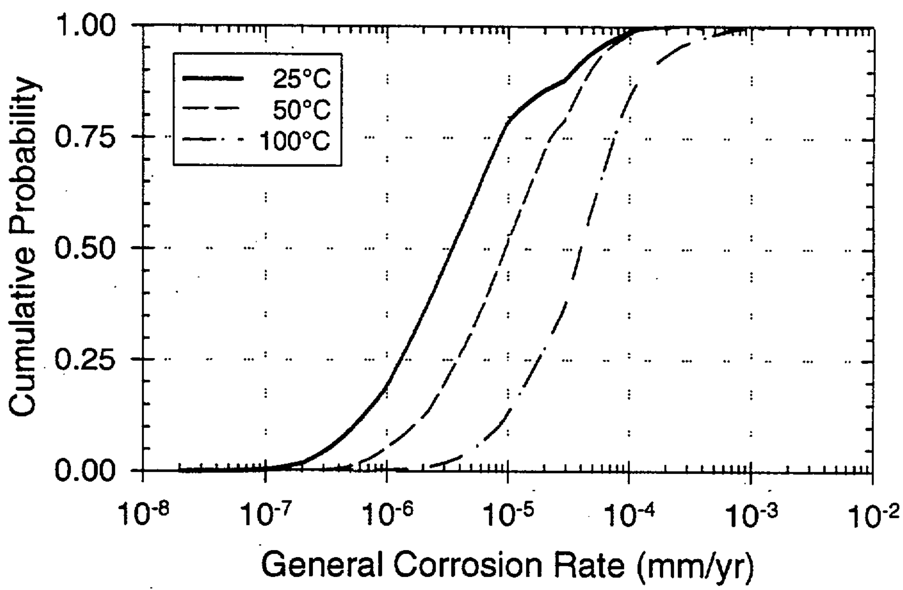

Figure 5-37. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 25, 50, and 100°C in presence of dripping using a 50 percent/50 percent uncertainty/variability partition ratio and the 50th uncertainty percentile.

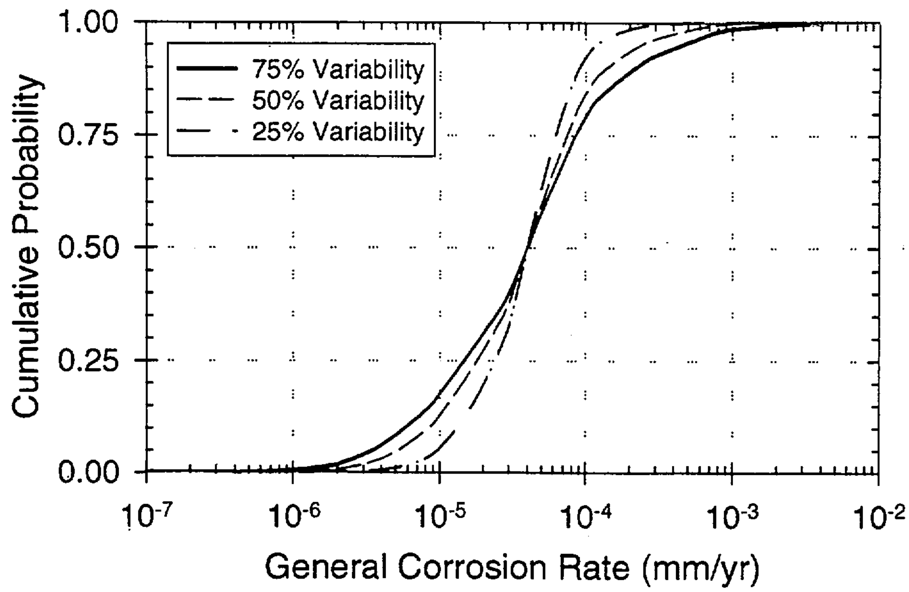

Figure 5-38. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the presence of dripping using 25 percent/75 percent, 50 percent/50 percent, and 75 percent/25 percent uncertainty/variability partition ratios and the 50th uncertainty percentile.

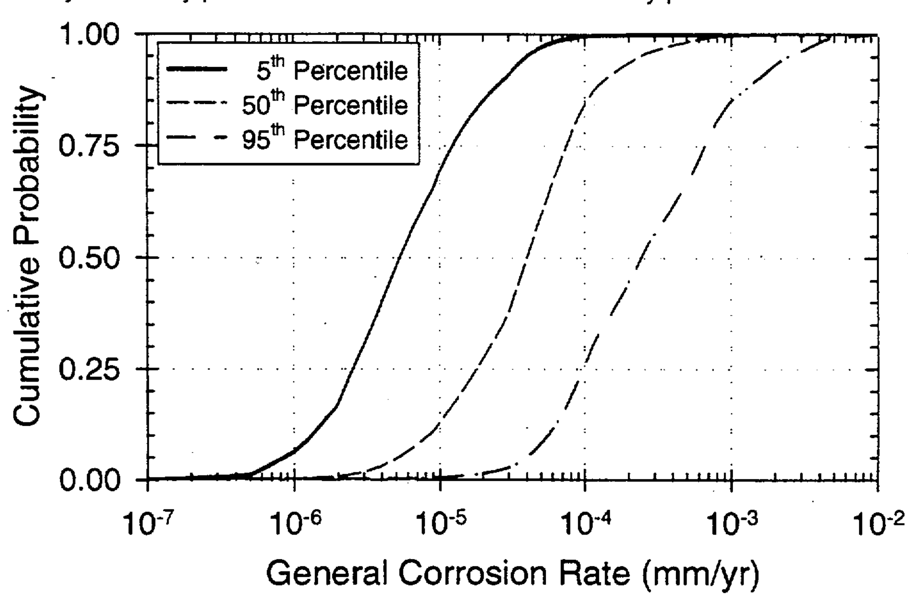

Figure 5-39. The variability cumulative distribution functions for the general corrosion rate of Alloy 22 at 100°C in the presence of dripping using a 50 percent/50 percent uncertainty/variability partition ratio and the 5th, 50th, and 95th uncertainty percentiles.

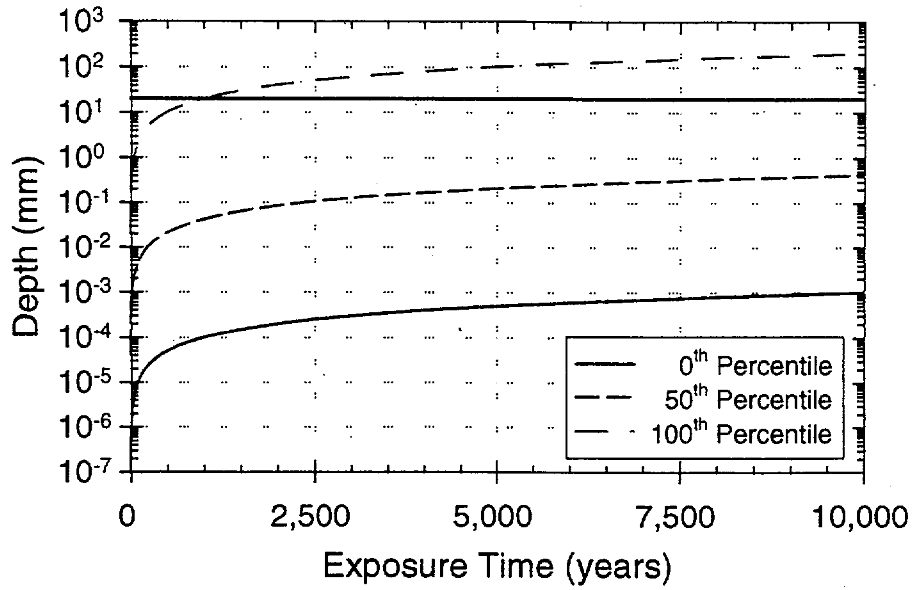

Figure 5-40. Alloy 22 CRM general corrosion depth variation with time up to 10,000 years at 100°C in the presence of dripping using a 50 percent/50 percent uncertainty/variability partition ratio, the 50th uncertainty percentile, and the 0, 50th, and 100th variability percentile corrosion rates.

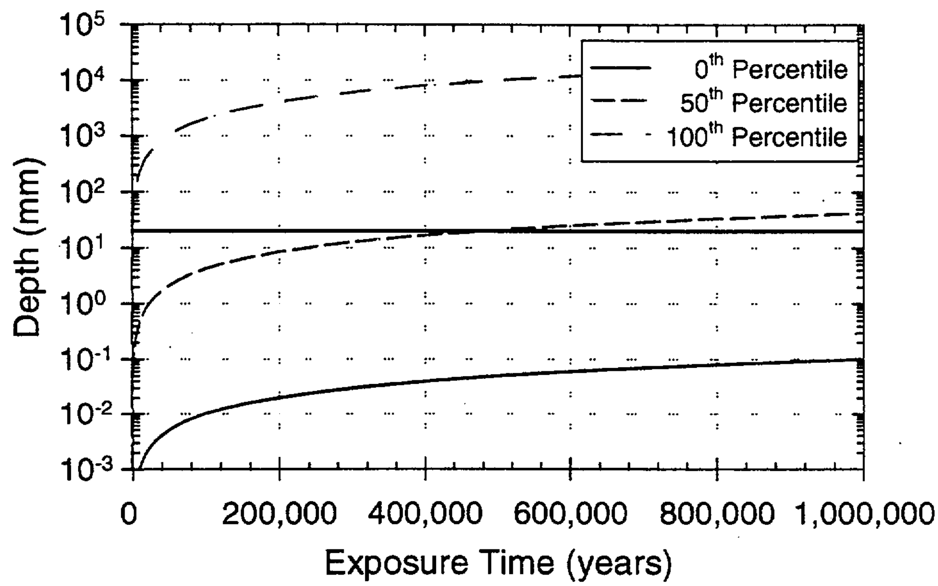

Figure 5-41. Alloy 22 CRM general corrosion depth variation with time up to 1,000,000 years at 100°C in the presence of dripping using a 50 percent/50 percent uncertainty/variability partition ratio, the 50th uncertainty percentile, and the 0, 50th, and 100th variability percentile corrosion rates.

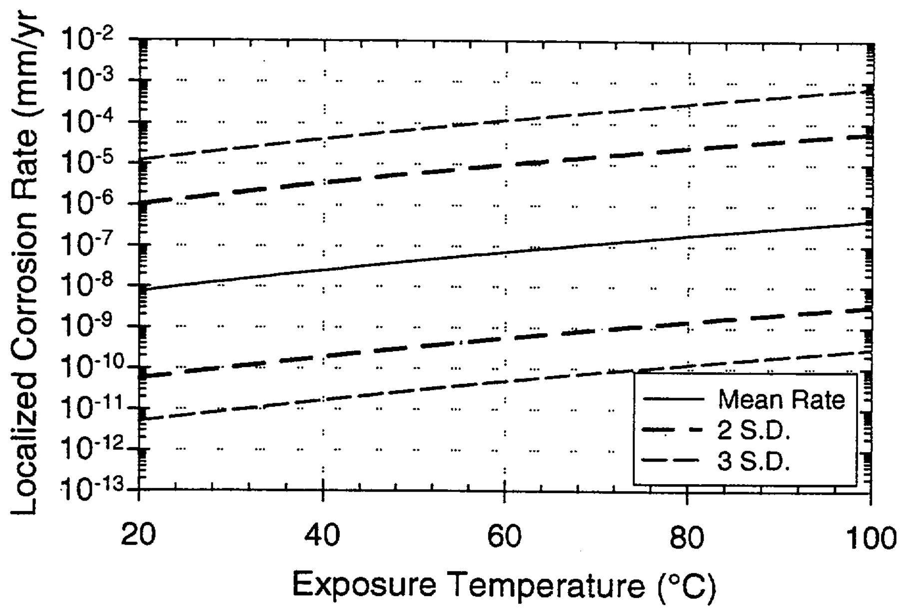

Figure 5-42. Localized corrosion rate of the inner barrier as a function of temperature predicted by the CRM localized corrosion model at 1,000 year exposure time. The mean of the model and 2 and 3 standard deviations of the mean are shown.

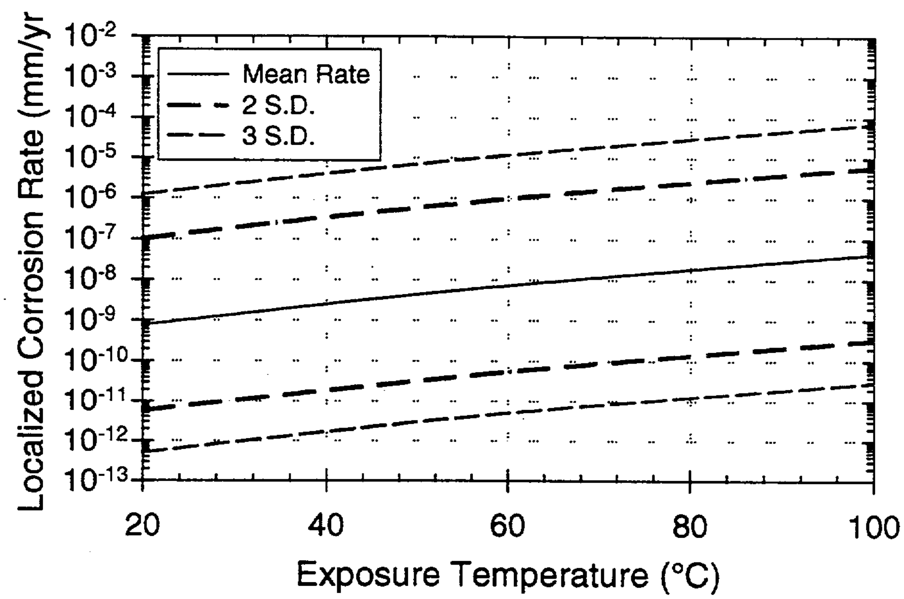

Figure 5-43. Localized corrosion rate of the inner barrier as a function of temperature predicted by the CRM localized corrosion model at 100,000 year exposure time. The mean of the model and 2 and 3 standard deviations of the mean are shown.

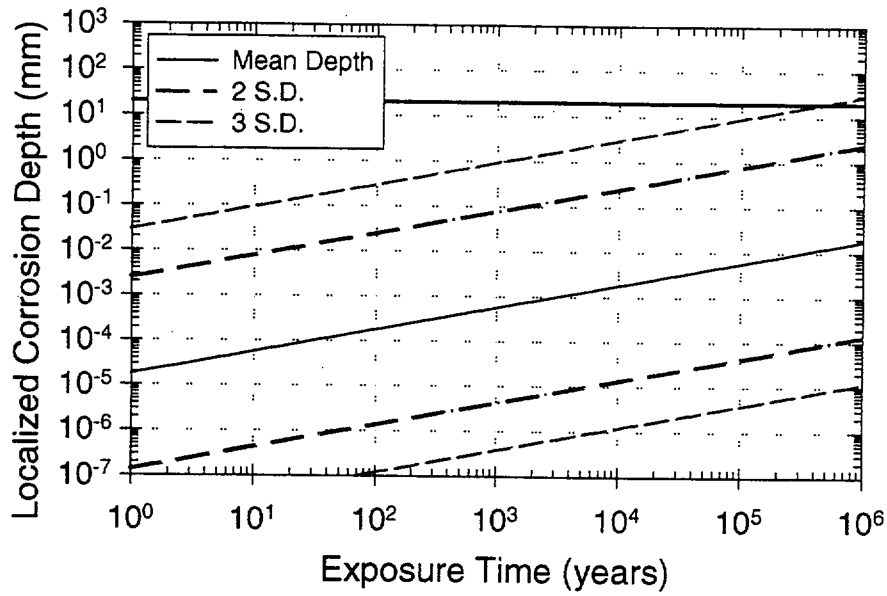

Figure 5-44. Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 90°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.

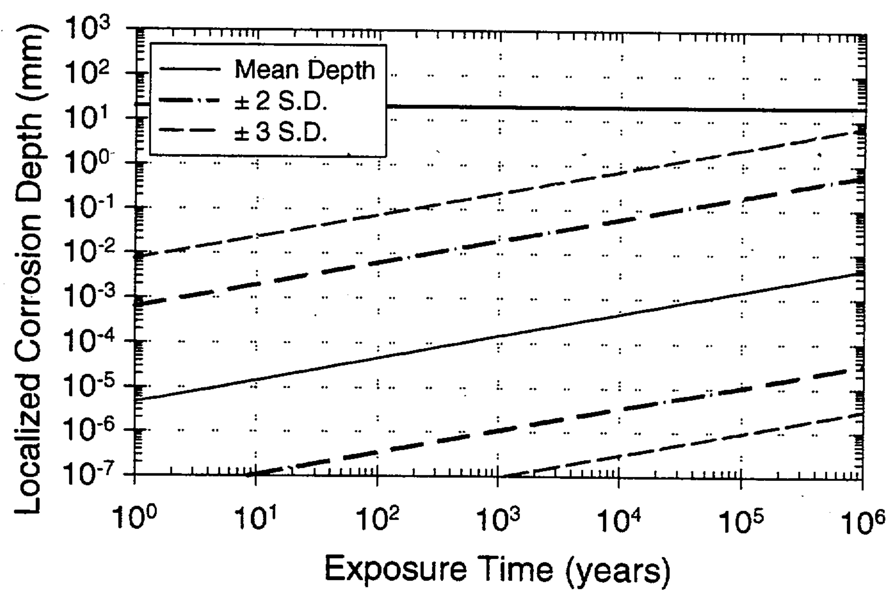

Figure 5-45. Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 60°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.

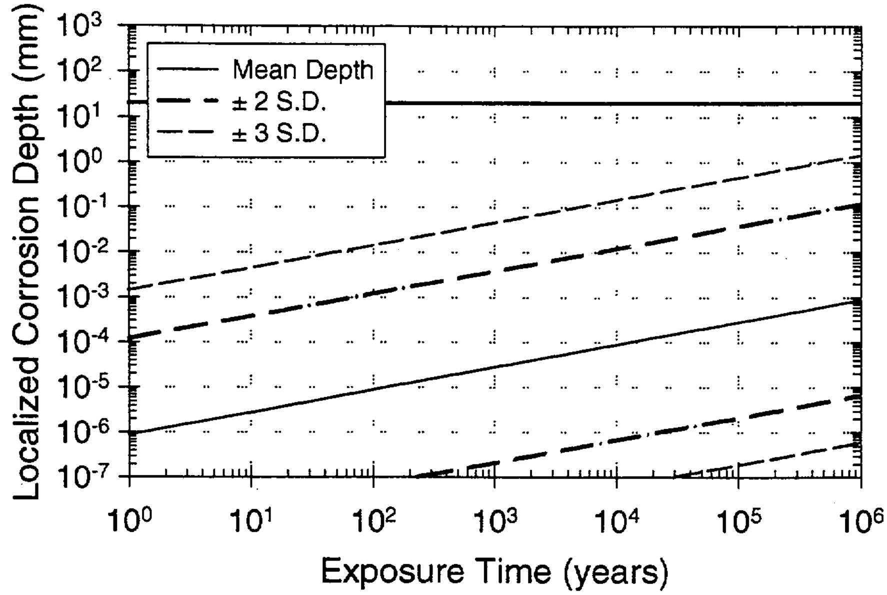

Figure 5-46. Localized corrosion depth of the inner barrier as a function of exposure time predicted by the CRM localized corrosion model at 30°C. The mean of the model and 2 and 3 standard deviations of the mean are shown.

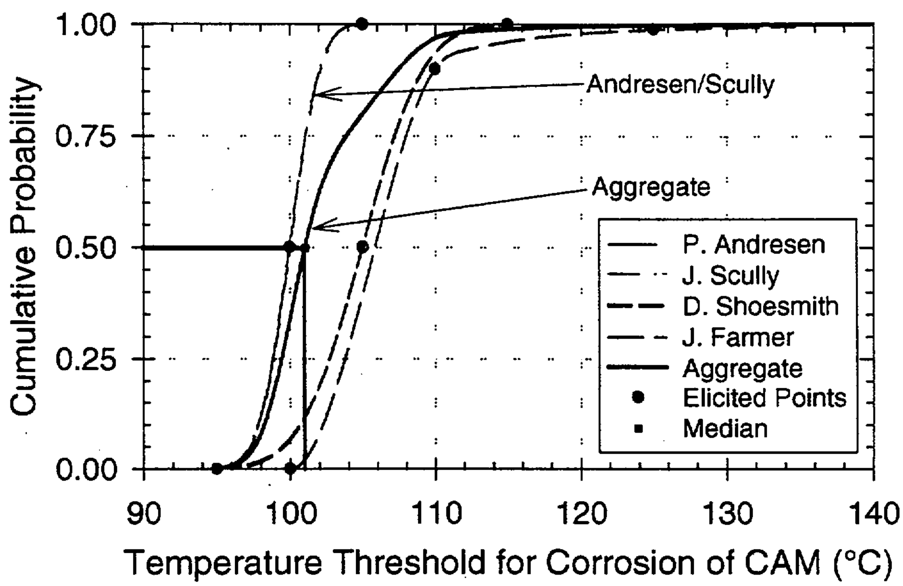

Figure 5-47. Cumulative Distribution Function for the temperature threshold for CAM corrosion initiation from the WPDEE (CRWMS M&O 1997e).

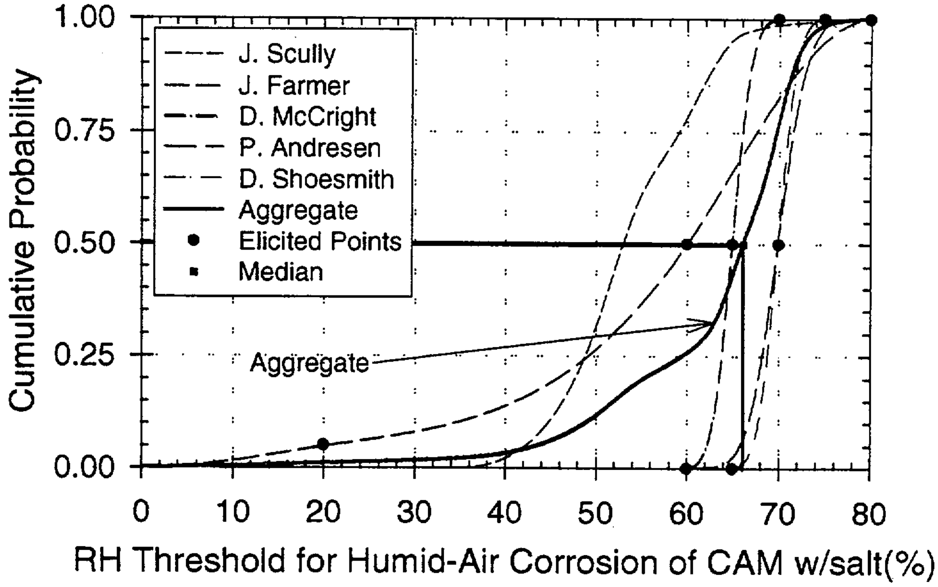

Figure 5-48. Cumulative Distribution Function for the relative humidity threshold for CAM humid air corrosion initiation including the effects of salts from the WPDEE (CRWMS M&O 1997e).

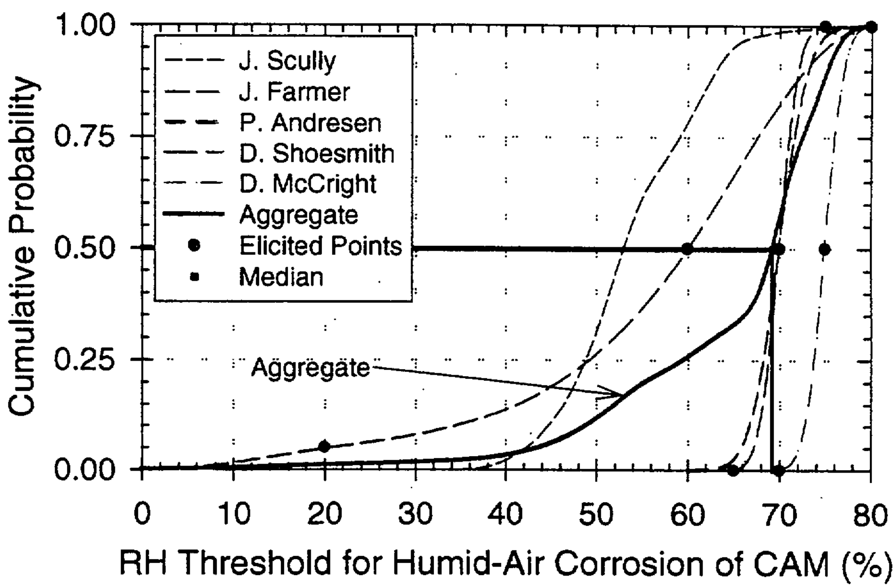

Figure 5-49. Cumulative Distribution Function for the relative humidity threshold for CAM humid air corrosion initiation from the WPDEE (CRWMS M&O 1997e).

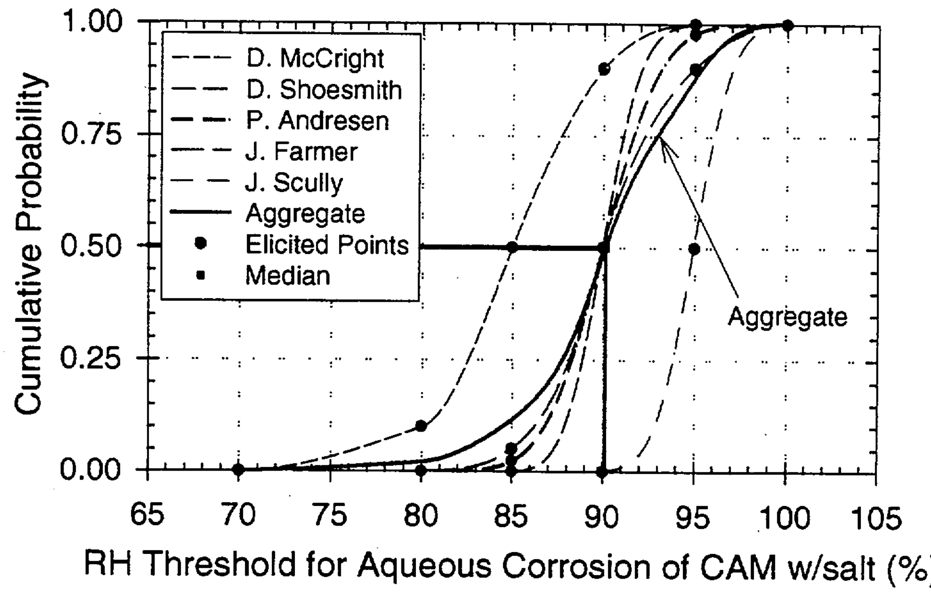

Figure 5-50. Cumulative Distribution Function for the relative humidity threshold for CAM aqueous corrosion initiation including the effects of salts from the WPDEE (CRWMS M&O 1997e).

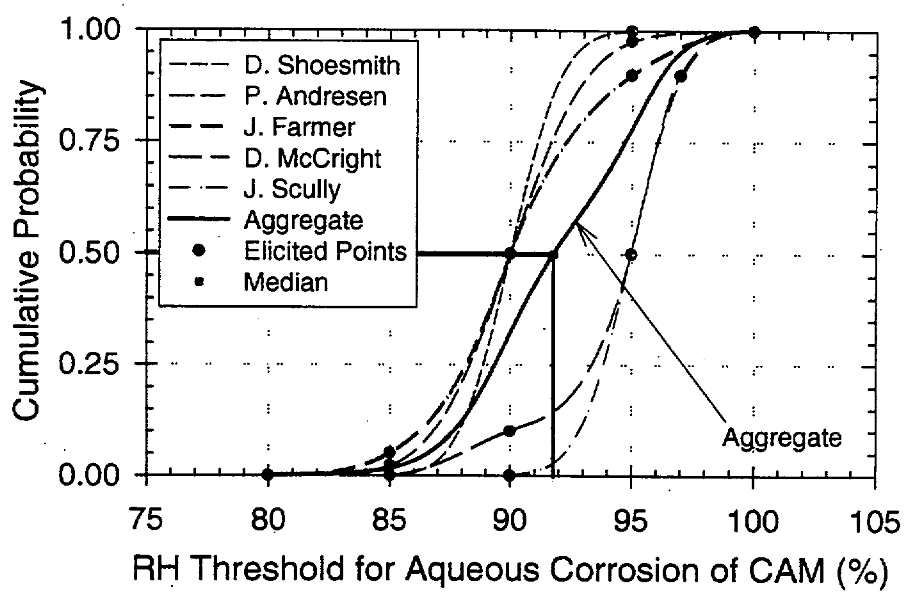

Figure 5-51. Cumulative Distribution Function for the relative humidity threshold for CAM aqueous corrosion initiation from the WPDEE (CRWMS M&O 1997e).

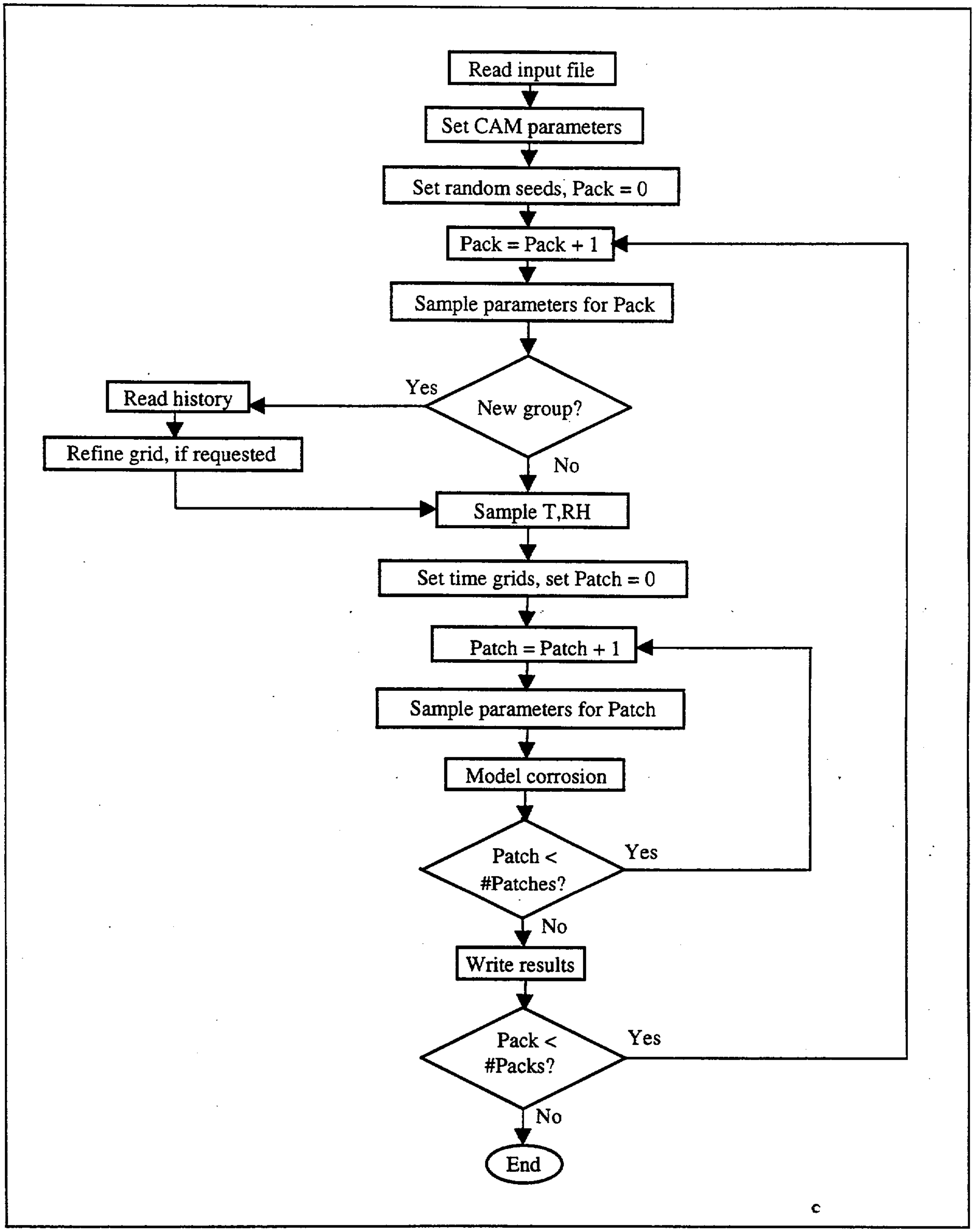

Figure 5-52. Main flow chart for WAPDEG.

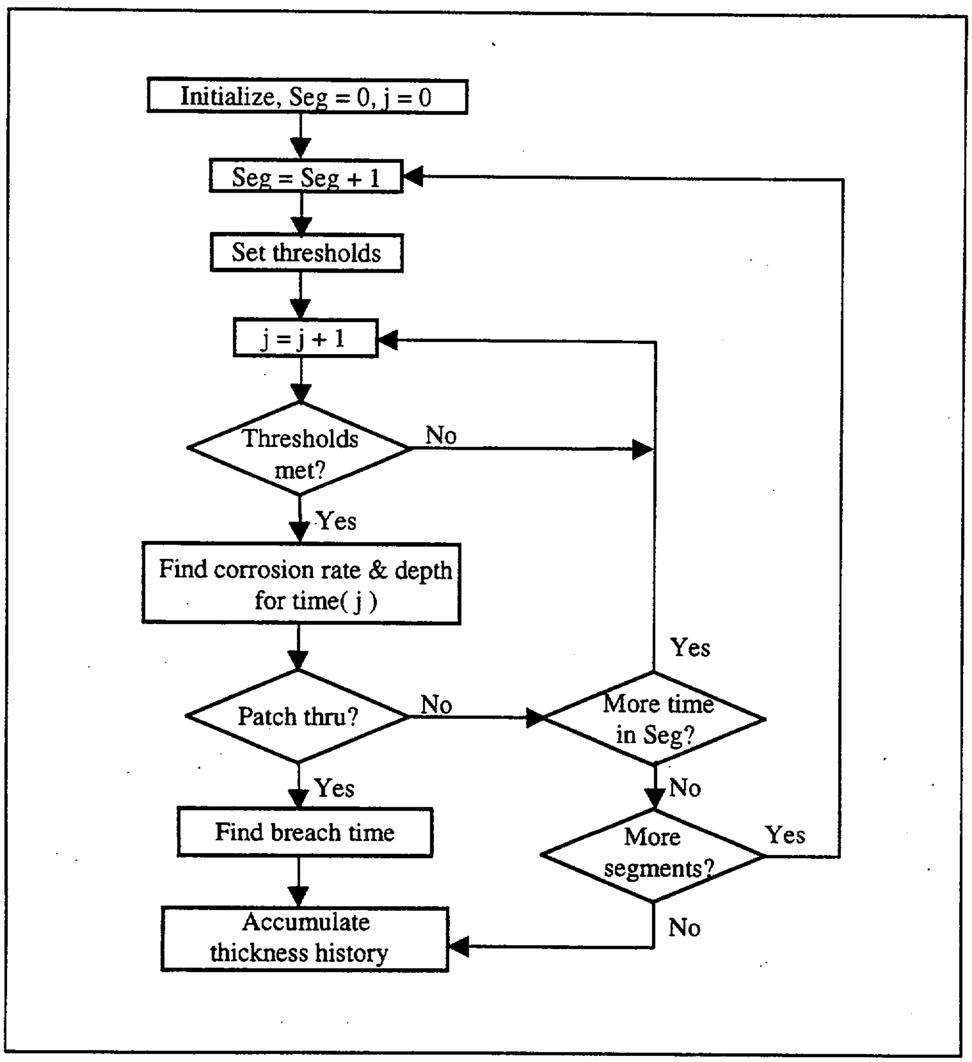

Figure 5-53. Flow chart for CAM General Corrosion Modeling.

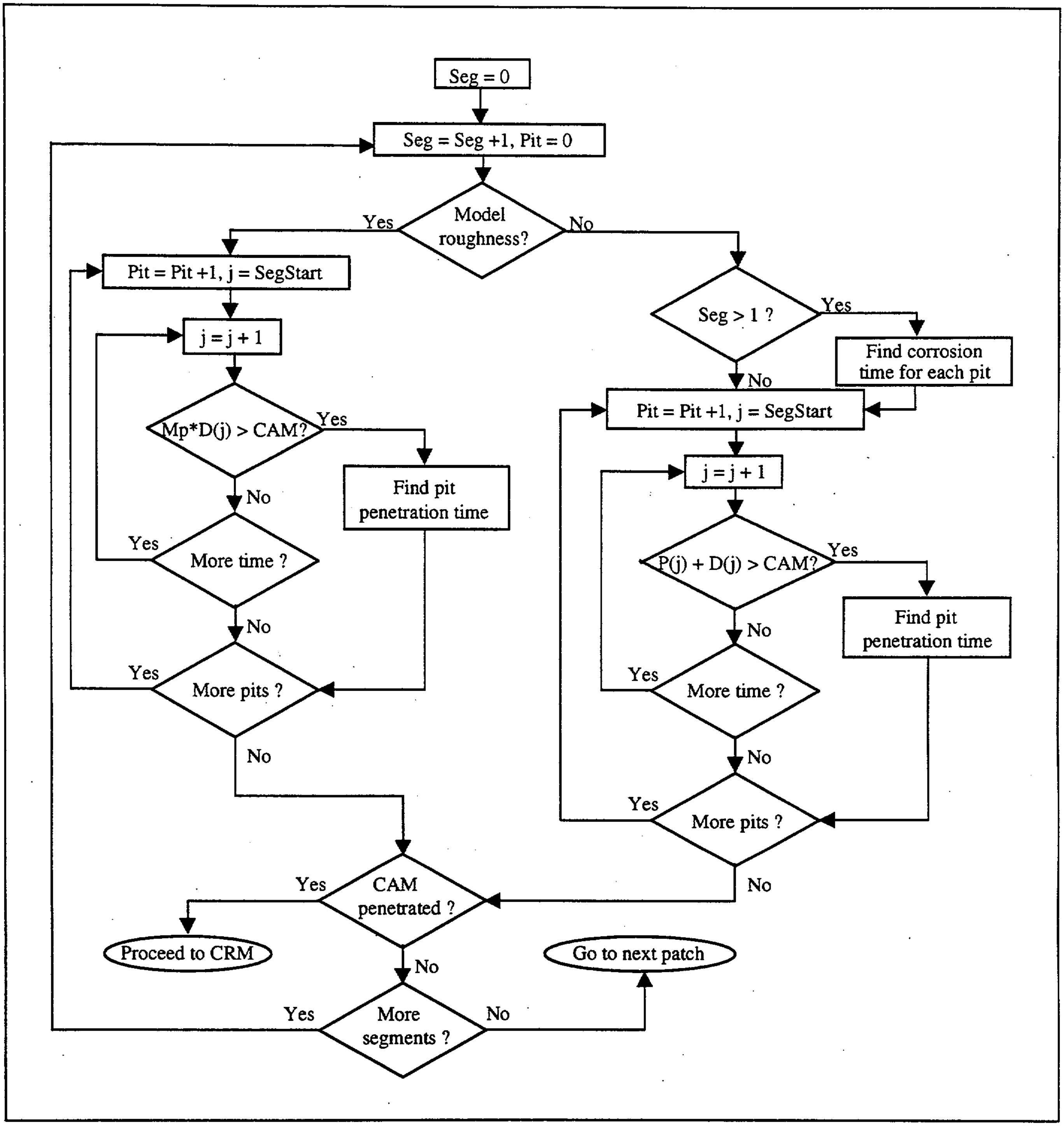

Figure 5-54. Flow chart for CAM Corrosion Modeling with roughness factor or high-aspect ratio pit growth law.

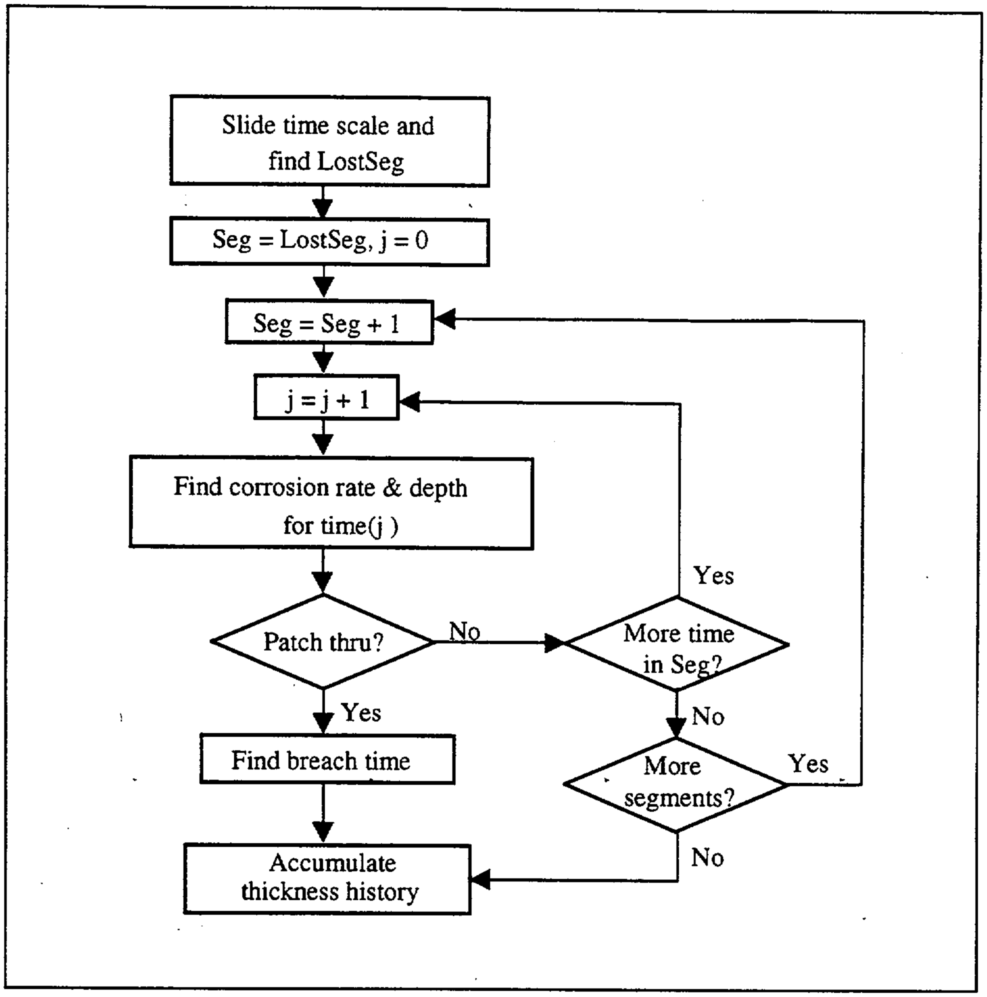

Figure 5-55. Flow chart for CRM General Corrosion Modeling.

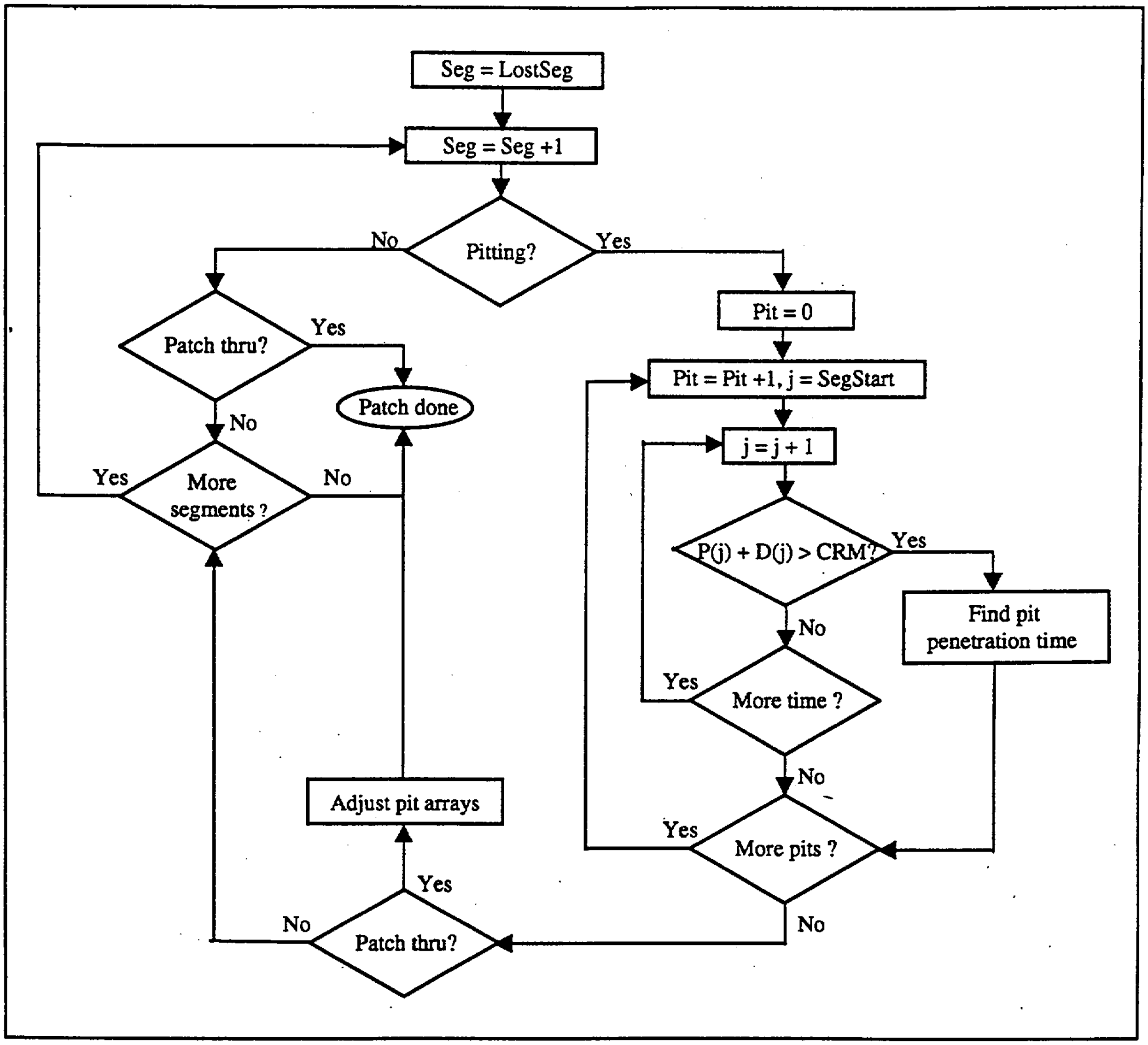

Figure 5-56. Flow chart for CRM Pitting Corrosion Modeling.

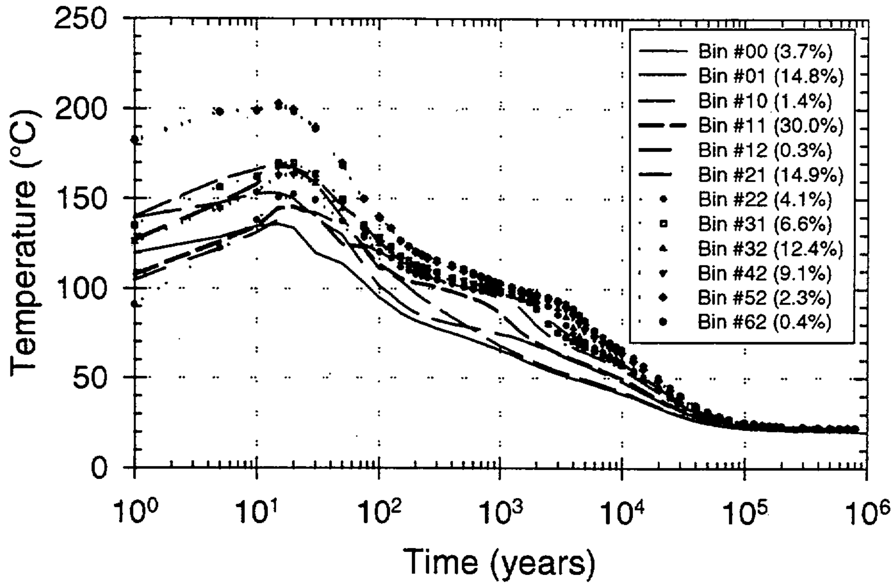

Figure 5-57. Temperature versus time history for waste package groups in the NE region, spent nuclear fuel, long-term average, nominal infiltration, α_{mean}, and no backfill.

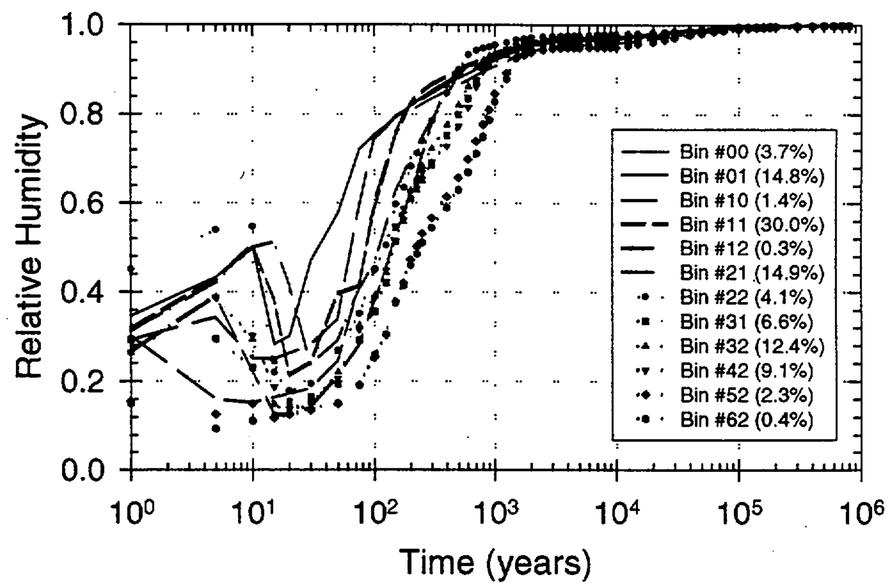

Figure 5-58. Relative humidity versus time history of waste package groups in the NE region, spent nuclear fuel, long-term average, nominal infiltration, α_{mean}, and no backfill.

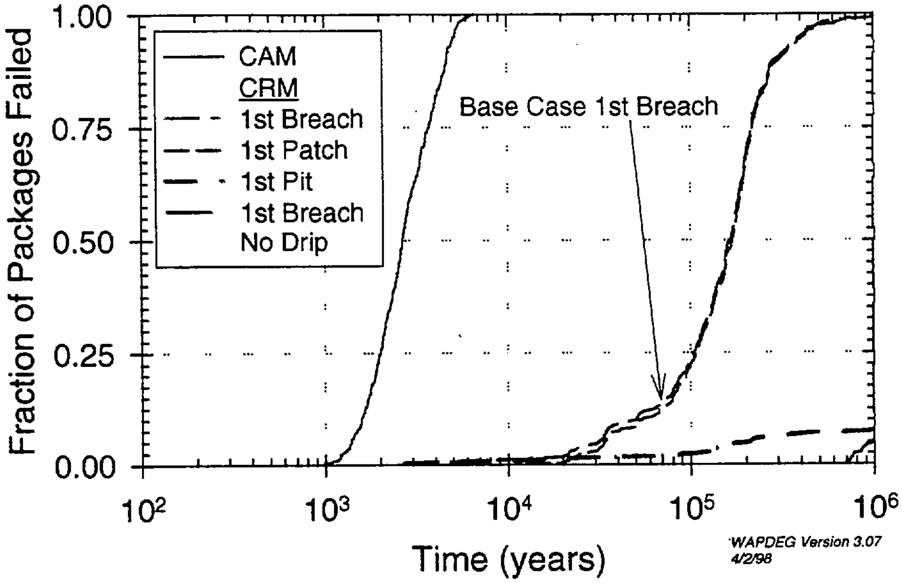

Figure 5-59. First breach, first pit-breach, and first patch-breach profiles of waste packages with time for the base case waste package degradation.

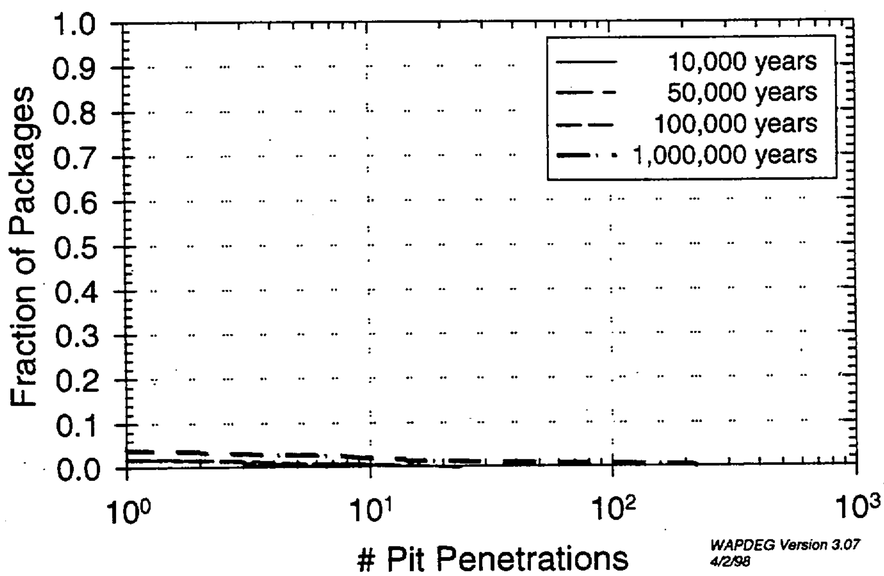

Figure 5-60. Number of pit perforations in waste packages at different times for the base case waste package degradation.

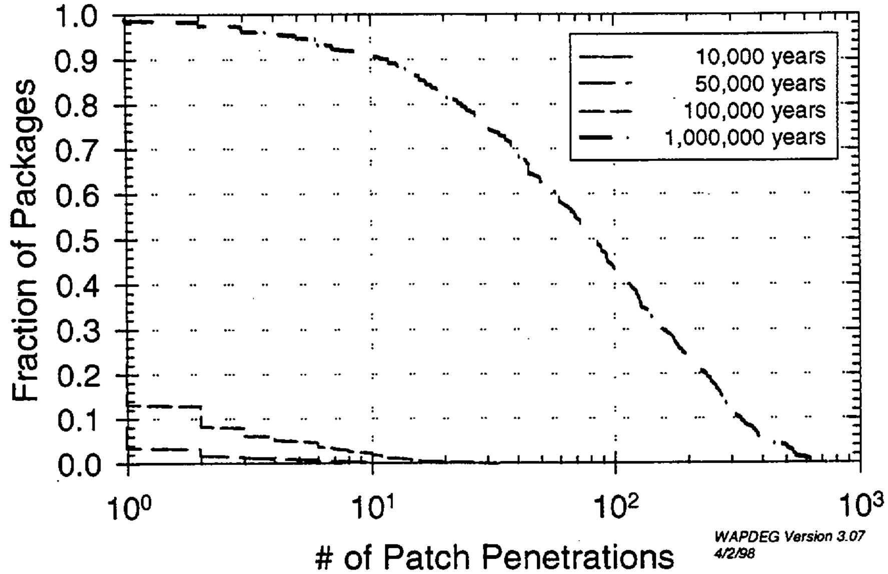

Figure 5-61. Number of patch perforations in waste packages for the base case waste package degradation.

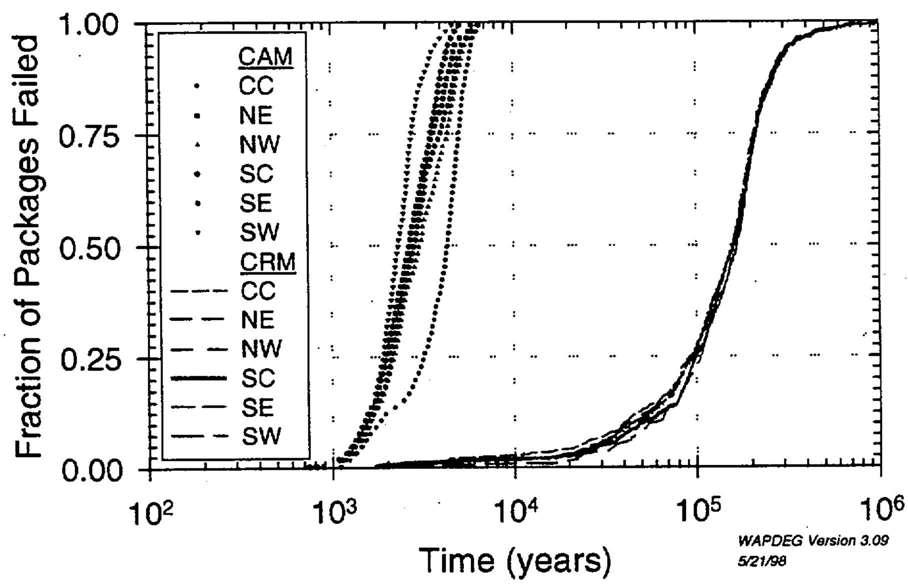

Figure 5-62. Sensitivity of the first breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in six different repository regions.

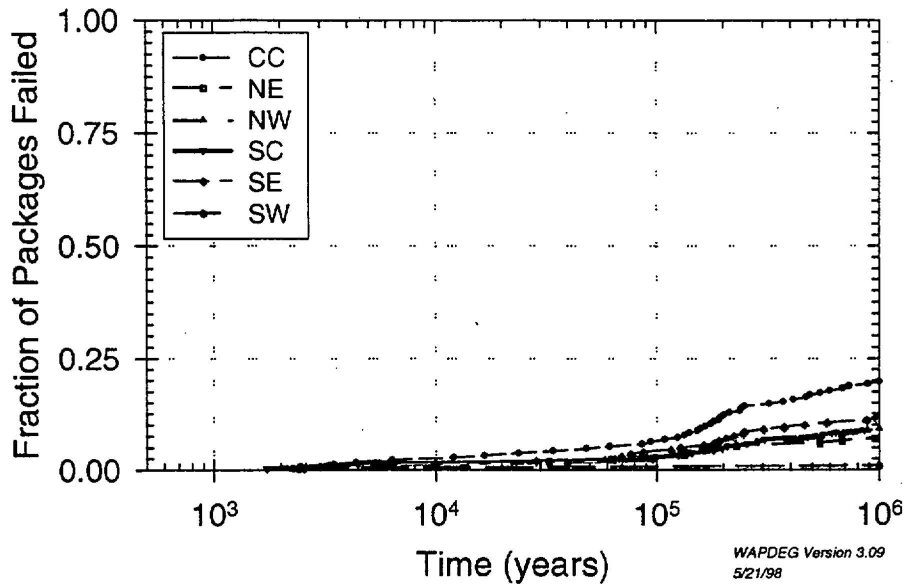

Figure 5-63. Sensitivity of the first pit-breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in six different repository regions.

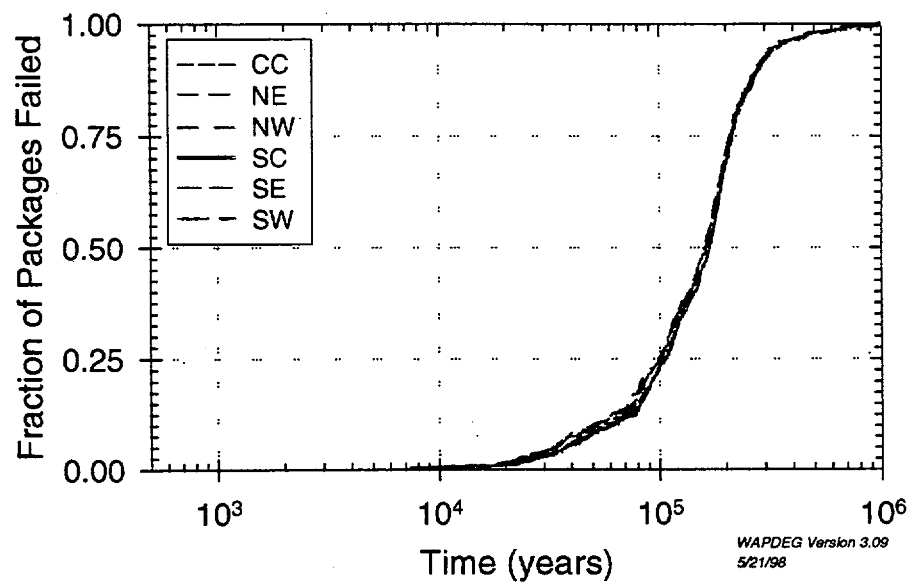

Figure 5-64. Sensitivity of the first patch-breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in six different repository regions.

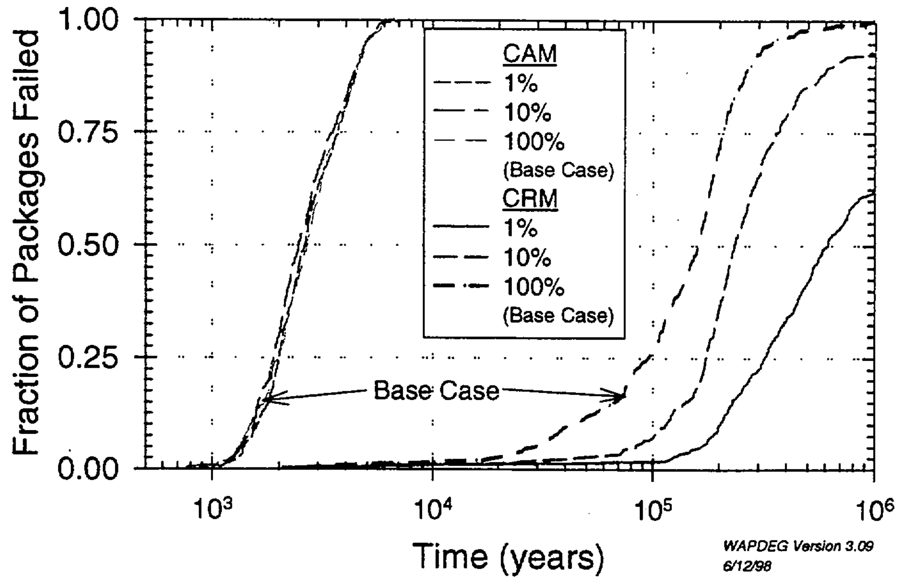

Figure 5-65. Sensitivity of the first breach profiles of waste packages with time to different surface fractions of the waste package surface wetted by drips.

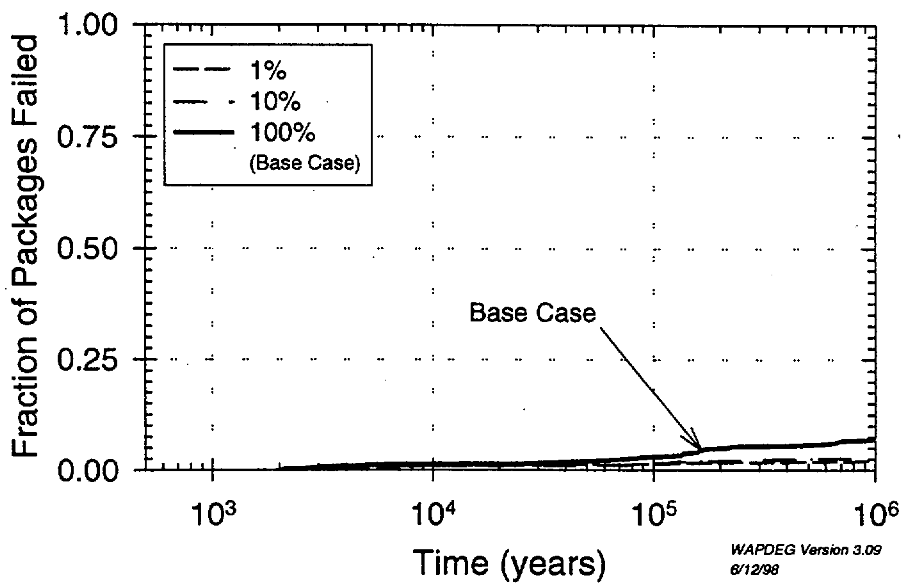

Figure 5-66. Sensitivity of the first pit-breach profiles of waste packages with time to different surface fractions of the waste package surface wetted by drips.

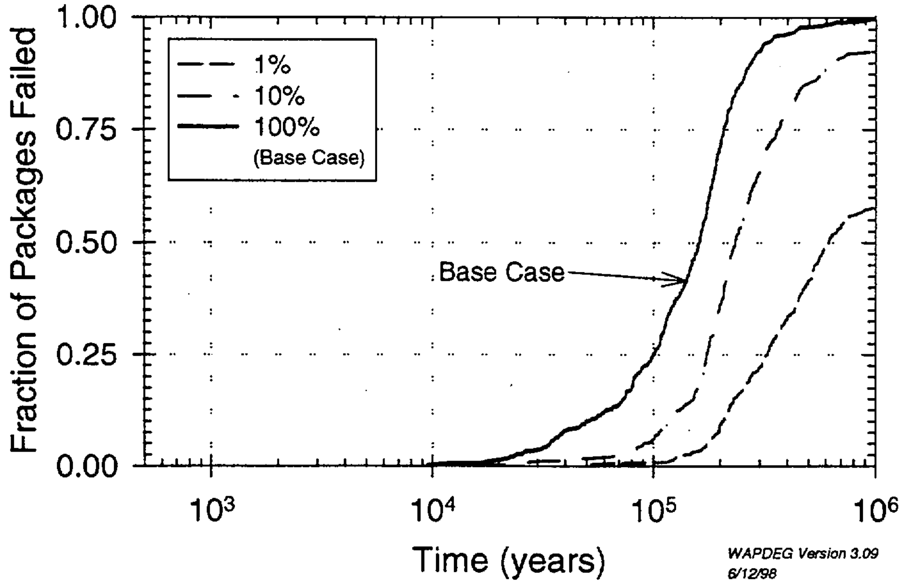

Figure 5-67. Sensitivity of the first patch-breach profiles of waste packages with time to different surface fractions of the waste package surface wetted by drips.

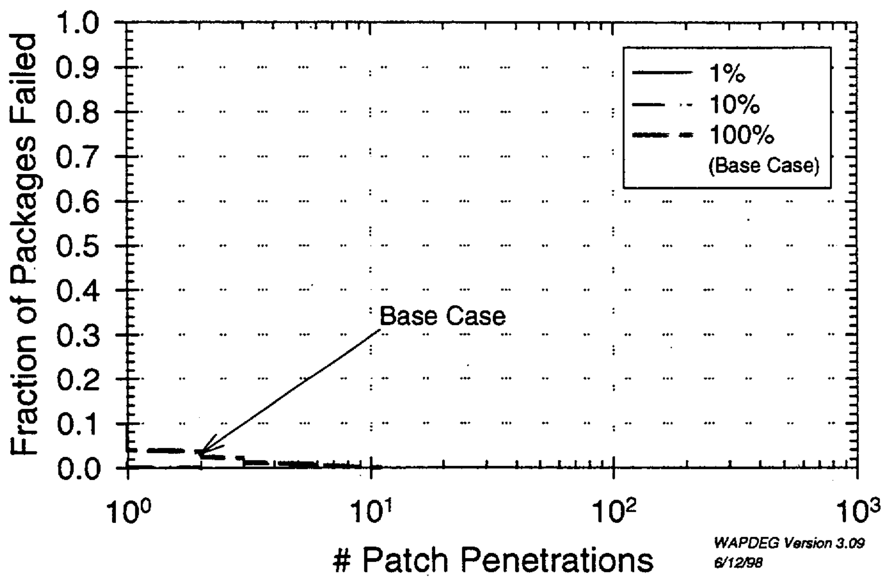

Figure 5-68. Sensitivity of the number of patch perforations in waste packages at 50,000 years to different surface fractions of the waste package surface wetted by drips.

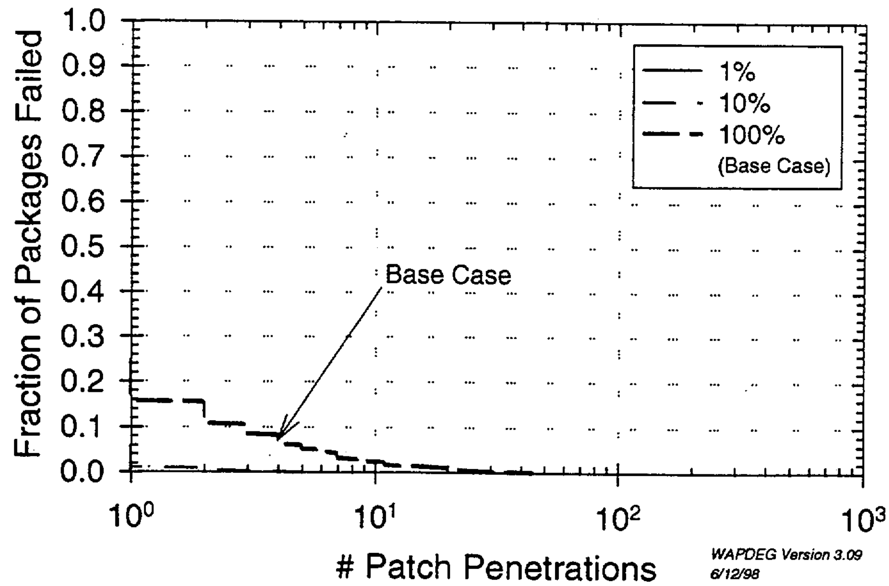

Figure 5-69. Sensitivity of the number of patch perforations in waste packages at 100,000 years to different surface fractions of the waste package surface wetted by drips.

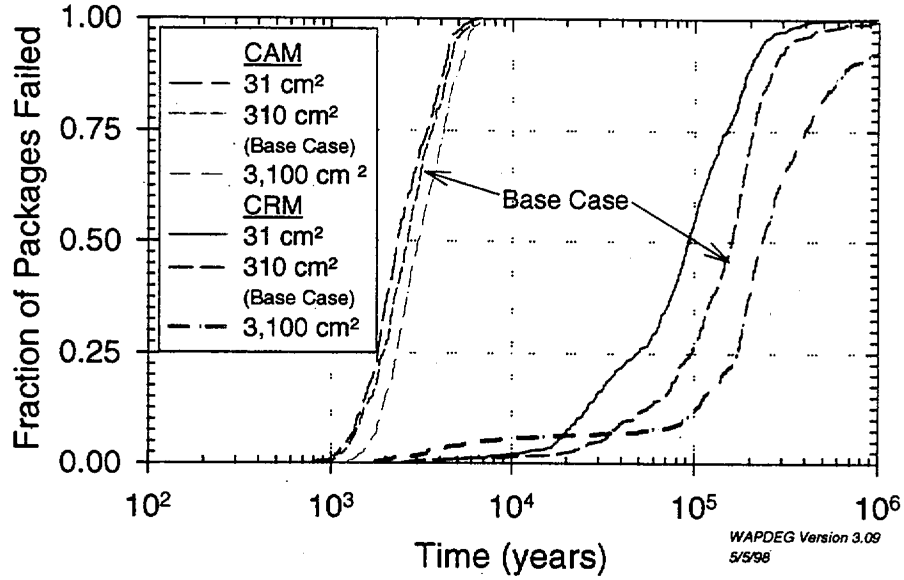

Figure 5-70. Sensitivity of the first breach profiles of waste packages with time to different patch sizes.

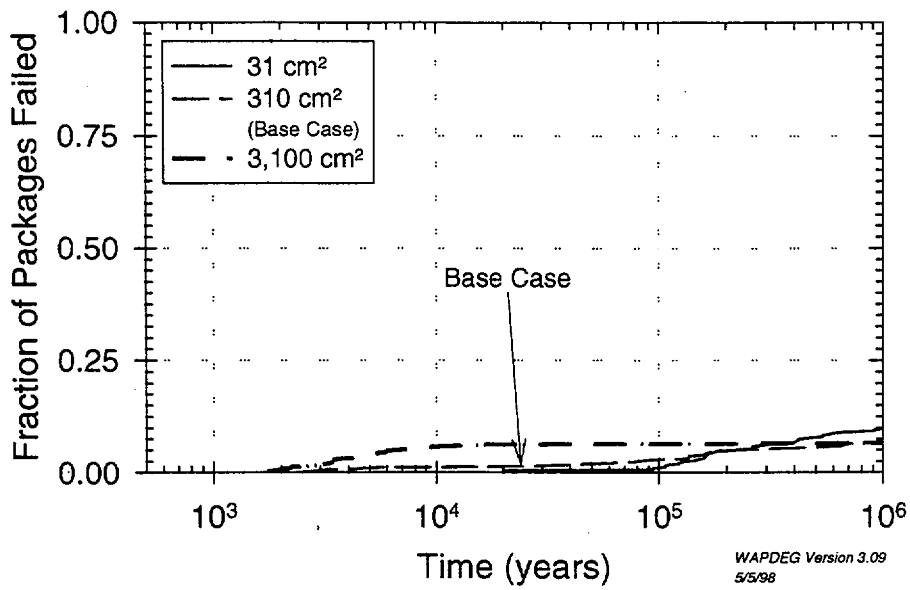

Figure 5-71. Sensitivity of the first pit-breach profiles of waste packages with time to different patch sizes.

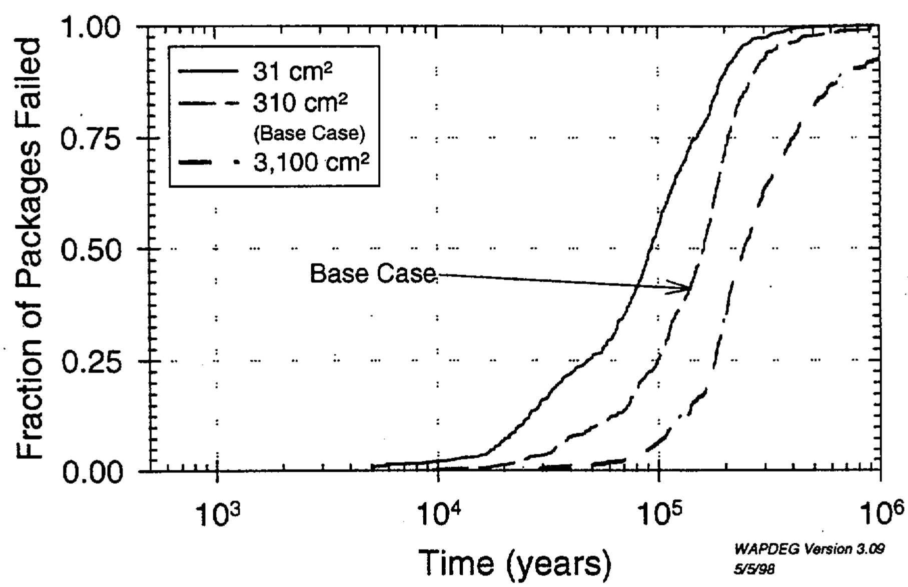

Figure 5-72. Sensitivity of the first patch-breach profiles of waste packages with time to different patch sizes.

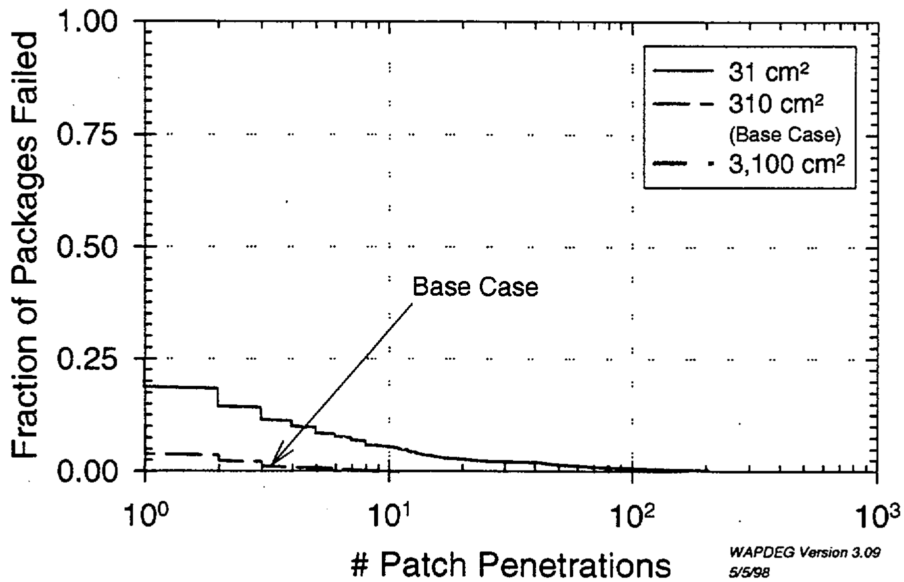

Figure 5-73. Sensitivity of the number of patch perforations at 50,000 years in waste packages to different patch sizes.

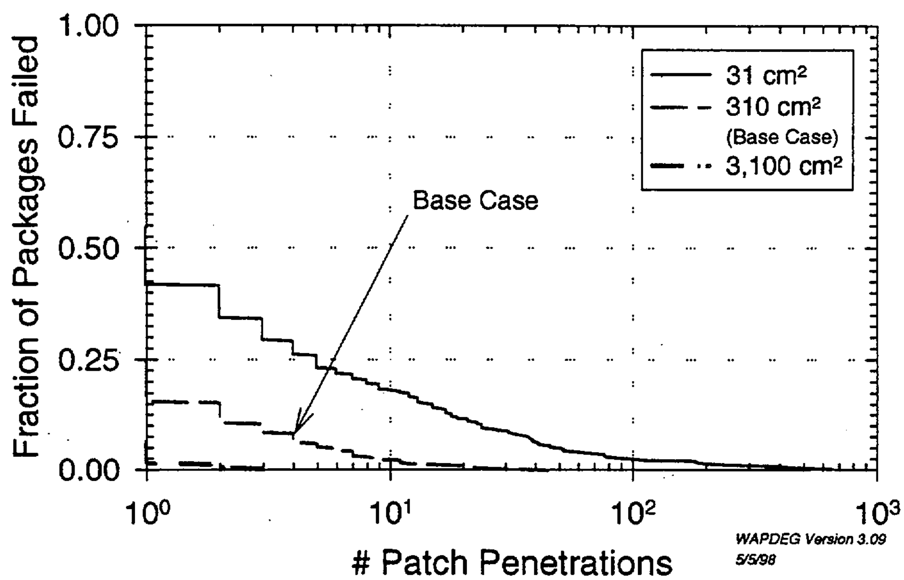

Figure 5-74. Sensitivity of the number of patch perforations at 100,000 years in waste packages to different patch sizes.

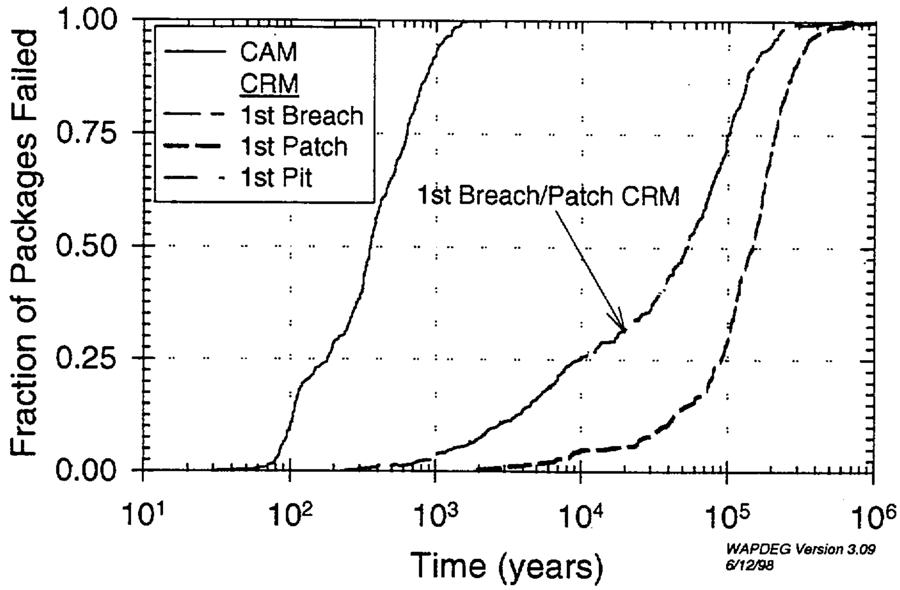

Figure 5-75. Sensitivity of the first breach, first pit-breach, and first patch-breach profiles of waste packages with time to high-aspect ratio pitting corrosion of the CAM under alkaline dripping condition (pH≥10) for the first 10,000 years after emplacement.

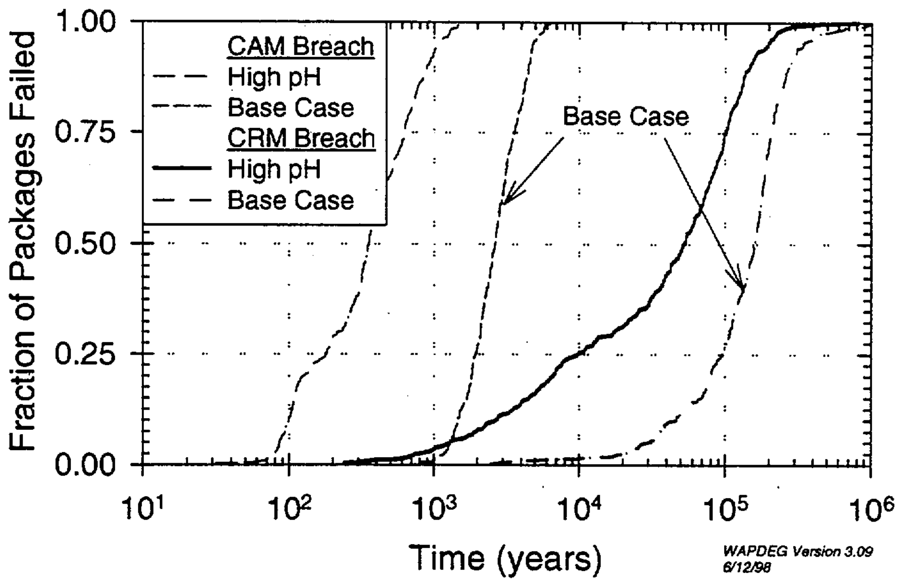

Figure 5-76. Sensitivity of the first breach, first pit-breach, and first patch-breach profiles of waste packages with time to high-aspect ratio pitting corrosion of the CAM under alkaline dripping condition (pH > 10) for the first 10,000 years after emplacement.

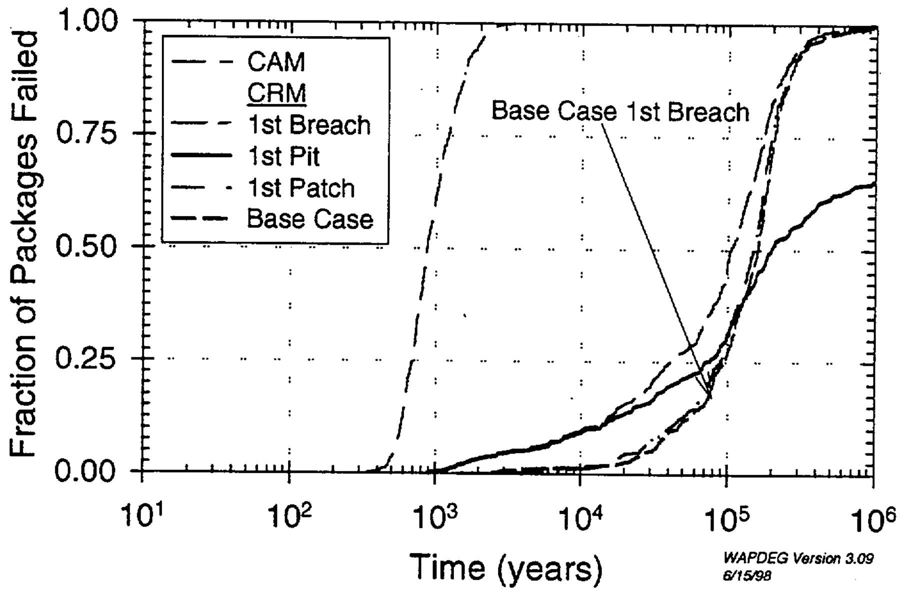

Figure 5-77. Sensitivity of the first breach, first pit-breach, and first patch-breach profiles of waste packages with time to enhanced general corrosion rates of the CAM under an assumed condition of sustained microbiologically influenced corrosion.

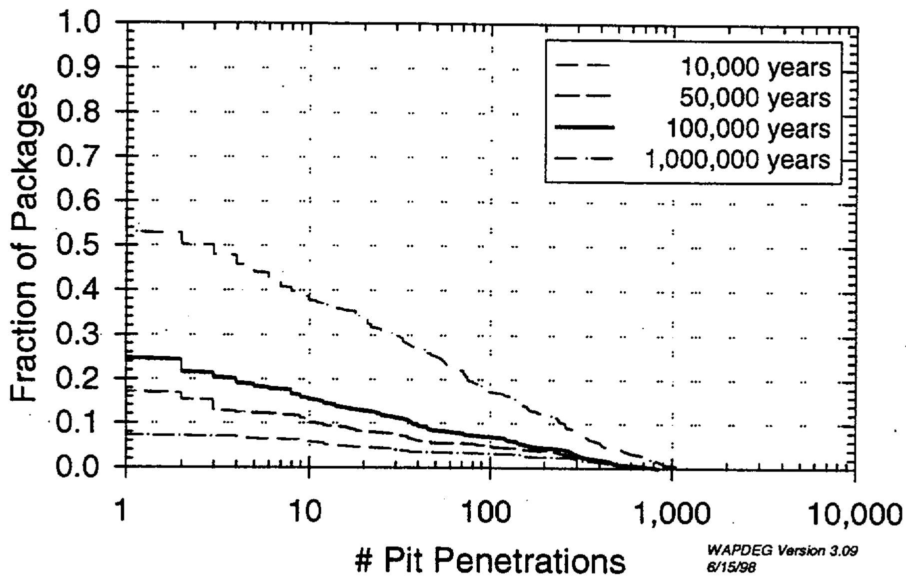

Figure 5-78. Sensitivity of the number of pit perforations at different times in waste packages to enhanced general corrosion rates of the CAM under an assumed condition of sustained microbiologically influenced corrosion.

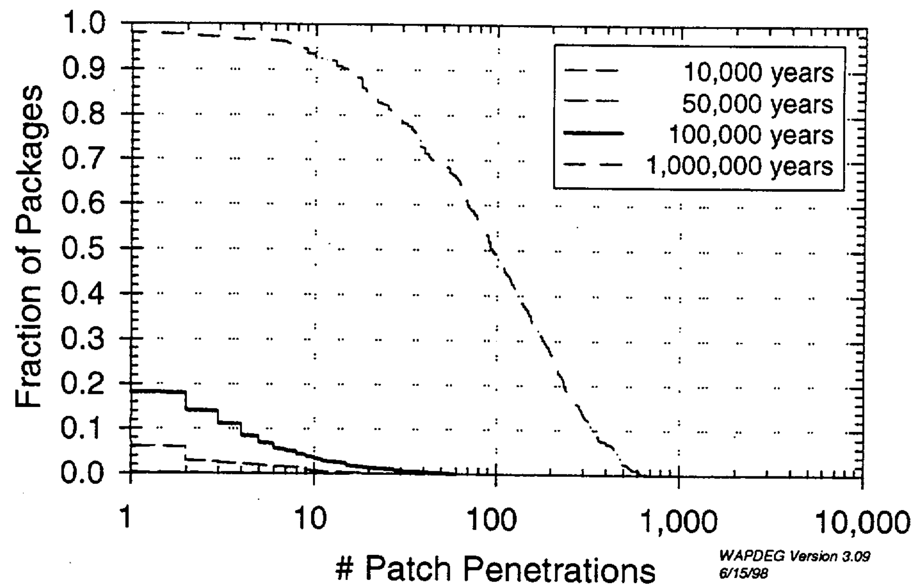

Figure 5-79. Sensitivity of the number of patch perforations at different times in waste packages to enhanced general corrosion rates of the CAM under an assumed condition of sustained microbiologically influenced corrosion.

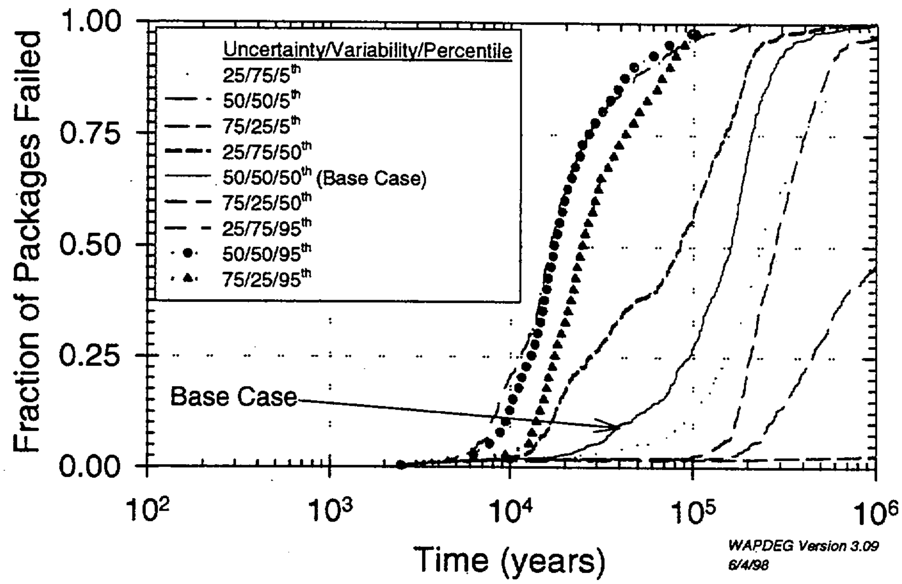

Figure 5-80. Sensitivity of the first breach profiles of waste packages with time to alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates.

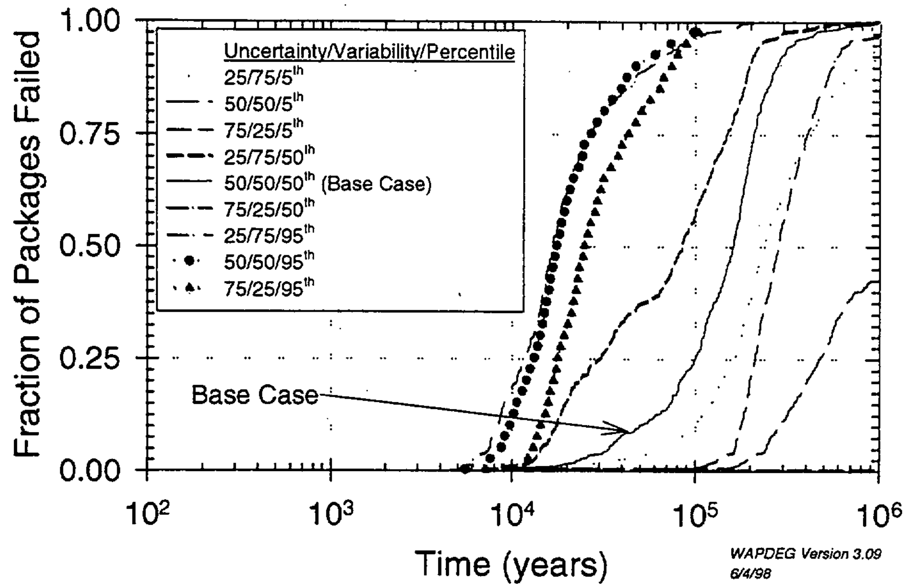

Figure 5-81. Sensitivity of the first patch-breach profiles of waste packages with time to alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates.

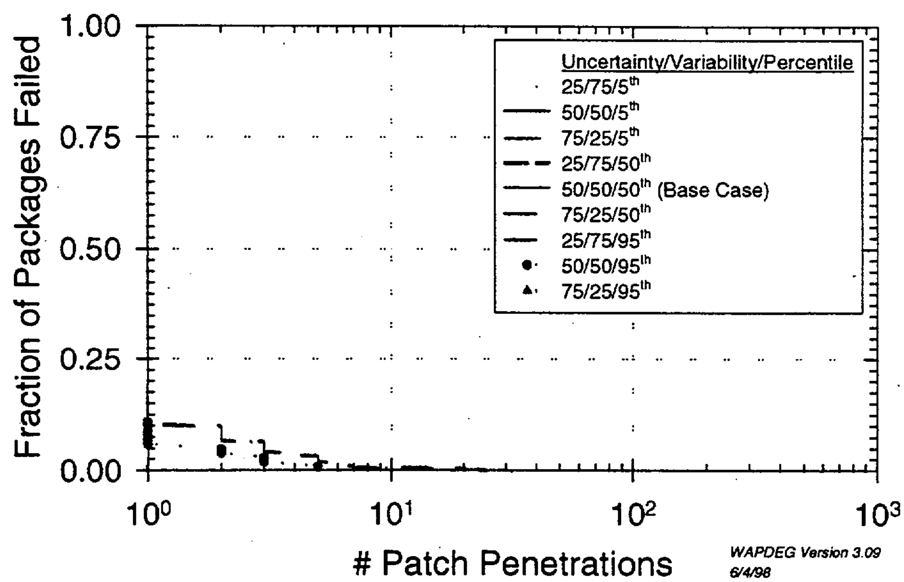

Figure 5-82. Sensitivity of the number of patch perforations in waste packages at 10,000 years to alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates.

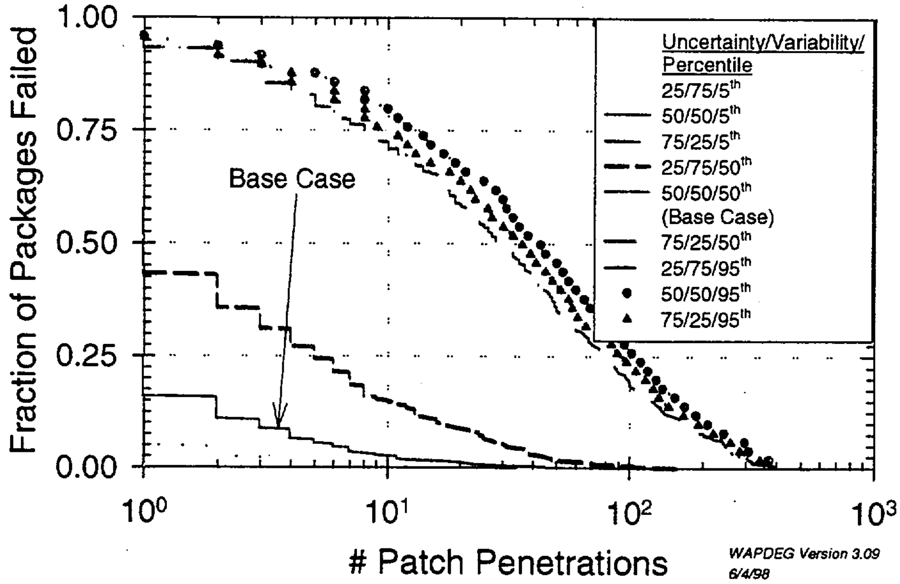

Figure 5-83. Sensitivity of the number of patch perforations in waste packages at 100,000 years to alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates.

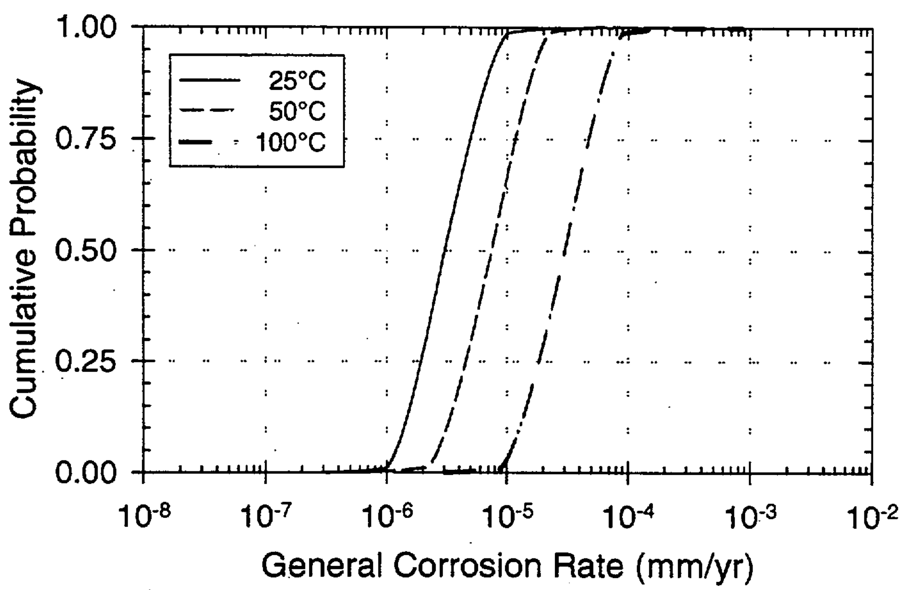

Figure 5-84. Cumulative distribution functions for the composite CRM general corrosion rates with drips at three temperatures, provided by Peter Andresen.

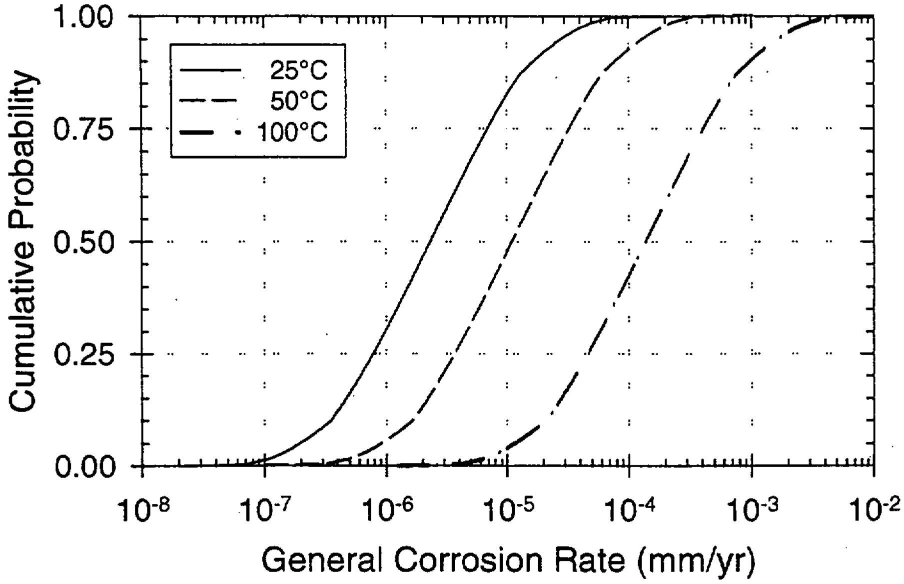

Figure 5-85. Cumulative distribution functions for the composite CRM general corrosion rates with drips at three temperatures, provided by Joseph Farmer.

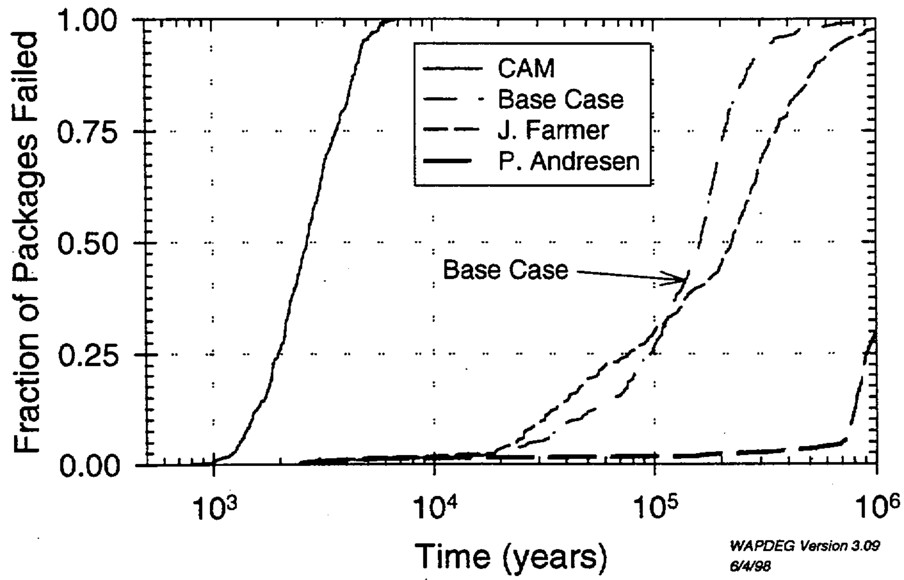

Figure 5-86. Sensitivity of the first breach profiles of waste packages with time to two end members of the expert elicitation for CRM general corrosion rate distribution under dripping condition.

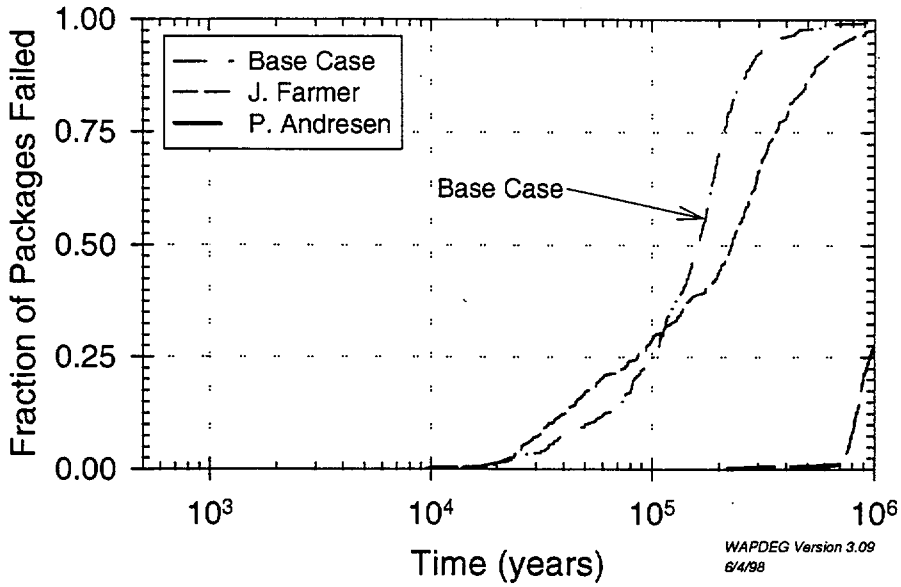

Figure 5-87. Sensitivity of the first patch-breach profiles of waste packages with time to two end members of the expert elicitation for CRM general corrosion rate distribution under dripping condition.

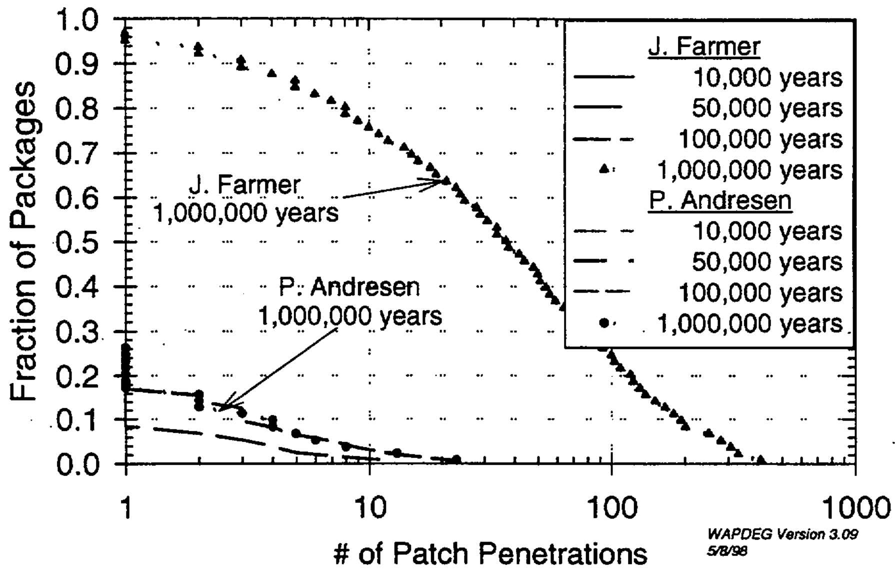

Figure 5-88. Sensitivity of the number of patch perforations in waste packages to two end members of the expert elicitation for CRM general corrosion rate distribution under dripping condition.

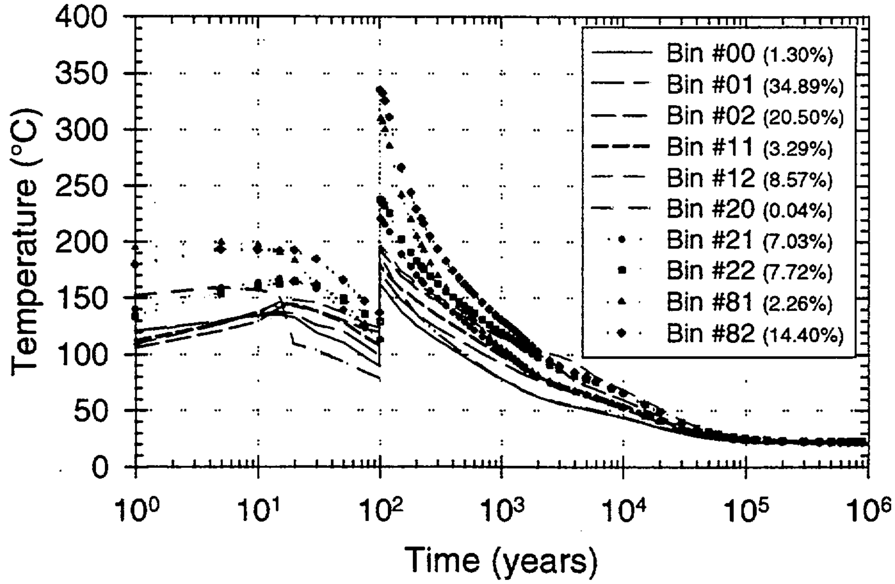

Figure 5-89. Temperature profiles of different waste package groups in the NE region in the presence of backfill emplaced at 100 years after waste emplacement.

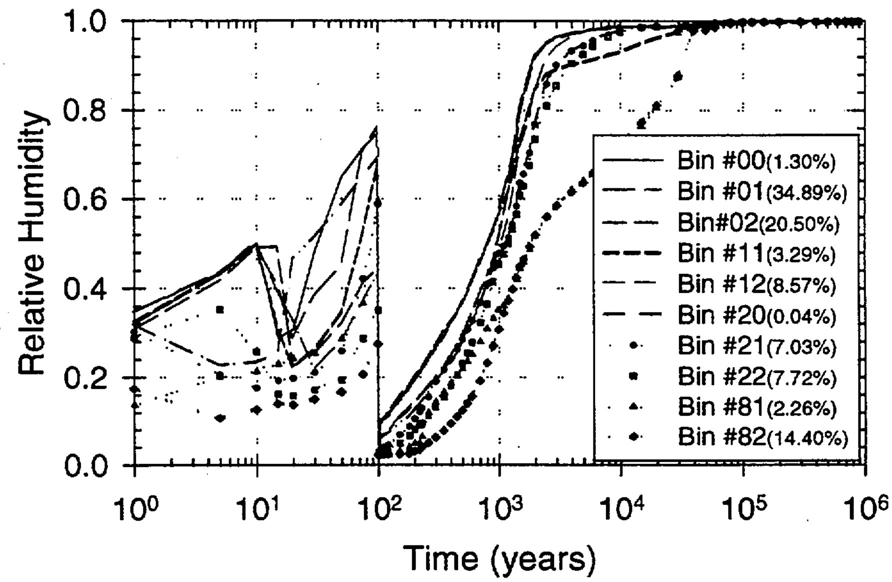

Figure 5-90. Relative humidity profiles of different waste package groups in the NE region in the presence of backfill emplaced at 100 years after waste emplacement.

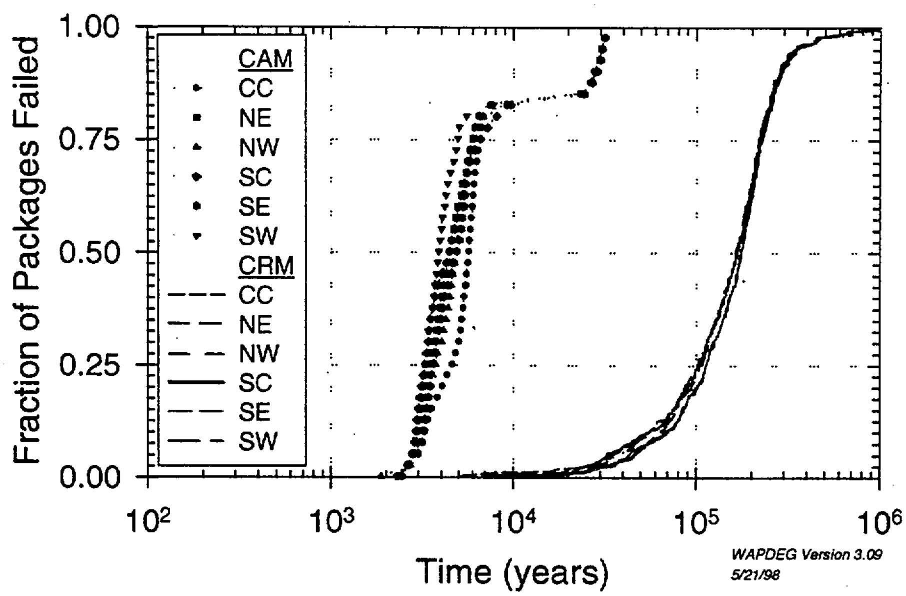

Figure 5-91. Sensitivity of the first breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in the presence of backfill in six different repository regions.

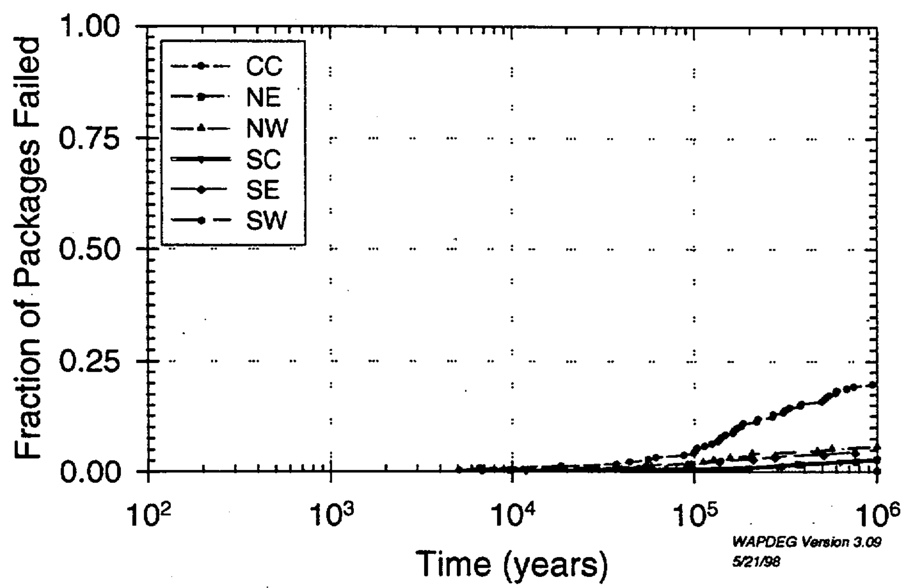

Figure 5-92. Sensitivity of the first pit-breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in the presence of backfill in six different repository regions.

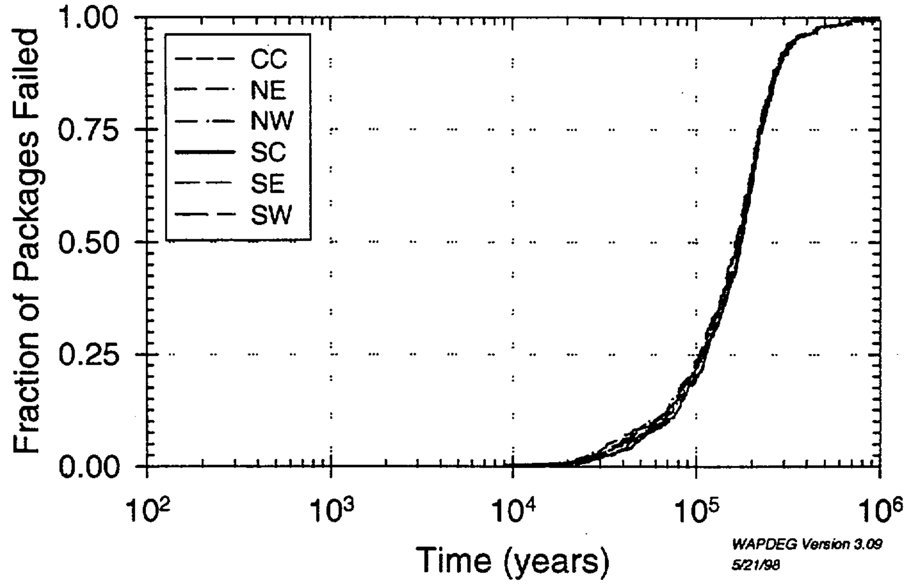

Figure 5-93. Sensitivity of the first patch-breach profiles of waste packages with time to different relative humidity and temperature conditions at the waste package surface in the presence of backfill in six different repository regions.

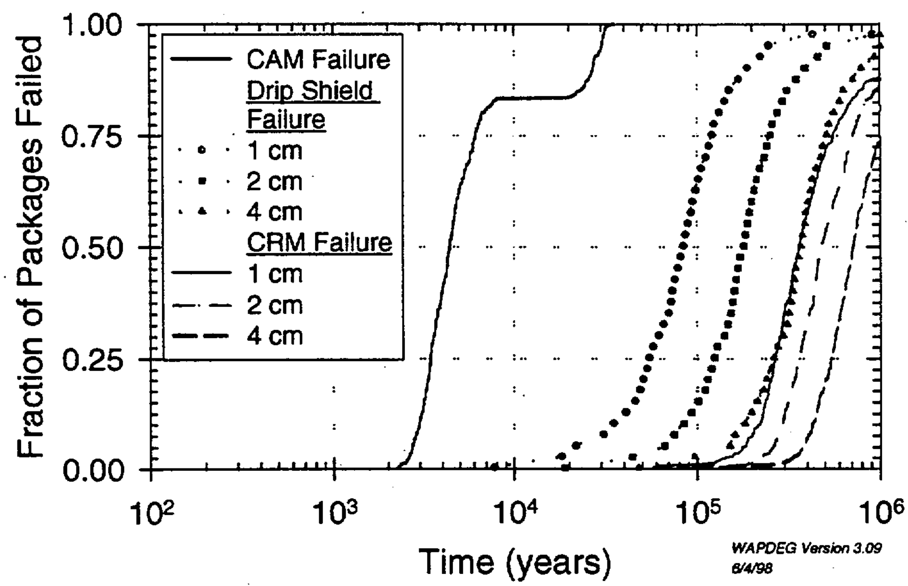

Figure 5-94. Sensitivity of the first breach profiles of waste packages with time to the varying drip shield thickness.

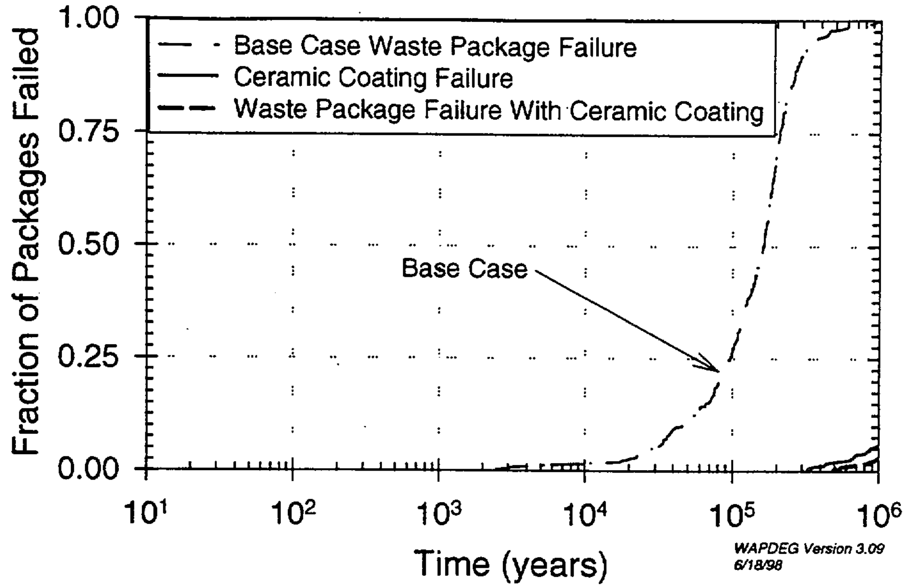

Figure 5-95. Profile of waste packages with the ceramic coating breach and the first breach of waste packages with time.

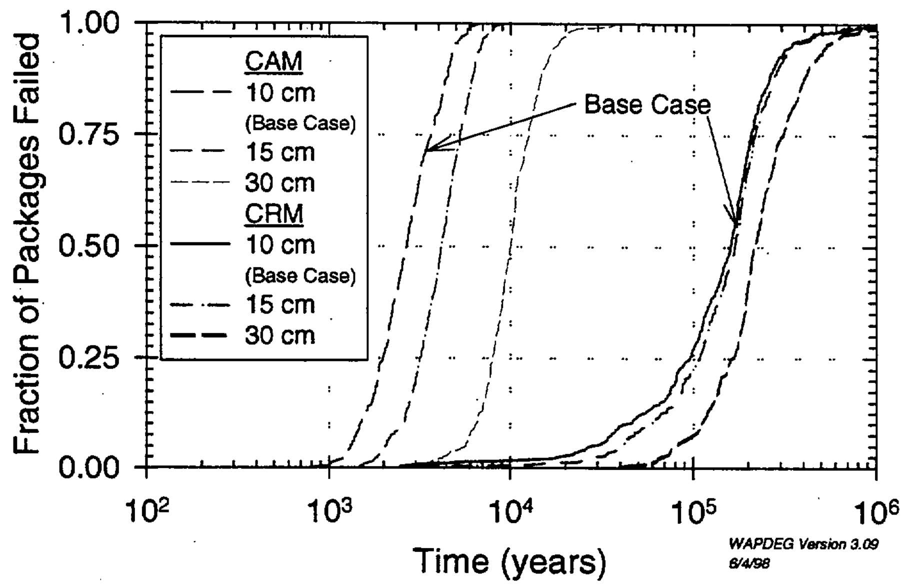

Figure 5-96. Sensitivity of the first breach profiles of waste packages with time to the varying CAM thickness.

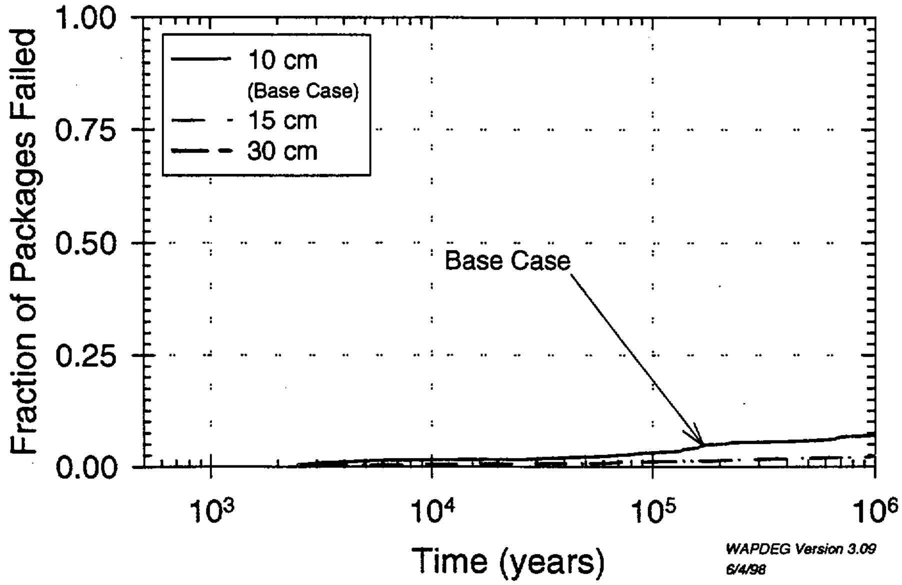

Figure 5-97. Sensitivity of the first pit-breach profiles of waste packages with time to the varying CAM thickness.

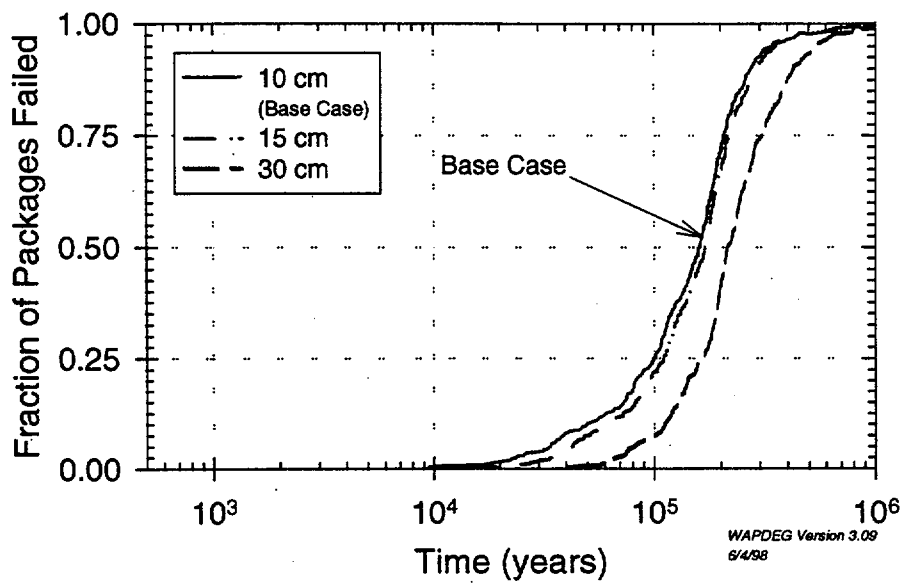

Figure 5-98. Sensitivity of the first patch-breach profiles of waste packages with time to the varying CAM thickness.

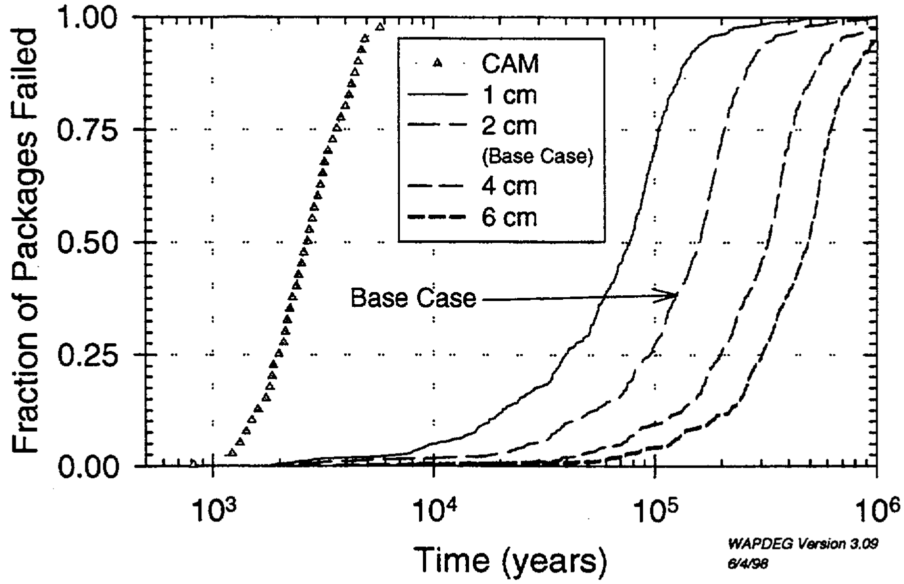

Figure 5-99. Sensitivity of the first breach profiles of waste packages with time to the varying CRM thickness.

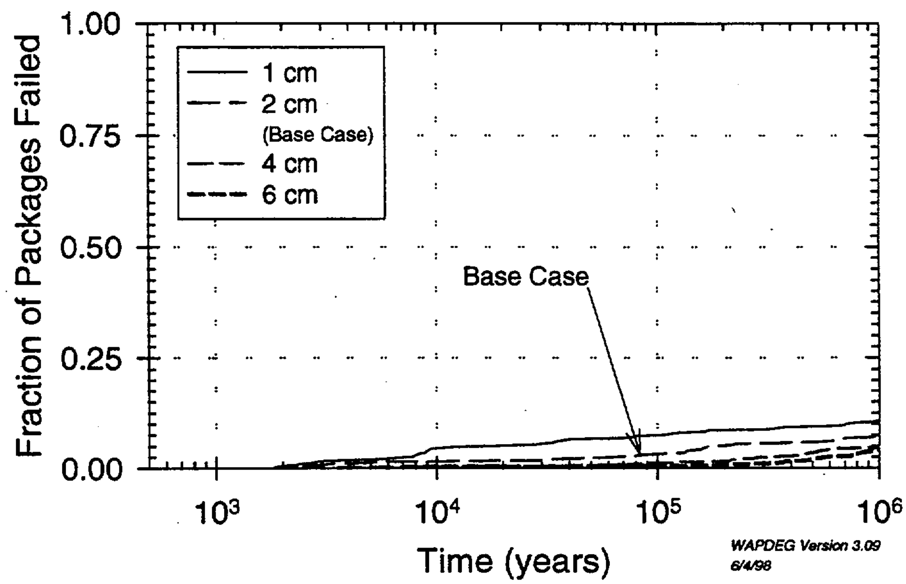

Figure 5-100. Sensitivity of the first pit-breach profiles of waste packages with time to the varying CRM thickness.

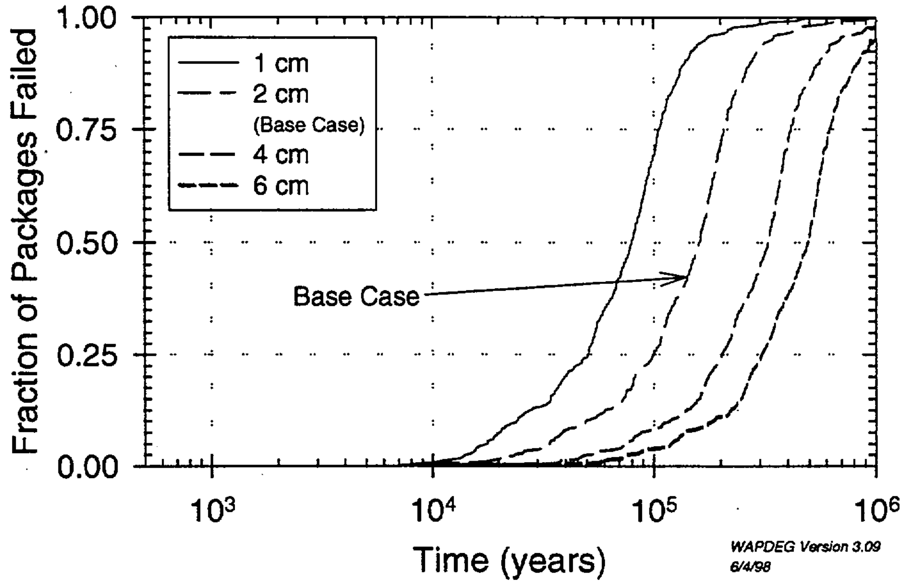

Figure 5-101. Sensitivity of the first patch-breach profiles of waste packages with time to the varying CRM thickness.

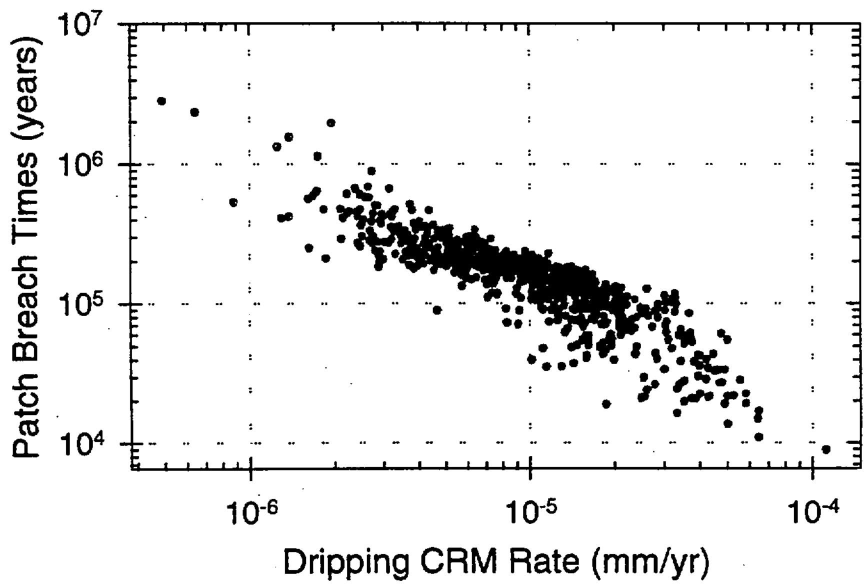

Figure 5-102. Scatter plot of first-patch breach times versus CRM corrosion rate under dripping conditions resulting from sensitivity analysis Case WPSA1.

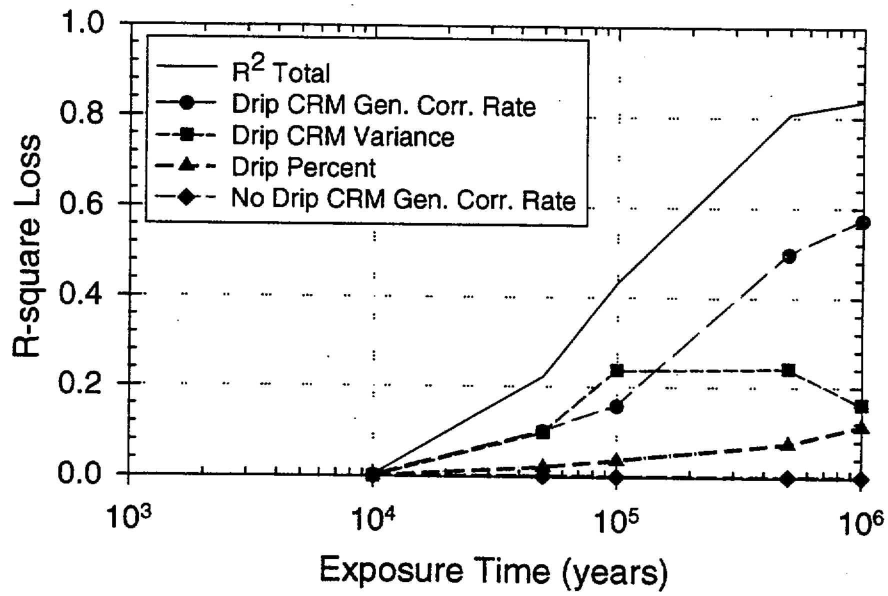

Figure 5-103. Plot of R^2-loss versus exposure time for salient input variables resulting from sensitivity study Case WPSA2.

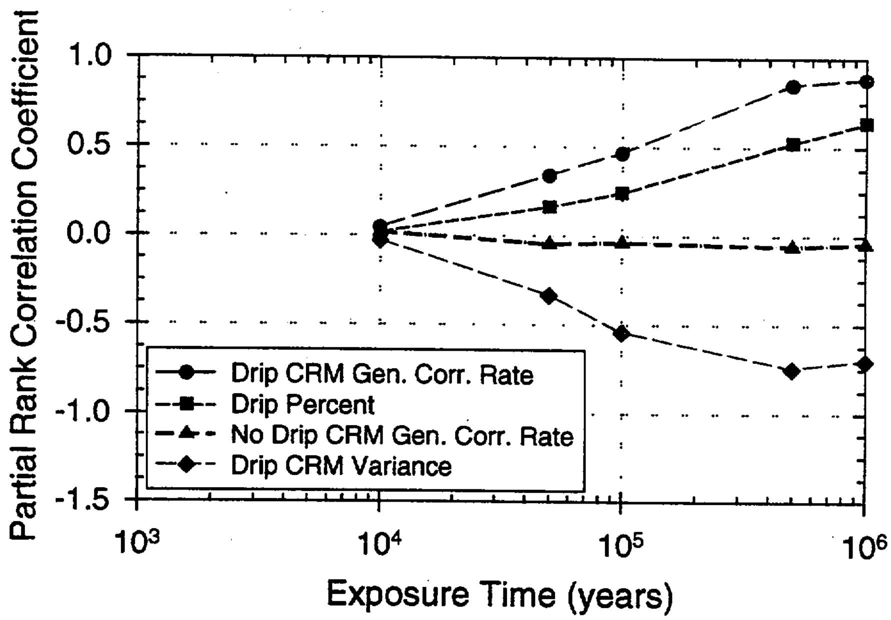

Figure 5-104. Plot of Partial Rank Correlation Coefficient (PRCC) versus exposure time for salient input variables resulting from sensitivity study Case WPSA2.

Chapter 5
Tables

Table 5- 1 Dimensions of Three Representative Waste Package Types (Benton 1997).

Waste Package Type	Outer Diameter (meter)	Outer Length with Extensions (meter)[a]	Outer Length without Extensions (meter)[a]	Outer Barrier Thickness (meter)	Inner Barrier Thickness (meter)
21 Pressurized Water Reactor (PWR) Waste Package	1.65	5.34	4.89	0.10	0.02
44 Boiling Water Reactor (BWR) Waste Package	1.60	5.34	4.89	0.10	0.02
Co-disposal Waste Package[b]	1.97	5.30	4.85	0.10	0.02

a. Waste package has the outer barrier extensions for lifting 0.225 meters on each end.

b. Co-disposal waste package includes five defense high-level waste (DHLW) canisters with one DOE spent nuclear fuel (DSNF) canister.

Table 5- 2 Humid-Air Corrosion Data Used in the Model Development.

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	$[SO_2]$ ($\mu g/m^3$)	Depth (μm)	Rate ($\mu m/yr$)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ ($\mu m/yr$)	Remarks
1	0.25	8	78	71.14	17.75	71.01	0.772	0.19	6.60	85.77	91.97	carbon steel; urban
2	0.50	8	78	71.14	23.67	47.34	0.772	0.39	6.60	85.77	61.32	area.
3	1.00	8	78	71.14	35.51	35.51	0.772	0.77	6.60	85.77	45.99	**Letnany**
4	2.00	8	78	71.14	71.01	35.51	0.772	1.54	6.60	85.77	45.99	
5	5.00	8	78	71.14	118.35	23.67	0.772	3.86	6.60	85.77	30.66	
6	10.00	8	78	71.14	150.90	15.09	0.772	7.72	6.60	85.77	19.54	
7	0.50	8	81	89.27	67.14	134.29	0.820	0.41	7.05	86.47	163.69	Carbon steel; urban
8	1.00	8	81	89.27	85.71	85.71	0.820	0.82	7.05	86.47	104.48	area.
9	2.00	8	81	89.27	107.14	53.57	0.820	1.64	7.05	86.47	65.30	**Letnany**
10	3.00	8	81	89.27	131.43	43.81	0.820	2.46	7.05	86.47	53.40	
11	5.00	8	81	89.27	150.00	30.00	0.820	4.10	7.05	86.47	36.57	
12	10.00	8	81	89.27	190.00	19.00	0.820	8.20	7.05	86.47	23.16	
13	0.50	10	76	36.47	21.43	42.86	0.732	0.37	8.33	85.11	58.51	carbon steel; rural
14	1.00	10	76	36.47	42.14	42.14	0.732	0.73	8.33	85.11	57.54	area.
15	2.00	10	76	36.47	58.57	29.29	0.732	1.46	8.33	85.11	39.98	**Hurbanovo**
16	3.00	10	76	36.47	71.43	23.81	0.732	2.20	8.33	85.11	32.51	
17	5.00	10	76	36.47	90.00	18.00	0.732	3.66	8.33	85.11	24.58	
18	10.00	10	76	36.47	111.43	11.14	0.732	7.32	8.33	85.11	15.21	
19	1.00	18	84	2.06	19.18	19.18	0.849	0.85	17.68	86.17	22.60	carbon steel; rural
20	2.00	18	84	2.06	26.66	13.33	0.849	1.70	17.68	86.17	15.71	area.
21	3.00	18	84	2.06	32.32	10.77	0.849	2.55	17.68	86.17	12.70	**Dalat**
22	4.00	18	84	2.06	37.06	9.26	0.849	3.39	17.68	86.17	10.92	
23	5.00	18	84	2.06	41.20	8.24	0.849	4.24	17.68	86.17	9.71	
24	1.00	23	83	2.06	20.58	20.58	0.830	0.83	22.61	85.39	24.80	carbon steel; rural
25	2.00	23	83	2.06	37.33	18.66	0.830	1.66	22.61	85.39	22.49	area.
26	3.00	23	83	2.06	52.88	17.63	0.830	2.49	22.61	85.39	21.24	**Vinhphu**
27	4.00	23	83	2.06	67.70	16.92	0.830	3.32	22.61	85.39	20.40	
28	5.00	23	83	2.06	82.00	16.40	0.830	4.15	22.61	85.39	19.76	
29	1.00	24	82	2.06	32.31	32.31	0.815	0.81	23.48	85.03	39.66	carbon steel; urban
30	2.00	24	82	2.06	56.37	28.19	0.815	1.63	23.48	85.03	34.59	area.
31	3.00	24	82	2.06	78.07	26.02	0.815	2.44	23.48	85.03	31.94	**Hanoi**
32	4.00	24	82	2.06	98.36	24.59	0.815	3.26	23.48	85.03	30.18	
33	5.00	24	82	2.06	117.66	23.53	0.815	4.07	23.48	85.03	28.88	

Table 5-2. (continued).

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	$[SO_2]$ ($\mu g/m^3$)	Depth (μm)	Rate (μm/yr)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ (μm/yr)	Remarks
34	1.00	27	83	3.61	38.44	38.44	0.825	0.83	26.68	84.97	46.60	carbon steel; urban
35	2.00	27	83	3.61	61.12	30.56	0.825	1.65	26.68	84.97	37.04	area.
36	3.00	27	83	3.61	80.17	26.72	0.825	2.48	26.68	84.97	32.39	**HoChiMinh**
37	4.00	27	83	3.61	97.18	24.30	0.825	3.30	26.68	84.97	29.45	
38	5.00	27	83	3.61	112.83	22.57	0.825	4.13	26.68	84.97	27.35	
39	1.00	22	81	57.25	61.41	61.41	0.803	0.80	21.29	85.00	76.50	carbon steel; rural-
40	2.00	22	81	57.25	92.24	46.12	0.803	1.61	21.29	85.00	57.46	urban area.
41	3.00	22	81	57.25	117.02	39.01	0.803	2.41	21.29	85.00	48.60	**Tsing-Hua**
42	4.00	22	81	57.25	138.55	34.64	0.803	3.21	21.29	85.00	43.16	
43	5.00	22	81	57.25	157.94	31.59	0.803	4.01	21.29	85.00	39.36	
44	8.00	22	81	57.25	208.12	26.02	0.803	6.42	21.29	85.00	32.41	
45	1.00	25	77	42.44	42.83	42.83	0.732	0.73	23.74	83.75	58.53	carbon steel; rural-
46	2.00	25	77	42.44	69.05	34.52	0.732	1.46	23.74	83.75	47.18	urban area.
47	3.00	25	77	42.44	91.30	30.43	0.732	2.20	23.74	83.75	41.59	**Sun Yat-Sen**
48	4.00	25	77	42.44	111.32	27.83	0.732	2.93	23.74	83.75	38.03	
49	5.00	25	77	42.44	129.82	25.96	0.732	3.66	23.74	83.75	35.48	
50	8.00	25	77	42.44	179.46	22.43	0.732	5.85	23.74	83.75	30.65	
51	1.00	25	77	42.44	42.78	42.78	0.732	0.73	23.74	83.75	58.46	carbon steel; rural-
52	2.00	25	77	42.44	63.73	31.87	0.732	1.46	23.74	83.75	43.54	urban area.
53	3.00	25	77	42.44	80.46	26.82	0.732	2.20	23.74	83.75	36.65	**Sun Yat-Sen**
54	4.00	25	77	42.44	94.94	23.73	0.732	2.93	23.74	83.75	32.43	
55	5.00	25	77	42.44	107.93	21.59	0.732	3.66	23.74	83.75	29.50	
56	8.00	25	77	42.44	141.43	17.68	0.732	5.85	23.74	83.75	24.16	
57	1.00	27	83	58.7	45.00	45.00	0.825	0.83	26.68	84.97	54.54	wrought iron;
58	2.00	27	83	58.7	81.00	40.50	0.825	1.65	26.68	84.97	49.09	tropical area.
59	4.00	27	83	58.7	121.00	30.25	0.825	3.30	26.68	84.97	36.67	Aston wrought
60	8.00	27	83	58.7	175.00	21.88	0.825	6.60	26.68	84.97	26.51	Pickled
61	16.00	27	83	58.7	310.00	19.38	0.825	13.20	26.68	84.97	23.48	
62	1.00	27	83	58.7	42.00	42.00	0.825	0.83	26.68	84.97	50.91	wrought iron;
63	2.00	27	83	58.7	80.00	40.00	0.825	1.65	26.68	84.97	48.48	tropical area.
64	4.00	27	83	58.7	118.00	29.50	0.825	3.30	26.68	84.97	35.76	Millscale
65	8.00	27	83	58.7	182.00	22.70	0.825	6.60	26.68	84.97	27.58	
66	16.00	27	83	58.7	290.00	19.00	0.825	13.20	26.68	84.97	21.97	
67	1.00	27	83	58.7	35.00	35.00	0.825	0.83	26.68	84.97	42.42	carbon steel;
68	2.00	27	83	58.7	65.00	32.50	0.825	1.65	26.68	84.97	39.39	tropical area.
69	4.00	27	83	58.7	106.00	26.50	0.825	3.30	26.68	84.97	32.12	Pickled

Table 5-2. (continued).

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	$[SO_2]$ ($\mu g/m^3$)	Depth (μm)	Rate ($\mu m/yr$)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ ($\mu m/yr$)	Remarks
70	8.00	27	83	58.7	160.00	20.00	0.825	6.60	26.68	84.97	24.24	
71	16.00	27	83	58.7	290.00	18.13	0.825	13.20	26.68	84.97	21.97	
72	1.00	27	83	58.7	38.00	38.00	0.825	0.83	26.68	84.97	46.06	carbon steel;
73	2.00	27	83	58.7	71.00	35.50	0.825	1.65	26.68	84.97	43.03	tropical area.
74	4.00	27	83	58.7	105.00	26.25	0.825	3.30	26.68	84.97	31.82	Millscale
75	8.00	27	83	58.7	163.00	20.38	0.825	6.60	26.68	84.97	24.70	
76	16.00	27	83	58.7	304.00	19.00	0.825	13.20	26.68	84.97	23.03	
77	1.00	27	83	58.7	35.00	35.00	0.825	0.83	26.68	84.97	42.42	carbon steel;
78	2.00	27	83	58.7	57.00	28.50	0.825	1.65	26.68	84.97	34.54	tropical area.
79	4.00	27	83	58.7	86.00	21.50	0.825	3.30	26.68	84.97	26.06	Machined
80	8.00	27	83	58.7	128.00	16.00	0.825	6.60	26.68	84.97	19.39	
81	16.00	27	83	58.7	218.00	13.63	0.825	13.20	26.68	84.97	16.51	
82	1.00	27	83	58.7	31.00	31.00	0.825	0.83	26.68	84.97	37.57	cast iron; tropical
83	2.00	27	83	58.7	51.00	25.50	0.825	1.65	26.68	84.97	30.91	area.
84	4.00	27	83	58.7	79.00	19.75	0.825	3.30	26.68	84.97	23.94	Machined
85	8.00	27	83	58.7	113.00	14.13	0.825	6.60	26.68	84.97	17.12	
86	16.00	27	83	58.7	191.00	11.94	0.825	13.20	26.68	84.97	14.47	
87	1.00	27	83	58.7	25.00	25.00	0.825	0.83	26.68	84.97	30.30	gray cast iron;
88	2.00	27	83	58.7	42.00	21.00	0.825	1.65	26.68	84.97	25.45	tropical area.
89	4.00	27	83	58.7	69.00	17.25	0.825	3.30	26.68	84.97	20.91	Machined
90	8.00	27	83	58.7	99.00	12.38	0.825	6.60	26.68	84.97	15.00	
91	16.00	27	83	58.7	151.00	9.44	0.825	13.20	26.68	84.97	11.44	
92	1.00	10	68	20.0	31.82	31.82	0.554	0.55	7.12	83.51	57.47	carbon steel; rural
93	2.00	10	68	20.0	52.28	26.14	0.554	1.11	7.12	83.51	47.21	area.
94	4.00	10	68	20.0	86.92	21.73	0.554	2.21	7.12	83.51	39.25	**Saylorsburg, PA**
95	8.00	10	68	20.0	129.52	16.19	0.554	4.43	7.12	83.51	29.24	
96	1.00	13	66	245.0	50.00	50.00	0.502	0.50	9.87	82.84	99.61	carbon steel; urban
97	2.00	13	66	245.0	65.90	32.95	0.502	1.00	9.87	82.84	65.64	area.
98	4.00	13	66	245.0	81.24	20.31	0.502	2.01	9.87	82.84	40.46	**Newark, NJ**
99	8.00	13	66	245.0	101.68	12.71	0.502	4.02	9.87	82.84	25.32	
100	1.50	10	68	20.00	44.00	29.33	0.554	0.83	7.12	83.51	52.98	carbon steel; semi-
101	3.50	10	68	20.00	73.00	20.86	0.554	1.94	7.12	83.51	37.67	rural area.
102	7.50	10	68	20.00	117.00	15.60	0.554	4.15	7.12	83.51	28.17	**S. Bend, PA**
103	15.50	10	68	20.00	179.00	11.55	0.554	8.58	7.12	83.51	20.86	
104	1.50	10	71	300.0	56.00	37.33	0.625	0.94	7.58	84.07	59.70	carbon steel;

Table 5-2. (continued).

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	$[SO_2]$ ($\mu g/m^3$)	Depth (μm)	Rate (μm/yr)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ (μm/yr)	Remarks
105	3.50	10	71	300.0	93.00	26.57	0.625	2.19	7.58	84.07	42.49	semi-industrial
106	7.50	10	71	300.0	130.00	17.33	0.625	4.69	7.58	84.07	27.72	area.
107	15.50	10	71	300.0	193.39	12.48	0.625	9.69	7.58	84.07	19.95	**Monroeville, PA**
108	0.50	13	66	245.0	35.00	70.00	0.502	0.25	9.87	82.84	139.46	carbon steel;
109	1.50	13	66	245.0	60.00	40.00	0.502	0.75	9.87	82.84	79.69	industrial area.
110	3.50	13	66	245.0	84.00	24.00	0.502	1.76	9.87	82.84	47.81	**Newark, NJ**
111	7.50	13	66	245.0	104.00	13.87	0.502	3.76	9.87	82.84	27.63	
112	15.50	13	66	245.0	134.00	8.65	0.502	7.78	9.87	82.84	17.22	
113	0.33	10	65	406	19.22	58.24	0.480	0.16	6.67	82.99	121.41	urban area.
114	0.67	10	65	406	30.48	45.72	0.480	0.32	6.67	82.99	95.31	**Chicago**
115	1.33	10	65	406	52.8	39.60	0.480	0.64	6.67	82.99	82.55	
116	0.33	10	65	406	18.59	56.33	0.480	0.16	6.67	82.99	117.43	
117	0.67	10	65	406	30.42	45.63	0.480	0.32	6.67	82.99	95.12	
118	1.33	10	65	406	45.64	34.23	0.480	0.64	6.67	82.99	71.36	
119	0.33	12	69	79	14.64	44.36	0.576	0.19	9.31	83.48	77.04	urban area.
120	0.67	12	69	79	18.94	28.41	0.576	0.38	9.31	83.48	49.33	**Cincinnati**
121	1.33	12	69	79	23.18	17.39	0.576	0.77	9.31	83.48	30.19	
122	2.67	12	69	79	28.82	10.81	0.576	1.54	9.31	83.48	18.77	
123	5.33	12	69	79	37.98	7.12	0.576	3.07	9.31	83.48	12.37	
124	0.33	12	69	79	14.05	42.58	0.576	0.19	9.31	83.48	73.93	
125	0.67	12	69	79	18.13	27.19	0.576	0.38	9.31	83.48	47.22	
126	1.33	12	69	79	22.51	16.88	0.576	0.77	9.31	83.48	29.32	
127	2.67	12	69	79	28.1	10.54	0.576	1.54	9.31	83.48	18.30	
128	5.33	12	69	79	37.34	7.00	0.576	3.07	9.31	83.48	12.16	
129	0.33	5	67	118	12.24	37.09	0.534	0.18	1.89	83.86	69.48	urban area.
130	0.67	5	67	118	25.12	37.68	0.534	0.36	1.89	83.86	70.59	**Detroit**
131	1.33	5	67	118	34.19	25.64	0.534	0.71	1.89	83.86	48.04	
132	2.67	5	67	118	49.95	18.73	0.534	1.42	1.89	83.86	35.09	
133	5.33	5	67	118	74.13	13.90	0.534	2.85	1.89	83.86	26.04	
134	0.33	5	67	118	16.12	48.85	0.534	0.18	1.89	83.86	91.51	
135	0.67	5	67	118	24.39	36.58	0.534	0.36	1.89	83.86	68.54	
136	1.33	5	67	118	33.64	25.23	0.534	0.71	1.89	83.86	47.26	
137	2.67	5	67	118	50.15	18.81	0.534	1.42	1.89	83.86	35.23	
138	5.33	5	67	118	74.07	13.89	0.534	2.85	1.89	83.86	26.02	
139	0.33	16	70	39	9.72	29.45	0.595	0.20	13.53	83.25	49.48	urban area.
140	0.67	16	70	39	11.63	17.44	0.595	0.40	13.53	83.25	29.31	**Los Angeles**

Table 5-2. (continued).

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	[SO_2] (μg/m³)	Depth (μm)	Rate (μm/yr)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ (μm/yr)	Remarks
141	1.33	16	70	39	15.97	11.98	0.595	0.79	13.53	83.25	20.12	
142	2.67	16	70	39	19.57	7.34	0.595	1.59	13.53	83.25	12.33	
143	5.33	16	70	39	25.81	4.84	0.595	3.17	13.53	83.25	8.13	
144	0.33	16	70	39	8.98	27.21	0.595	0.20	13.53	83.25	45.72	
145	0.67	16	70	39	10.42	15.63	0.595	0.40	13.53	83.25	26.26	
146	1.33	16	70	39	14.82	11.12	0.595	0.79	13.53	83.25	18.67	
147	2.67	16	70	39	18.71	7.02	0.595	1.59	13.53	83.25	11.79	
148	5.33	16	70	39	24.83	4.66	0.595	3.17	13.53	83.25	7.82	
149	0.33	19	77	24	10.12	30.67	0.739	0.24	17.64	84.38	41.47	urban area.
150	0.67	19	77	24	16.51	24.76	0.739	0.49	17.64	84.38	33.49	**New Orleans**
151	1.33	19	77	24	24.52	18.39	0.739	0.99	17.64	84.38	24.87	
152	2.67	19	77	24	35.38	13.27	0.739	1.97	17.64	84.38	17.94	
153	0.33	19	77	24	8.56	25.94	0.739	0.24	17.64	84.38	35.08	
154	0.67	19	77	24	14.82	22.23	0.739	0.49	17.64	84.38	30.06	
155	1.33	19	77	24	23.48	17.61	0.739	0.99	17.64	84.38	23.81	
156	2.67	19	77	24	34.85	13.07	0.739	1.97	17.64	84.38	17.67	
157	0.33	12	66	218	19.5	59.09	0.503	0.17	8.85	82.94	117.53	urban area.
158	0.67	12	66	218	24.16	36.24	0.503	0.34	8.85	82.94	72.08	**Philadelphia**
159	1.33	12	66	218	32.09	24.07	0.503	0.67	8.85	82.94	47.87	
160	2.67	12	66	218	41.37	15.51	0.503	1.34	8.85	82.94	30.86	
161	5.33	12	66	218	51.5	9.66	0.503	2.68	8.85	82.94	19.21	
162	0.33	12	66	218	18.09	54.82	0.503	0.17	8.85	82.94	109.03	
163	0.67	12	66	218	23.16	34.74	0.503	0.34	8.85	82.94	69.10	
164	1.33	12	66	218	31.54	23.66	0.503	0.67	8.85	82.94	47.05	
165	2.67	12	66	218	40.41	15.15	0.503	1.34	8.85	82.94	30.14	
166	5.33	12	66	218	50.95	9.55	0.503	2.68	8.85	82.94	19.00	
167	0.33	13	73	34	10.8	32.73	0.667	0.22	10.93	84.16	49.09	urban area.
168	0.67	13	73	34	17.74	26.61	0.667	0.44	10.93	84.16	39.92	**San Francisco**
169	1.33	13	73	34	28.61	21.46	0.667	0.89	10.93	84.16	32.19	
170	2.67	13	73	34	41.44	15.54	0.667	1.78	10.93	84.16	23.31	
171	5.33	13	73	34	57.36	10.76	0.667	3.56	10.93	84.16	16.13	
172	0.33	13	73	34	8.57	25.97	0.667	0.22	10.93	84.16	38.96	
173	0.67	13	73	34	16.34	24.51	0.667	0.44	10.93	84.16	36.77	
174	1.33	13	73	34	27.95	20.96	0.667	0.89	10.93	84.16	31.44	
175	2.67	13	73	34	41.18	15.44	0.667	1.78	10.93	84.16	23.16	
176	5.33	13	73	34	57.94	10.86	0.667	3.56	10.93	84.16	16.30	

Table 5-2. (continued).

	Time (years)	T_{avg} (°C)	RH_{avg} (%)	$[SO_2]$ ($\mu g/m^3$)	Depth (μm)	Rate ($\mu m/yr$)	f_{70}	t_{new} (years)	T_{new} (°C)	RH_{new} (%)	$Rate_{new}$ ($\mu m/yr$)	Remarks
177	0.33	13	63	126	14.58	44.18	0.429	0.14	9.42	82.35	102.98	urban area.
178	0.67	13	63	126	20.5	30.75	0.429	0.29	9.42	82.35	71.68	**Washington, DC**
179	1.33	13	63	126	25.87	19.40	0.429	0.57	9.42	82.35	45.23	
180	2.67	13	63	126	33.94	12.73	0.429	1.14	9.42	82.35	29.67	
181	5.33	13	63	126	43.04	8.07	0.429	2.29	9.42	82.35	18.81	
182	0.33	13	63	126	13.14	39.82	0.429	0.14	9.42	82.35	92.81	
183	0.67	13	63	126	19.34	29.01	0.429	0.29	9.42	82.35	67.62	
184	1.33	13	63	126	25.16	18.87	0.429	0.57	9.42	82.35	43.98	
185	2.67	13	63	126	33.35	12.51	0.429	1.14	9.42	82.35	29.15	
186	5.33	13	63	126	42.59	7.99	0.429	2.29	9.42	82.35	18.61	

Table 5- 3 Humid-Air Corrosion Roughness Factor Data at 16-Year Exposure Time for Different Types of Steels.

Material	Sample ID *	Avg. depth (μm)	Deepest Pit (μm)	Avg. of 20 Deepest Pits (μm)	Roughness Factor for Deepest Pit	Roughness Factor for 20 Deepest Pits
Aston Wrought Iron	90	310	940	559	3.03	1.80
Aston Wrought Iron	190	290	1,499	1,016	5.17	3.50
Pickled Carbon Steel	35	290	838	559	2.89	1.93
Millscale Carbon Steel	34	304	1,143	686	3.76	2.26
Machined Carbon Steel	36	218	660	483	3.03	2.22
Machined Cast Steel	70	191	787	457	4.12	2.39
Machined Grey Cast Iron	78	151	940	559	5.21	3.03

- Sample identification used in Southwell and Bultman (1982).

Table 5- 4 Aqueous General Corrosion Data Used in the Model Development.

	Time (years)	Temperature (°C)	Depth (µm)	Comments
1	1	27.78	195.58	Southwell & Alexander 1970
2	2	27.78	304.80	Table 2 – Class A
3	4	27.78	431.80	carbon steel; lake water
4	8	27.78	558.80	Panama
5	16	27.78	711.20	
6	1	27.78	190.50	Southwell & Alexander 1970
7	2	27.78	304.80	Table 2 – Class B
8	4	27.78	406.40	carbon steel; lake water
9	8	27.78	508.00	Panama
10	16	27.78	635.00	
11	1	27.78	160.02	Southwell & Alexander 1970
12	2	27.78	241.30	Table 2 – Class C
13	4	27.78	355.60	carbon steel; lake water
14	8	27.78	482.60	Panama
15	16	27.78	635.00	
16	1	27.78	200.66	
17	2	27.78	304.80	Southwell & Alexander 1970
18	4	27.78	457.20	Table 2 – Class D
19	8	27.78	584.20	carbon steel; lake water
20	16	27.78	736.60	Panama
21	1	27.78	208.28	Southwell & Alexander 1970
22	2	27.78	304.80	Table 2 – Class M
23	4	27.78	355.60	cast steel; lake water
24	8	27.78	482.60	Panama
25	16	27.78	660.40	
26	1	27.78	177.80	Southwell & Alexander 1970
27	2	27.78	304.80	Table 2 – Class O
28	4	27.78	381.00	cast iron; lake water
29	8	27.78	584.20	Panama
30	16	27.78	838.20	
31	1	27.78	193.04	Southwell & Alexander 1970
32	2	27.78	304.80	Table 2 – Class N
33	4	27.78	406.40	cast steel; lake water
34	1	27.78	200.66	Southwell & Alexander 1970
35	2	27.78	330.20	Table 2 – Class P

Table 5-4. (continued).

	Time (years)	Temperature (°C)	Depth (μm)	Comments
36	4	27.78	431.80	cast iron; lake water
37	1	15.00	182.90	Coburn 1978
38	1	15.00	161.80	Figure 4
39	1	15.00	135.50	**carbon steel; river water**
40	2	15.00	306.60	Charleroi, PA
41	2	15.00	236.80	
42	2	15.00	229.00	
43	2	15.00	223.60	
44	2	15.00	210.60	
45	4	15.00	431.60	
46	4	15.00	410.40	
47	4	15.00	389.60	
48	4	15.00	294.80	
49	8	15.00	863.20	
50	8	15.00	631.20	
51	8	15.00	579.20	
52	8	15.00	442.40	
53	8	15.00	431.20	
54	1	15.00	106.60	Coburn 1978
55	1	15.00	103.90	Figure 4
56	1	15.00	100.00	**carbon steel; river water**
57	2	15.00	189.40	Kittanning, PA
58	2	15.00	176.20	
59	4	15.00	278.80	
60	4	15.00	273.60	
61	4	15.00	260.40	
62	8	15.00	484.00	
63	8	15.00	479.20	
64	0.27	5.00	1.76	Brasher & Mercer 1968
65	0.27	25.00	9.60	Mercer et al. 1968
66	0.27	40.00	20.15	mild steel; distilled water
67	0.27	60.00	42.73	
68	0.27	70.00	42.26	
69	0.27	80.00	18.35	
70	0.27	90.00	13.53	

Table 5- 5 Aqueous Corrosion Roughness Factor Data at 16-Year Exposure Time.

Material	Sample ID *	Avg. depth (μm)	Deepest Pit (μm)	Avg. 20 Deepest Pits (μm)	Roughness Factor Deepest Pit	Roughness Factor Avg 20 Deepest Pits
Wrought Carbon Steel	A	711	2,362	1,829	3.32	2.57
Wrought Carbon Steel	B	635	2,388	1,651	3.76	2.60
Wrought Carbon Steel	C	635	2,311	1,676	3.64	2.64
Wrought Carbon Steel, 0.3% Cu	D	737	2,261	1,626	3.07	2.21
Cast Steel	M	660	3,556	2,489	5.38	3.77

* Sample identification used in Southwell and Alexander (1970).

Table 5- 6 Local Corrosion Environment Scenarios on the CRM and the Probabilities of Occurrence from the WPDEE (Pendleton 1998).

Expert	Environment		
	pH = 3-10 340 mV SHE	pH = 2.5 340 mV SHE	pH = 2.5 640 mV SHE
Andresen	0.99	0.01	10^{-5}
Farmer	0.45	0.45	0.10
McCright	0.94	0.05	0.01
Shoesmith	0.98	0.01	0.01
Average	0.84	0.13	0.03

Table 5- 7 All the Corrosion Data for Alloy 22 Used in the Development of the Correlation of the Corrosion Rate (Pasupathi 1997).

Comments Data Source	Identification S/N Reference	Exposure Time Hours	dp/dt µm/yr	Temperature (°C)	pH	NaCl wt. %	$FeCl_3$ wt. %	Air Fract. Sat.
Long Term Test - SAW	DWA 001	4296	2.53E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DWA 003	4296	5.07E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DWB 001	4296	1.13E-01	60	2.7	4.616	0	1
Long Term Test - SAW	DWB 002	4296	1.64E-01	60	2.7	4.616	0	1
Long Term Test - SAW	DWB 003	4296	6.03E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DWB 005	4296	3.45E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DWB 006	4296	3.47E-02	60	2.7	4.616	0	1
Polarization - NaCl	unknown	1	3.00E-04	60	2.69	1	0	1
Polarization - NaCl	082697c2	1	3.00E-03	60	6.53	5	0	1
Polarization - NaCl	082797c2	1	2.01E-02	90	6.53	5	0	1
Polarization - NaCl	090996c1	1	3.02E-02	90	6.83	10	0	1
Polarization - NaCl	102397c1	1	2.01E-01	90	2.69	1	0	0
Polarization - NaCl	102497c2	1	2.01E-01	90	2.67	1	0	0
Polarization - NaCl	102797c1	1	2.01E-01	90	2.69	5	0	0
Long Term Test - SAW	DCA 001	4296	8.58E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 002	4296	1.13E-01	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 003	4296	7.70E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCB 001	4296	2.81E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCB 002	4296	1.87E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCB 003	4296	9.31E-03	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 004	4296	1.04E-01	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 005	4296	8.11E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 006	4296	1.17E-01	60	2.7	4.616	0	1

Table 5-7. (continued).

Comments Data Source	Identification S/N Reference	Exposure Time Hours	dp/dt µm/yr	Temperature (°C)	pH	NaCl wt. %	$FeCl_3$ wt. %	Air Fract. Sat.
Long Term Test - SAW	DCB 004	4296	6.56E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCB 005	4296	6.61E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCB 006	4296	4.71E-02	60	2.7	4.616	0	1
Long Term Test - SAW	DCA 034	4344	2.45E-01	90	2.7	4.616	0	1
Long Term Test - SAW	DCA 035	4344	7.31E-01	90	2.7	4.616	0	1
Long Term Test - SAW	DCA 036	4344	1.76E-01	90	2.7	4.616	0	1
Long Term Test - SAW	DCB 035	4344	4.16E-02	90	2.7	4.616	0	1
Long Term Test - SAW	DCB 036	4344	1.07E-01	90	2.7	4.616	0	1
Polarization - $FeCl_3$	110497c2	4344	3.00E-03	90	2.14	0	0.61	0
Polarization - $FeCl_3$	110397c1	4344	6.00E-03	90	2.16	0	0.61	0
Polarization - $FeCl_3$	103097c1	4344	2.01E-01	90	1.72	0	3.05	0
Polarization - $FeCl_3$	103197c2	4344	2.01E+00	90	1.72	0	3.05	0
Asphahani - Hanes Intl.	Gdowski UCRL	100	2.50E+00	25	1	0	10	1
Asphahani - Hanes Intl.	Gdowski UCRL	100	2.50E+00	50	1	0	10	1
Asphahani - Hanes Intl.	Gdowski UCRL	100	1.27E+01	75	1	0	10	1

Table 5- 8 Theoretical Distributions Offered by WAPDEG.

Distribution	Parameters
Fixed	Single value
Normal	Mean and standard deviation
Bounded Normal	Mean, standard deviation, and upper and lower bounds
Lognormal	Mean and standard deviation of underlying normal
Uniform	Minimum and maximum
Loguniform	Minimum and maximum

Table 5- 9 Summary of WAPDEG Output Files.

File Extension	Description
OUT	Echo file input, package summary output
AUX	Warning messages, package properties
CAM	CAM thickness versus time by package
CRM	CRM thickness versus time by package
PAT	Patch failures versus time by package
BIN	Pit penetrations versus time by package

Table 5- 10 Corrosion Models and Parameters Used in the TSPA-VA Base Case Waste Package Degradation Analysis.

Model Parameter	Description	Value/Distribution*	Source
T threshold for corrosion initiation	A temperature threshold below which corrosion of waste package induced by electrochemical processes could occur.	CDF: 95 - 150°C	CRWMS M&O (1997e), MOL 19980218.0231
RH threshold for CAM humid-air corrosion initiation	A relative humidity threshold above which the carbon steel outer barrier is subject to corrosion in humid-air condition	CDF: 0 - 91.02%	CRWMS M&O (1997e), MOL 19980218.0231
RH threshold for CAM aqueous corrosion initiation	A relative humidity threshold above which the carbon steel outer barrier is subject to corrosion in aqueous condition.	CDF: 80 - 100%	CRWMS M&O (1997e), MOL 19980218.0231
CAM humid-air general corrosion model	A model to calculate general corrosion depth of the carbon steel outer barrier as a function of time, T and RH. The model currently has five parameters with their associated uncertainty.	$a_0 = 17.185$ $a_1 = -623.46$ $a_2 = -974.46$ $a_3 = 0.62270$ covariance matrix $V = \begin{bmatrix} 6.9934 & -231.79 & -523.80 & -2.4608 \cdot 10^{-2} \\ -231.79 & 104703 & -10892 & 2.5731 \\ -523.80 & -10892 & 47470 & 1.3009 \\ -2.4608 \cdot 10^{-2} & 2.5731 & 1.3009 & 6.9319 \cdot 10^{-4} \end{bmatrix}$ error variance mean = 0, $\sigma = 0.12757$	CRWMS M&O (1998c)
Localization factor for CAM in humid-air condition	A factor employed to estimate localized variations of the outer barrier corrosion depth in humid-air condition. The factor is used as a multiplier to the general corrosion depth.	Bounded normal 1.5, 0.25, 1.0, 1.0e6 [Mean, σ, Minimum , Maximum	CRWMS M&O (1997e), MOL 19980218.0231

Table 5-10. (continued).

Model Parameter	Description	Value/Distribution*	Source
CAM aqueous general corrosion model	A model to calculate general corrosion depth of the carbon steel outer barrier as a function of time and T. The model currently has five parameters with their associated uncertainty.	$b_o = 111.53$ $b_1 = 0.53199$ $b_2 = -23291$ $b_3 = -3.1918 \times 10^{-4}$ covaraiance matrix $V = \begin{bmatrix} 116.63 & -9.4226 \cdot 10^{-4} & -24761 & -3.7926 \cdot 10^{-4} \\ -9.4226 \cdot 10^{-4} & 7.4149 \cdot 10^{-4} & 1.7704 \cdot 10^{-11} & 2.7491 \cdot 10^{-19} \\ -24761 & 1.1689 \cdot 10^{-11} & 5.2627 \cdot 10^{6} & 8.0311 \cdot 10^{-2} \\ -3.7926 \cdot 10^{-4} & 1.8355 \cdot 10^{-19} & 8.0311 \cdot 10^{-2} & 1.2410 \cdot 10^{-9} \end{bmatrix}$ error variance mean = 0, σ = 0.0362	CRWMS M&O (1998c)
Localization factor for CAM in aqueous condition	A factor employed to estimate localized variations of the outer barrier corrosion depth in aqueous condition. The factor is used as a multiplier to the general corrosion depth.	Bounded normal 1.5, 0.25, 1.0, 1.0e6 lMean, σ, Minimum , Maximum	CRWMS M&O (1997e), MOL 19980218.0231
Pitting corrosion model for CAM under drips with elevated pH condition	Pit growth law model for a high aspect-ratio pitting corrosion of the outer barrier in alkaline pH conditions (pH >= 10). The model is expressed as a function of time, and has two parameters with their associated uncertainty.	$D = B\,t^n$ model B is CDF: .0.1 - 1.84e6 $\mu m/yr^n$ n is CDF: 0 - 1	CRWMS M&O (1997e), MOL 19980218.0231
CRM general corrosion rate with no drips-CDF tables	CDF tables at 25, 50 and 100°C expressing a potential range of constant general corrosion rates of the Alloy 22 inner barrier in the absence of dripping on waste package.	25°C CDF: 5.62e-10 - 3.00e-5 mm/yr 50°C CDF: 2.39e-9 - 5.00e-5 mm/yr 100°C CDF: 2.39e-8 - 2.00e-4 mm/yr	Pendleton (1998), MOL 19980615.0089

Table 5-10. (continued).

Model Parameter	Description	Value/Distribution*	Source
Uncertainty/variability allocation of no-drip CRM general corrosion rate-CDF tables	A fractional split of the total variance of the no-drip Alloy 22 general corrosion rate to represent associated uncertainty of the rate and spatial variability of the rate among waste packages and for a single waste package.	expected value = 75% uncertainty - 25% variability, uncertainty sampled at 50^{th} Percentile 8 others used at each of 3 temperatures (25, 50, and 100°C): Uncertainty% / Variability% / Uncertainty Percentile 25 / 75 / 5^{th} 25 / 75 / 50^{th} 25 / 75 / 95^{th} 50 / 50 / 5^{th} 50 / 50 / 50^{th} 50 / 50 / 95^{th} 75 / 25 / 5^{th} 75 / 25 / 50^{th} 75 / 25 / 95^{th}	Pendleton (1998), MOL 19980615.0089
Variability allocation of no-drip CRM general corrosion rate-CDF tables	A fractional split of the total variability of the no-drip Alloy 22 general corrosion rate to represent spatial variability of the rate among waste packages and for regions in a single waste package.	50% waste package to waste package 50% region to region (patch to patch)	Pendleton (1998), MOL 19980615.0089
CRM general corrosion rate with drips-CDF tables	CDF tables at 25, 50 and 100°C expressing a potential range of constant general corrosion rates of the Alloy 22 inner barrier in the presence of dripping on waste package.	25°C CDF: 2.06e-8 - 9.00e-3 mm/yr 50°C CDF: 9.99e-8 - 1.25e-2 mm/yr 100°C CDF: 1.00e-7 - 2.00e-2 mm/yr	Pendleton (1998), MOL 19980615.0089
Uncertainty/variability allocation of drip CRM general corrosion rate-CDF tables	A fractional split of the total variance of the drip Alloy 22 general corrosion rate to represent associated uncertainty of the rate and spatial variability of the rate among waste packages and for a single waste package.	expected value = 50% uncertainty - 50% variability, uncertainty sampled at 50^{th} Percentile 8 others used at each of 3 temperatures (25, 50, and 100°C): Uncertainty% / Variability% / Uncertainty Percentile 25 / 75 / 5^{th} 25 / 75 / 50^{th} 25 / 75 / 95^{th} 50 / 50 / 5^{th} 50 / 50 / 95^{th} 75 / 25 / 5^{th} 75 / 25 / 50^{th} 75 / 25 / 95^{th}	Pendleton (1998), MOL 19980615.0089
Variability allocation of drip CRM general corrosion rate-CDF tables	A fractional split of the total variability of the drip Alloy 22 general corrosion rate to represent spatial variability of the rate among waste packages and for regions in a single waste package.	35% waste package to waste package 65% region to region (patch to patch)	Pendleton (1998), MOL 19980615.0089

Table 5-10. (continued).

Model Parameter	Description	Value/Distribution*	Source
CRM general corrosion model	A model expressing the general corrosion rate of the Alloy 22 inner barrier as a function of temperature. The model uses the drip or no drip CDFs discussed above.	D = Rate × time Rate is sampled from the drip or no drip CDFs discussed above as appropriate.	Pendleton (1998), MOL 19980615.0089
CRM localized corrosion model	A model expressing localized corrosion rate of the Alloy 22 inner barrier as a function of time and temperature. The model currently has four parameters with their associated uncertainty.	$D_{LC} = \exp\left(b_o - \frac{b_1}{T}\right)t^n$ Normal — lDistribution type for bo 11.275, 2.4495 — lMean and stand. dev. Fixed — lDistribution type for b1 5.5494e+003 — lDistribution parameter(s) Fixed — lDistribution type for n 0.5 — lDistribution parameter(s)	CRWMS M&O (1998c)
Localized corrosion threshold	A threshold to initiate localized corrosion in the Alloy 22 inner barrier. It is currently expressed as a function of temperature. No localized corrosion initiates at temperatures less than the threshold temperature.	Uniform distribution between 80 and 100°C.	Pendleton (1998), MOL 19980615.0089

* CDF = cumulative distribution function

σ = one standard deviation

Table 5- 11 Inputs to the TSPA-VA Base Case Waste Package Degradation Analysis.

Input Parameter	Description	Value/Distribution	Source
T history at the waste package surface	A history of temperature at the surface of waste packages in the NE region.	12 waste package groups used; vary with time between ~20 - 200°C	CRWMS M&O 1998l
RH history at the waste package surface	A history of relative humidity at the surface of waste packages in the NE region.	12 waste package groups used; vary with time between ~10 - 100%.	CRWMS M&O 1998l
Thickness of CAM	A thickness of the carbon steel outer barrier.	10 cm	Benton (1997),
Thickness of CRM	A thickness of the Alloy 22 inner barrier.	2 cm	Benton (1997),
Number of waste packages	A total number of waste packages considered in a simulation.	400 (occasionally 800)	Section 5.11.1 of this chapter
Number of patches per waste package	A total number of patches per waste package. A patch is defined as a minimum local area having a uniform general corrosion depth over an entire simulation period.	964	Section 5.11.1 of this chapter
Fraction for waste package top	A fraction of the waste package surface to be considered in the simulation as the top of the waste package.	180°	Section 5.11.1 of this chapter
Fraction for waste package bottom	A fraction of the waste package surface to be considered in the simulation as the bottom of the waste package. The remaining fraction of the waste package surface (after subtracting the top and bottom fractions) is considered as the side.	180°	Section 5.11.1 of this chapter
Fraction of the waste package top surface wetted under dripping	A fraction of the waste package top surface wetted in the presence of dripping.	100%	Section 5.11.1 of this chapter
Fraction of the waste package bottom surface wetted under dripping	A fraction of the waste package bottom surface wetted in the presence of dripping.	100%	Section 5.11.1 of this chapter
Pit density of CAM	Number of pits per unit area that form in the outer barrier undergoing corrosion.	10 pits/cm^2	CRWMS M&O (1997e); MOL 19980218.0231; Section 5.11.1 of this chapter

Table 5-11. (continued).

Input Parameter	Description	Value/Distribution	Source
Pit density of CRM	Number of pits per unit area that form in the inner barrier undergoing localized corrosion.	10 pits/cm^2	CRWMS M&O (1997e); MOL 19980218.0231; Section 5.11.1 of this chapter
Drip initiation time	Time for the initiation of drips on waste package.	0 years	Section 5.11.1 of this chapter
Drip stop time	Time for the cessation of drips on waste package.	10^6 years	Section 5.11.1 of this chapter

Table 5- 12 A List of One-Off Sensitivity Cases Studied in This Report.

Class	Sensitivity Case	Description
Waste-Package Level or Repository Condition Parameters	Repository Regions	Sensitivity of waste package degradation to different thermal-hydrologic environment (in terms of temperature and relative humidity profiles at the waste package surface) in six regions of repository.
	Fraction of Waste Package Surface Wetted by Drips	Sensitivity of waste package degradation to different surface fractions of the waste package surface wetted by drips.
	Patch Size in Waste Package Degradation Modeling	Sensitivity of waste package degradation to different patch sizes used in waste package degradation (WAPDEG) simulation.
CAM Corrosion Parameters	Alkaline pH Dripping	Sensitivity of waste package degradation to high aspect-ratio pitting corrosion of the CAM under alkaline dripping condition (pH≥10) for the first 10,000 years after emplacement.
	Microbiologically Influenced Corrosion	Sensitivity of waste package degradation to enhanced general corrosion rates of the CAM under an assumed condition of sustained microbiologically influenced corrosion.
CRM Corrosion Parameters	Alternative Allocations of Variability and Uncertainty of CRM General Corrosion Rate Variance under Dripping Condition	Sensitivity of waste package degradation to alternative allocations for the variability and uncertainty of the CRM general corrosion rate variance under dripping and alternative median rates of the uncertainty variance
	Two End Members of Expert Elicitation for CRM General Corrosion Rate under Dripping	Sensitivity of waste package degradation to two end members (most conservative and most optimistic) of the expert elicitation for CRM general corrosion rate distribution under dripping condition.
Waste Package and Engineered Barrier System Design Options	Backfill	Sensitivity of waste package degradation to different relative humidity and temperature conditions at the waste package surface in the presence of backfill in six different repository regions.
	Drip Shield	Sensitivity of waste package degradation to the varying drip shield thickness in the presence of backfill.
	Ceramic Coating	Sensitivity of waste package degradation to the ceramic coating on the CAM surface in the presence of backfill.
	CAM Thickness	Sensitivity of waste package degradation to varying CAM thickness.
	CRM Thickness	Sensitivity of waste package degradation to varying CRM thickness.

Table 5- 13 Three Alternative Allocations for the Uncertainty and Variability of the CRM General Corrosion Rate Under Dripping Conditions and Three Alternative Median Rates.

	Allocation for Uncertainty/Variability (Percent)		
	25/75	50/50	75/25
Median Corrosion Rate from the Uncertainty Variance	5th percentile (Set 1)	5th percentile (Set 2)	5th percentile (Set 3)
	50th percentile (Set 4)	50th percentile (Set 5)	50th percentile (Set 6)
	95th percentile (Set 7)	95th percentile (Set 8)	95th percentile (Set 9)

- The base case model is based on the 50%/50% split for the uncertainty and variability allocation and the median rate sampled at the 50th percentile of the uncertainty variance (indicated with a shade).
- Designation for each of the 9 cases (Set 1 to Set 9) for the result discussion is indicated in the table.

Table 5- 14 Distribution of the CAM General Corrosion Rate Reduction Factor in Aqueous Condition Used in the Ceramic Coating Design Option Sensitivity Analysis.

Percentile	Reduction Factor in Aqueous Condition
0	0
1	1.7E-6
5	5.0E-6
50	5.7E-5
95	6.5E-4
100	1.9E-3
Critical threshold CAM general corrosion depth = 0.095 cm	

Source: Pasupathi (1998)

Table 5- 15 Input Parameters Considered in the Regression-Based Sensitivity Analysis Case WPSA1.

Input Parameter	Distribution	Source
Temperature threshold for CAM corrosion initiation for patches without drips	TThresh.cdf	CRWMS M&O 1998i
RH threshold for CAM humid-air corrosion initiation for patches without drips	HARH.cdf	Section 5.5-5
CAM humid-air general corrosion coefficient a_0 (intercept coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5-3
CAM humid-air general corrosion coefficient a_1 (temperature coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5-3
CAM humid-air general corrosion coefficient a_3 (time coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5-3
No drip CRM general corrosion rate at 50°C	Gnd27550.cdf	CRWMS M&O 1998f
Temperature threshold for CAM corrosion initiation for patches with drips	TThresh.cdf	CRWMS M&O 1998i
RH threshold for CAM humid-air corrosion initiation for patches with drips	HARH.cdf	Section 5.5-6
Temperature threshold for CRM localized corrosion initiation	Uniform(80, 100)	Section 5.9-6
CAM aqueous general corrosion coefficient b_0 (intercept coefficient)	Joint Normal(b_0,b_1)	Section 5.6-3
CAM aqueous general corrosion coefficient b_1 (time coefficient)	Joint Normal(b_0,b_1)	Section 5.6-3
CRM general corrosion rate with drips at 50°C	g8435050.cdf	CRWMS M&O 1998g
C_{LC} term in CRM localized corrosion model	Normal(4.367, 2.4495)	Section 5.9-4

Table 5- 16 Input Parameters Considered in the Regression-Based Sensitivity Analysis Case WPSA2.

Input Parameter	Distribution	Source
The number of patches on waste package	Uniform(96, 9640)	N/A
Temperature threshold for CAM corrosion initiation for patches without drips	TThresh.cdf	CRWMS M&O 1998i
RH threshold for CAM humid-air corrosion initiation for patches without drips	HARH.cdf	Section 5.5.6
CAM general corrosion variance split for waste package-to-waste package and patch-to-patch variability	Uniform(0, 1)	N/A
CAM humid-air general corrosion coefficient a_0 (intercept coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5.3
CAM humid-air general corrosion coefficient a_1 (temperature coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5.3
CAM humid-air general corrosion coefficient a_3 (time coefficient)	Joint Normal(a_0,a_1,a_3)	Section 5.5.3
No drip CRM general corrosion rate variance split for waste package-to-waste package and patch-to-patch variability	Uniform(0, 1)	N/A
No drip CRM general corrosion rate at 50°C	gnd27550.cdf	CRWMS M&O 1998f
Top fraction of waste package seeing dripping conditions	Uniform(0, 1)	
Temperature threshold for CAM corrosion initiation for patches with drips	TThresh.cdf	CRWMS M&O 1998i
RH threshold for CAM humid-air corrosion initiation for patches with drips	HARH.cdf	Section 5.5.6
Temperature threshold for CRM localized corrosion initiation	Uniform(80, 100)	Section 5.9.2
CRM localized corrosion initiation temperature threshold variance split for waste package-to-waste package and patch-to-patch variability	Uniform(0, 1)	N/A
CAM aqueous general corrosion variance split for waste package-to-waste package and patch-to-patch variability	Uniform(0, 1)	N/A
CAM aqueous general corrosion coefficient b0 (intercept coefficient)	Joint Normal(b_0, b_1)	Section 5.6.3
CAM aqueous general corrosion coefficient b1 (time coefficient)	Joint Normal(b_0, b_1)	Section 5.6.3
Drip CRM general corrosion rate variance split for waste package-to-waste package and patch-to-patch variability	Uniform(0, 1)	N/A
Drip CRM general corrosion rate at 50°C	g8435050.cdf	CRWMS M&O 1998g
C_{LC} of CRM localized corrosion model	Normal(4.367, 2.4495)	Section 5.9.4
Time exponent of CRM localized corrosion model	B-Normal(0.5,0.125,0.0, 1.0)	Section 5.9.4

Table 5- 17 Output Parameters Studied in Regression-Based Sensitivity Analysis for Cases WPSA1 and WPSA2.

Output Parameter	
First waste package breach time	
First pit-breach time	
First patch-breach time	
Fraction of failed patches at	10,000 years
Fraction of failed patches at	50,000 years
Fraction of failed patches at	100,000 years
Fraction of failed patches at	500,000 years
Fraction of failed patches at	1,000,000 years

Table 5- 18 Importance Ranking of Input Variables on First Patch-Breach Output Variable (R^2 = 0.8492).

Rank	Description	SRRC[a]	R^2 Loss[b]	PRCC[c]
1	Variance share of CRM general corrosion rate with drips	0.702	0.4910	0.875
2	CRM general corrosion rate with drips	-0.563	0.3158	-0.823
3	Fraction of top waste package surface seeing dripping condition	-0.153	0.0233	-0.366
4	Number of patches	-0.143	0.0204	-0.345
5	Variance share for CRM localized corrosion rate	0.0271	0.0007	0.069
6	CRM general corrosion rate without drips	0.0270	0.0007	0.069

a. SRRC (Standardized Rank Regression Coefficients) is the coefficients in the rank regression model after the input variables have been standardized.

b. R^2 Loss is the reduction in R^2 if the input variable is dropped from the regression model.

c. PRCC (Partial Rank Correlation Coefficients) indicates the strength of a linear correlation between the input variable (rank) and the output variable (rank), after eliminating the correlation of all other input variables.