From: Luis Ibarra
Sent: Friday, February 09, 2007 10:53 AM
To: Osvaldo Pensado; Xihua He
Subject: RE: Drip Shield corrosion rate
Attachments: Lognormal Option Corrosion Rate 020907.doc

Osvaldo,

The updated file contains two more figures that include the loguniform proposal. Actually, I tried to make it fit to the data modifying the boundaries, but this distribution offers less flexibility than the lognormal.

Thanks.

Luis

> -----Original Message-----
> **From:** Osvaldo Pensado [mailto:opensado@cnwra.swri.edu]
> **Sent:** Thursday, February 08, 2007 3:49 PM
> **To:** 'Luis Ibarra'; xhe@cnwra.swri.edu
> **Subject:** RE: Drip Shield corrosion rate
>
> Interesting. I would be curious to see how the comparison looks to the log-uniform proposal (which is the real proposal on the table, not the log-normal).
>
> > -----Original Message-----
> > **From:** Luis Ibarra [mailto:libarra@cnwra.swri.edu]
> > **Sent:** Thursday, February 08, 2007 2:03 PM
> > **To:** xhe@cnwra.swri.edu; opensado@cnwra.swri.edu
> > **Subject:** RE: Drip Shield corrosion rate
> >
> > Please take a look at the attachment in which I introduced an alternative lognormal curve. I'm going to a meeting but if you need to discuss this approach, I'll be available tomorrow Friday.
> >
> > Thanks.
> >
> > Luis
> >
> > > -----Original Message-----
> > > **From:** Xihua He [mailto:xhe@cnwra.swri.edu]
> > > **Sent:** Thursday, February 08, 2007 8:41 AM
> > > **To:** opensado@cnwra.swri.edu; 'Luis Ibarra'
> > > **Subject:** RE: Drip Shield corrosion rate
> > >
> > > I discussed this with Luis. Most corrosion rates are in the order of 10-8 and 10-7, but we can not ignore the one in the order of 10-6. I agree to put more weight on the lower corrosion rate side. It appears that the log-uniform distribution is the best choice.
> > >
> > > Xihua
> > >
> > > > -----Original Message-----
> > > > **From:** Osvaldo Pensado [mailto:opensado@cnwra.swri.edu]
> > > > **Sent:** Wednesday, February 07, 2007 6:36 PM
> > > > **To:** 'Luis Ibarra'; 'Xihua He'
> > > > **Subject:** RE: Drip Shield corrosion rate

Luisito and Xihua

I updated the file s:\opensado\DripShieldCorrosionRate.wpd to incorporate other alternatives (log-normal, normal, triangular).

Bottom line: still the log-uniform distribution appears the best option that incorporates the literature bounds, yet highlighting the low corrosion rates.

The file also includes an answer to what should be the shape of the corrosion rate distribution that would cause the corrosion time be uniformly distributed.

It is true that more experiments could point to different boundaries. When those new data are available, the information would have to be evaluated. Higher and lower corrosion rates can be equally conjectured at this time.

Please take a look at the file. We need to wrap this parameter up.

> -----Original Message-----
> **From:** Luis Ibarra [mailto:libarra@cnwra.swri.edu]
> **Sent:** Wednesday, February 07, 2007 10:23 AM
> **To:** opensado@cnwra.swri.edu; 'Xihua He'
> **Subject:** RE: Drip Shield corrosion rate
>
> Osvaldo,
>
> The loguniform distribution represents an improvement and we could work with this model if you consider that there are arguments to justify this distribution.
>
> However, I still think that the distribution should be more lumped towards lower corrosion rates. For instance, the 50th for the corrosion rate is a bit more than 3x10-7 m/yr in the CDF of the loguniform distribution. This value is higher than DOE 50th (2.3x10-8 * 2 sides = 4.6x10-8 m/yr reported in WAPDEG), or the German data (4x10-8 x 2 sides = 8x10-8). Regarding CNWRA 2001-03 data, the average value of the proposed range is 6.45x10-8 x 2 sides = 1.29x10-7 m/yr, which is closer to the 50th of the proposed distribution.
>
> So, I find the corrosion rates obtained from this distribution rather high and probably a lognormal distribution could close this gap and still assign a reasonable density area for the region of high corrosion rates reported by Hua and Gordon. As we discussed yesterday, there are additional decisions associated with an unbounded distribution that would have to be addressed. In any case, similar decisions are taken for the loguniform distribution but at early stages of the decision process (e.g., the assigned lower and upper boundaries are based on the extreme results reported in several sources. In this case, it could be pointed out that the number of experiments and results used for setting these boundaries is rather limited and that there is a chance that these limits are exceeded if more experiments are performed).
>
> Thanks.
>
> Luis
>
> > -----Original Message-----
> > **From:** Osvaldo Pensado [mailto:opensado@cnwra.swri.edu]
> > **Sent:** Tuesday, February 06, 2007 6:25 PM
> > **To:** Xihua He; Luis Ibarra
> > **Subject:** Drip Shield corrosion rate
> >
> > Look at the file s:\opensado\DripShieldCorrosionRate.wpd

It is a good idea to use a log-uniform instead of uniform distribution for the corrosion rates since I believe the lower rates are more likely.

See the file for a CDF of the corrosion rate, corrosion failure time, and other statistics.

Let me know if you agree with this proposed change to be incorporated in the TPA code.

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Osvaldo Pensado, Ph.D.
Senior Research Scientist, SwRI
6220 Culebra Road. San Antonio TX 78238
(210) 522 6084
Fax: (210) 522 6081

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Hearing Identifier: HLW_YuccaMountain_Hold_EX
Email Number: 1198

Mail Envelope Properties (000001c74c62$5b74dd80$c6c8a281)

Subject: RE: Drip Shield corrosion rate
Sent Date: 2/9/2007 10:52:52 AM
Received Date: 2/9/2007 10:52:53 AM
From: Luis Ibarra

Created By: libarra@cnwra.swri.edu

Recipients:
"Osvaldo Pensado" <opensado@cnwra.swri.edu>
Tracking Status: None
"Xihua He" <xhe@cnwra.swri.edu>
Tracking Status: None

Post Office: cnwra.swri.edu

Files	**Size**	**Date & Time**
MESSAGE	5223	2/9/2007 10:52:53 AM
Lognormal Option Corrosion Rate 020907.doc	219201	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

An alternative lognormal distribution is proposed below by trying to resemble counted CDFs obtained from the data located in the parameters.wpd file for corrosion rates.

The orange curve is the curve presented by Osvaldo as the lognormal option. The mean of the data and the standard deviation of the log of the data are derived from lower and upper boundaries of 7.6×10^{-8} and 1.32×10^{-6} associated with 0.001 and 0.999 of the density area, respectively.

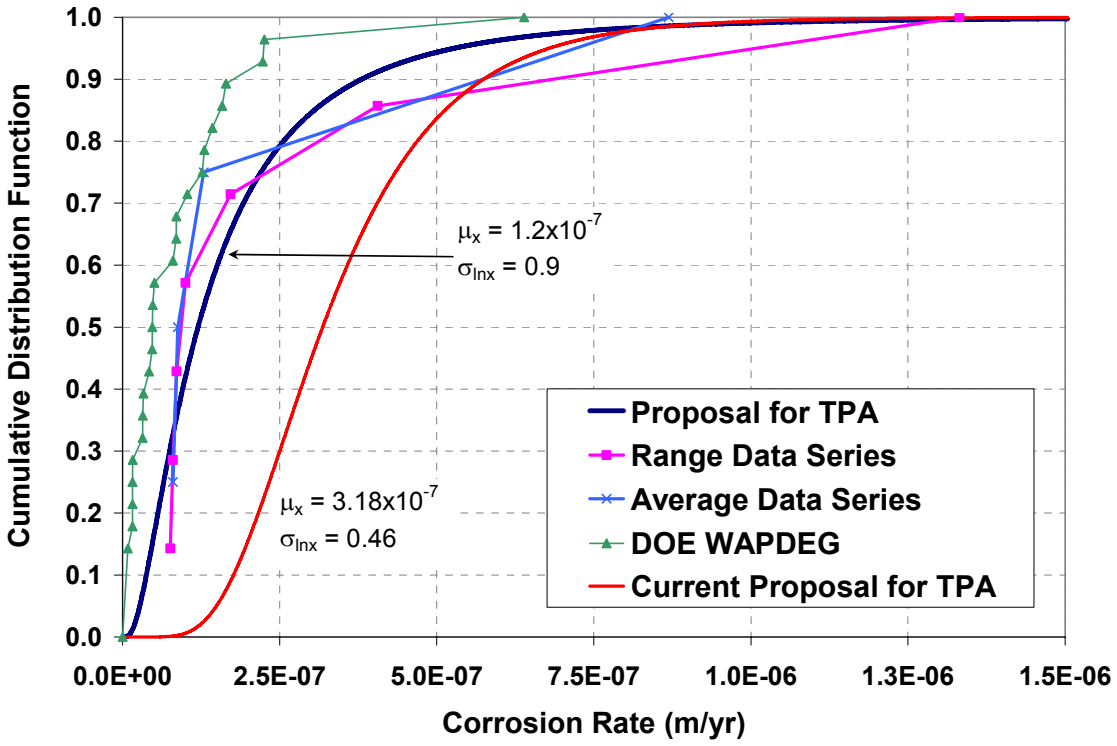
The navy blue curve is an alternative lognormal option with different mean and dispersion values that fits better the blue and pink curves. The lower limit at 0.001 would correspond to 7.44×10^{-9}, and the upper limit to 1.94×10^{-6}.

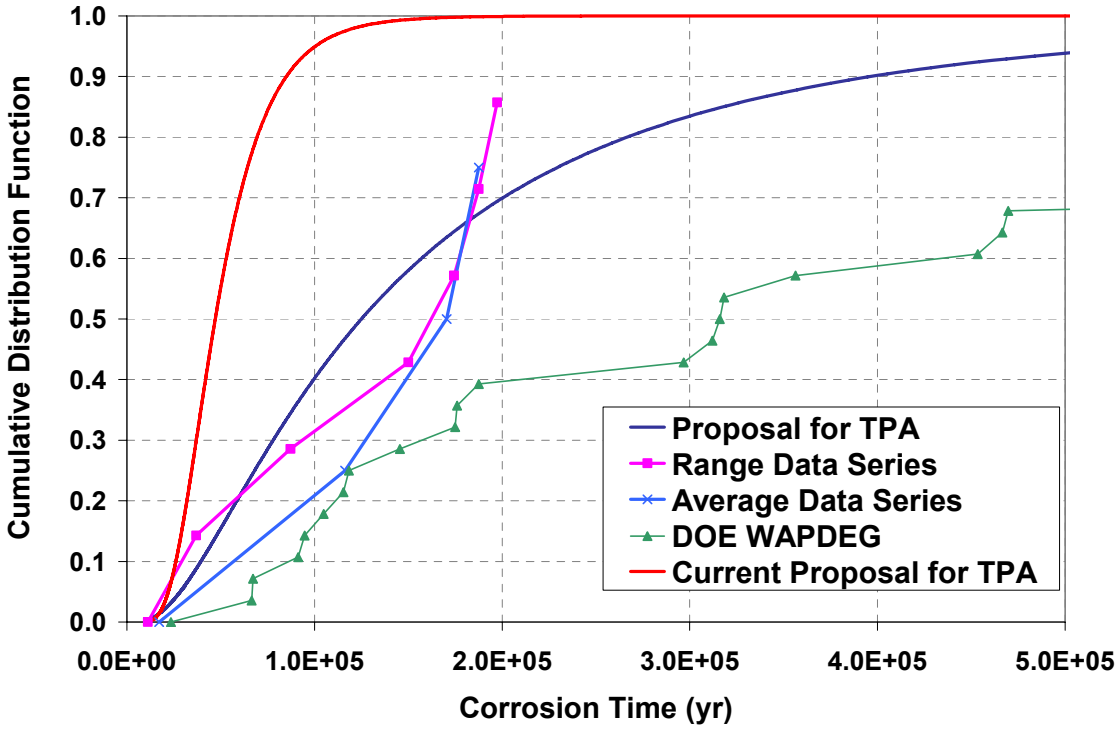
The green curve is the cumulative distribution function (CDF) proposed by DOE in the WAPDEG document. This one is shown just for comparison purposes to indicate that event the proposed lognormal distribution exhibits higher deterioration rates.

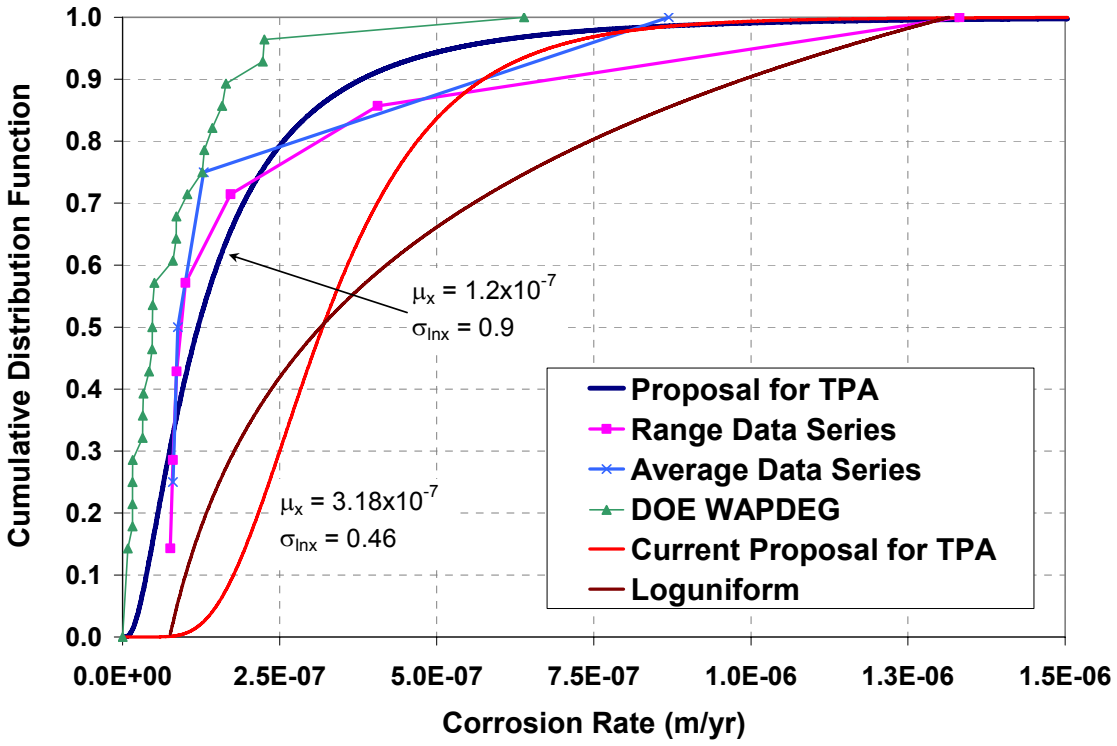
The pink curve is a counted CDF made with seven points obtained from the lower and upper limits of CNWRA 2001-03, DOE range, Xua and Gordon limits, and the German data at 170 C. Taking the upper and lower limits is a gross approximation and is done because of the small number of points.

The cyan curve is a counted CDF made with four points obtained from the average of CNWRA 2001-03, DOE and Xua and Gordon average, plus the German data at 170 C. A counted CDF based on averages is more stable, but there is no enough number of points to draw definite conclusions.

The brown curve in the third and fourth graphs is loguniform distribution with lower and upper limits of 8.6e-8 and 1.32e-7.


Cumulative Distribution Function
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0E+00
2.5E-07
5.0E-07
7.5E-07
1.0E-06
1.3E-06
1.5E-06
Corrosion Rate (m/yr)
μx = 1.2x10-7
σlnx = 0.9
μx = 3.18x10-7
σlnx = 0.46
Proposal for TPA
Range Data Series
Average Data Series
DOE WAPDEG
Current Proposal for TPA


Cumulative Distribution Function
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0E+00
1.0E+05
2.0E+05
3.0E+05
4.0E+05
5.0E+05
Corrosion Time (yr)
Proposal for TPA
Range Data Series
Average Data Series
DOE WAPDEG
Current Proposal for TPA


Cumulative Distribution Function
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0.9
0.8
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0.1
0.0
0.0E+00
2.5E-07
5.0E-07
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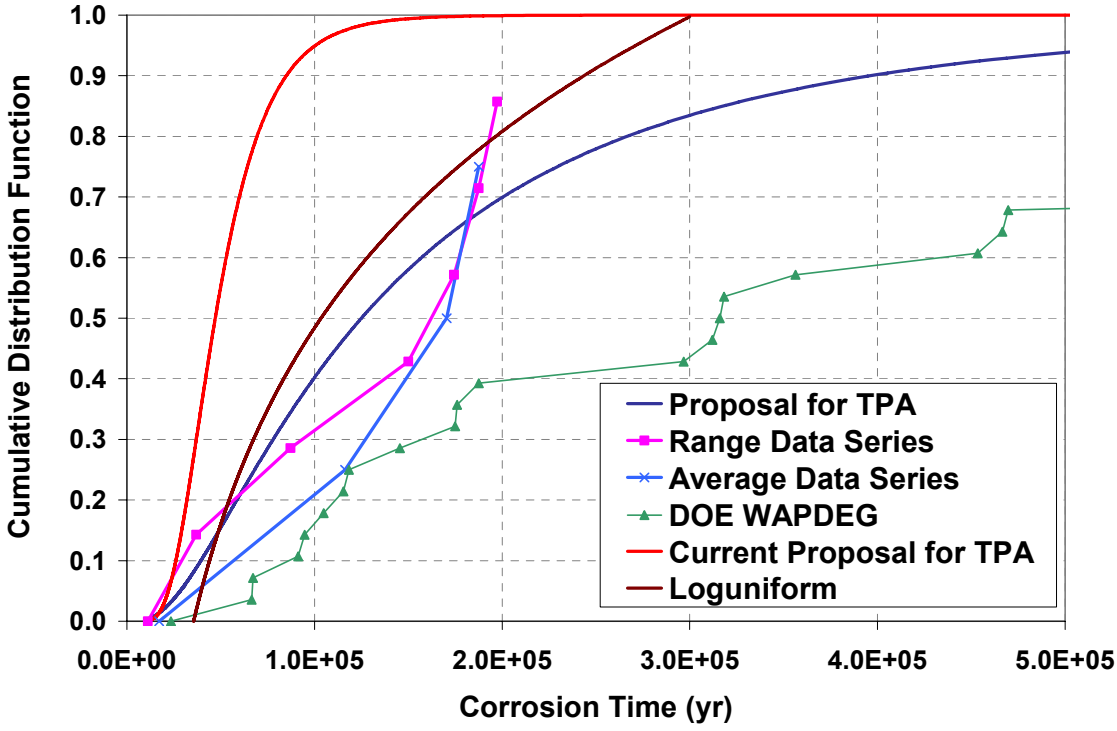
Proposal for TPA
Range Data Series
Average Data Series
DOE WAPDEG
Current Proposal for TPA
Loguniform


Cumulative Distribution Function
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0.2
0.1
0.0
0.0E+00
1.0E+05
2.0E+05
3.0E+05
4.0E+05
5.0E+05
Corrosion Time (yr)
Proposal for TPA
Range Data Series
Average Data Series
DOE WAPDEG
Current Proposal for TPA
Loguniform