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COMMENTS DRAFT FINAL LINER COMPATIBILITY STUDY

10/07/96

OEPA DOE-FN
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COMMENTS

OhioEPA
State of Ohio Environmental Protection Agency
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425

George V. Voinovich
Governor

October 7, 1996

RE: DOE FEMP
MSL 531-0297
HAMILTON COUNTY
COMMENTS DRAFT FINAL
LINER COMPATIBILITY STUDY

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

Dear Mr. Reising:

This letter provides as an attachment Ohio Environmental Protection Agency comments on the Draft Final Leachate/Liner Compatibility Study received on August 28, 1996.

If you have any questions, please contact Tom Ontko or me.

Sincerely,

Tom Ontko for

Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, FERMCO
Ruth Vandergrift, ODH
Mike Proffitt, DD&GW
Sharon McLellan, PRC
Manager, TPSS/DERR,CO
Dave Ward, GeoTrans
DFLELICS.LTT

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Ohio Environmental Protection Agency Comments on the Draft Final Leachate/Liner Compatibility Study Report

Commenting Organization: Ohio EPA Commentor: OFFO
Section #: Pg #: Line #: Code: M
Original Comment #:
Comment: The data analysis does not support the conclusions that the leachate caused no observable effects on the physical or mechanical properties of the geomembranes. The analysis of the data performed by GeoTrans shows that an observable effect does exist. The fact that these effects are generally not deleterious to the mechanical properties does not alter the general conclusion that an effect does exist. Furthermore, GeoTrans' data analysis is limited to only two of the liner materials ,GSE-SLT and Polyflex. GeoTrans did not evaluate the data for the NSC, GSE-Gundle or the Serrot geomembranes.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 2.3 Selection of Test Leachate Pg. #: Code: c
Original Comment #
Comment: In retrospect, it would have been more conservative to use concentrated leachate to mimic the long-term effects.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 2.3 Selection of Test Leachate Pg. #: 2-4 Code: M
Original Comment #
Comment: In the first bullet on this page FERMCO implies that the concentrations of VOCs are below a level of concern for HDPE degradation. However, on Table 2-1 on page 2-5, the range of concentrations of PCE and TCE are up to 10,000 ppb. The test leachate concentrations for these compounds are 90 and 650 ppb respectively. The test leachate does not conservatively represent the perched groundwater considering that some perched waters in the production area have concentrations of over 2000 ppb PCE (Well 1145 and Pit Leachate 1776) and over 1400 ppb TCE (Wells 1031 and 1145 and several others). What concentrations of VOCs are considered by the manufacturers to be of concern for degradation of their products?

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 3.5 Summary of Results Pg. #: 3-9 Code: C
Original Comment #
Comment: The column titled "Interpretation" on Table 3-1 seems to be altered. For the physical properties, all entries in the Interpretations column begin with "Extractable content increase most likely due to...." Please update this table.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: 4.0 Conclusions Pg. #: 4-1 Code: M
Original Comment #
Comment: Please explain the basis of the conclusions stated in the last paragraph on this page. If the design life of the landfill is considered in the data evaluation, any measurable variation in the

properties tested would warrant concern. Unfortunately, USEPA Method 9090A provides very few details of the methods to evaluate the test data that is collected.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: Appendix B, Geomembrane/Leachate USEPA Method 9090 Code: M
Original Comment #
Comment: Please explain the rationale for the method of the evaluation of data from compatibility testing which was performed using USEPA Method 9090. The aforementioned EPA method indicates the data should be analyzed by looking at the percent change in each parameter. The data analysis provided consists of calculating the mean and the standard deviation (SD) for 2 to 5 controls as a group and 2 to 5 experimentals as a group for each exposure period. For example, in Appendix B 2.1, the masses of the four specimens have been averaged. An error bar is provided that graphically displays the estimated errors in this measurement. Averaging the controls and the experimentals is essentially providing manufacturing quality control, (that is how similar the test specimens weigh) not evaluating the effect of the leachate on the parameter of interest. The data would more appropriately be evaluated by calculating the mean and SD for the percent difference between the control and experimental for each specimen.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: Appendix B, Geomembrane/Leachate, USEPA Method 9090 Code: C
Original Comment #
Comment: The graphs of the percentage change for the different parameters are not drawn with scales that are appropriate to illustrate significant changes. These graphs should be prepared using more appropriate scales, so variations can be seen. The percent changes in the parameters are observable if plotted at an appropriate scale. Statistics must be used to indicate if these changes are statistically significant.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #: Appendix B, Geomembrane/Leachate USEPA Method 9090 Code: C
Original Comment #
Comment: A statistical analysis was completed on some of the data presented in this report. The procedure was to calculate the mean and standard deviation of percent changes for select parameters and all exposure periods for materials GSE-SLT and Polyflex. The T-test was then performed to determine if 0 percent change (no effect) fell within the two tailed 90% confidence interval for a normal distribution. If this was the case, then the t-test did not statistically show an effect from exposure to the leachate. The results of this statistical test for both materials and select parameters are included in Tables 1 and 2. The following comments on Appendix B are based on these results. An explanation of the statistical method used for the analyses follows.

In order to determine whether a given parameter changed significantly as a result

of the materials test, the percentage change for each of the samples was calculated. If there was no change as a result of the tests, the mean percentage change is expected to be zero. Thus:

H_o : The arithmetic mean of the % change = 0
and
H_a : The arithmetic mean of the % change $\neq$ 0

We have used a two tailed test because both positive and negative percent changes are possible and of interest. For the threshold level of significance we have used α = 0.1. We have assumed the frequency distribution of % change to be normal.

For a sample size of five measurements (df=4), the value for $t_{\alpha/2[4]}$ is $\pm$2.132.
Our test statistic is:

$$t = \frac{(\text{sample mean} - \mu)}{(\text{sample standard deviation} / \text{square root of the sample size})}$$

For example, the percent change of the five results for the 30-day Mullen Burst Test on the GSE-SLT material were 3.03, 6.25, 11.11, 6.25, and 11.11. The mean of these values is 7.55 and the standard deviation is 3.51. In order to estimate whether the population mean is zero (given these sample variables) the test statistic becomes:

$$t = \frac{(7.55 - 0)}{((3.51)/(5)^{1/2})} = 4.81$$

Because this value lies outside the acceptance region of $\pm$2.132, the null hypothesis is rejected and the percent change of the Burst Test measurements is said to depart significantly from zero (i.e. the testing had a significant effect). Although in this particular case, the observed effect is not deleterious.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.1, Mass Pg. #: B-3 Code: C
Original Comment #
Comment: For Mass, 1 of 4 data sets analyzed by the t-test indicated the GSE-SLT material was affected during the 120-day exposure period. The effect was shown to be a loss of mass. The conclusion of no measurable impact is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.

Section #:Appendix B, Section 2.3, Dimensions Pg. #: B-25 Code: C
Original Comment #
Comment: For Width, 1 of the 4 data sets analyzed by the t-test indicated the GSE-SLT material was affected during the exposure period. The effect was shown to be a decrease in the material width. The conclusion of no measurable impact is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.4, Specific Gravity Pg. #: B-36 Code: C
Original Comment #
Comment: For Specific Gravity, 7 of the 8 data sets analyzed by the t-test indicated for GSE-SLT and Polyflex materials were affected during the exposure periods. In 6 of 7 instances the effect was shown to be an increase in the specific gravity. The conclusion of no measurable impact is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.5, Volatiles Loss Pg. #: B-42 to B-44 Code: C
Original Comment #
Comment: For Volatiles Loss, 3 of the 4 data sets analyzed by the t-test indicated for GSE-SLT material was affected during the exposure periods. In all instances the effect was shown to be an increase in the volatiles loss. The conclusion may be incorrect. The results of this test correlate well with the results of the specific gravity tests.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.6, Extractables Content Pg. #: B-50 to B-52 Code: C
Original Comment #
Comment: For Extractables Content, 3 of the 8 data sets analyzed by the t-test indicated the GSE-SLT and Polyflex materials were affected during the exposure periods. In all instances the effect was shown to be an increase in the Extractables Content. The conclusion of no impact from exposure to the leachate is questionable. The comparison to results of specific gravity and volatiles loss indicates this effect is probably due to exposure to the leachate.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.7, Stress and Strain at Yield Pg. #: B-58 to B-61 Code: C
Original Comment #
Comment: For Stress at Yield, 4 of the 8 data sets analyzed by the t-test indicated for GSE-SLT and Polyflex materials were affected during the exposure periods. In all instances the effect was shown to be an increase in the Stress at Yield.
For Strain at Yield, 4 of the 8 data sets analyzed by the t-test indicated for GSE-SLT and Polyflex materials were affected during the exposure periods. In all instances the effect was shown to be an increase in the Strain at Yield. The conclusion of no impact on the Stress and Strain at Yield of the materials from exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.8, Stress and Strain at Break Pg. #: B-82 to B-85 Code: C
Original Comment #
Comment: For Stress at Break, 3 of the 4 data sets analyzed by the t-test indicated the GSE-SLT material was affected during the exposure periods. In all instances the effect was shown to be an increase in the Stress at Break.
For Strain at Break, 2 of the 8 data sets analyzed by the t-test indicated the GSE-SLT material was affected during the exposure periods. In both instances the effect was shown to be an increase in the Strain at Break. The conclusion that there is no impact on the Stress and Strain at Break of the materials from exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.10, Initial Tearing Resistance Pg. #: B-139 to B-140 Code: C
Original Comment #
Comment: For Initial Tearing Resistance, all of the data sets analyzed by the t-test indicated the Polyflex material was affected during the exposure periods. The conclusion that there is no impact on the Initial Tearing Resistance of the material due to exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.11, Hardness Pg. #: B-151 Code: C
Original Comment #
Comment: For Hardness, 2 of the 4 data sets analyzed by the t-test indicated the Polyflex material was affected during the exposure periods. In both instances the effect was shown to be an increase in the Hardness. The conclusion that there is no impact on the Hardness of the material due to exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.12, Puncture Resistance Pg. #: B-162 to B-163 Code: C
Original Comment #
Comment: For Puncture Resistance, 2 of the 8 data sets analyzed by the t-test indicated the GSE-SLT and Polyflex materials were affected during the exposure periods. The conclusion that there is no impact on the Puncture Resistance of the material due to exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.13, Mullen Burst Strength Pg. #: B-174 Code: C
Original Comment #
Comment: For Mullen Burst Strength, 5 of the 8 data sets analyzed by the t-test indicated the GSE-SLT and Polyflex materials were affected during the exposure periods. In 4 of the 7 instances the effect was shown to be an increase in the Mullen Burst Strength. The conclusion

that there is no impact on the Mullen Burst Strength of the material due to exposure to the leachate is questionable.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Section 2.14.1, Pg. #: B-180 Code: C Original
Comment #
Comment: Please review and update the interpretations of the leachate/liner compatibility physical properties testing results. It would be helpful to indicate how these results will be used to predict the long term compatibility of the leachate and the liner. Results of the specific gravity analyses indicated exposure to the leachate resulted in an increase in specific gravity. Mass and width of the GSE-SLT material were also affected.

Commenting Organization: OEPA Commentor: GeoTrans, Inc.
Section #:Appendix B, Sect. 2.14.2, Pg. #:B-180 Code: C
Original Comment #
Comment: Please review and update the interpretations of the leachate/liner compatibility mechanical properties testing results. It would be helpful to indicate how these results will be used to predict the long term compatibility of the leachate and the liner. Results of many of the mechanical properties test indicated an effect on the liner from exposure to the leachate.

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Table 1 - Results for Testing of GSE-SLT Material at 23 C										
Physical Properties										
Property	Direction	Degrees	Exposure Period, days							
		of Freedom	30	60	90	120				
Mass	na	3				s				
Thickness	na	3								
Dimensions (Width)	na	3	s							
Specific Gravity	na	4	s	s	s					
Volatiles Loss	na	1	s	s		s				
Extractable Content	na	1	s	s						
Mechanical Properties										
Property	Direction	Degrees	Exposure Period, days							
		of Freedom	30	60	90	120				
Stress at Yield	Roll	4			s	s				
Strain at Yield	Cross Roll	4		s		s				
Stress at Break	Cross Roll	4				s				
Strain at Break	Roll	4				s				
Modulus of Elasticity	Roll	4				s				
Initial Tearing Resistance	Cross Roll	4								
Hardness	na	4								
Puncture Resistence	na	4								
Mullen Burst Strength	na	4			s	s				
Note:	for Physical Properties, "s" denotes significant exposure effect using a two-tailed t-Test with alpha = 10 %									
	for Mechanical Properties, "s" denotes significant exposure effect using a single-tailed t-Test with alpha = 10 %									
	for Mechanical Properties only a reduction in value of the property was considered									

Table 2 - Results for Testing of POLYFLEX Material at 23 C										
Physical Properties										
Property	Direction	Degrees	Exposure Period, days							
		of Freedom	30	60	90	120				
Mass	na	3								
Thickness	na	3								
Dimensions (Width)	na	3								
Specific Gravity	na	4	s	s	s	s				
Volatiles Loss	na	1								
Extractable Content	na	1		s						
Mechanical Properties										
Property	Direction	Degrees	Exposure Period, days							
		of Freedom	30	60	90	120				
Stress at Yield	Roll	4		s		s				
Strain at Yield	Cross Roll	4	s	s						
Stress at Break	Cross Roll	4								
Strain at Break	Roll	4								
Modulus of Elasticity	Roll	4				s				
Initial Tearing Resistance	Cross Roll	4			s	s				
Hardness	na	4								
Puncture Resistence	na	4				s				
Mullen Burst Strength	na	4				s				
Note:	for Physical Properties, "s" denotes significant exposure effect using a two-tailed t-Test with alpha = 10 %									
	for Mechanical Properties, "s" denotes significant exposure effect using a single-tailed t-Test with alpha = 10 %									
	for Mechanical Properties only a reduction in value of the property was considered									

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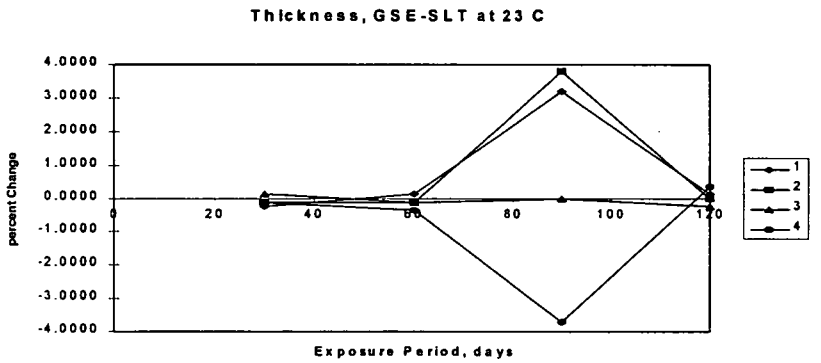

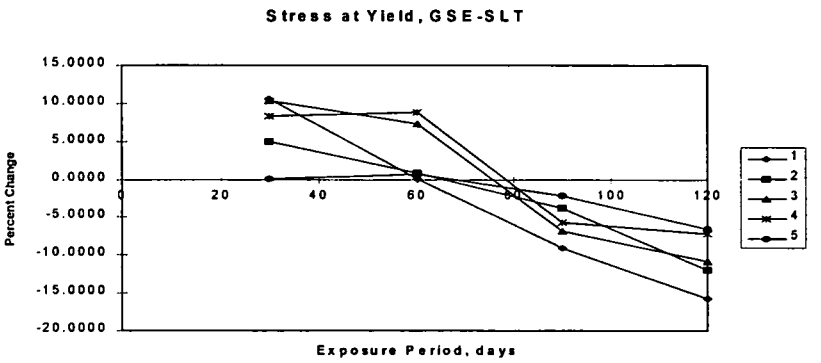

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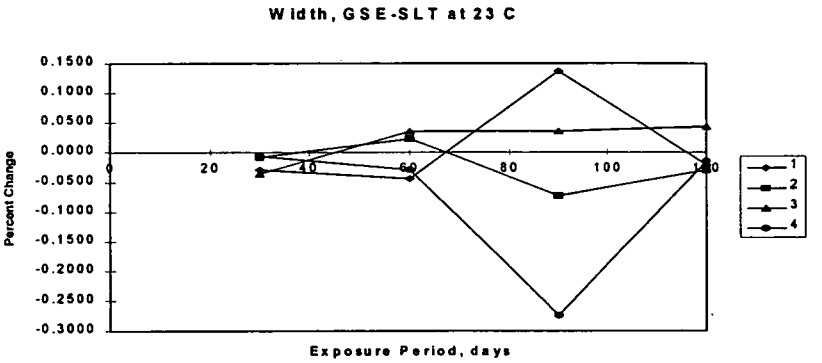

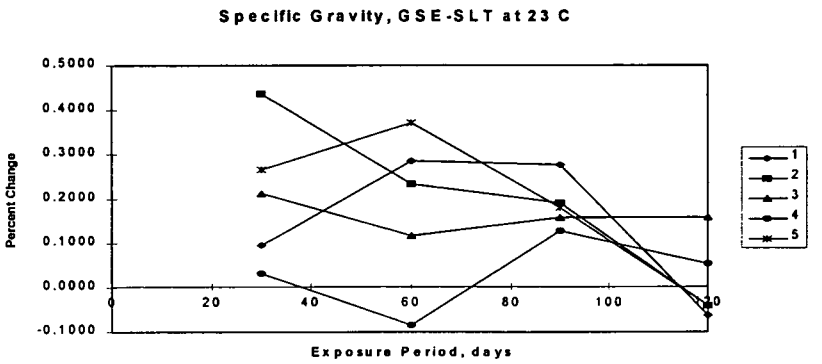

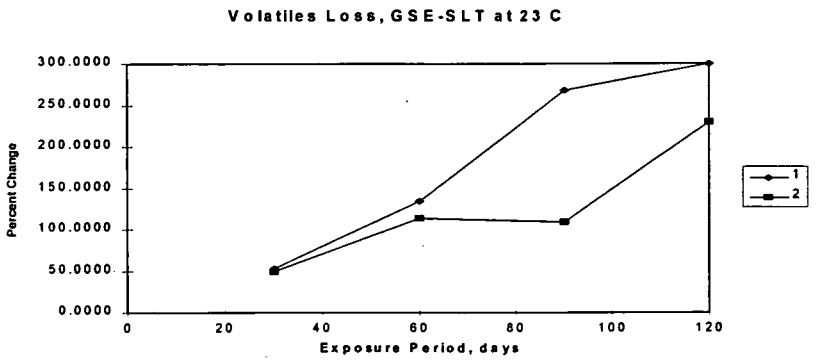

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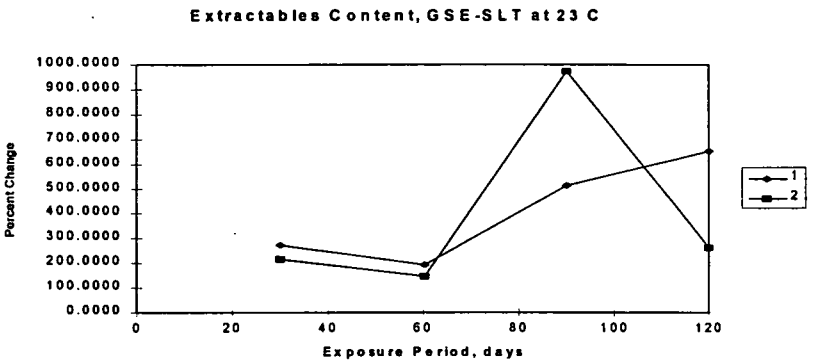

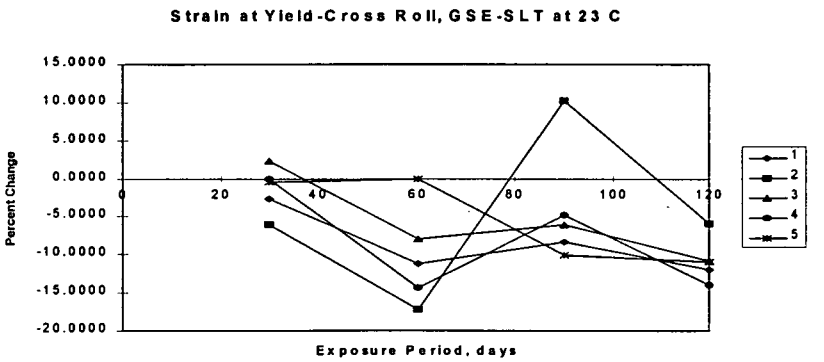

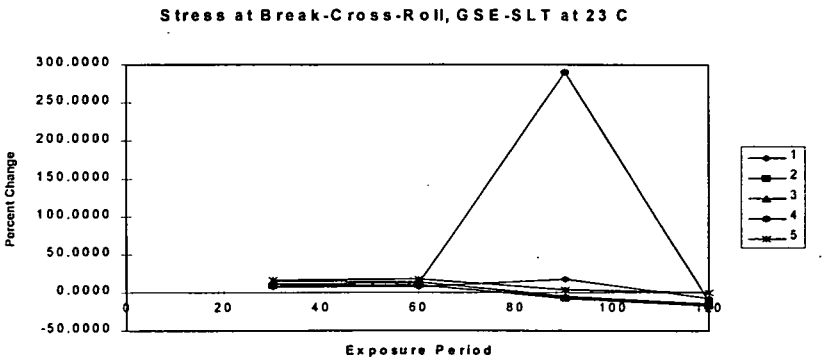

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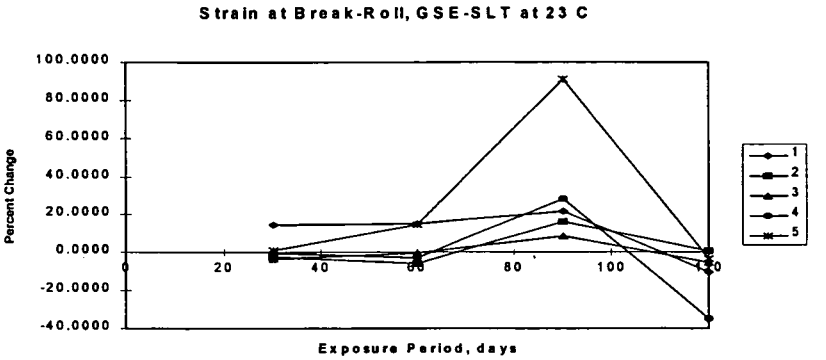

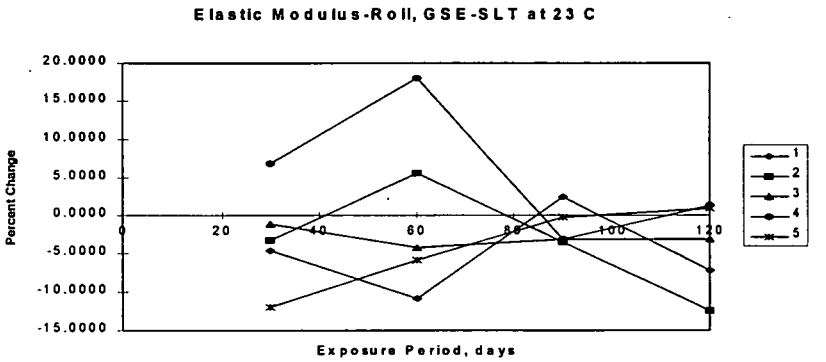

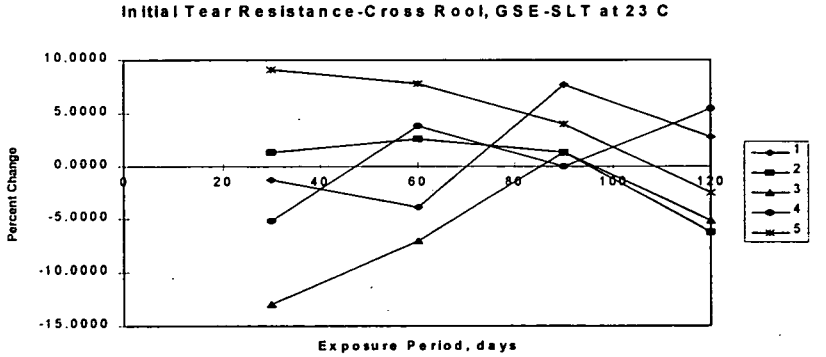

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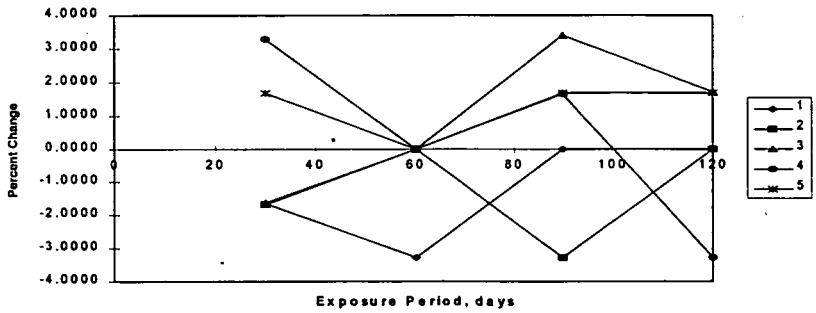
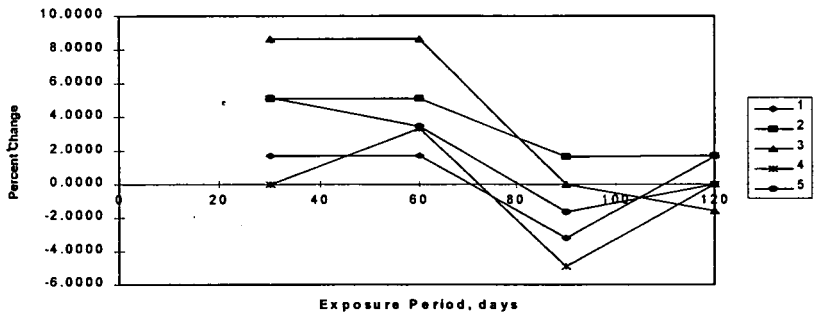
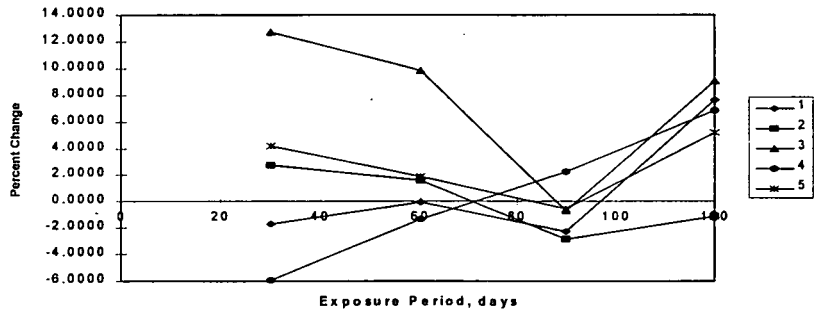
Hardness, GSE-SLT at 23 C



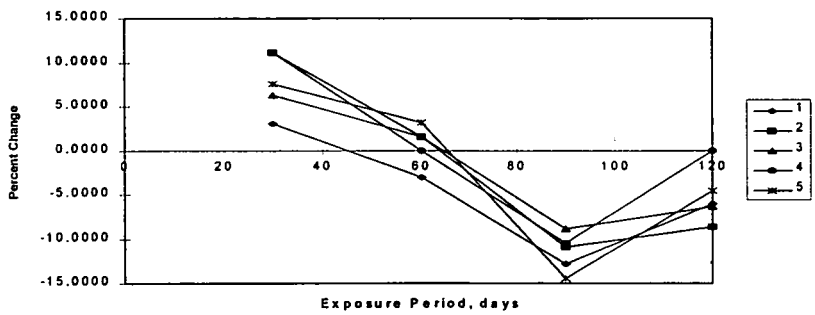
Hardness, POLYFLEX, 23 C



Puncture Resistance, GSE-SLT at 23 C



Mullen Burst Strength, GSE-SLT at 23 C



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