



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10 HANFORD PROJECT OFFICE
712 SWIFT BOULEVARD, SUITE 5
RICHLAND, WASHINGTON 99352

0051561

071179

July 23, 1999

Mr. Owen C. Robertson
Senior Project Manager, Remedial Action Project
Department of Energy
P.O. Box 550, MSN H0-12
Richland, WA 99352

RECEIVED

JUL 26 1999

DOE-RL / DIS

Re: ERDF Cells 3 and 4 at the Department of Energy Hanford Site Construction Quality Assurance Audit

Dear Mr. Robertson:

The U.S. Environmental Protection Agency (EPA), as the lead regulatory agency overseeing the construction of the Environmental Restoration Disposal Facility (ERDF) Cells 3 and 4 at the Department of Energy Hanford Site, conducted an audit of the Construction Quality Assurance (CQA) from July 9 through July 20, 1999. Attached are the results of the audit. No further actions are required from the Department of Energy with respect to the audit.

If you have any questions or concerns with respect to the audit, please contact David Einan of the EPA at 376-3883.

Sincerely,

Pamela S. Innis
EPA ERDF Construction Project Manager



Attachments (2)

cc w/attach: Vern Dronen, BHI
Greg Mitchem, BHI
Ernie Mokuiki, BHI

071179

**Final EPA ERDF Phase II CQC/CQA Audit
Geomembrane Seam Destructives**

July 23, 1999

**Pamela S. Innis
EPA ERDF Construction Project Manager**

INTRODUCTION

The U.S. Environmental Protection Agency (EPA), as the lead regulatory agency overseeing the construction of the Environmental Restoration Disposal Facility (ERDF) Cells 3 and 4 at the Department of Energy Hanford Site, conducted an audit of the Construction Quality Assurance (CQA) from July 9 through July 20, 1999. The audit focused on the destructive testing of the field seams as described in Section 4.5.2.4 of the ERDF Construction Quality Assurance Plan (BHI-01143, Rev. C).

The initial phase of the audit consisted of a review and comparison of the field logs from Golder Construction Services (GCS) and Serrot Corporation (Serrot). A preliminary draft was provided to Bechtel Hanford (BHI) and Serrot Corporation in a meeting held July 12, 1999. The results are below.

Minor Inconsistencies

The initial evaluation compared the field logs themselves. Any inconsistencies between the two logs regarding Serrot operator, machine or seam number were noted.

Audit Results:

DS-5	Operator: GCS - PM, Serrot - WEO
DS-10	Operator: GCS - RM, Serrot - WEO Machine: GCS - 153, Serrot - 116
DS-13	Machine: GCS - 132, Serrot - 116
DS-15	Operator: GCS - WEO, Serrot - RM Machine: GCS - 116, Serrot - 153
DS-18A/18B	Machine: GCS - 132, Serrot - 153
DS-23/23A/ 23B	Operator: GCS - WEO, Serrot - RM Machine: GCS - 132, Serrot - 153
DS-32	Operator: GCS - RM, Serrot - MA Machine: GCS - 153, Serrot - 133
DS-33	Operator: GCS - WEO, Serrot - PM Machine: GCS - 132, Serrot - 116
DS-34	GCS marked failure in passing test result block
DS-35	Seam #: GCS - 42/43, Serrot - 44/45 Operator: GCS - RM, Serrot - PM Machine: GCS - 153, Serrot - 116
DS-58	Seam #: GCS - 47/12P, Serrot - 10/EXT Operator: GCS - RM, Serrot - PM Machine: GCS - 70, Serrot - 68
DS-59	Seam #: GCS - 10/EXT, Serrot - 1/EXT
DS-60	Seam #: GCS - 1/EXT, Serrot - 65/66
DS-61	Seam #: GCS - 65/66, Serrot - 66/67
DS-88	Seam #: GCS - 49/28H, Serrot - 49/EXT

DS-89	Machine: GCS -2042, Serrot - 2045
DS-90	Seam #: GCS - 86/87, Serrot - 85/87
DS-93	Machine: GCS - 2042, Serrot - 2052
DS-103	Operator: GCS - PM, Serrot - RM
DS-104	Machine: GCS - 164, Serrot - 184
DS-128	Seam #: GCS - 28/EXT, Serrot - 29/EXT
DS-132	Operator: GCS - GM, Serrot - OO
DS-133	Seam #: GCS - 19/20, Serrot - 17/18
DS-149	Seam #: GCS - 57/58, Serrot - 56/57
DS-162	Seam #: GCS -74/75, Serrot - 76/74
DS-168	Seam #: GCS - 88/87, Serrot - 89/87
DS-182	Operator: GCS - MA, Serrot - GM

Response: GCS submitted a response to BHI to the preliminary draft of the EPA audit on July 13, 1999. The GCS response was submitted to the EPA on July 15, 1999. In their response, a review of the inconsistencies was completed and corrections made as necessary. (See attached response from GCS dated July 13, 1999).

Required Action/ Recommendations: No further actions are required.

Data Discrepancies/Concerns

A review of the field logs for destructive tests were completed. The review focused on assuring that all destructive test seam failures had a corresponding passing test. No as-builts were available for this review so it was unclear if seams had been topped or capped. The results are below.

DS-64	Seam failures on 64, 64B, 64B1, 64B2, 64B3; Passing retest on 64A, 64A1; No passing retest on 64B
DS-70/71	Failed extrusion welds on SP-49/EXT, No passing tests
DS-77	Seam failures on 77, 77A, 77B; No passing retests
DS-78	Seam failures on 78 and 78A; Passing retest on 78B; No passing on 78A
DS-80	Seam failures on 80, 80A and 80B; No passing retests
DS-82	Seam failures on 82 and 82A; Passing retest on 82B; No passing retest on 82A
DS-84	Seam failure on 84 and 84B; No 84A destructive run; No passing retest on 84B
DS-122	Seam failure on 122, 122A, 122B, 122B1; Passing retest on 122A1; No passing retest on 122B
DS-123	Seam failure on 123, 123A, 123A1, 123A2, 123A3, 123B, 123B1; Passing retest on 123B2; No passing retest on 123A

Response: GCS submitted a response to BHI to the preliminary draft of the EPA audit on July 13, 1999. The GCS response was submitted to the EPA on July 15, 1999. In their response, GCS accounted for the failed seams through tracking to passing destructives or extrusion welding/ capping of those seams. GCS provide preliminary as-builts which assisted in verification of all destructive tests. (See attached response from GCS dated July 13, 1999).

Required Action/ Recommendations: No further actions are required.

Low Peel Failure Values - Not a QA Specification

The current ERDF specifications for Cells 3 and 4 did not set a minimum seam peel strength for geomembrane destructive samples but only a film tear bond (FTB). The EPA examined the destructive tests for both GCS and Serrot as a separate evaluation, outside of the CQA requirements, to evaluate a hypothetical outcome of specifying a minimum seam peel strength. The EPA used two values in the examination, 100 lbs/in and 90 lbs/in.

In the provided test data for the approximately 271 destructives, a maximum of 29 destructives had peels with values of less than 100 lbs/in and a maximum of 14 destructives had peels with values of less than 90 lbs/in. The average range of the peel strength for the 245 fusion welds was 135-166 lbs/in with a low value of 53 lbs/in. The average peel strength for 26 extrusion welds was 135.6 lbs/in with a low value of 81 lbs/in. Of the destructives with values less than 90 lbs/in, a maximum of five peel tests passed the FTB requirement.

Response: GCS submitted a response to BHI to the preliminary draft on July 13, 1999. The GCS response was submitted to the EPA on July 15, 1999. In their response, GCS confirmed that minimum seam peel strength was not applied to the destructive tests. (See attached response from GCS dated July 13, 1999).

Required Action/Recommendations: No further actions are required.

It is strongly recommended that, on all future ERDF expansion projects and similar projects where geomembranes are used, the specifications for destructive testing include the following:

- Shear testing - specified required minimum seam shear strength
(EPA guidance (EPA/600/R-93/182) recommends 95% of specified minimum yield strength of the parent material for HDPE)
 - FTB
- Peel Testing - specified required minimum seam peel strength
(EPA guidance (EPA/600/R-93/182) recommends 65% of specified minimum yield strength of the parent material for HDPE)
 - FTB

Missing Information

An asterisk (*) shown on Serrot primary destructive data sheet - An explanation of the marking is requested.

No GCS data sheet for DS-117

Partial copy of GCS data sheet for DS-164

Response: All missing information was obtained. All clarifications were addressed.

Destructive Field Test Audit

On July 20, 1999, the EPA conducted an audit of the destructive testing completed on Cells 3 and 4 geomembrane liners. The audit focused on the peel testing of the geomembrane seams. Selected samples from the following destructives were examined by EPA personnel: DS18 through DS24, DS36 through DS38, DS42 through DS45, DS74 through DS76, DS111 through DS116, DS140 through DS145, and DS167 through DS172. Out of the approximately 271 total destructive tests, this test sample accounted for 71 destructives (including retests) for an examination of approximately 26%.

Required Actions/ Recommendations: No further actions required.

On all future ERDF expansion projects and similar projects where geomembranes are used, the specifications for destructive testing should address the number of failures allowed per number of tests conducted. Many specifications in industry allow for one failure out of five coupons tested per destructive sample (EPA/600/R-93/182). Many industry specifications also state an allowable percentage peel incursion into the weld zone. An allowable incursion of 10% may be considered, as was applied on ERDF Phase I, Cells 1 and 2 geomembrane destructives. Industry standards should be researched prior to finalization of specifications.



Golder Construction Services, Inc.
Quality Assurance and Construction Management

071179

July 13, 1999

Our ref.: 987-3081

Bechtel Hanford, Inc.
3350 George Washington Way
Richland, Washington 99352

ATTENTION: Mr. Ernest Mokuiki

RE: SUBCONTRACT NO. 0600X-SC-G0019
HANFORD-ERC
ERDF CELLS 3 & 4 CQA
RESPONSE TO
EPA ERFD Phase II CQC/CQA Audit Geomembrane Seam Destructives
Dated July 9, 1999

Dear Mr. Mokuiki:

Yesterday morning, Monday, July 12, 1999, I received a list from Jack Howard (BHI) expressing concerns that Ms. Pamela Innis of the EPA had concerning the destructive test data sheets provided by GCS to BHI last week. A response to Ms. Innis's concerns that pertain to GCS is given below. Please refer to the attached copy of the list prepared by Ms. Innis.

Page 1 of 3 - Cover Page only

Page 2 of 3 - Minor Inconsistencies

The destructive test data sheets that were provided to BHI were raw data sheets. GCS is currently reviewing and performing internal quality control checks on our data. At the time that the data sheets were provided to BHI, GCS had not completed the review/QC on the data. Our review is in progress and the current results of the review are provided in Table 1 of this letter below.

Page 3 of 3 - Data Discrepancies/Concerns

A destructive sample summary table was delivered to Jim Carson's - BHI Quality control Manager - on-site in-box on Thursday, July 9. The table summarizes the status of each destructive and how each failed destructive sample was resolved. A copy of the summary table is attached. Please forward a copy to Ms. Innis.

gcsbhi11

Page 3 of 3 – Low Peel Failure Values

Item DS-38: There is no specification for a minimum strength for peel testing. GCS performed the destructive seam testing in our onsite laboratory and the results reported are those generated by GCS. The pass/fail status of each coupon tested by GCS is based upon the method of failure, i.e., FTB vs. non-FTB. The type of failure for each coupon is coded and is listed on the destructive data test sheets. Copies of the codes are attached for both fusion and extrusion samples. Furthermore, GCS did not receive Serrot's destructive test results data and the project documents do not require Serrot to submit their test results. The results reported as determined by GCS are based on our laboratory testing. During peel testing GCS keeps track of the inside and outside orientation of individual coupons. This provides a more consistent range of values than if the orientation is not tracked.

Item DS-65: The GCS results are based on our testing, we did not received the results of the testing performed by Serrot, and we were unaware their results. The variation in the test values may be due to several factors such as differing amounts of grinding, temperature differences, speed, etc.

Page 3 of 3 – Missing Information

The data sheet for DS-117 is attached.

A copy of the data sheet for DS-164 is attached.

The other items listed under this heading do not pertain to GCS.

Sincerely,

GOLDER CONSTRUCTION SERVICES, INC.



Michael Lumpkin
CQA Engineer

MSL/msl

cc: Jack Howard - BHI
Clifford Knitter - GCS
John Swift, P.E. - GCS
File

Table 1
Corrections to Minor Inconsistencies

- DS-5 Operator: GCS – PM, Serrot – WEO
Written incorrectly on archive sample. GCS seaming shows WEO as the operator.
- DS-10 Operator: GCS – RM, Serrot – WEO
Machine: GCS – 153, Serrot – 116
Serrot's seaming field form shows RM as the operator and 153 as the machine number.
- DS-13 Machine: GCS – 132, Serrot 116
Serrot seaming field forms show wedge 132 was used.
- DS-15 Operator: GCS – WEO, Serrot – RM
Machine: GCS – 116, Serrot – 153
The seam was split into two sections and two machines were used to weld the seam. The GCS information is correct for the destructive sample location.
- DS-18A/18B
Machine: GCS – 132, Serrot – 153
Serrot's field forms have 132, perhaps a typo.
- DS-23/23A/23B
Operator: GCS – WEO, Serrot – RM
Machine: GCS – 132, Serrot – 153
The seam was split into two sections and two machines were used to weld the seam. The GCS information is correct for the destructive sample location.
- DS-32 Operator: GCS – RM, Serrot – MA
Machine: GCS – 153, Serrot – 133
The seam was split into two sections and two machines were used to weld the seam. The GCS information is correct for the destructive sample location.
- DS-33 Operator: GCS – WEO, Serrot – PM
Machine: GCS – 132, Serrot – 116
The seam was split into two sections and two machines were used to weld the seam. The Serrot information is correct for the destructive sample location.
- DS-34 GCS marked failure in passing test result block.
The "F" was transferred from the Passing line to the Failing line.
- DS-35 Seam #: GCS – 42/43, Serrot – 44/45
Operator: GCS – RM, Serrot – PM
Machine: GCS – 153, Serrot – 116
Serrot's field seaming log shows the same information as GCS

Table 1
Corrections to Minor Inconsistencies
continued

- DS-58 Seam #: GCS - 47/12P, Serrot - 10 EXT
Operator: GCS - RM, Serrot - PM
Machine: GCS - 70, Serrot - 68
Serrot's seaming field forms have 47/cap, which is referring to repair number 12P
PM/68 welded one side of the repair; RM/70 welded the other side. The correct
information is PM/68.
- DS-59 Seam #: GCS - 10/EXT, Serrot - 1/ EXT
Serrot's seaming field forms have 10/EXT.
- DS-60 Seam #: GCS - 1/EXT, Serrot - 65/66
Serrot's seaming field forms have 1/EXT.
- DS-61 Seam #: GCS - 65/66, Serrot - 66/67
Serrot's field forms have 65/66.
- DS-88 Seam #: GCS - 49/28H, Serrot - 49/EXT
Same location just referenced differently.
- DS-89 Machine #: GCS - 2042, Serrot - 2045
GCS mistook the 5 for a 2. The correct welder would be 2045.
- DS-90 Seam #: GCS - 86/87, Serrot - 85/87
Seam # written incorrectly on archive. GCS seaming log has 85/87.
- DS-93 Machine: GCS -2042, Serrot - 2052
Serrot's seaming field forms have 2042.
- DS-103 Operator: GCS - PM, Serrot - RM
Leg of "R" was left off. Operator is RM
- DS-104 Machine: GCS - 164, Serrot -184
On archive sample the "8" looks like a "6". The correct machine is 184.
- DS-128 Seam #: GCS - 28/ EXT, Serrot - 29/ EXT
Seam was written incorrectly on the archive sample. GCS seaming log has
29/EXT.
- DS-132 Operator: GCS - GM, Serrot - OO
GM and OO were using same welder that day. Both had trial seams for the
machine.

Table 1
Corrections to Minor Inconsistencies
continued

DS-133 Seam #: GCS – **19/20**, Serrot 17/18

Serrot mistook DS-140 on Seam 17/18 for DS-133.

DS-149 Seam #: GCS – 57/58, Serrot **56/57**

GCS seaming log has 56/57. Seam written incorrectly on archive.

DS-162 Seam #: GCS – 74/75, Serrot **76/74**

GCS seaming log has 74/76. Archive sample has 74/76.

DS-168 Seam #: GCS – 88/87, Serrot – 89/87

GCS seam log has **83/87**. Archive sample is faint, "3" was mistaken for an "8".

DS-182 Operator: GCS – MA, Serrot – **GM**

GCS seam log has GM as operator. "MA" written on archive to denote machine.

Archive has operator as GM

Note: **Bold** items denote correct information. GCS made the necessary corrections to the field form and summaries.

MIKE - 7/12/99 0900
1725
PLEASE ANSWER THE
ATTACHED CLAIMS ON AN
INFORMAL BASIS FOR
NOW.

PLEASE SUPPLY INFORMATION
JUSTIFYING YOUR POSITION

ON: ① PG. 3

② PG. 2

JAY - JACK H.

EPA ERDF Phase II CQC/CQA Audit
Geomembrane Seam Destructives

July 9, 1999

Pamela S. Innis
EPA ERDF Construction Project Manager

Received from
Jack Howard - BHI
7/12/99
MSL

p1/3

LOWER PRIORITY

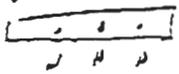
Minor Inconsistencies

DS-5 Operator: GCS - PM, Serrot - WEO
DS-10 Operator: GCS - RM, Serrot - WEO
Machine: GCS - 153, Serrot - 116
DS-13 Machine: GCS - 132, Serrot - 116
DS-15 Operator: GCS - WEO, Serrot - RM
Machine: GCS - 116, Serrot - 153
DS-18A/18B Machine: GCS - 132, Serrot - 153
DS-23/23A/
23B Operator: GCS - WEO, Serrot - RM
Machine: GCS - 132, Serrot - 153
DS-32 Operator: GCS - RM, Serrot - MA
Machine: GCS - 153, Serrot - 133
DS-33 Operator: GCS - WEO, Serrot - PM
Machine: GCS - 132, Serrot - 116
DS-34 GCS marked failure in passing test result block
DS-35 Seam #: GCS - 42/43, Serrot - 44/45
Operator: GCS - RM, Serrot - PM
Machine: GCS - 153, Serrot - 116
DS-58 Seam #: GCS - 47/12P, Serrot - 10/EXT
Operator: GCS - RM, Serrot - PM
Machine: GCS - 70, Serrot - 68
DS-59 Seam #: GCS - 10/EXT, Serrot - 1/EXT
DS-60 Seam #: GCS - 1/EXT, Serrot - 65/66
DS-61 Seam #: GCS - 65/66, Serrot - 66/67
DS-88 Seam #: GCS - 49/28H, Serrot - 49/EXT
DS-89 Machine: GCS - 2042, Serrot - 2045
DS-90 Seam #: GCS - 86/87, Serrot - 85/87
DS-93 Machine: GCS - 2042, Serrot - 2052
DS-103 Operator: GCS - PM, Serrot - RM
DS-104 Machine: GCS - 164, Serrot - 184
DS-128 Seam #: GCS - 28/EXT, Serrot - 29/EXT
DS-132 Operator: GCS - GM, Serrot - OO
DS-133 Seam #: GCS - 19/20, Serrot - 17/18
DS-149 Seam #: GCS - 57/58, Serrot - 56/57
DS-162 Seam #: GCS - 74/75, Serrot - 76/74
DS-168 Seam #: GCS - 88/87, Serrot - 89/87
DS-182 Operator: GCS - MA, Serrot - GM

p2/3

*EXPLANATION
NEED TO*

no passing



Data Discrepancies/Concerns

- DS-64 Seam failures on 64, 64A, 64B, 64B1, 64B2, 64B3; Passing retest on 64A1; No passing retest on 64B *extrusion*
- DS-70/71 Failed extrusion welds on SP-49/EXT, No passing tests
- DS-77 Seam failures on 77, 77A, 77B; No passing retests
- DS-78 Seam failures on 78 and 78A; Passing retest on 78B; No passing on 78A
- DS-80 Seam failures on 80, 80A and 80B; No passing retests
- DS-82 Seam failures on 82 and 82A; Passing retest on 82B; No passing retest on 82A
- DS-84 Seam failure on 84 and 84B; No 84A destructive run; No passing retest on 84B
- DS-122 Seam failure on 122, 122A, 122B, 122B1; Passing retest on 122A1; No passing retest on 122B
- DS-123 Seam failure on 123, 123A, 123A1, 123A2, 123A3, 123B, 123B1; Passing retest on 123B2; No passing retest on 123A

Low Peel Failure Values - Not a QA Specification

- DS-38 GCS outside peel load 101 - 112 #/in; Serrot outside peel 88 - 140 #/in on seam 46/47 (pull roll information) *how to see what we can do now. how we can best support captain (quality support)*
- DS-65 GCS extrusion peel all < 90, Serrot peel between 79 and 106

no testing on the peel

Missing Information

Asterisk (*) shown on Serrot primary destructive data sheet - Meaning? *5-10% pull - trying to check on holder results.*

- No Serrot sample information for DS-114A1
- No GCS data sheet for DS-117
- Partial copy of GCS data sheet for DS-164
- No Serrot sample information for DS 183

need info.

2/1 print

HIGH PRIORITY

- PLEASE PROVIDE GCS'S RESPONSE TO THESE CLAIMS.

destructs

Destructive Number	Date Received	Date Completed	Result	Fusion	Mach. Number	Tech	Seam	History
DS-005	4/22/99	4/22/99	F	solid wedge	70	PM	SP-001/EXT	Topped and solid wedge was not used again
DS-006	4/22/99	4/23/99	F	solid wedge	70	WEO	SP-001/EXT	Topped and solid wedge was not used again
DS-007	4/26/99	4/27/99	F	Fusion	132	PM	SP-007/008	Tracked to passing destructives DS-007A2, DS-007B1
DS-007A	4/29/99	4/29/99	F					
DS-007A1	4/30/99	4/30/99	F					
DS-007A2	4/30/99	4/30/99	P					
DS-007B	4/29/99	4/29/99	F					
DS-007B1	4/30/99	4/30/99	P					
DS-018	4/28/99	4/28/99	F	Fusion	132	WEO	SP-022/023	Tracked to passing destructives DS-018A, DS-018B2
DS-018A	4/30/99	4/30/99	P					
DS-018B	4/30/99	4/30/99	F					
DS-018B1	4/30/99	4/30/99	F					
DS-018B1	5/3/99	5/3/99	F					
DS-018B2	5/3/99	5/3/99	P					
DS-020	4/26/99	4/27/99	F	solid wedge	70	GM	SP-010/EXT	Topped and solid wedge was not used again
DS-023	4/28/99	4/28/99	F	Fusion	132	WEO	SP-027/028	Tracked to passing destructives DS-023A, DS-023B
DS-023A	4/30/99	4/30/99	P					
DS-023B	4/30/99	4/30/99	P					
DS-024	4/28/99	4/28/99	F	Fusion	132	WEO	SP-028/029	Tracked to passing destructives DS-024A1, DS-024B
DS-024A	5/3/99	5/3/99	F					
DS-024A1	5/4/99	5/4/99	P					
DS-024B	4/30/99	4/30/99	P					
DS-034	4/29/99	4/29/99	F	Fusion	116	PM	SP-041/042	Tracked to passing destructives DS-034A, DS-034B
DS-034A	4/30/99	4/30/99	P					
DS-034B	4/30/99	4/30/99	P					
DS-045	5/6/99	5/6/99	F	Fusion	132	RM	SP-053/054	Tracked to passing destructives DS-045A2, DS-045B2
DS-045A	5/7/99	5/7/99	F					
DS-045A1	5/10/99	5/10/99	F					
DS-045A2	5/13/99	5/13/99	P					
DS-045B	5/7/99	5/7/99	F					
DS-045B1	5/10/99	5/10/99	F					
DS-045B2	5/13/99	5/13/99	P					
DS-063	5/10/99	5/10/99	F	Fusion	132	WEO	SP-067/068	Tracked to passing destructives DS-063A1, DS-063B1
DS-063A	5/10/99	5/10/99	F					
DS-063A1	5/14/99	5/13/99	P					
DS-063B	5/10/99	5/10/99	F					
DS-063B1	5/18/99	5/18/99	P					
DS-064	5/7/99	5/7/99	F	Fusion	132	WEO	SP-067/068	Tracked to passing destructives DS-064A, DS-063A1
DS-064A	5/10/99	5/10/99	P					
DS-064A1	5/18/99	5/18/99	P					Tracked out additional for check
DS-064B	5/10/99	5/10/99	F					
DS-064B1	5/18/99	5/18/99	F					
DS-064B2	5/18/99	5/18/99	F					
DS-064B3	5/19/99	5/18/99	F					
DS-070	5/6/99	5/7/99	F	Extrusion	2052	GM	SP-049/EXT	Capped, subsequent destructives DS-088, DS-089
DS-071	5/7/99	5/7/99	F	Extrusion	2052	GM	SP-049/EXT	Capped, subsequent destructives DS-088, DS-089
DS-077	5/12/99	5/12/99	F	Fusion	137	RM	SP-085/086	All seams welded by wedge #137 were topped
DS-077A	5/13/99	5/13/99	F					
DS-077B	5/17/99	5/17/99	F					
DS-078	5/12/99	5/12/99	F	Fusion	133	GM	SP-086/088	Tracked to passing destructive DS-078B,
DS-078A	5/13/99	5/13/99	F					All after seams welded by wedge #133 topped.
DS-078B	5/13/99	5/13/99	P					Wedge not used after this
DS-080	5/12/99	5/12/99	F	Fusion	137	RM	SP-096/097	All seams welded by wedge #137 were topped
DS-080A	5/13/99	5/13/99	F					
DS-080B	5/13/99	5/13/99	F					
DS-082	5/12/99	5/12/99	F	Fusion	59	OO	SP-102/103	Tracked to passing destructive DS-082B,
DS-082A	5/17/99	5/17/99	F					All welding by wedge #59 topped in the after direction
DS-082B	5/13/99	5/14/99	P					

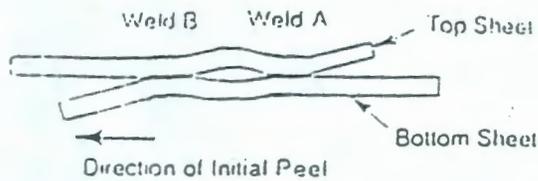
destructs

DS-084	5/12/99	5/12/99	F	Fusion	137	RM	SP-104/105	All seams welded by wedge #137 were topped
DS-084B	5/13/99	5/14/99	F					
DS-087	5/13/99	5/13/99	F	Fusion	121	MA	SP-057/084	Tracked to passing destructive DS-087B.
DS-087B	5/14/99	5/14/99	P					All welding by wedge #121 capped in the after direction.
DS-092	5/19/99	5/19/99	F	Extrusion	2042	OO	SP-103/105	Tracked to passing destructives DS-092A, DS-092B
DS-092A	5/19/99	5/19/99	P					
DS-092B	5/19/99	5/19/99	P					
DS-101	5/27/99	5/27/99	F	Fusion	116	PM	PP-007/008	Tracked to passing destructives DS-101A4, DS-101B1
DS-101A	5/28/99	5/28/99	F					
DS-101A1	6/1/99	6/1/99	F					
DS-101A2	6/2/99	6/2/99	F					
DS-101A3	6/3/99	6/3/99	F					
DS-101A4	6/3/99	6/3/99	P					
DS-101B	5/28/99	5/28/99	F					
DS-101B1	6/1/99	6/1/99	P					
DS-111	6/1/99	6/1/99	F	Fusion	116	PM	PP-017/018	Tracked to passing destructives DS-111A5, DS-111B5
DS-111A	6/2/99	6/2/99	F					
DS-111A1	6/3/99	6/3/99	F					
DS-111A2	6/3/99	6/3/99	F					
DS-111A3	6/4/99	6/4/99	F					
DS-111A4	6/4/99	6/4/99	F					
DS-111A5	6/7/99	6/7/99	P					
DS-111B	6/2/99	6/2/99	F					
DS-111B1	6/3/99	6/3/99	F					
DS-111B2	6/3/99	6/3/99	F					
DS-111B3	6/4/99	6/4/99	F					
DS-111B4	6/4/99	6/4/99	F					
DS-111B5	6/7/99	6/7/99	P					
DS-113	6/1/99	6/1/99	F	Fusion	116	PM	PP-019/020	Tracked to passing destructives DS-113A3, DS-113B
DS-113A	6/2/99	6/2/99	F					
DS-113A1	6/3/99	6/3/99	F					
DS-113A2	6/3/99	6/3/99	<i>ZF</i>					<i>Not on summary Entered</i>
DS-113A3	6/4/99	6/4/99	P					
DS-113B	6/2/99	6/2/99	P					
DS-114	6/1/99	6/1/99	F	Fusion	21	RM	PP-020/021	Tracked to passing destructives DS-114A1, DS-114B
DS-114A	6/2/99	6/2/99	F					
DS-114A1	6/3/99	6/3/99	P					
DS-114B	6/2/99	6/2/99	P					
DS-122	6/8/99	6/8/99	F	Fusion	21	RM	PP-029/030	Tracked to passing destructives DS-122A1, DS-115
DS-122A	6/9/99	6/9/99	F					
DS-122A1	6/10/99	6/10/99	P					
DS-122B	6/9/99	6/9/99	F					
DS-122B1	6/10/99	6/10/99	F					
DS-123	6/8/99	6/8/99	F	Fusion	184	MA	PP-030/031	Tracked to passing destructive DS-123B2, DS-125
DS-123A	6/9/99	6/9/99	F					
DS-123A1	6/10/99	6/10/99	F					
DS-123A2	6/10/99	6/10/99	F					
DS-123A3	6/10/99	6/10/99	F					
DS-123B	6/9/99	6/9/99	F					
DS-123B1	6/10/99	6/10/99	F					
DS-123B2	6/10/99	6/10/99	P					
DS-127	6/8/99	6/8/99	F	Fusion	21	RM	PP-036/037	Tracked to passing destructives DS-127A, DS-127B
DS-127A	6/9/99	6/9/99	P					
DS-127B	6/9/99	6/9/99	P					
DS-148	6/10/99	6/10/99	F	Fusion	196	RM	PP-055/056	Tracked to passing destructives DS-148A, DS-148B
DS-148A	6/10/99	6/10/99	P					
DS-148B	6/10/99	6/10/99	P					

destructs

DS-181	6/22/99	6/22/99	F	Extrusion	2052	GM	PP-055/056	Tracked to passing destructives DS-181A, DS-181B1
DS-181A	6/24/99	6/24/99	P					
DS-181B	6/24/99	6/24/99	F					
DS-181B1	6/24/99	6/24/99	P					
FAILED WHOLE NUMBER DESTRUCTIVES								
								GM = 5
								MA = 2
								OO = 2
								PM = 6
								RM = 8
								WEO = 7

**Schematic of
Untested Specimen**



Types of Break	Locus-of-Break Code	Break Description	Classification ^a
	AD	Adhesion failure.	Non-FTB
	BRK	Break in sheeting. Break can be in either top or bottom sheet.	FTB
	SE1	Break at outer edge of seam. Break can be in either top or bottom sheet.	FTB
	SE2	Break at inner edge of seam through both sheets.	FTB
	AD-BRK	Break in first seam after some adhesion failure. Break can be in either the top or bottom sheet.	FTB

^a FTB = Film - Tear Bond

NOT TO SCALE

Locus-of-break codes for dual hot-wedge seams in semicrystalline FML's tested for seam strength in shear and peel modes. In cases where the Weld A fails in adhesion in a peel test, it is recommended that the test be stopped, that the specimen be replaced in the testing machine, and that Weld B be tested by peeling in the direction opposite to that used to Weld A.

Reference - Figure A-6, NSF International Standard 54-1993.

Golder Construction Services, Inc.			TITLE		
CLIENT/PROJECT			DATE		
DRAWN			SCALE		JOB NO.
CHECKED		REVIEWED	FILE NO.	DWG. NO. / REV. NO.	FIGURE

Schematic of Untested Specimen



Type of Breaks	Locus-of-Break Code	Break Description	Classification ^a
	AD1	Failure in adhesion. Specimens may also delaminate under the bead and break through the thin extruded material in the outer area.	Non-FTB
	AD2	Failure in adhesion.	Non-FTB
	AD-WLD	Break through the fillet. Breaks through the fillet range from breaks starting at the edge of the top sheet to breaks through the fillet after some adhesion failure between the fillet and the bottom sheet.	Non-FTB ^b
	SE1	Break at seam edge in the bottom sheet. Specimens may break anywhere from the bead/outer area edge to the outer area/buffed area edge. (Applicable to shear only).	FTB
	SE2	Break at seam edge in the top sheet. Specimens may break anywhere from bead/outer area edge to the outer area/buffed area edge.	FTB
	SE3	Break at seam edge in the bottom sheet. (Applicable to peel only).	FTB
	BRK1	Break in the bottom sheeting. A "B" in parentheses following the code means the specimen broke in the buffed area. (Applicable to shear only).	FTB
	BRK2	Break in the top sheeting. A "B" in parentheses following the code means the specimen broke in the buffed area.	FTB
	AD-BRK	Break in the bottom sheeting after some adhesion failure between the fillet and the bottom sheet. (Applicable to peel only).	FTB
	HT	Break at the edge of the hot tack for specimens which could not be delaminated in the hot tack.	No Test

^a FTB = Film - Tear Bond.

^b Acceptance of AD-WLD breaks may depend on whether test values meet a minimum specification value and not on classification as a FTB or non-FTB break.

Locus-of-break codes for fillet-extrusion weld seams in semi-crystalline FML's tested for seam strength in shear and peel modes.
Reference - Figure A-4, NSF International Standard 54-1993.

Golder Construction Services, Inc.			TITLE		
			CLIENT/PROJECT		
			DATE	SCALE	JOB NO.
DRAWN	CHECKED	REVIEWED	FILE NO.	DWG. NO. / REV. NO.	FIGURE

DESTRUCTIVE TEST OBSERVATION

PROJECT No: 987-0381 CONTRACT TITLE: ERDF Cells 3 & 4
 OWNER: US DOE
 LOCATION: HANFORD 600 AREA
 CONTRACTOR: SERROT sub to Delhur Industries DATE: 5/25

DESTRUCTIVE SAMPLE NUMBER: DS-117
 SEAM NUMBER: TR/EXT
 SAMPLE LOCATION: 25' N of SECS
 REPAIR NUMBER: 32H
 SEAMING TECHNICIAN: CC
 SEAMING APPARATUS: 2042
 SEAM TYPE (Fus/Ext): EXT

LABORATORY TEST RESULTS

SHEAR TEST MODE

No.	Load (lbs/inch width)	Mode of Failure Code
1	<u>113</u>	<u>BRKI</u>
2	<u>160</u>	<u>BRKI</u>
3	<u>160</u>	<u>BRKI</u>
4	<u>160</u>	<u>BRKI</u>
5	<u>157</u>	<u>BRKI</u>

INSIDE TRACK PEEL

No.	Load (lbs/inch width)	Mode of Failure Code
1	<u>133</u>	<u>SE3</u>
2	<u>119</u>	<u>SE3</u>
3	<u>140</u>	<u>SE3</u>
4	<u>124</u>	<u>SE3</u>
5	<u>118</u>	<u>SE3</u>

OUTSIDE TRACK PEEL

No.	Load (lbs/inch width)	Mode of Failure Code
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

SHEET THICKNESS

Top: 60 mils
 Bottom: 60 mils

TEST RESULTS

Pass: Pass
 Fail: _____

REMARKS

TR/Ext.

LABORATORY TECHNICIAN



DESTRUCTIVE TEST OBSERVATION

PROJECT No: 987-0381 CONTRACT TITLE: ERDF Cells 3 & 4
 OWNER: US DOE
 LOCATION: HANFORD 600 AREA
 CONTRACTOR: SERROT sub to Delhur Industries DATE: 6/16/99

DESTRUCTIVE SAMPLE NUMBER: DS-164
 SEAM NUMBER: PP-77/79
 SAMPLE LOCATION: 74' E of W
 REPAIR NUMBER: 45A
 SEAMING TECHNICIAN: GM
 SEAMING APPARATUS: 116
 SEAM TYPE (Fus/Ext): Fus

LABORATORY TEST RESULTS

SHEAR TEST MODE

No.	Load (lbs/inch width)	Mode of Failure Code
1	<u>200</u>	<u>BRK</u>
2	<u>201</u>	<u>BRK</u>
3	<u>197</u>	<u>BRK</u>
4	<u>198</u>	<u>BRK</u>
5	<u>192</u>	<u>BRK</u>

INSIDE TRACK PEEL

No.	Load (lbs/inch width)	Mode of Failure Code
1	<u>153</u>	<u>SEI</u>
2	<u>165</u>	<u>SEI</u>
3	<u>154</u>	<u>SEI</u>
4	<u>160</u>	<u>SEI</u>
5	<u>158</u>	<u>SEI</u>

OUTSIDE TRACK PEEL

No.	Load (lbs/inch width)	Mode of Failure Code
1	<u>116</u>	<u>SEI</u>
2	<u>115</u>	<u>SEI</u>
3	<u>118</u>	<u>SEI</u>
4	<u>117</u>	<u>SEI</u>
5	<u>117</u>	<u>SEI</u>

SHEET THICKNESS

Top: 60 mils
 Bottom: 60 mils

TEST RESULTS

Pass: Pass
 Fail: _____

REMARKS

Tex / tex

LABORATORY TECHNICIAN

[Signature]