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Department of Energy
Washington, DC 20585
February 28, 2003

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... SAFETY BOARD

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

The purpose of this letter is to respond to your February 6, 2003 letter concerning issues related to proper sealing and inerting of Multi-Canister Overpacks (MCO) at the Hanford Spent Nuclear Fuel Project. The attached report from the Hanford Site addresses your concerns on the following:

- Proper sealing/inerting of MCOs prior to welding,
- Lifting stresses on mechanical seals during movement of the canisters have received proper analyses, and
- The disposition of previously welded MCOs is satisfactory.

We welcome this opportunity to receive your technical input and guidance and to answer your concerns on matters of importance to the Defense Nuclear Facilities Safety Board.

If you have any questions, please call me at (202) 586-7709 or Paul Golan, Chief Operating Officer, Office of Environmental Management at (202) 586-0738.

Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Attachment

cc: Mark Whitaker, S-3.1
Keith Klein, RL

RL-F-1325.6 (02/98)

United States Government | Department of Energy

memorandum

Richland Operations Office

DATE: FEB 1 2003

REPLY TO ATTN OF: SFO:LDE/03-SFO-0021

SUBJECT: HANFORD SPENT NUCLEAR FUEL (SNF) PROJECT MULTI-CANISTER OVERPACK (MCO) WELDING

TO: Jessie Hill Roberson, Assistant Secretary for Environmental Management EM-1, HQ

References:

(1) DNFSB letter to you, from John T. Conway, dated February 6, 2002.

(2) DOE letter to John T. Conway, DNFSB, from you, dated April 18, 2002.

(3) DNFSB letter to you, from John T. Conway, dated February 15, 2002.

In response to Reference (1), attached please find a technical summary, with applicable attached supporting information, which describes the MCO welding process currently employed at the Hanford SNF Project. The intent of this description is to provide acceptable assurance that:

- MCOs are properly sealed and inerted prior to welding;
- the lifting stresses imposed on the mechanical seal during movements at the Canister Storage Building (CSB) have been properly analyzed; and
- the disposition of previously welded MCOs is satisfactory.

The design of the MCO mechanical seal and supporting MCO shell/collar structure ensures the MCO maintains the required helium atmosphere for a 40-year storage life if the seal is properly set and the leak rate through the seal is less than 10^{-5} cc/sec. To date, the majority of MCO seal leak rates have been measured with no detectable leakage (NDL). A few seals have been measured with leak rates within three orders of magnitude (i.e., 10^{-6} to 10^{-8} cc/sec) of the leak specification. The leak rate data for all currently processed MCOs is presented in Attachment 1.

The MCO shell/collar design ensures handling operations at the CSB do not have an appreciable affect on the mechanical seal. Attachment 2 analyzes the lifting stresses imposed on the mechanical seal during movements at the CSB. Stress calculations conclude the MCO Handling Machine (MHM) operations do not affect the adequacy of the mechanical seal.

The mechanical seal is set during MCO closure at the K-West Basin with a hydraulic ram that applies a direct force of 150,000 pounds. This force ensures adequate compression of the mechanical seal ring. Following the use of the hydraulic ram, the 18 locking ring closure bolts are manually torque checked in a disciplined operation with Quality Assurance observation and verification to ensure the seal is adequately set prior to shipment to the Cold Vacuum Drying Facility (CVDF). The MCO is dried at the CVDF and the internal helium environment is established. The final operation at the CVDF is the integrated leak test, which verifies the adequacy of the mechanical seal by testing for leakage greater than the 10^{-5} cc/sec specification limit. Following the successful leak test at the CVDF, the MCO is transported to the CSB where its cover cap is immediately welded in place, or the MCO is moved to a storage tube for welding at a later date consistent with the planned sequence. Additional information regarding data and the welding sequence for the backlogged MCOs is included in Attachment 1.

Through February 10, 2003, 193 MCOs have been processed at the K-West Basin. Of these, 66 did not have their closure bolts manually torque checked at the K-West Basin (MCOs 1 through 40 and MCOs 105 through 130). As stated in Reference (2), DOE committed to verify the closure bolt torque for MCOs 1 through 40 and, if necessary, the internal pressure will be verified and adjusted, prior to welding. As an additional conservative step, MCOs 105 through 130 will also undergo manual torque verification and internal pressure verification as necessary, as stated in Appendix 4 of Operating Procedure OP-23-004S Rev 0C *MCO to Canister Cover Assembly Weld Process*. Therefore, all of the MCOs will have a manual torque check prior to welding with MCOs 1 through 40 and MCOs 105 through 130 occurring at the CSB and the reaminder at K-West.

The Richland Operations Office (RL) is complying with the commitments made in Reference (2). It should be noted; however, that in order to build proficiency into the welding process, the first three MCOs selected for welding were previously manually torque verified at the K-West Basin. Subsequent to this proficiency step, the welding sequence will follow the selection described in Reference (2).

In conclusion, RL believes the current MCO closure process provides an acceptable assurance and certainty relative to the adequacy of the MCO mechanical seal prior to welding operations. Additionally, technical analysis of the current operations concludes that MCO handling activities from the CVDF to, and within, the CSB will not invalidate the integrity of a previously acceptable mechanical seal. The current MCO operations will also identify and safely disposition any processing anomalies such as determined with MCOs 63 and 128. Consequently, RL plans to continue processing and welding MCOs consistent with the current processes and with the commitments as outlined in Reference (2). Additionally, RL does not plan any further actions to be performed on the MCOs already welded.

RL is committed to safely removing SNF from the Columbia River shore and transferring it to interim safe storage on Hanford's Central Plateau. As always, we welcome technical input and feedback from the Defense Nuclear Facilities Safety Board, as well as other stakeholders. RL uses this information as part of their commitment to integrated safety management and continuous improvement.

If you have any questions, please contact me, or your staff may contact Steve Veitenheimer, Director, Office of Spent Nuclear Fuels on (509) 373-9725.

Keith A. Klein
Manager

Attachments:
1. MCO Shield Plug Gasket Analyses
2. MCO Leak rate and welding data

cc w/attachs:
T. J. Hull, EM-43
M. B. Whittaker, Jr., S-3.1

ATTACHMENT 1
MCO Leak Rate and Welding Priority for Backlogged MCOs

MCO PROD. #	MCO #	LEAK RATE STATUS	TORQUED	WELDING PRIORITY
51	H-103	NDL	YES	1
44	H-130	NDL	YES	2
95	H-180	NDL	YES	3
63	H-166	FAILED	YES	TBD*
20	H-072	10^-6	NO	4
167	H-200	10^-6	YES	5
109	H-038	NDL	NO	6
6	H-037	NDL	NO	7
108	H-052	NDL	NO	8
110	H-046	NDL	NO	9
107	H-048	NDL	NO	10
106	H-045	NDL	NO	11
105	H-049	NDL	NO	12
119	H-056	NDL	NO	13
117	H-061	NDL	NO	14
121	H-058	NDL	NO	15
122	H-057	NDL	NO	16
7	H-069	NDL	NO	17
116	H-068	NDL	NO	18
112	H-067	NDL	NO	19
120	H-066	NDL	NO	20
111	H-071	NDL	NO	21
114	H-064	NDL	NO	22
115	H-065	NDL	NO	23
18	H-076	10^-7	NO	24
23	H-077	NDL	NO	25
22	H-074	NDL	NO	26
24	H-078	NDL	NO	27
26	H-079	NDL	NO	28
8	H-082	10^-8	NO	29
12	H-083	NDL	NO	30
21	H-080	NDL	NO	31
13	H-087	NDL	NO	32
5	H-032	10^-8	NO	33
4	H-033	NDL	NO	34
2	H-035	10^-7	NO	35
3	H-034	NDL	NO	36
11	H-039	NDL	NO	37
9	H-089	NDL	NO	38
10	H-088	NDL	NO	39
17	H-090	NDL	NO	40
19	H-094	NDL	NO	41
15	H-099	NDL	NO	42
16	H-096	NDL	NO	43
118	H-097	NDL	NO	44
14	H-093	NDL	NO	45
33	H-107	NDL	NO	46

MCO PROD. #	MCO #	LEAK RATE STATUS	TORQUED	WELDING PRIORITY
34	H-109	NDL	NO	47
35	H-115	10^-8	NO	48
36	H-114	NDL	NO	49
32	H-110	NDL	NO	50
31	H-122	NDL	NO	51
28	H-123	NDL	NO	52
30	H-124	NDL	NO	53
25	H-119	NDL	NO	54
27	H-113	NDL	NO	55
29	H-120	NDL	NO	56
37	H-133	NDL	NO	57
40	H-112	NDL	NO	58
39	H-128	10^-7	NO	59
38	H-134	NDL	NO	60
123	H-168	NDL	NO	61
130	H-183	NDL	NO	62
125	H-190	NDL	NO	63
126	H-185	NDL	NO	64
129	H-188	10^-7	NO	65
128	H-193	10^-7	NO	66
124	H-194	10^-7	NO	67
127	H-195	NDL	NO	68
104	H-070	NDL	YES	69
101	H-054	NDL	YES	70
176	H-053	10^-7	YES	71
175	H-051	NDL	YES	72
102	H-042	10^-7	YES	73
153	H-075	NDL	YES	74
98	H-043	NDL	YES	75
140	H-073	NDL	YES	76
103	H-047	NDL	YES	77
141	H-081	NDL	YES	78
100	H-044	10^-6	YES	79
137	H-086	NDL	YES	80
179	H-050	10^-6	YES	81
138	H-084	NDL	YES	82
178	H-055	NDL	YES	83
165	H-040	NDL	YES	84
174	H-059	NDL	YES	85
151	H-092	NDL	YES	86
180	H-063	NDL	YES	87
136	H-098	NDL	YES	88
177	H-060	10^-6	YES	89
139	H-095	NDL	YES	90
55	H-108	NDL	YES	91
60	H-106	NDL	YES	92
50	H-100	NDL	YES	93
62	H-101	NDL	YES	94
49	H-105	NDL	YES	95
53	H-104	NDL	YES	96
48	H-102	NDL	YES	97
47	H-116	NDL	YES	98
61	H-121	NDL	YES	99

MCO PROD. #	MCO #	LEAK RATE STATUS	TORQUED	WELDING PRIORITY
52	H-117	10^-6	YES	100
54	H-118	NDL	YES	101
41	H-131	NDL	YES	102
45	H-127	NDL	YES	103
46	H-132	NDL	YES	104
42	H-126	NDL	YES	105
43	H-125	NDL	YES	106
135	H-135	NDL	YES	107
68	H-129	NDL	YES	108
88	H-142	NDL	YES	109
85	H-143	NDL	YES	110
86	H-144	NDL	YES	111
69	H-141	NDL	YES	112
90	H-139	NDL	YES	113
89	H-137	NDL	YES	114
84	H-147	NDL	YES	115
87	H-148	NDL	YES	116
80	H-145	NDL	YES	117
83	H-146	NDL	YES	118
79	H-138	NDL	YES	119
81	H-140	NDL	YES	120
99	H-041	10^-7	YES	121
82	H-149	NDL	YES	122
76	H-154	NDL	YES	123
77	H-155	NDL	YES	124
73	H-158	NDL	YES	125
74	H-157	NDL	YES	126
78	H-151	10^-7	YES	127
71	H-153	NDL	YES	128
70	H-150	NDL	YES	129
75	H-152	NDL	YES	130
64	H-162	NDL	YES	131
188	H-163	NDL	YES	132
65	H-161	NDL	YES	133
66	H-164	NDL	YES	134
67	H-167	10^-6	YES	135
59	H-171	NDL	YES	136
56	H-172	NDL	YES	137
57	H-173	NDL	YES	138
93	H-174	NDL	YES	139
94	H-175	NDL	YES	140
97	H-179	NDL	YES	141
91	H-181	NDL	YES	142
96	H-182	NDL	YES	143
92	H-177	NDL	YES	144
133	H-178	NDL	YES	145
134	H-184	NDL	YES	146
131	H-186	NDL	YES	147
132	H-191	NDL	YES	148
172	H-192	NDL	YES	149
173	H-197	NDL	YES	150
169	H-198	10^-6	YES	151
170	H-199	10^-6	YES	152
171	H-202	10^-6	YES	153

MCO PROD. #	MCO #	LEAK RATE STATUS	TORQUED	WELDING PRIORITY
168	H-204	NDL	YES	154
166	H-205	10^-7	YES	155
182	H-206	NDL	YES	156
161	H-207	NDL	YES	157
162	H-210	NDL	YES	158
163	H-213	NDL	YES	159
164	H-208	NDL	YES	160
157	H-212	10^-7	YES	161
159	H-211	NDL	YES	162
160	H-214	10^-7	YES	163
158	H-215	NDL	YES	164
148	H-217	NDL	YES	165
150	H-216	NDL	YES	166
149	H-218	10^-6	YES	167
147	H-219	NDL	YES	168
155	H-221	10^-8	YES	169
152	H-220	NDL	YES	170
154	H-223	NDL	YES	171
156	H-222	NDL	YES	172
185	H-225	NDL	YES	173
187	H-224	NDL	YES	174
183	H-227	NDL	YES	175
184	H-226	NDL	YES	176
186	H-209	NDL	YES	177
144	H-201	NDL	YES	178
143	H-231	NDL	YES	179
142	H-233	NDL	YES	180
145	H-232	NDL	YES	181
146	H-238	NDL	YES	182
181	H-241	NDL	YES	183
189	H-253	NDL	YES	TBD
190	H-252	NDL	YES	TBD
191	H-256	NDL	YES	TBD
192	H-249	NDL	YES	TBD
193	H-254	NDL	YES	TBD
1	H-036	NDL	NO**	TBD
113	H-136	NDL	NO**	TBD
58	H-169	NDL	YES	TBD
72	H-189	NDL	YES	TBD

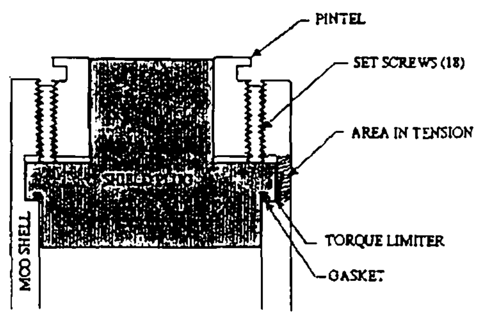
* MCO 63 will be welded when the required nuclear safety reviews are completed.

** MCOs 1 and 113 are monitored MCOs.

ATTACHMENT 2
Relaxation of the MCO Shield Plug Gasket
Due to Lifting and Handling at the CSB

During closure, a shield plug is pressed into the MCO with 150,000 lbs of force by a hydraulic ram to crush the gasket and make a seal. The torque limiter limits gasket compression to the prescribed amount. The shield plug is held in place by 18 set screws, which maintain the preload on the gasket after the ram is removed. The top of the MCO contains a pintel by which it is lifted. The pintel is part of the locking ring, which is attached to the MCO shell by a buttress thread, and forms a single component for this stress analysis. This threaded joint is not shown for clarity. See Figure 1 for a schematic representation.

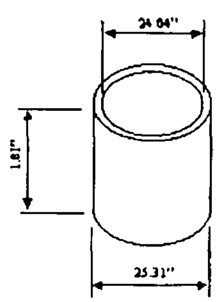
Figure 1



MCO DIAGRAM

A loaded MCO weighs approximately 20,000 lbs, but the safety class Load Cell Verification System (LCV) high limit in the MCO Handling Machine (MHM) is 25,797 lbs and the high-high limit is 28,220 lbs. Assuming an MCO became stuck in a CSB tube and the first LCV limit failed, pulling on an MCO's pintel would stretch the MCO wall at the area in tension by approximately 38 millionths of an inch, as shown in Figure 2.

Figure 2



MCO SHELL
AREA IN TENSION

$$A = \frac{\pi(Do^2 - Di^2)}{4} = \frac{\pi(25.31^2 - 24.04^2)}{4} = 49.22\ in^2$$

$$S = \frac{P}{A} = \frac{28{,}220}{49.22} = 573.3\ psi$$

$$e = \frac{S \cdot L}{E} = \frac{573.3 \cdot 1.81}{27.6E6} = 0.000{,}038\ in$$

Where:
- A = Area in Tension, in² [ref 1]
- S = Stress, psi
- P = Load (Set Point of MHM Load Cell), lbs [ref 2]
- e = elongation, in
- L = Original Length, in [ref 1]
- E = Modulus of Elasticity, psi [ref 3]

Ref:
1. H-2-828042, Rev 5
2. SP-15-005S
3. Marks Handbook

Because the shield plug is in compression it will expand by some amount, as determined by the relative ratio of the MCO wall area to shield plug compression area, and the amount of compression in the gasket. In the best-case scenario, the shield plug would expand by 38 millionths of an inch also, so the gasket compression would not relax. In the worst-case scenario the shield plug would not expand at all and the gasket compression would relax by 38 millionths of an inch. Based on an evaluation of the Helicoflex seal (gasket), it is estimated that it would take approximately .005 inches of relaxation to affect the sealing capability. Therefore, the effect on sealing is insignificant.

Task Detail Report 02/12/2003 08:50 AM

Task #: DOE-SFO-2003-0021

Parent Task #:
Reference #: LMSI-RLCC-SFO-2003-0012/D0666178
Subject: Concur - Hanford SNF Project MCO Welding
Deliverable: None
Category: None
Status: Open
Due Date:
Priority: High
Originator: Corbin, Peggy A
Originator Phone: (509)376-7465

Assigned By: Self
Assigned Date: 02/11/2003
Assigned Role: Originator
Assigned Due Date:

Routing Lists: ⊞ **Final List - Active**

☐ Schlender, Michael H - Approve - Awaiting Response
☐ Klein, Keith A - Approve - Awaiting Response

Instructions:
None

⊞ **Route List - Inactive**

☐ Earley, Larry D - Approve - Approve - 02/11/2003 16:17
☐ Veitenheimer, Steve J - Approve - Approve - 02/12/2003 08:03 (By: Corbin, Peggy A)
☐ Fiscus, Brian A - Approve - Approve - 02/12/2003 08:35

Instructions:
bcc:
SFO Rec Cpy
SFO Rdg File
L. D. Earley, SFO
B. A. Fiscus, OIO
RECORD NOTE: This memorandum answers requests made by the DNFSB in their letter to Jessie Hill Roberson, dated February 6, 2002. (The date was in error - it should have been February 6, 2003, and received on February 11, 2003), relating to the welding of the SNF Multi-Canister Overpacks for their transfer from K-West Basin to the Cold Vacuum Drying Facility for processing, followed by the transport to the Canister Storage Building for interim storage and final sealing via welding. This closes LMSI-RLCC-SFO-2003-0012/D0666178.

Attachments:
1. 03-SFO-0021.doc
2. Attachs 1&2 03-SFO-0021.doc

Comments

Task Due Date History:

Date Modified	Task Due Date	Modified By

-- End of Report --