

APPENDIX A
INITIAL ENGINEERED ALTERNATIVES SCREENING CANDIDATES



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TABLE A-1
INITIAL ENGINEERED ALTERNATIVES SCREENING CANDIDATES

The individual Engineered Alternatives (EA) found in the 1991 Engineered Alternatives Task Force (EATF) Final Report (DOE, 1991), #1 through #64, are as follows:

- | | | |
|----|----|---|
| 1 | 1 | Compact Waste |
| 2 | 2 | Incinerate and Cement |
| 3 | 3 | Incinerate and Vitrify |
| 4 | 4 | Wet Oxidation |
| 5 | 5 | Shred and Bituminize |
| 6 | 6 | Shred and Compact |
| 7 | 7 | Shred and Cement |
| 8 | 8 | Shred and Polymer Encapsulation |
| 9 | 9 | Shred add Salt and Compact |
| 10 | 10 | Plasma Processing |
| 11 | 11 | Melt Metals |
| 12 | 12 | Add Salt Backfill |
| 13 | 13 | Add other Sorbents |
| 14 | 14 | Add Gas Suppressant |
| 15 | 15 | Shred and Add Bentonite |
| 16 | 16 | Acid Digestion |
| 17 | 17 | Sterilization |
| 18 | 18 | Add Copper Sulfate |
| 19 | 19 | Add Gas Getters |
| 20 | 20 | Add Fillers |
| 21 | 21 | Segregate Waste Forms |
| 22 | 22 | Decontaminate Metals |
| 23 | 23 | Change Waste Generation Process |
| 24 | 24 | Add Anti-Bacterial Material |
| 25 | 25 | Accelerate Waste Digestion Process |
| 26 | 26 | Alter Corrosion Environment |
| 27 | 27 | Alter Bacterial Environment in WIPP |
| 28 | 28 | Transmutation of Radionuclides |
| 29 | 29 | Vitrify Sludges |
| 30 | 30 | Salt Backfill Only |
| 31 | 31 | Salt Backfill Plus Gas Getters |
| 32 | 32 | Compact Backfill |
| 33 | 33 | Salt Plus Brine Sorbents |
| 34 | 34 | Preformed Compacted Backfill |
| 35 | 35 | Grout Backfill |
| 36 | 36 | Bitumen Backfill |
| 37 | 37 | Add Gas Suppressant |
| 38 | 38 | Minimize Space Around Waste Stack |
| 39 | 39 | Segregate Waste in WIPP |
| 40 | 40 | Decrease Amount of Waste per Room |
| 41 | 41 | Emplace Waste and Backfill Simultaneously |
| 42 | 42 | Selected Vegetative Uptake |

TABLE A-1 (CONTINUED)
INITIAL ENGINEERED ALTERNATIVES SCREENING CANDIDATES



1	43	Brine Isolating Dikes
2	44	Raise Waste Above the Floor
3	45	Brine Sump and Drains
4	46	Gas Expansion Volume
5	47	Seal Repository Room Walls
6	48	Vent Facility
7	49	Ventilate Facility
8	50	Add floor of Brine Sorbents
9	51	Change Mine Extraction Ratio
10	52	Change Room Configurations
11	53	Seal Individual Rooms
12	54	Two Level Repository
13	55	Monument Forest Over Repository
14	56	Monument Covering the Entire Repository
15	57	Buried Steel Plate Over the Repository
16	58	Artificial Surface layer Over the Repository
17	59	Add Marker Dye to Strata
18	60	Drain Castile Reservoir
19	61	Grout Culebra Foundation
20	62	Increase Land Withdrawal Area
21	63	Change Waste Container Shape
22	64	Change Waste Container Material
23		
24		The EATF Combination EAs, #65 through #79
25		
26	65	EATF Baseline—As received with salt backfill.
27	66	EATF Alternative 1—Shred and cement organics and inorganics only, salt backfill.
28	67	EATF Alternative 2—Cement sludges, shred and cement organics and inorganics, salt backfill.
29		
30	68	EATF Alternative 3—Cement sludges, shred and cement organics and inorganics, grout backfill.
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32	69	EATF Alternative 4—Cement sludges, incinerate and cement organics, shred and cement inorganics, salt backfill.
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34	70	EATF Alternative 5—Cement sludges, incinerate and cement organics, shred and cement inorganics, grout backfill.
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36	71	EATF Alternative 6—Vitrify sludges, incinerate and vitrify organics, melt metals into TRU waste ingots, salt backfill.
37		
38	72	EATF Alternative 7—Vitrify sludges, incinerate and vitrify organics, melt metals into TRU waste ingots, grout backfill.
39		
40	73	EATF Alternative 8—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, salt backfill, non-ferrous container.
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TABLE A-1 (CONTINUED)
INITIAL ENGINEERED ALTERNATIVES SCREENING CANDIDATES

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| 1 | 74 | EATF Alternative 9—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, grout backfill, non-ferrous container. |
| 2 | | |
| 3 | 75 | EATF Alternative 10—Remove metals and decontaminate by vibratory finishing and eliminate from the WIPP inventory, no backfill, nickel alloy rectangular container, 10x31x188 rooms. |
| 4 | | |
| 5 | 76 | EATF Alternative 11—Supercompact organics and inorganics, grout backfill, monolayer of 2000 drums in a 6x33x300 room. |
| 6 | | |
| 7 | 77 | EATF Alternative 12—Supercompact organics and inorganics, grout backfill, monolayer of 2000 drums, in a 6x33x300 room. |
| 8 | | |
| 9 | 78 | EATF Alternative 13—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag, and metals are eliminated from the WIPP, no backfill, non-ferrous rectangular containers, minimize space around waste stack in a 10x31x188 room. |
| 10 | | |
| 11 | 79 | EATF Alternative 14—Supercompact organics, and inorganics, salt aggregate backfill, compartmentalize waste, 2000 drums per room, salt dikes and waste separation. |
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The Systems Prioritization Methodology-II (SPM-2) original EAs (SNL/NM, 1995), #80 through #99, are as follows:

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|----|----|--|
| 18 | 80 | SPM-Baseline |
| 19 | 81 | SPM-A Salt backfill 50% filling efficiency |
| 20 | 82 | SPM-B Salt/Bentonite backfill 50-50 mix, 50% filling efficiency |
| 21 | 83 | SPM-C Salt/pH buffer backfill some amount of CaO |
| 22 | 84 | SPM-D Cement grout backfill 100% filling efficiency |
| 23 | 85 | SPM-E Salt/Grout backfill 100% efficiency |
| 24 | 86 | SPM IT-1 Shred and cement organics and inorganics, salt backfill 50% filling efficiency |
| 25 | 87 | SPM IT-2 Cement sludges, shred and cement organics and inorganics, salt backfill 50% filling efficiency, nickel alloy container. |
| 26 | 88 | SPM IT-3 Cement sludges, shred and cement organics and inorganics, cement grout 100% filling efficiency. |
| 27 | 89 | SPM IT-4 Cement sludges, shred and cement organics and inorganics, salt/pH buffer backfill with some amount of CaO. |
| 28 | 90 | SPM IT-5 Cement sludges, shred and compact organics and inorganics, salt backfill with 50% filling efficiency, 200 drum monolayer, 6x33x300 room. |
| 29 | 91 | SPM IT-6 Cement sludges, shred and compact organics and inorganics, cement grout backfill 100% filling efficiency, 2000 drum monolayer, 6x33x300 room. |
| 30 | 92 | SPM IT-7 Cement sludges, compact organics and inorganics, salt/pH buffer backfill with some amount of CaO, 2000 drums monolayer, 6x33x300 room. |
| 31 | 93 | SPM IT-8 Cement sludges, shred and add bentonite to organics and inorganics, salt backfill 50% filling efficiency. |
| 32 | 94 | SPM IT-9 Cement sludges, shred and add bentonite to organics and inorganics, cement grout backfill 100% efficiency. |
| 33 | 95 | SPM IT-10 Decontaminate metals, nickel alloy container, cement grout backfill 100% filling efficiency. |
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TABLE A-1 (CONTINUED)
INITIAL ENGINEERED ALTERNATIVES SCREENING CANDIDATES

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|---|----|--|
| 1 | 96 | SPM EATF-8 Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass |
| 2 | | frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, |
| 3 | | salt backfill, non-ferrous container. |
| 4 | 97 | SPM EATF-9 Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass |
| 5 | | frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, |
| 6 | | grout backfill, non-ferrous container. |
| 7 | 98 | SPM DOE-1 Passive markers—no specific scenario given reduce human intrusion |
| 8 | | probability parameters. |
| 9 | 99 | SPM DOE-2 Compartmentalization of waste—various unspecified scenarios. |

The individual EAs found in Title 40, Code of Federal Regulations (CFR), Part 194 (40 CFR 194) (EPA, 1995), #100 through #109, are as follows:

- | | | |
|----|-----|--|
| 14 | 100 | 194—Cementation |
| 15 | 101 | 194—Shredding |
| 16 | 102 | 194—Supercompaction |
| 17 | 103 | 194—Incineration |
| 18 | 104 | 194—Vitrification |
| 19 | 105 | 194—Improved waste containers |
| 20 | 106 | 194—Grout and bentonite backfill |
| 21 | 107 | 194—Metal Melting |
| 22 | 108 | 194—Alternative configuration of waste emplacement |
| 23 | 109 | 194—Alternative disposal system dimensions |

The individual EAs added by the EA Screening Working Group during the screening process are as follows:

- | | | |
|----|-----|------------------------------------|
| 28 | 110 | Enhanced solidification of sludges |
| 29 | 111 | Clay based backfill |
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TABLE A-2

INITIAL ENGINEERED ALTERNATIVE CANDIDATE LIST

EAs considered in the 1991 EATF
EA #1 - #79

Alternative Number	Title
1	Compact Waste
2	Incinerate and Cement
3	Incinerate and Vitriify
4	Wet Oxidation
5	Shred and Bituminize
6	Shred and Compact
7	Shred and Cement
8	Shred and Polymer Encapsulation
9	Shred add Salt and Compact
10	Plasma Processing
11	Melt Metals
12	Add Salt Backfill
13	Add other Sorbents
14	Add Gas Suppressant
15	Shred and Add Bentonite
16	Acid Digestion
17	Sterilization
18	Add Copper Sulfate
19	Add Gas Getters
20	Add Fillers
21	Segregate Waste Forms
22	Decontaminate Metals
23	Change Waste Generation Process
24	Add Anti-Bacterial Material
25	Accelerate Waste Digestion Process
26	Alter Corrosion Environment
27	Alter Bacterial Environment in WIPP
28	Transmutation of Radionuclides
29	Vitriify Sludges
30	Salt Backfill Only
31	Salt Backfill Plus Gas Getters
32	Compact Backfill
33	Salt Plus Brine Sorbents
34	Preformed Compacted Backfill
35	Grout Backfill
36	Bitumen Backfill
37	Add Gas Suppressant
38	Minimize Space Around Waste Stack
39	Segregate Waste in WIPP
40	Decrease Amount of Waste per Room
41	Emplace Waste and Backfill Simultaneously
42	Selected Vegetive Uptake
43	Brine Isolating Dikes



TABLE A-2 (CONTINUED)
INITIAL ENGINEERED ALTERNATIVE CANDIDATE LIST

EAs considered in the 1991 EATF
EA #1 – #79 (Continued)

Alternative Number	Title
44	Raise Waste Above the Floor
45	Brine Sump and Drains
46	Gas Expansion Volumes
47	Seal Repository Room Walls
48	Vent Facility
49	Ventilate Facility
50	Add floor of Brine Sorbents
51	Change Mine Extraction Ratio
52	Change Room Configurations
53	Seal Individual Rooms
54	Two Level Repository
55	Monument Forest Over Repository
56	Monument Covering the Entire Repository
57	Buried Steel Plate Over the Repository
58	Artificial Surface layer Over the Repository
59	Add Marker Dye to Strata
60	Drain Castile Reservoir
61	Grout Culebra Foundation
62	Increase Land Withdrawal Area
63	Change Waste Container Shape
64	Change Waste Container Material
65	EATF Baseline—As Received with Salt Backfill
66	EATF Alternative 1—Shred and cement organics and inorganics only, salt Backfill.
67	EATF Alternative 2—Cement Sludges, shred and cement organics and inorganics, salt Backfill.
68	EATF Alternative 3—Cement sludges, shred and cement organics and inorganics, grout backfill.
69	EATF Alternative 4—Cement sludges, incinerate and cement organics, shred and cement inorganics, salt backfill.
70	EATF Alternative 5—Cement sludges, incinerate and cement organics, shred and cement inorganics, grout backfill.
71	EATF Alternative 6—Vitrify sludges, incinerate and vitrify organics, melt metals into TRU waste ingots, salt backfill.
72	EATF Alternative 7—Vitrify sludges, incinerate and vitrify organics, melt metals into TRU waste ingots, grout backfill.
73	EATF Alternative 8—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, salt backfill, non-ferrous container.
74	EATF Alternative 9—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, grout backfill, non-ferrous container.

TABLE A-2 (CONTINUED)**INITIAL ENGINEERED ALTERNATIVE CANDIDATE LIST**

EAs considered in the 1991 EATF
EA #1 - #79 (Continued)

Alternative Number	Title
75	EATF Alternative 10—Remove metals and decontaminate by vibratory finishing and eliminate from the WIPP inventory, no backfill, nickel alloy rectangular container, 10X31X188 rooms.
76	EATF Alternative 11—Supercompact organics and inorganics, grout backfill, monolayer of 2000 drums in a 6X33X300 room.
77	EATF Alternative 12—Supercompact organics and inorganics, grout backfill, monolayer of 2000 drums, in a 6X33X300 room.
78	EATF Alternative 13—Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag, and metals are eliminated from the WIPP, no backfill, non-ferrous rectangular containers, minimize space around waste stack in a 10X31X188 room.
79	EATF Alternative 14—Supercompact organics, and inorganics, salt aggregate backfill, compartmentalize waste, 2000 drums per room, salt dikes and waste separation.

EAs initially considered in the SPM
EA #80 - #99

Alternative Number	Title
80	SPM-Baseline
81	SPM-A Salt backfill 50% filling efficiency
82	SPM-B Salt/Bentonite backfill 50-50 mix, 50% filling efficiency
83	SPM-C Salt/pH buffer backfill some amount of CaO
84	SPM-D Cement grout backfill 100% filling efficiency
85	SPM-E Salt/Grout backfill 100% efficiency
86	SPM IT-1 Shred and cement organics and inorganics, salt backfill 50% filling efficiency
87	SPM IT-2 Cement sludges, shred and cement organics and inorganics, salt backfill 50% filling efficiency, nickel alloy container.
88	SPM IT-3 Cement sludges, shred and cement organics and inorganics, cement grout 100% filling efficiency.
89	SPM IT-4 Cement sludges, shred and cement organics and inorganics, salt/pH buffer backfill with some amount of CaO.
90	SPM IT-5 Cement sludges, shred and compact organics and inorganics, salt backfill with 50% filling efficiency, 200 drum monolayer, 6X33X300 room.
91	SPM IT-6 Cement sludges, shred and compact organics and inorganics, cement grout backfill 100% filling efficiency, 2000 drum monolayer, 6X33X300 room.
92	SPM IT-7 Cement sludges, compact organics and inorganics, salt/pH buffer backfill with some amount of CaO, 2000 drums monolayer, 6X33X300 room.

TABLE A-2 (CONTINUED)**INITIAL ENGINEERED ALTERNATIVE CANDIDATE LIST**

EAs initially considered in the SPM
EA #80 – #99 (Continued)

Alternative Number	Title
93	SPM IT-8 Cement sludges, shred and add bentonite to organics and inorganics, salt backfill 50% filling efficiency.
94	SPM IT-9 Cement sludges, shred and add bentonite to organics and inorganics, cement grout backfill 100% efficiency.
95	SPM IT-10 Decontaminate metals, nickel alloy container, cement grout backfill 100% filling efficiency.
96	SPM EATF-8 Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, salt backfill, non-ferrous container.
97	SPM EATF-9 Vitrify sludges, incinerate and vitrify organics, melt metals with glass/glass frit, radionuclides partitioned into slag and metals are eliminated from the WIPP inventory, grout backfill, non-ferrous container.
98	SPM DOE-1 Passive markers- no specific scenario given reduce human intrusion probability parameters.
99	SPM DOE-2 Compartmentalization of waste - various unspecified scenarios.

EAs Listed in 40 CFR 194
EA #100 – #109

Alternative Number	Title
100	194—Cementation
101	194—Shredding
102	194—Supercompaction
103	194—Incineration
104	194—Vitrification
105	194—Improved Waste Containers
106	194—Grout and Bentonite Backfill
107	194—Metal Melting
108	194—Alternative Configuration of Waste Emplacement
109	194—Alternative Disposal System Dimensions

TABLE A-3
FIRST PRIORITIZED EA LIST

ID Number	Description
# 10	Plasma Processing of All Waste
# 12	Salt Backfill Around Drums and Waste Stack
# 33	Salt Plus Clay Backfill
# 35	Salt Aggregate Grout Backfill Around Drums
# 53	Seal Individual Rooms
# 60	Depressurize Castile Reservoir
# 63	Change Waste Container Shape
# 74	Vitrify sludges, shred and vitrify organics, melt metals with frit to partition actinides, salt aggregate grout backfill, change container material.
# 75	Decontaminate surface of metallic wastes for LLW disposal, no backfill, change container material and shape, 10x31x188 rooms.
# 83	Salt backfill with CaO
# 89	Enhanced cement sludges, shred and cement organics and inorganics, salt backfill with CaO.
# 94	Enhanced cement sludges, shred and add clay based material to organics and inorganics, salt aggregate grout backfill.
# 95	Decontaminate surface of metallic waste for LLW disposal, change container material, salt aggregate grout backfill.
# 111	Clay Based Backfill

TABLE A-4

INITIAL PRIORITIZED LIST CHANGE JUSTIFICATIONS

EA#	Added, Removed, or Not Changed from Initial List	Description and Modifications	Basis for Modification, Addition, or Removal
1	Added	Supercompact Organics and Inorganics	High Feasibility, Lower Permeability, Increases shear strength
6	Added	Shred and Compact Organics and Inorganics	High Feasibility, Lower Permeability, Increases shear strength
10	No Change	Plasma Processing of all Waste	
12	Removed	Salt Backfill	No Benefit to Disposal System
33	No Change	Salt plus Clay backfill. <i>Examine using sand as the filler material instead</i>	Information to-date suggests that sand interacts more effectively with clay that does salt.
35	No Change	Salt Aggregate Grout Backfill Around Drums. <i>Perform an additional assessment with a cementitious grout.</i>	Allows the CAO to assess any additional benefits from using a cementitious grout.
53	Removed	Seal individual Rooms	Contrary to No Migration Determination
60	Removed	Depressurize the Castile Formation	Extra Holes and Assurance system is depressurized to 10K years not Justified (may enhance lateral flow from the repository)
63	Removed	Change Waste Container Shape	With Respect to Solubility and Shear Strength, adds No Benefit
74	Removed	Vitrify Sludges, shred and vitrify organics, melt metals and remove actinides, Salt/Agg Grout BF, Change Container Mat'l	Gas Generation Reduction EA

TABLE A-4 (CONTINUED)

INITIAL PRIORITIZED LIST CHANGE JUSTIFICATIONS

EA#	Added, Removed, or Not Changed from Initial List	Description and Modifications	Basis for Modification, Addition, or Removal
75	Removed	Decon Metals for LLW, no BF, change Container Mat'l and shape, 10x31x188 room	Gas Generation Reduction EA
77	Added	Supercompact Organics and inorganics, Salt Aggregate Grout Backfill, Monolayer of 2000 Drums in a 6x33x300 foot room. <i>Add assessments with clay-based backfill, sand/clay backfill, and high percentage CaO Backfill.</i>	Allows the CAO to assess increases in benefit for several types of backfill.
83	No Change	Salt Backfill with CaO.	CaO acts as a pH Buffer to decrease actinide solubility. The salt acts as a filler. the more CaO is emplaced the more effective the EA is at affecting solubility.
89	Removed	Enhance cement sludges, S&C orgs and inorgs, CaO BF	Very Similar to 94 which is a Final EA
94	No Change	Enhanced Cementation of Sludges, Shred and add Clay-Based Material to Organics and Inorganics. <i>Examine this alternative alone and with all combinations of backfills.</i>	Enables CAO to assess any additional benefit from adding backfill to the rooms when used in conjunction with the waste treatment activities.



TABLE A-4 (CONTINUED)**INITIAL PRIORITIZED LIST CHANGE JUSTIFICATIONS**

EA#	Added, Removed or Not Changed from Initial List	Description and Modifications	Basis for Modification, Addition, or Removal
95	Removed	Decon Metals for LLW, Salt/Agg Grout BF, change Container shape	Gas Generation Reduction EA
111	No Change	Clay-Based Backfill	

