

Cesium Management for the Low Activity Waste Pretreatment System (LAWPS)

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Outline

- Reasons for not returning cesium to tanks.
- Current ORP plans are the only path to make critical decision timeline for 2022 startup.
- Cesium pathways considered for WSC, several possible waste types.
- Possible change in cesium removal to increase efficiency; experimental but could likely work and has advantages. Would be considered as an addition at around or after LAWPS start up.
- There are enough pathways and improvements proposed. There is a need to look at cost, pathway destinations, and take a stab at environmental impacts in greater detail. Next Steps.

Reasons for Not Returning Cesium to Tanks from DFLAW

- Cesium is present in HLW mostly in salt cake and supernatant as stable Cs-133 and radioactive Cs-134, Cs-135, and Cs-137. Cs-134 has mostly decayed away, leaving Cs-135 and Cs-137. Cs-137 decays to Ba-137m which decays to Ba-137. This is the principle gamma source in tanks. There is ~3 to 4 times more total cesium verses Cs-137 radioactivity.
- Reasons for not return cesium to tanks, because Cs-137 is:
 - Principle RAD hazard for work force.
 - Makes up about 50% of hydrogen generated in tanks/Pretreatment. 7 of 12 tanks scheduled for DFLAW have high H₂ generation.
 - Places more RAD/heat stress on tanks; some nearing their design life.
 - Cost more money and creates more waste. Cheaper in the short run/more costly in the long run.
 - Returning cesium takes up tank space; less free DST space created/return 1 Mgal for every 3 Mgal removed from DSTs.

LAWPS Task Completion for CD-0,1,2 (90%),3,4 Requires Fixed Current Plan to make 2022 Start of Operations

- There is so much paperwork, signatures, and checks to do something large at DOE it typically takes 5-7 years to start construction. For LAWPS construction will have to begin in 3.5 to 4 years for an on-time start up. ORP must also include support facilities to use LAWPS and LAW which makes locking in design a requirement to meet schedule. LAWPS must use processes “guaranteed” to work.

Critical Decision Steps:

- CD-0 Approve Mission Need, 6 steps, ~23 items **Done**
- CD-1 Approve Alternative Selection and Cost Range, 9 steps, ~29 items
- CD-2 Approve Performance Baseline, 9 steps, ~20 items
- CD-3 Approve Start of Construction, 8 steps, ~18 items
- CD-4 Approve Start of Operations, 8 steps, ~17 items

Several Possibilities for Cesium Pathway Using Non-Elutable Resin, Package, and Disposal; RPP-RPT-57115

- Alternative 1: Use non-elutable CST resin and ship to deep geological repository as HLW. Not likely a solution since repository is not operational. This could change hopefully by time HLW glass is being made.
- Alternative 2: Use low loading zeolite exchange media, ship to WCS Texas, requires WIR. Class C waste because of Cs-137. Nevada National Security Site is the other option but more DOE red tape (paperwork) is required.
- Alternative 3: IDF disposal as in Alternative 2, not in TC&WM EIS/ROD so amendment required and WIR required. 2-4 of 12 DFLAW tanks spent resin is likely TRU, but don't tell Texas.

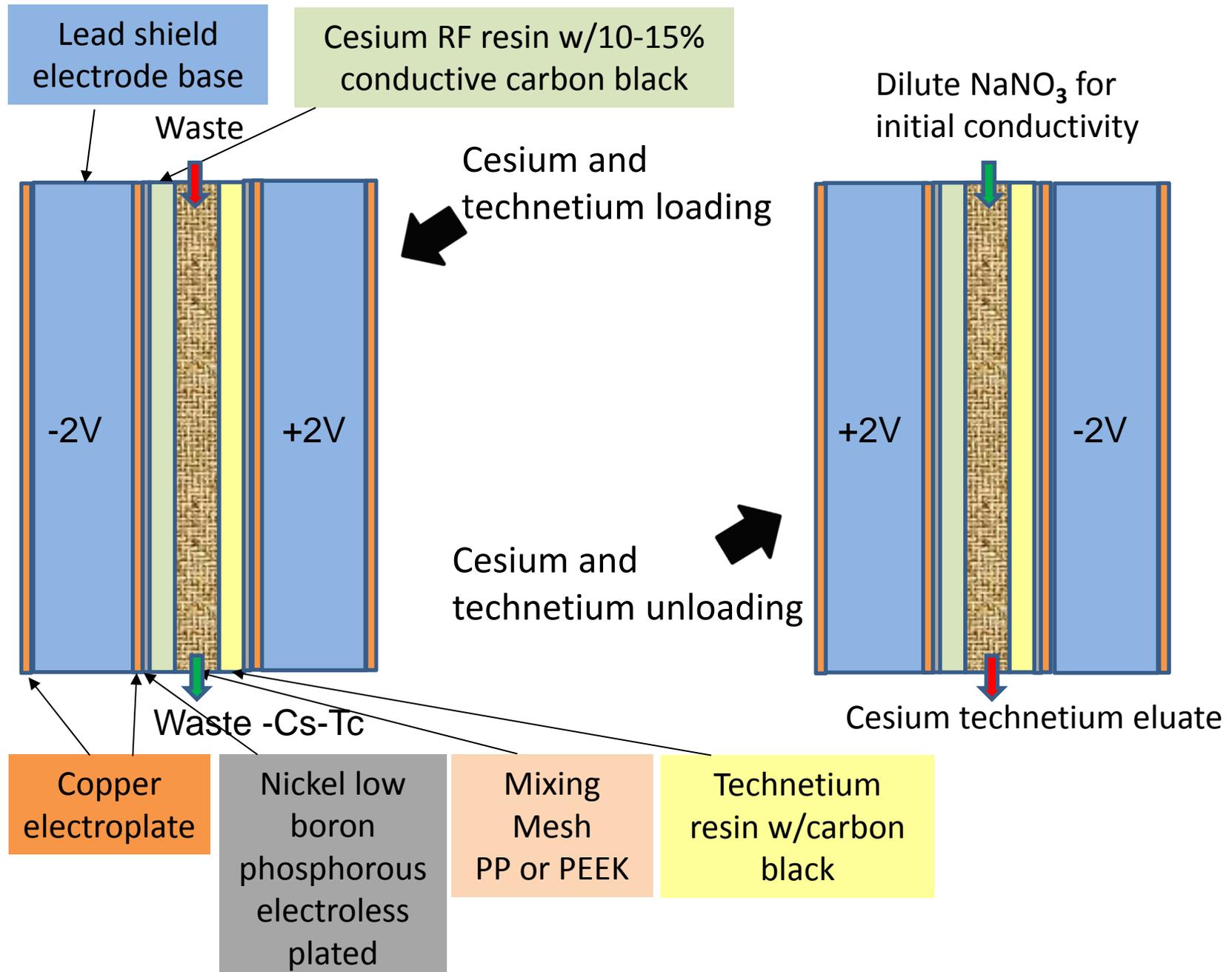
Cost for 5 years operations with resin disposal, \$Million

Item	Description	Alt. 1	Alt. 2	Alt. 3
1	Manage Spent IX Resin Disposition	8.7	8.7	8.7
2	ISF Permitting	12.4	13.8	9.7
3	Spent IX Resin ISF	11.9	33.3	25.4
4	Spent IX Resin Disposition	590.7	277.1	8.1
5	ISF Demolition & Remediation	2.4	7.2	5.1
	Total	626.1	340.1	67.1

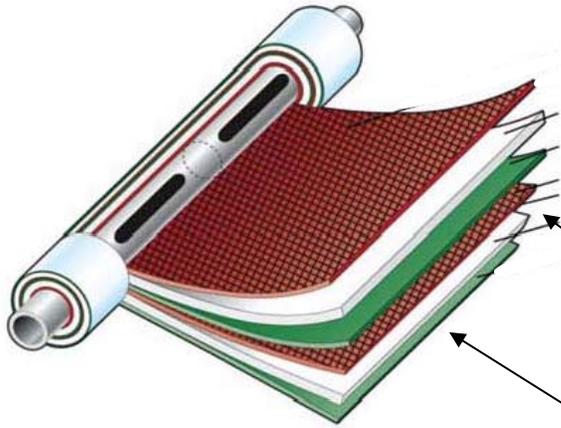
Cesium Pathway in Processes Using Non-Elutable Resin with Glass Stabilization and Elutable Resin with Less Waste

- Another alternative: Kurion and SRNL are proposing a modified Kurion system for cesium removal and interim storage in support of direct feed LAW. Details to be discussed. Likely a crystalline silicotitanate exchange media that is easily incorporated into glass, Geo Melter.
- Even another alternative: proposal to use Electro-active ion exchange by the Nez Perce Tribe. Used conductive ion exchange media of similar structure and selectivity to current resin. Does not require nitric acid and sodium hydroxide for regeneration and you get a counter-ion for free, technetium-99. Resin unloading is accomplished by switching electrical voltage opposite loading voltage. Waste comes off very concentrated giving small storage volume or borehole-able package sizes (grout). This is not electrodeionization (EDI). Electro-active ion exchange has not been evaluated much for nuclear waste, 1 or 2 minor examples. Could not be a mainstream proposal without proof of concept on Hanford waste types.

Cell Stack for Electro-Active Ion-Exchange Flat Electrode



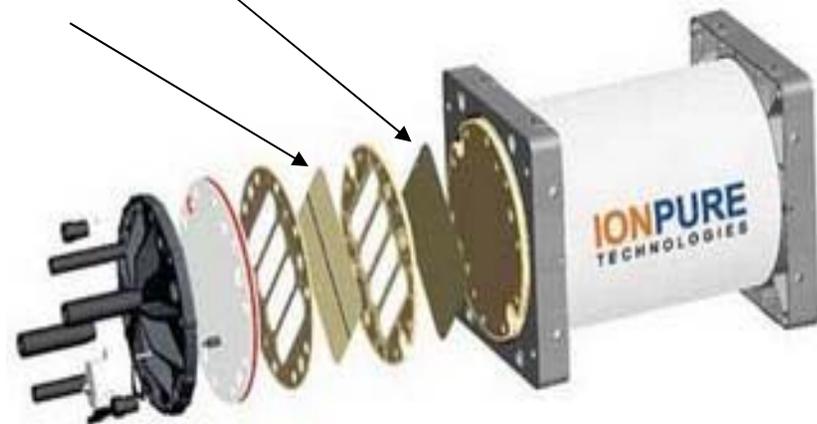
Types of Cell Configurations Electro-Active Ion Exchange



Spiral Wound Membranes/Electrodes: Efficient but throw away once useful life is gone. Harder to initially prototype.

Membranes/Electrodes

Flat Membrane/Electrode Stack:
Almost as efficient and can be serviced. Easier to initially prototype and easier to incorporate shielding.



An Unshielded Version of What an Electro-Active Ion Exchange End Product Would Look Like



Next Steps, Considerations

- Waste from ion exchange and spent elutable or spent non-elutable resin will be Class C, GTCC, CH-TRU, RH-TRU, and/or HLW.
- Need to determine approximate fraction of expected waste destinations and types for proposals.
- Need to determine basic short term and long term costs for the above disposition destinations. On a cost basis the results currently are: HLW deep geological repository = 2 X WCS = 10-72 X IDF. IDF looks unrealistically cheap.
- Need to determine cost and destination of deep boreholes. Is DOE serious about this and do they have a regulatory pathway which is achievable?
- Look at site impacts and see what pathways can minimize impacts. Rank depositions: HLW \approx RH-TRU \approx Deep Borehole > GTCC > Class C
- Out of the box thinking: Use current ORP plan and designate a DST for Cs-137 waste or build one with significant cooling that could handle it.