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System-Level Logistics Modeling of DPC Direct Disposal

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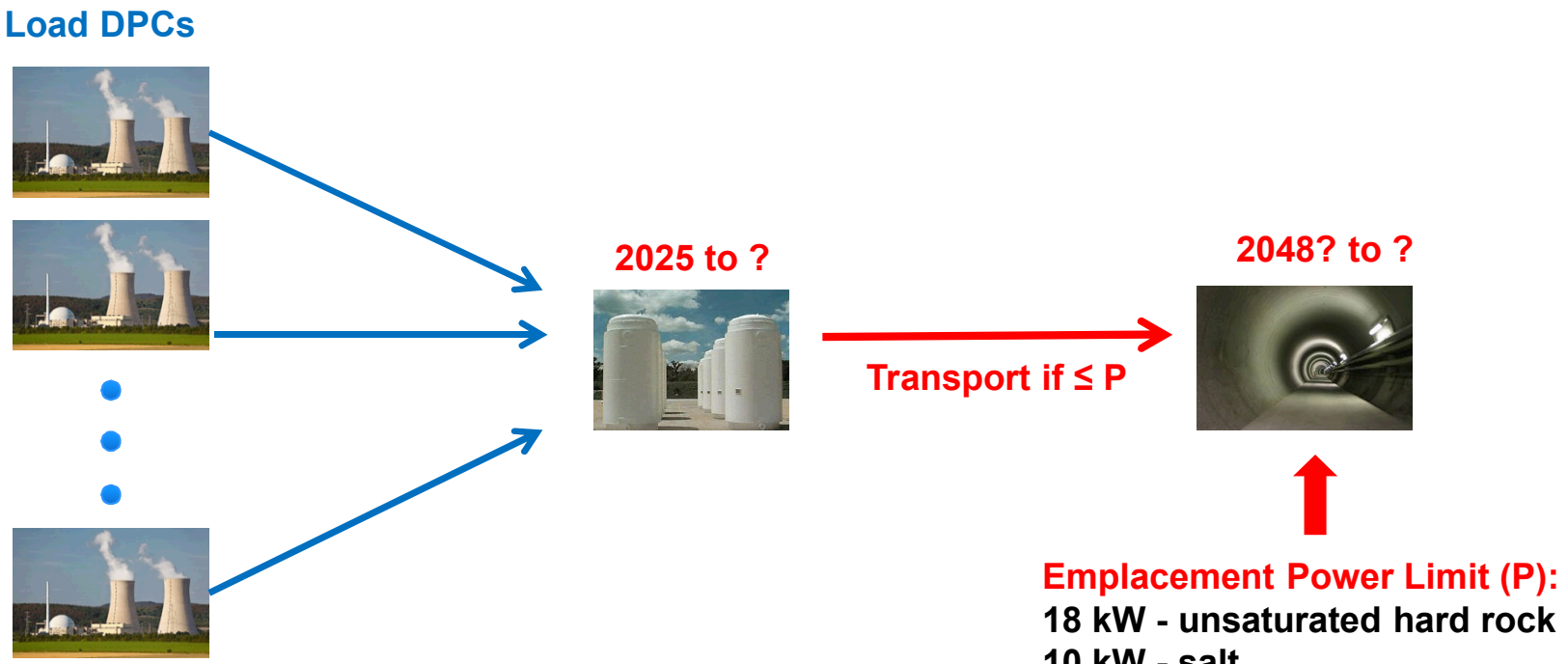
LOGISTIC SIMULATION OBJECTIVES

- ❑ Amount of SNF in DPCs available each year for disposal.
- ❑ Repository annual acceptance rate constrained by emplacement power limit
- ❑ Maximum capacity and operating time of an interim storage facility (ISF).
- ❑ Fuel age and burnup at emplacement.



LOGISTIC SIMULATION SETUP

Parameters

- **Repository Starting Dates: 2036 (early start); 2048 (planned start); and 2060 (late start).**
- **Emplacement Thermal Power Limits: 6 kW; 10 kW; and 18 kW.**
- **Fuel Loading Scenarios: DPCs-Only and DPCs and MPCs (4PWR)**

Assumptions

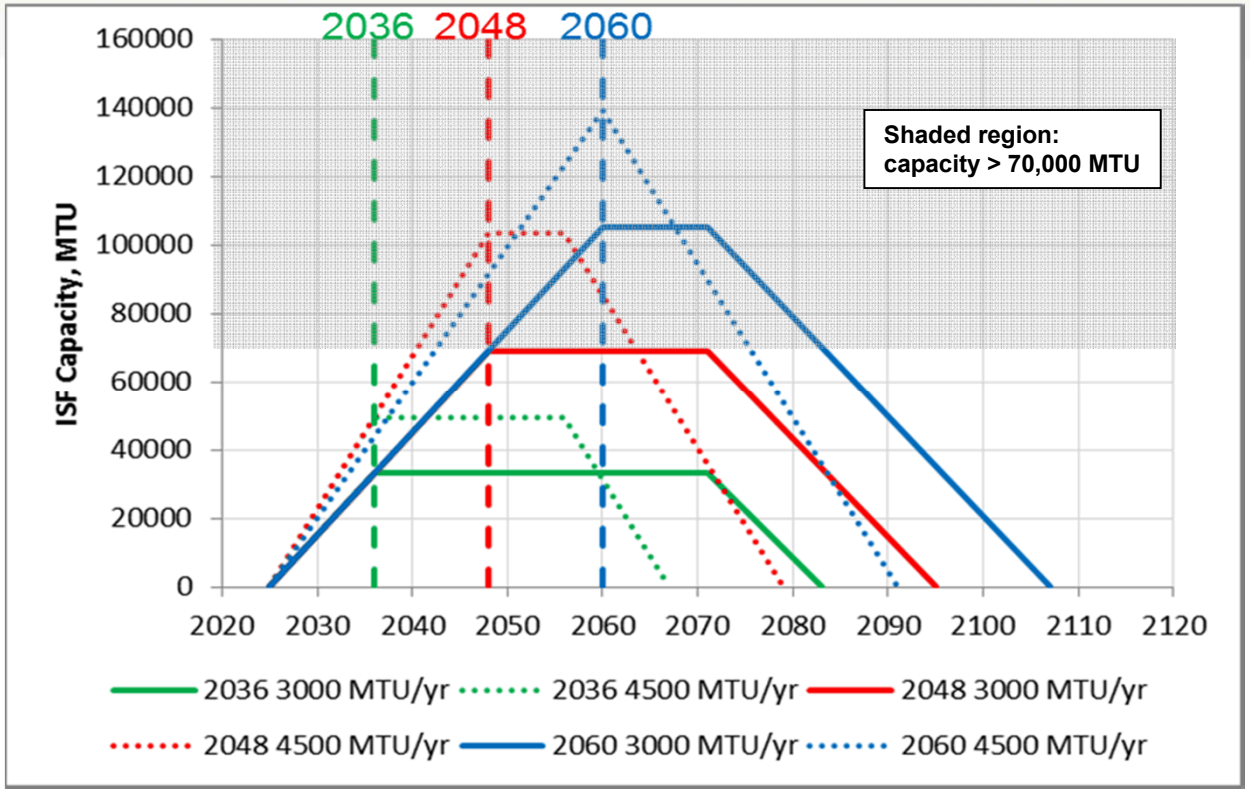
- **Loading of MPCs begins 5 years prior to the repository opening.**
- **All DPCs are transportable and disposable.**
- **ISF begins its full operations in 2025.**
- **The DPCs and MPCs are stored at ISF until they meet the repository emplacement power thermal limit.**

DIRECT DISPOSAL OF DPCS LOGISTIC SCENARIOS

Scenario	Repository Starting Date	Emplacement Power Limit (kW)	Fuel Loading Strategy
1	2036	6	DPCs-Only
2			DPCs and MPCs
3		10	DPCs-Only
4			DPCs and MPCs
5		18	DPCs-Only
6			DPCs and MPCs
7	2048	6	DPCs-Only
8			DPCs and MPCs
9		10	DPCs-Only
10			DPCs and MPCs
11		18	DPCs-Only
12			DPCs and MPCs
13	2060	6	DPCs-Only
14			DPCs and MPCs
15		10	DPCs-Only
16			DPCs and MPCs
17		18	DPCs-Only
18			DPCs and MPCs

FUEL REPACKAGING ALTERNATIVES

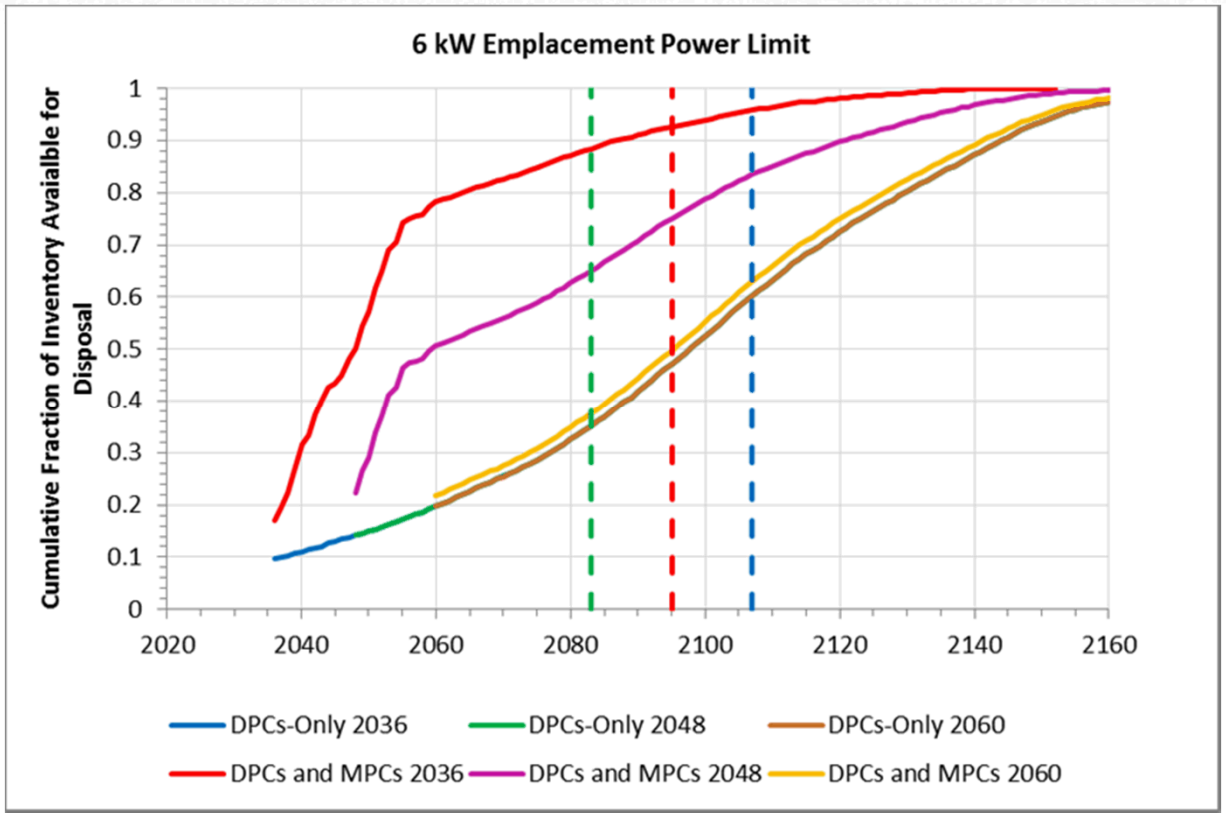
ISF Capacity and Operational Time for Different Repackaging Alternatives



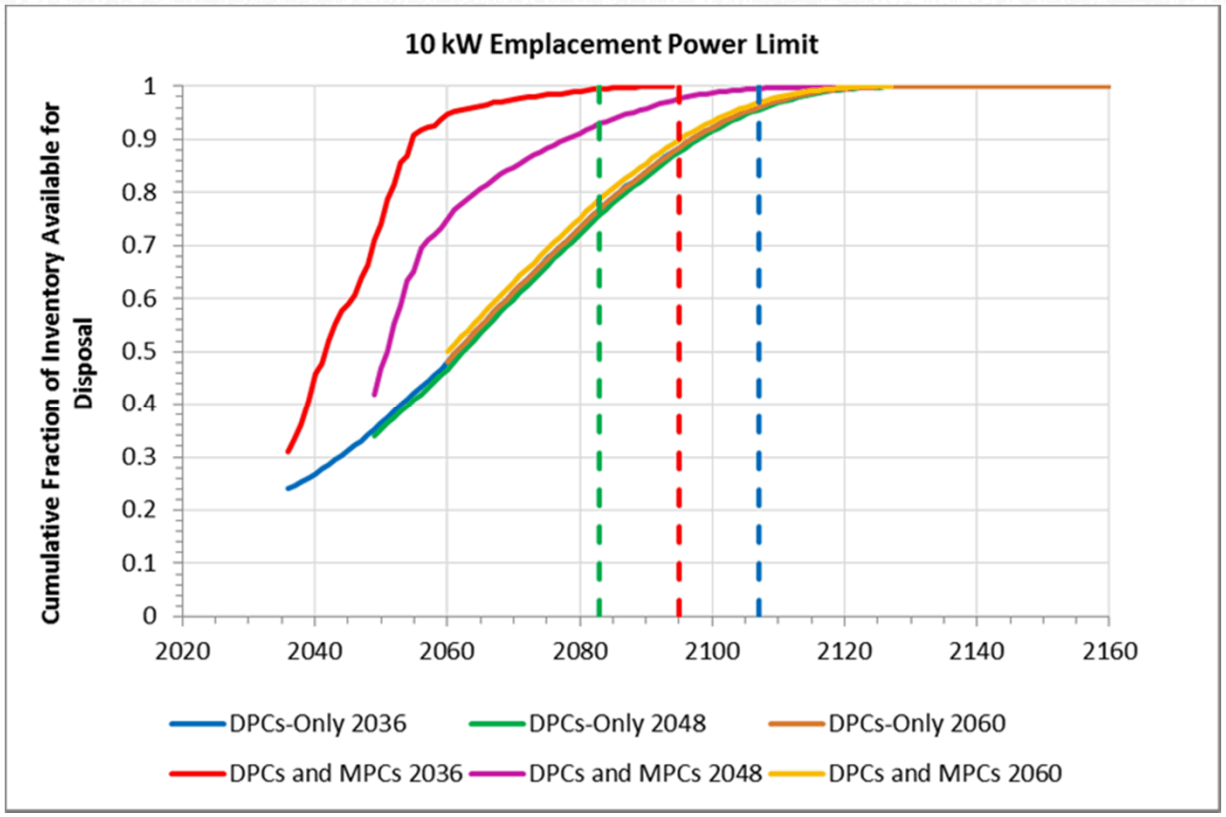
ISF Operational Time:

- **47 yrs for all alternatives with 3,000 MTU/yr)**
- **31 yrs for all alternatives woith 4,500 MTU/yr)**

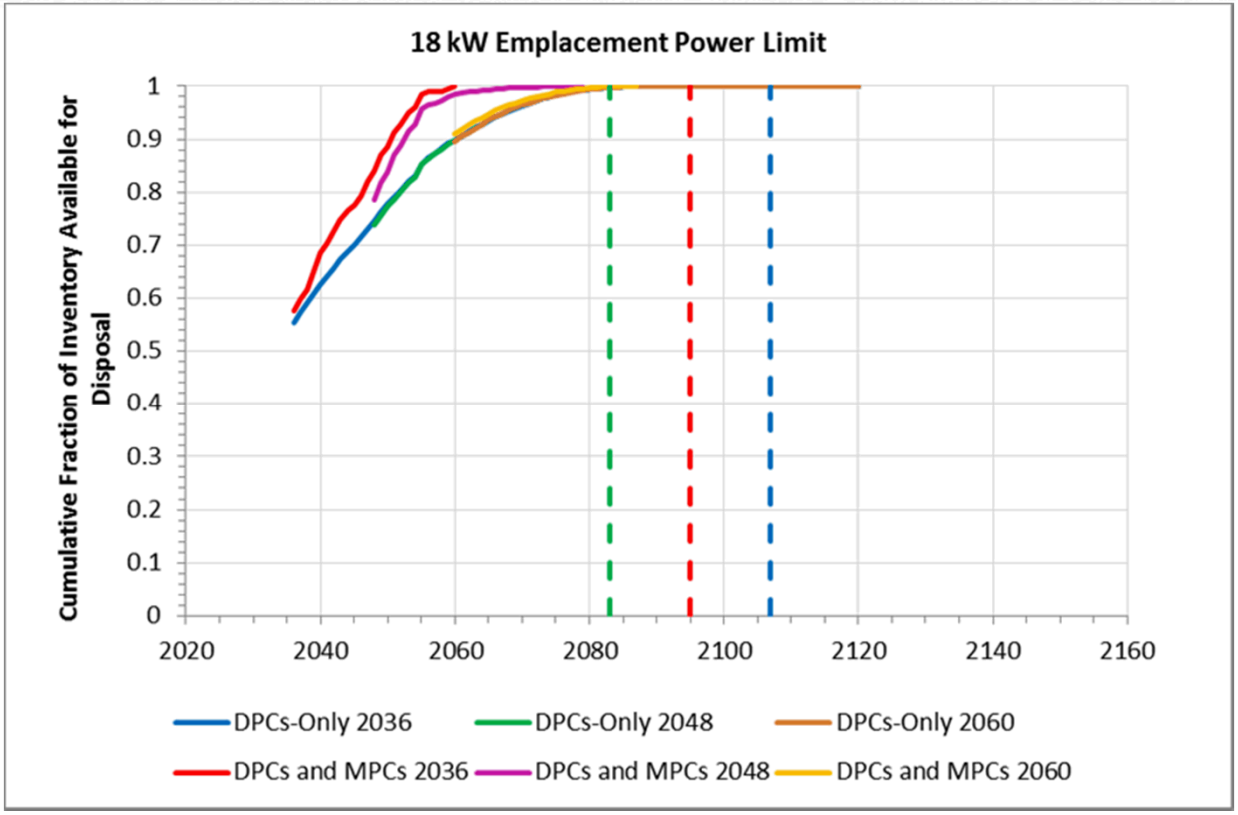
SNF IN DPCS AND MPCS AVAILABLE FOR DISPOSAL IN 6KW SCENARIOS



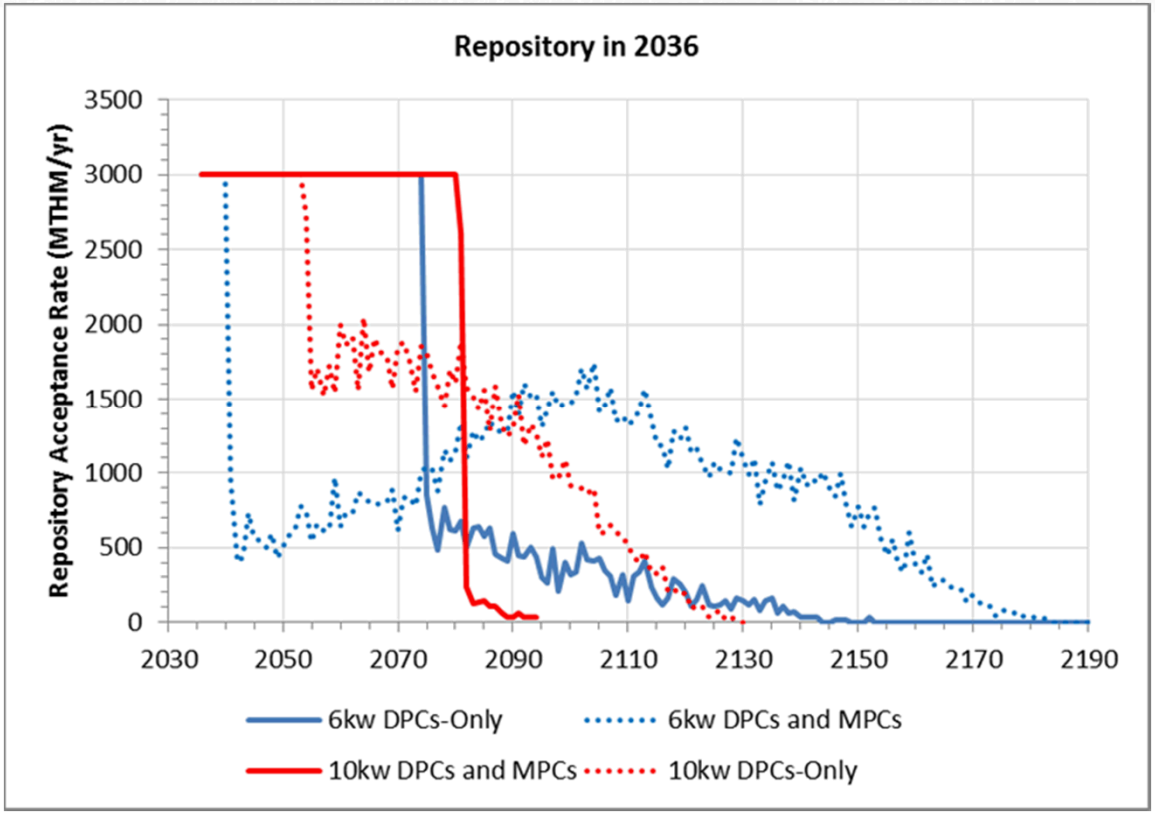
SNF IN DPCS AND MPCS AVAILABLE FOR DISPOSAL IN 10KW SCENARIOS



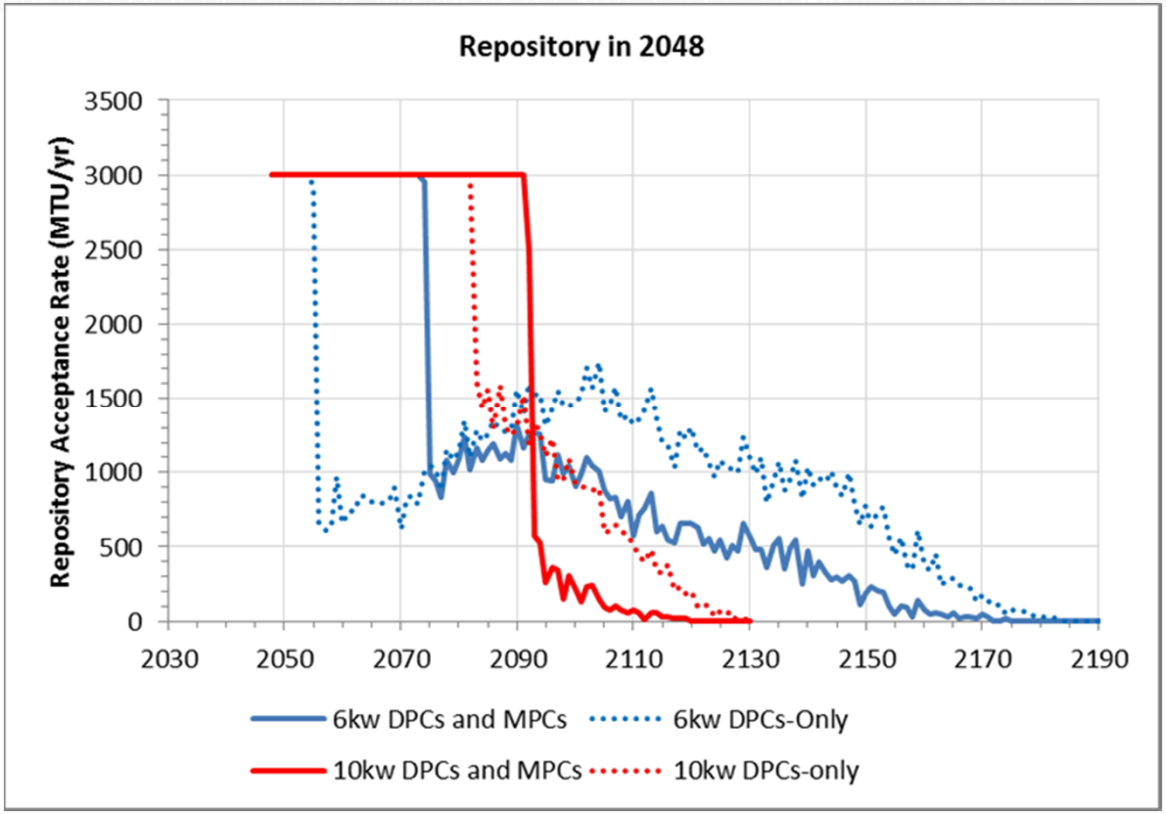
SNF IN DPCS AND MPCS AVAILABLE FOR DISPOSAL IN 18KW SCENARIOS



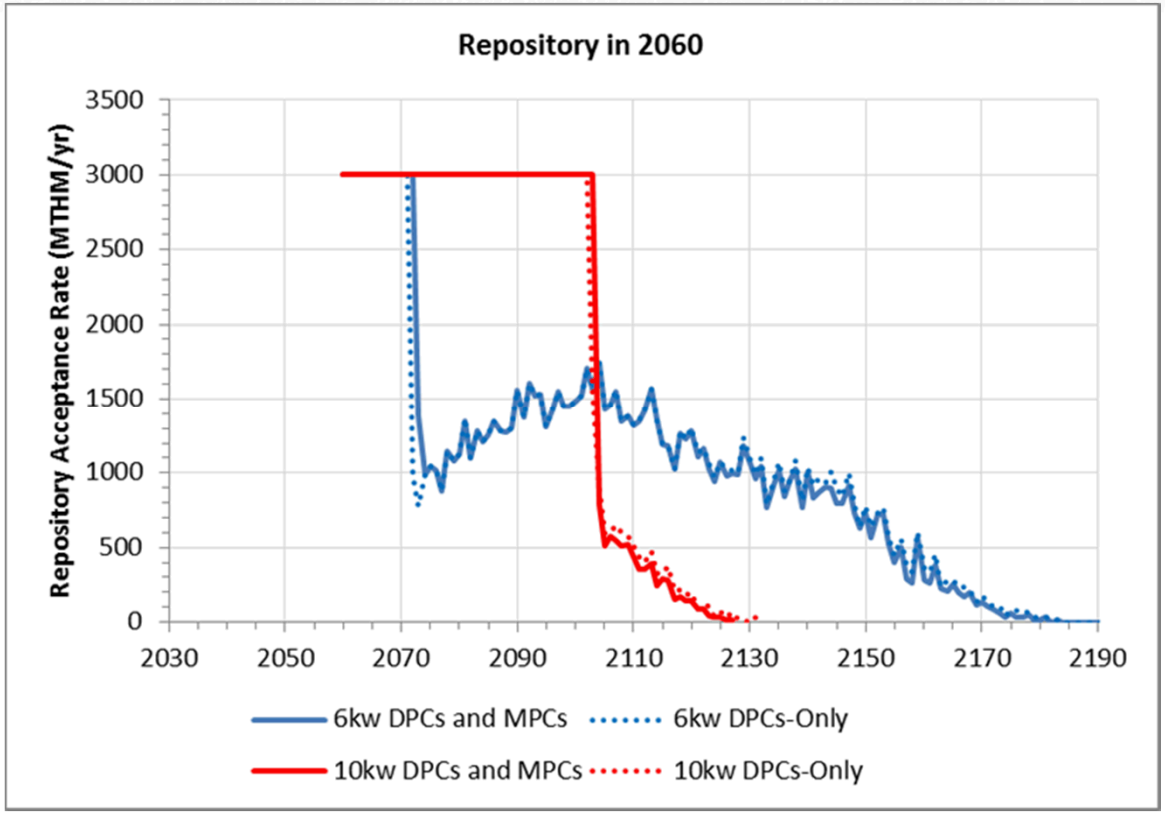
REPOSITORY ACCEPTANCE RATE FOR SCENARIOS WITH REPOSITORY IN 2036



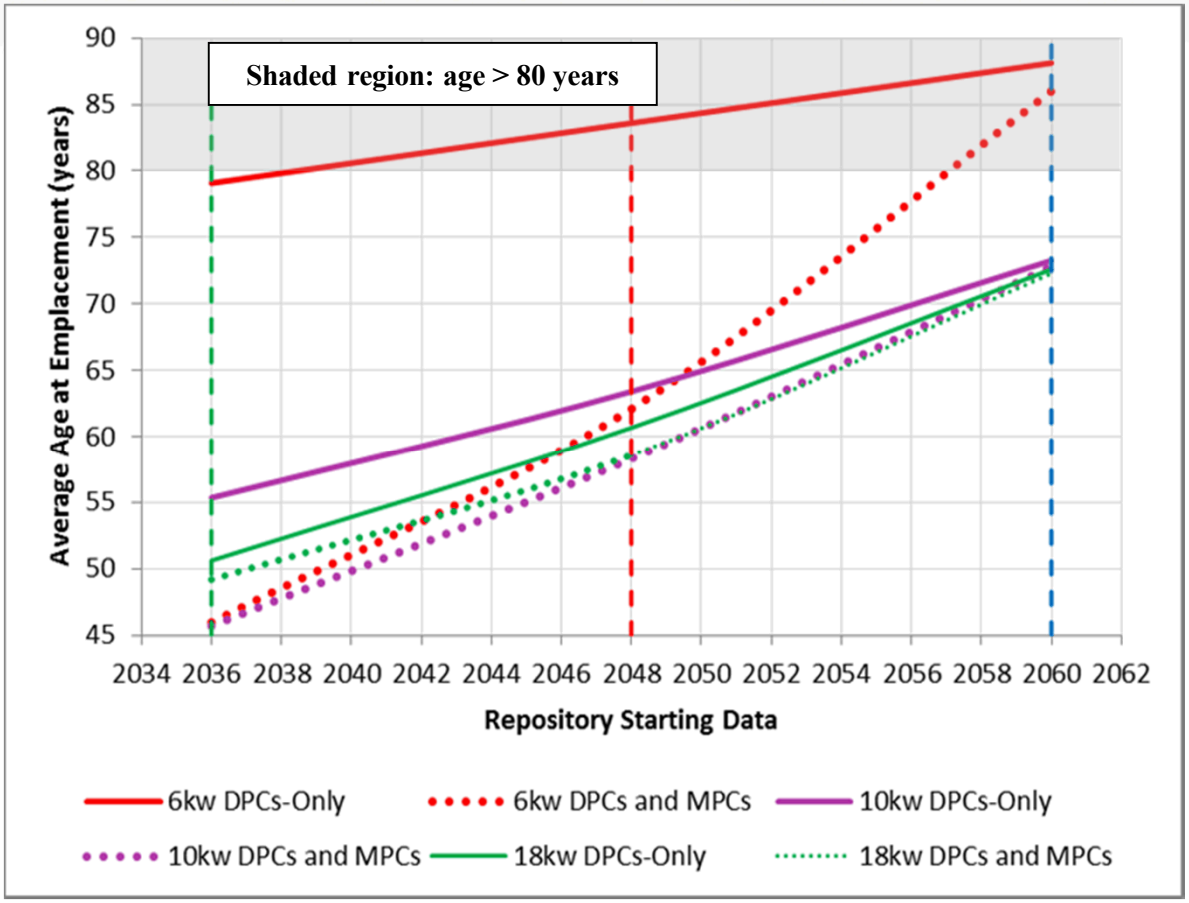
REPOSITORY ACCEPTANCE RATE FOR SCENARIOS WITH REPOSITORY IN 2048



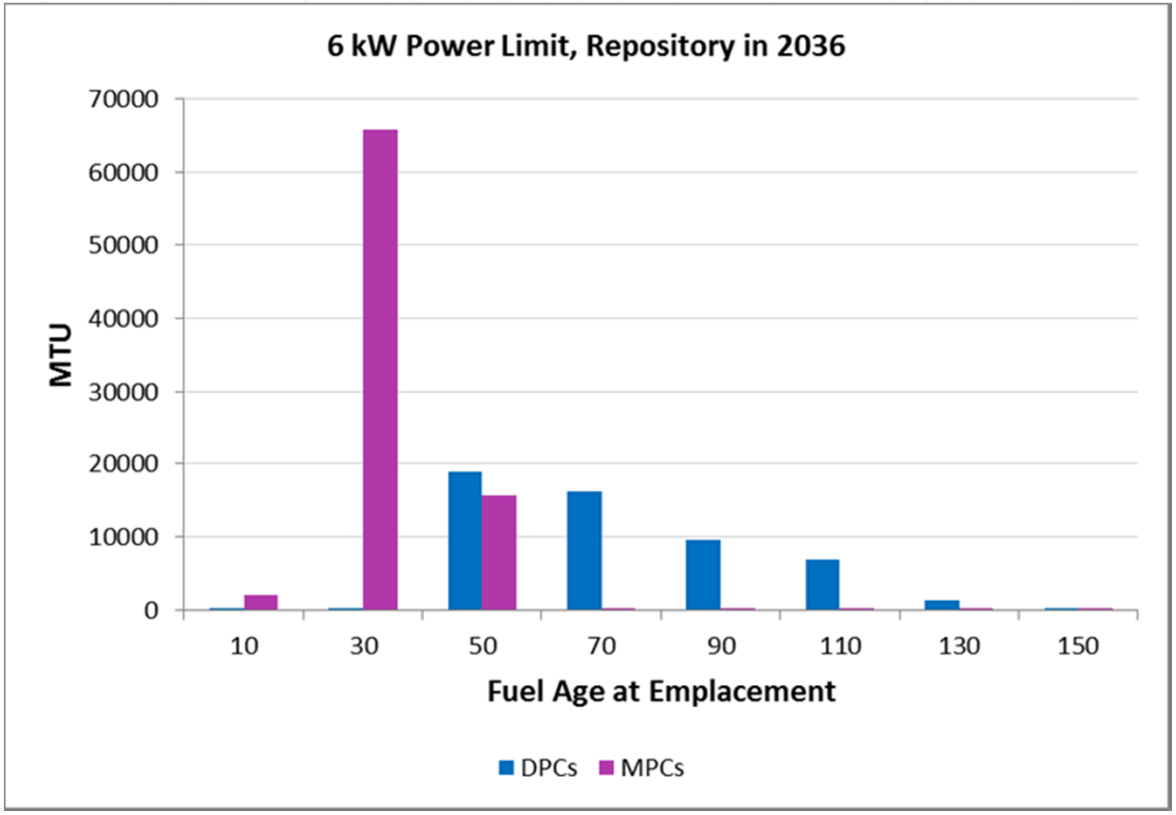
REPOSITORY ACCEPTANCE RATE FOR SCENARIOS WITH REPOSITORY IN 2060



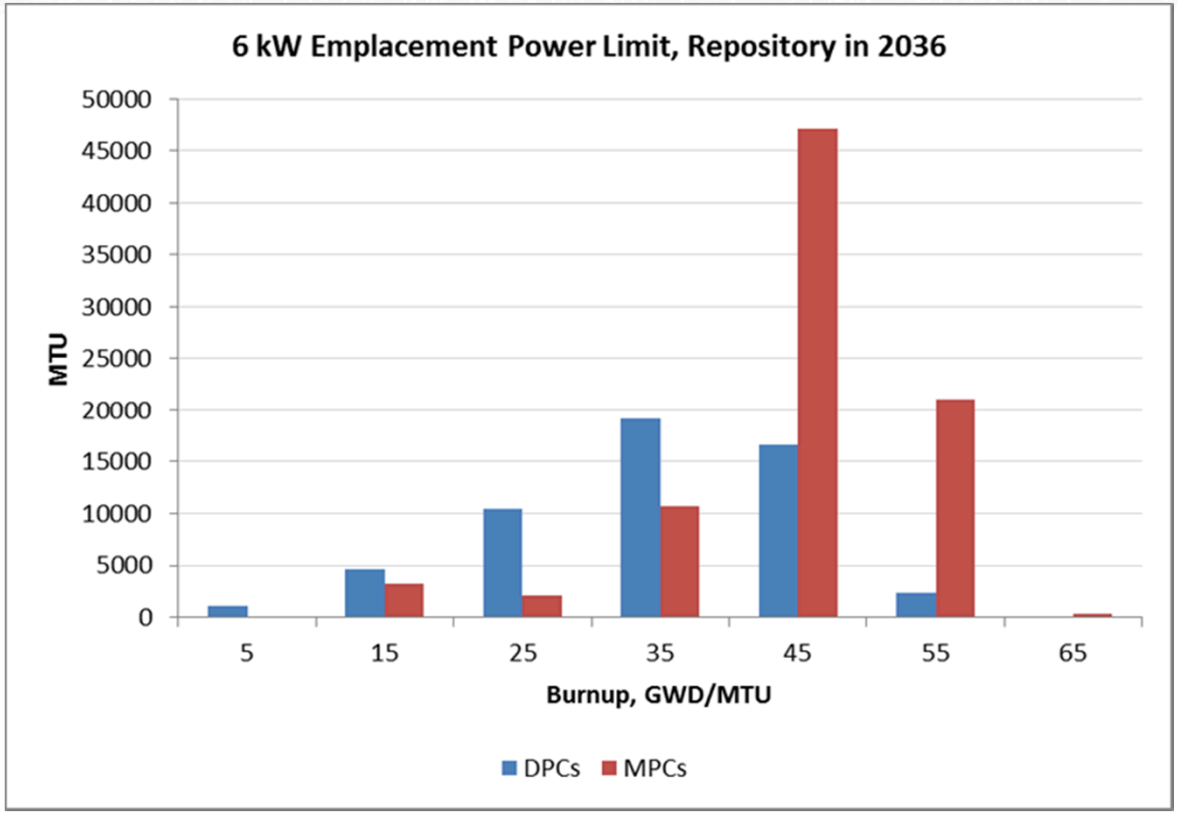
AVERAGE AGE AT EMPLACEMENT



AGE AT EMPLACEMENT FOR SNF IN DPCS AND MPCS



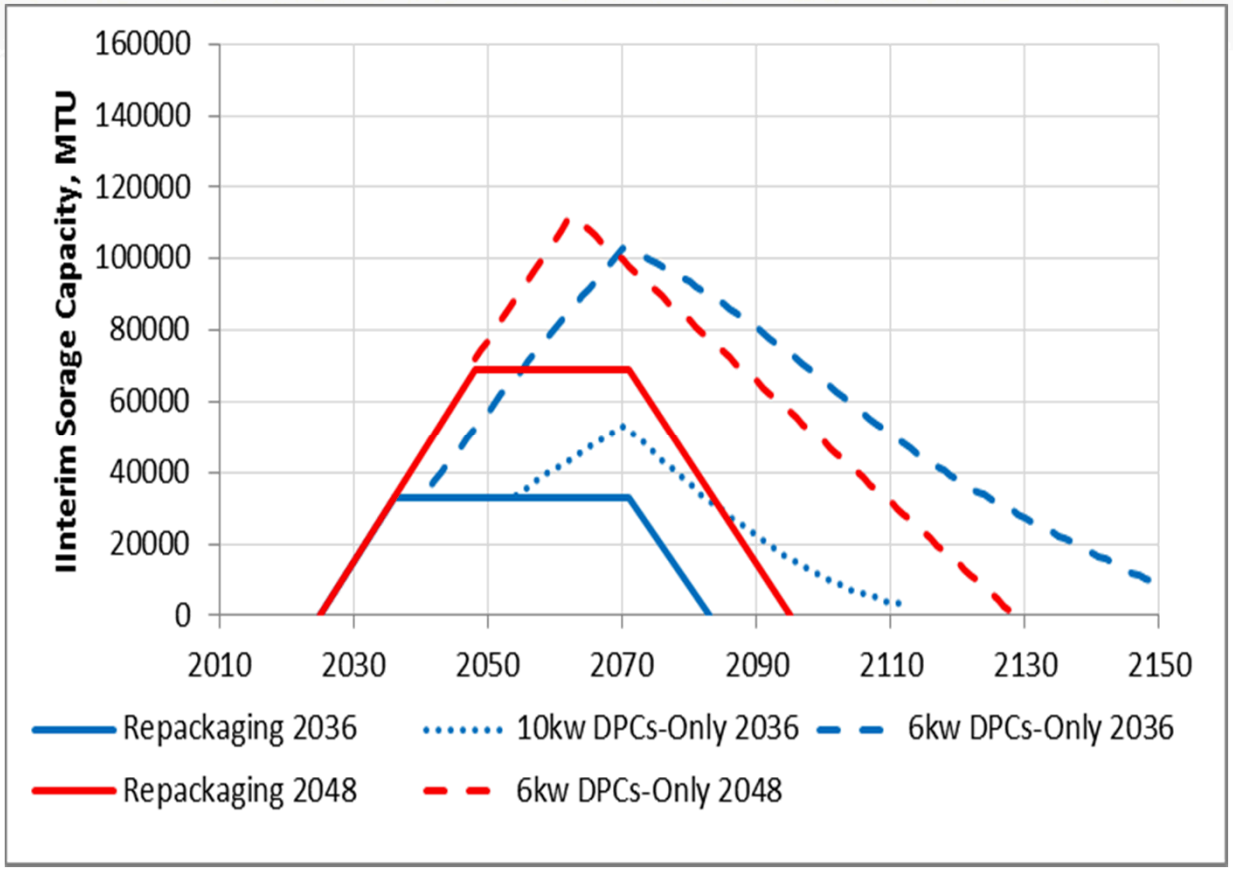
BURNUP AT EMPLACEMENT FOR SNF IN DPCS AND MPCS



ISF MAXIMUM CAPACITY AND OPERATIONAL TIME

Repository Start Date	Emplacement Power Limit (kW)	Fuel Loading Strategy	Additional Capacity (MTU)	Additional Operation (yrs)
2036	6	DPC only	69,701	79
		DPCs and MPCs	0	36
	10	DPC only	20,245	29
		DPCs and MPCs	0	0
	18	DPC only	0	0
		DPCs and MPCs	0	0
2048	6	DPC only	33,701	67
		DPCs and MPCs	0	50
	10	DPC only	0	17
		DPCs and MPCs	0	0
	18	DPC only	0	0
		DPCs and MPCs	0	0
2060	6	DPC only	0	55
		DPCs and MPCs	0	53
	10	DPC only	0	5
		DPCs and MPCs	0	3
	18	DPC only	0	0
		DPCs and MPCs	0	0

SCENARIOS REQUIRING ADITIONAL ISF STORAGE



CONCLUSIONS

- **18 kW scenarios –no additional cooling time and ISF capacity for direct disposal of DPCs.**
- **10 kW scenarios - some additional cooling time and ISF capacity for direct disposal of DPCs; little additional cooling time and no additional ISF capacity with MPCs.**
- **6 kW scenarios - significant additional cooling time and ISF capacity for direct disposal of DPCs; shorter cooling time and no additional ISF capacity with MPCs.**
- **Waste acceptance rate can be maintained at 3,000 MTU/yr only in 18 kW scenarios.**
- **The greatest potential benefits from implementing MPCs are for the smallest power limit and the earliest repository start date.**
- **MPCs would be used for 30 years or younger, higher burnup fuel.**
- **In the most limiting scenario (6 kW) the cooling time is still reasonable when 60% of the SNF is disposed of in MPCs and 40% is disposed of in DPCs.**