August 8, 2024

Lithium Occurrence: What We Have Learned from UCMR5

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Presentation Outline

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  - Human Health Effects of Lithium
  - Lithium Regulations
  - Historical Occurrence of Lithium
- UCMR5 Scope
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Sources of Lithium Contamination

- Natural occurrences such as rocks, soils, surface water, groundwater, and sea water, especially in regions with Li-rich brines and mineral deposits.
- Industrial activities such as manufacturing and improper disposal of lithium-ion batteries.
- Human consumption such as medicines used to treat certain mental illnesses (mania and hypomania, bipolar disorder, some types of depression, schizophrenia, etc.).

Human Health Effects of Lithium

- Nausea and vomiting
- Diarrhea
- Muscle weakness/hand tremors
- Confusion and vision changes
- Dazed feeling
- Weight gain

Lithium Regulations

- There is no drinking water standard for lithium in the United States of America.
- The USEPA established a provisional reference dose (p-RfD) of 2 ug/L of lithium of body weight per day.
- The USGS established a non-enforceable health-based drinking water screening level of 10 ug/L for lithium.

Historical Occurrence of Lithium

- To date, there have been few studies on the occurrence of lithium in drinking water at the national scale.
- The occurrence and concentrations of lithium were reported to be related to geographic regions, groundwater well depths, and characteristics of aquifers.
- Lithium concentrations in groundwater varied across the US. Arid southwestern and southern regions were detected with higher lithium concentrations than the midwest, southeast, and mid-Atlantic regions where lithium concentrations were similar.

UCMR5 Scope (2023 – 2025)

UCMR 5 Applicability to PWSs per AWIA

System[1] Size (# of people served)	National Sample: Assessment Monitoring Design	Total # of Systems per Size Category
Small Systems (25 – 3,299)	800 randomly selected systems (CWSs and NTNCWSs)	800
Small Systems (3,300 – 10,000)	All systems (CWSs and NTNCWSs)	~5,100
Large Systems (10,001 and over)	All systems (CWSs and NTNCWSs)	~4,400
TOTAL		**~10,300**

[1] Systems provide water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year

# systems (25 – 3,300 pop.)	61,884
Pop. Served	29,663,222
% of systems	87.2%
% of pop.	10.1%

~13% of the very small CWS and NTNCWS will be monitored.

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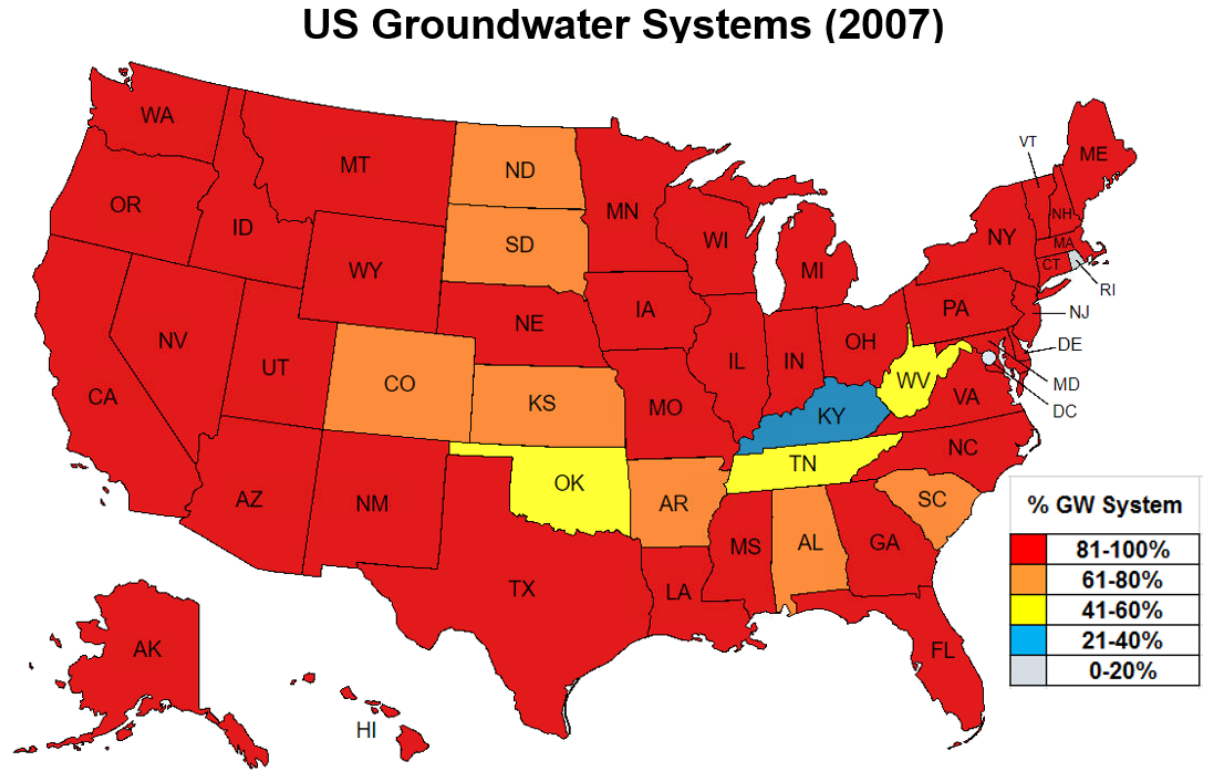
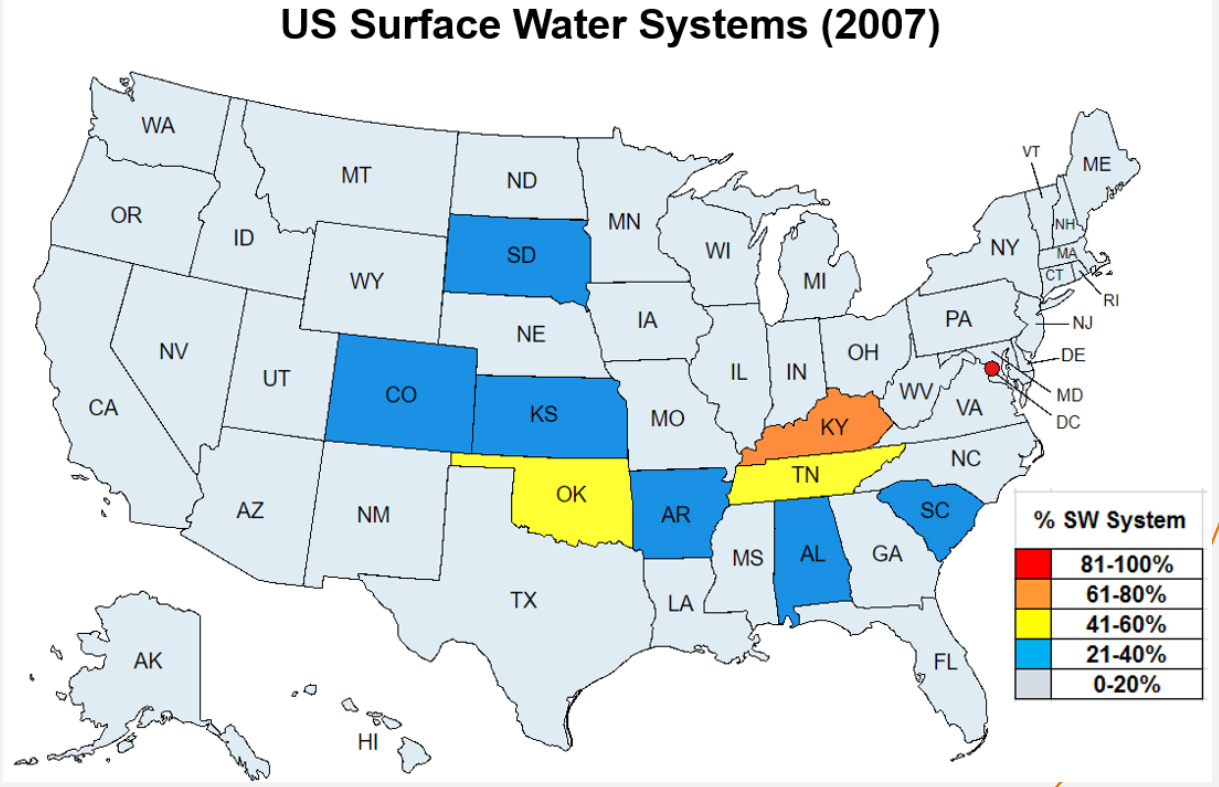
Most PWSs are groundwater facilities in the United States.





Over one-half of the PWSs are supplied by 90% or more groundwater.

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UCMR5 Occurrence Data

- Published in EPA's National Contaminant Occurrence Database (NCOD) as April, 2024.
- Represented ~35% of total UCMR5 results and ~47% of all UCMR5 PWSs.
- Included ~25,000 lithium, 4,835 PWSs, and ~6,900 EPs.
- The presented findings may be slightly deviated from the final UCMR5 results.

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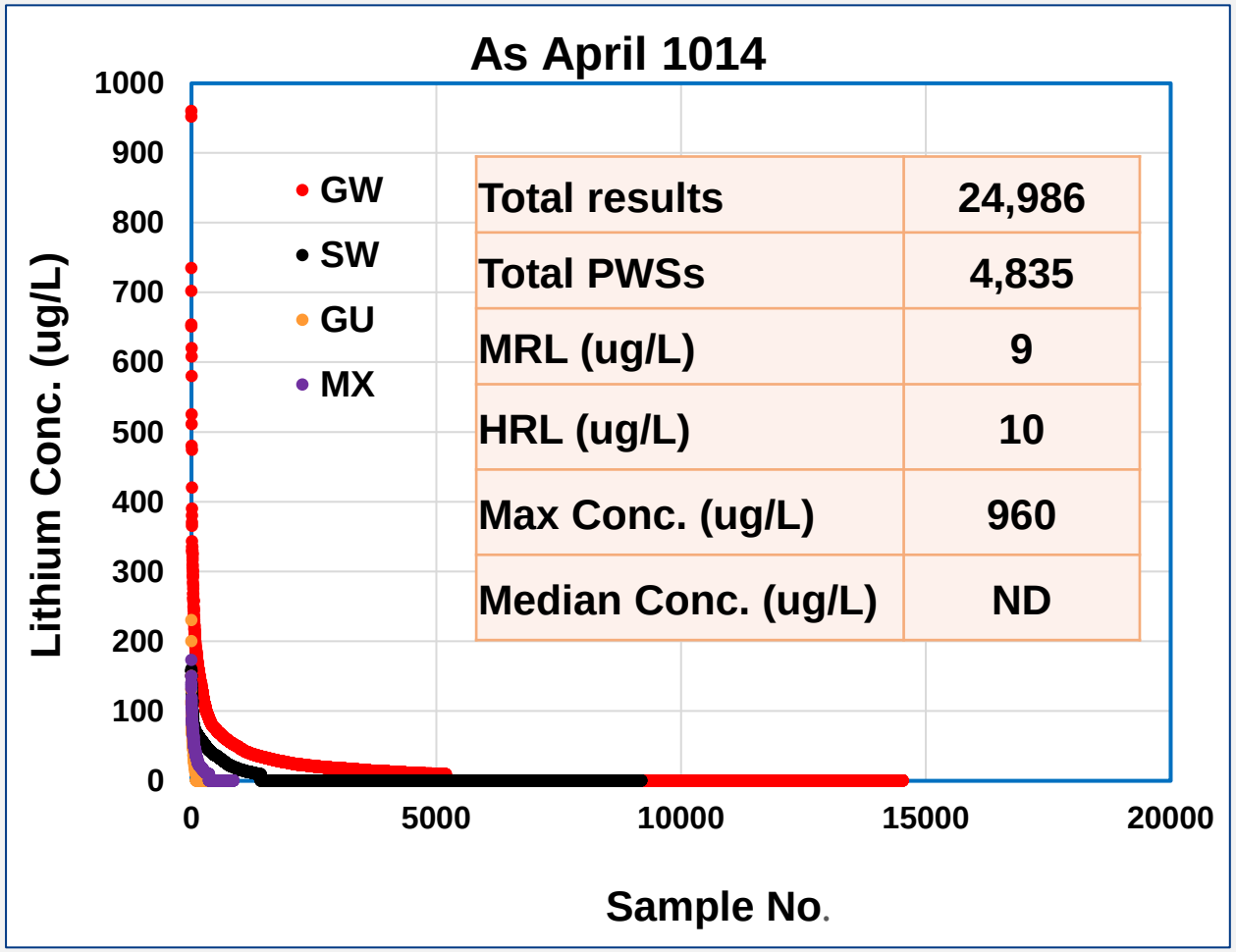
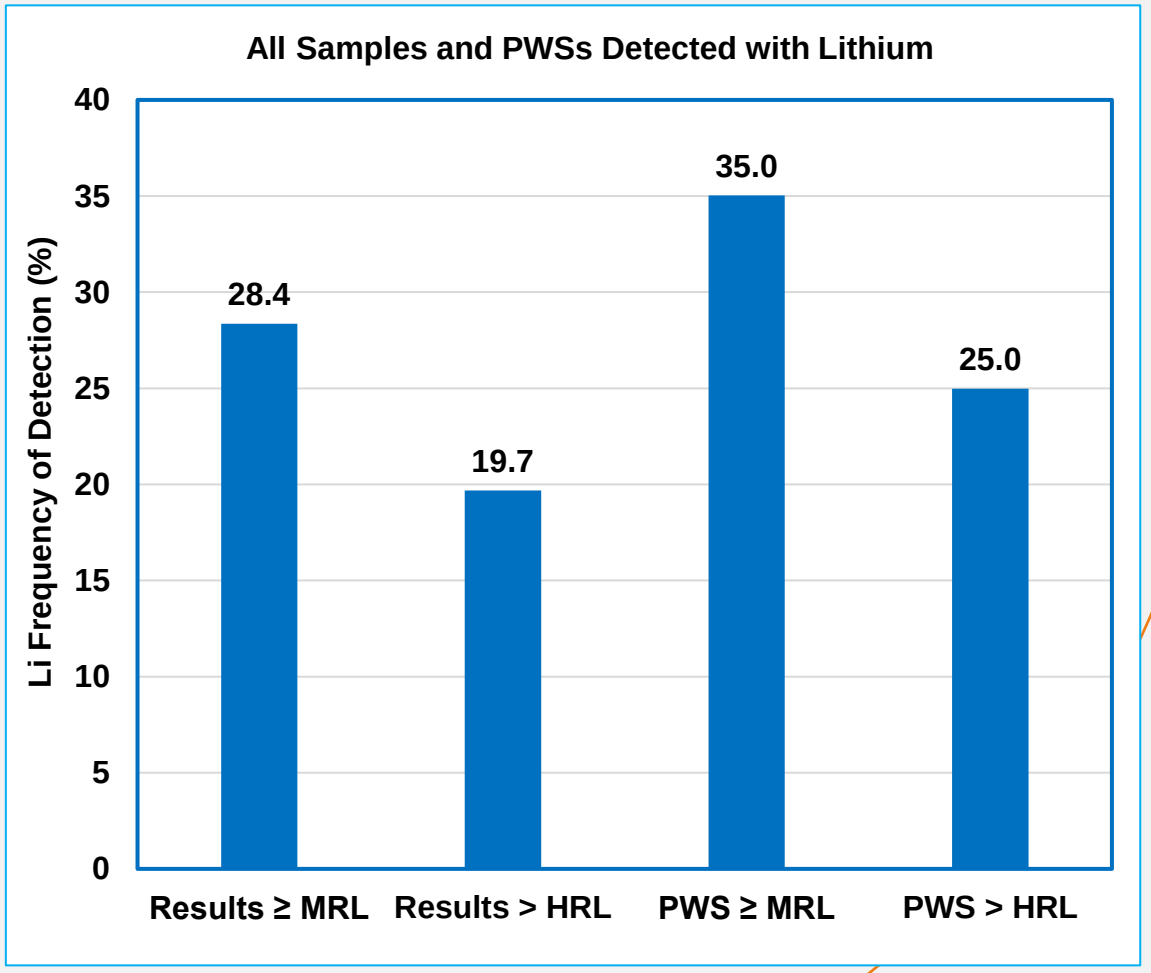
Lithium were detected in 59 states, territories, and tribes.



Total results	24,986
Total PWSs	4,835
MRL (ug/L)	9
HRL (ug/L)	10
Max Conc. (ug/L)	960
Median Conc. (ug/L)	ND



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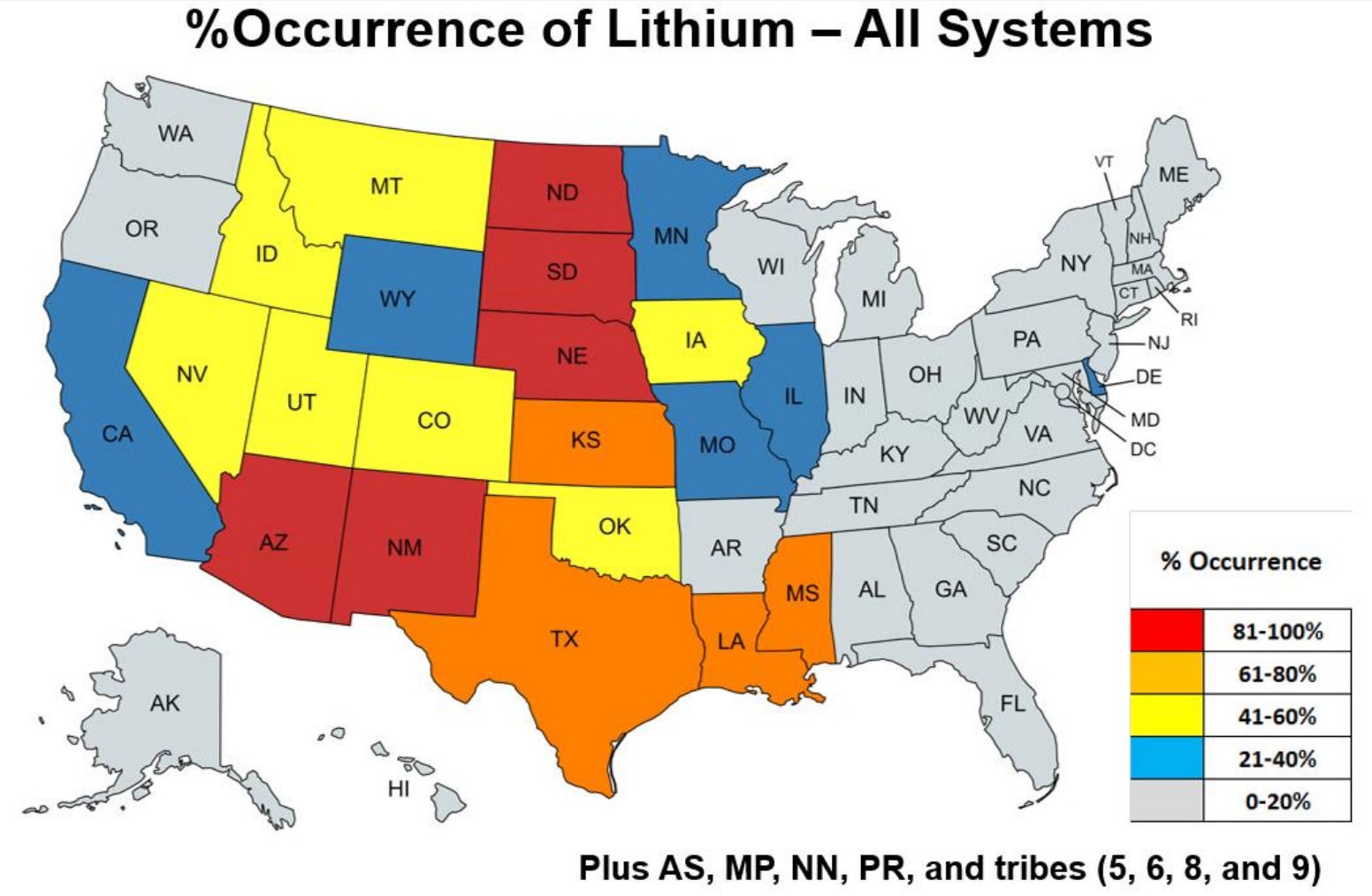
Overall Occurrence of Lithium (April, 2024)



Generally, more lithium detections were in the West North Central, West South Central, Southwestern and Mountain Regions.

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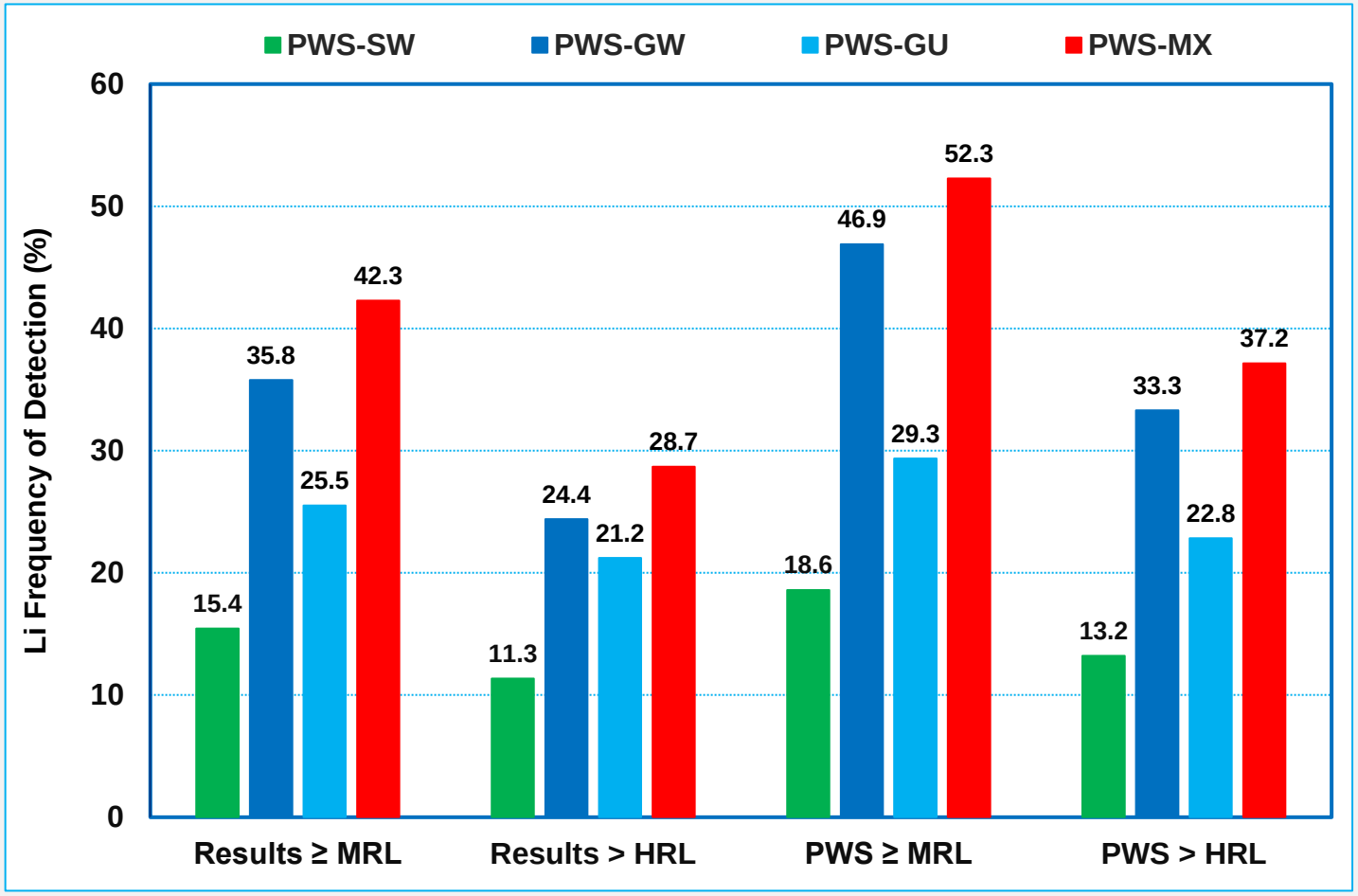
Overall, GW PWSs had more lithium detections than SW PWSs.



Facility Type	Max Conc. (ug/L)	90 Percentile Conc. (ug/L)
GW	960	34
SW	160	50
GU	230	48
MX	173	41.6

Generally, lithium detections were in order of MX > GW > GU > SW.

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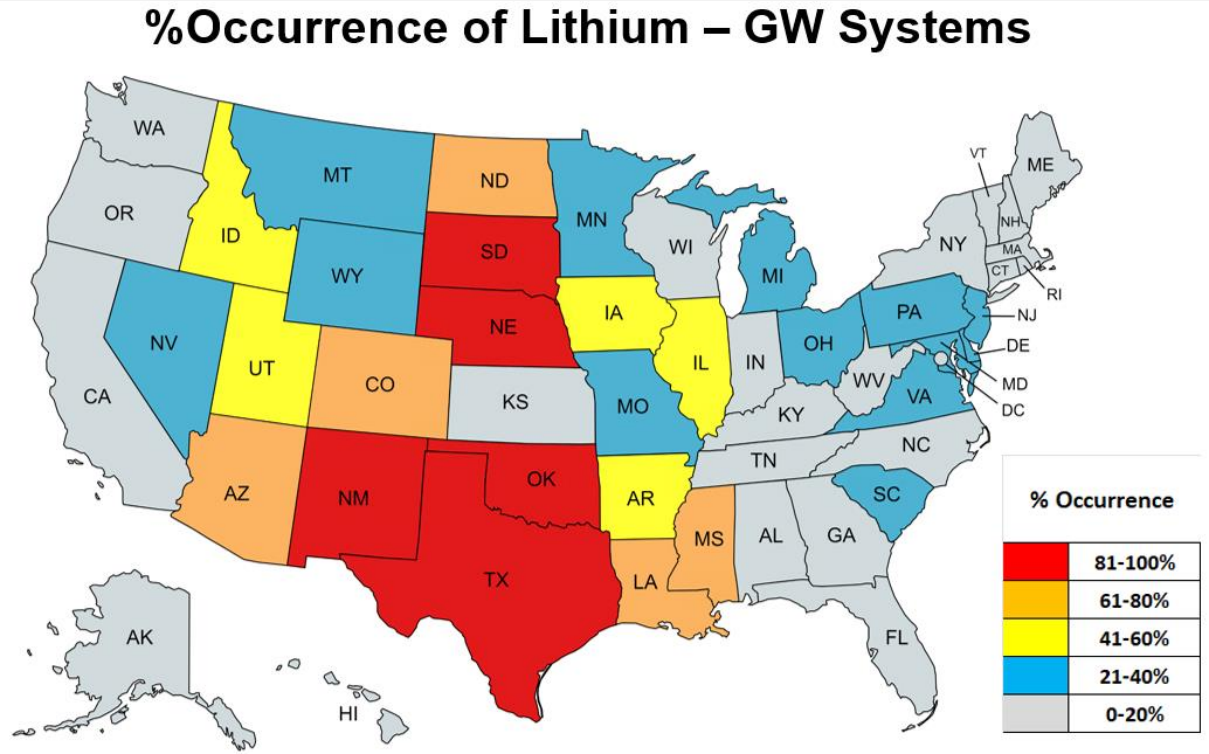
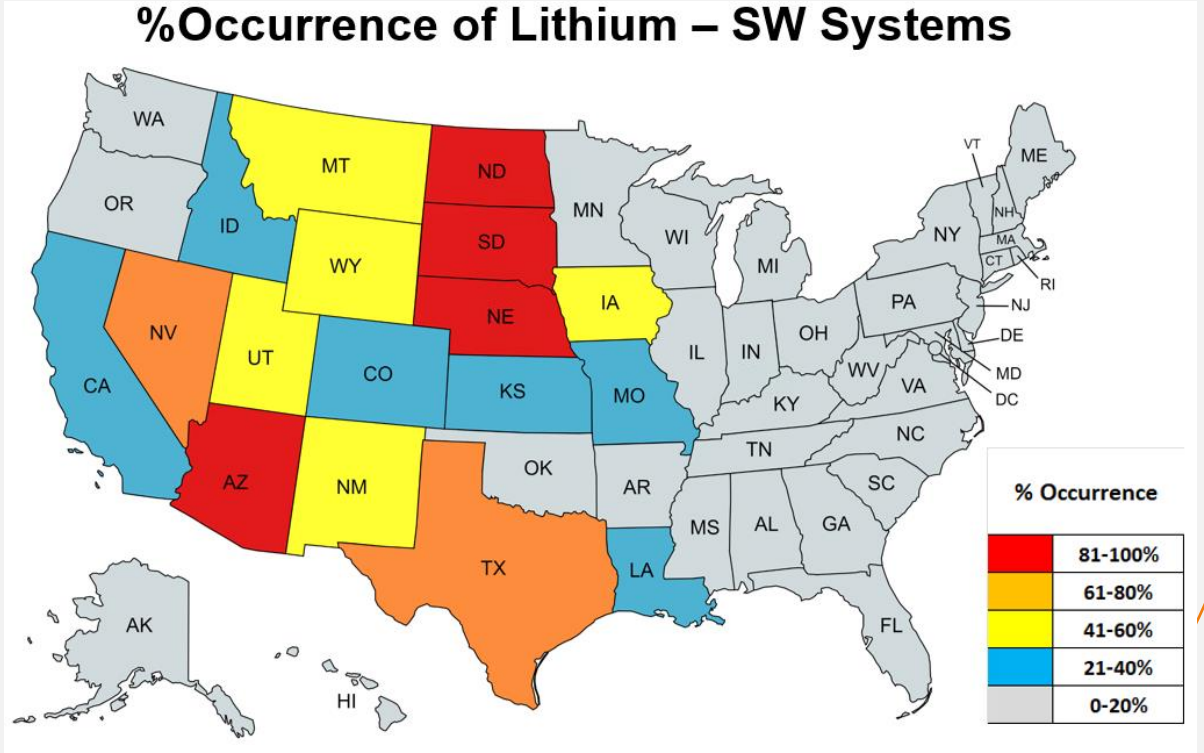
Occurrence of Lithium – System Types (April, 2024)





Overall, GW PWSs had more lithium detections than SW PWSs. However, the current UCMR5 data also indicated that SW PWSs had slightly more lithium detections than GW PWSs in a few states (ND, KS, MT, WY, NV, and CA).

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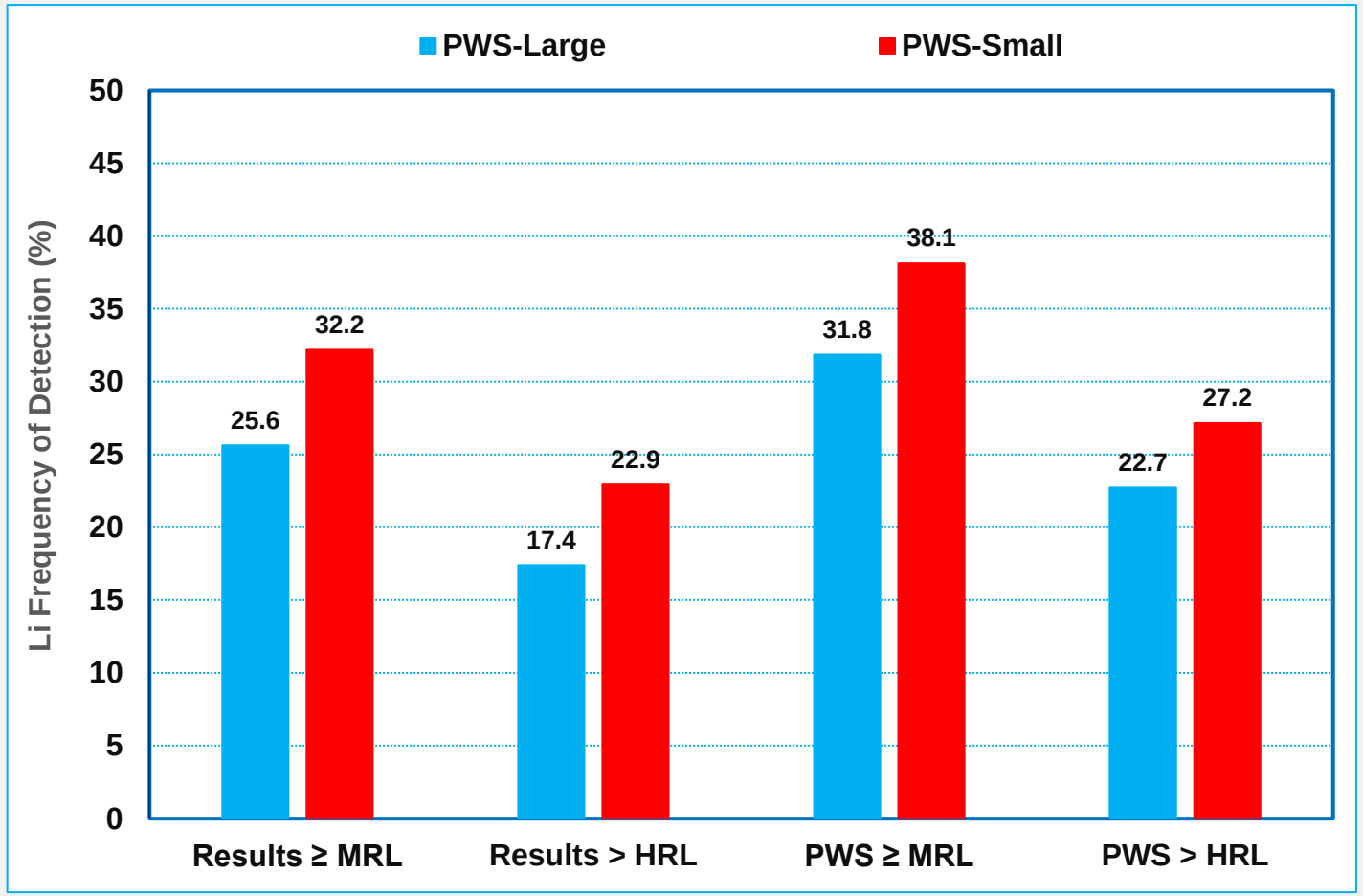
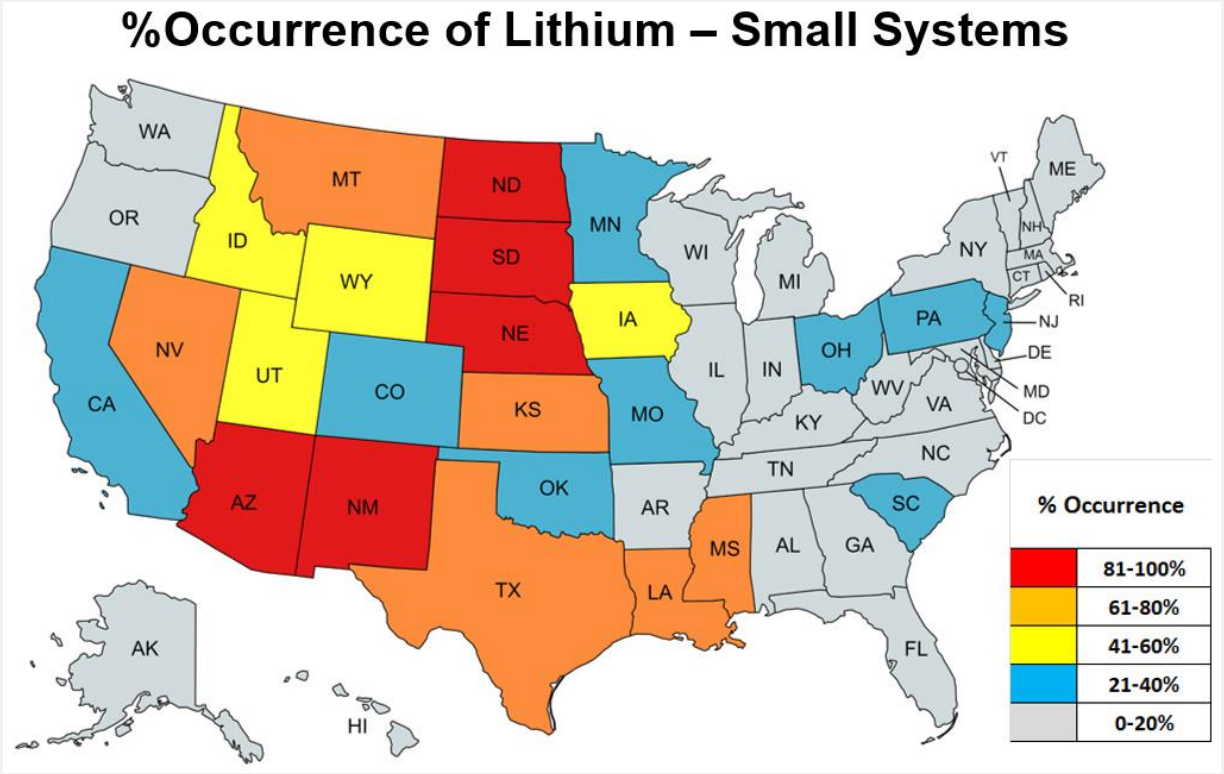
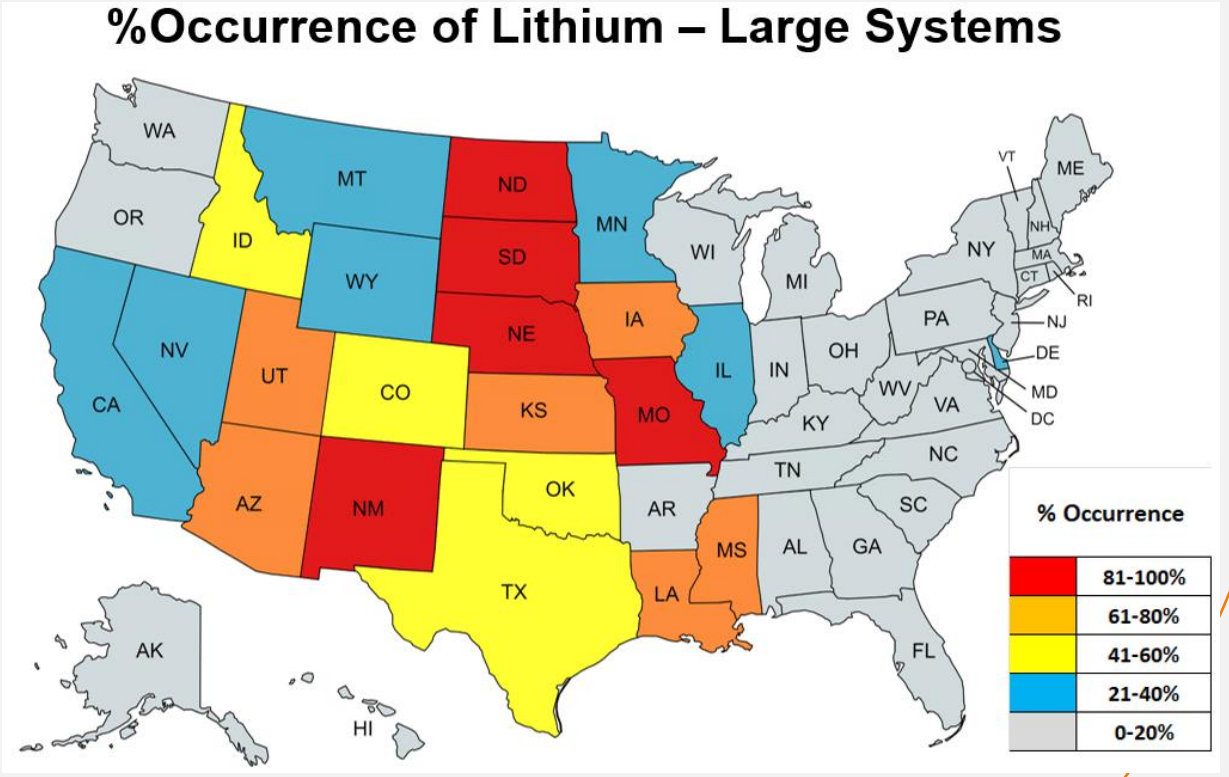
Overall, small PWSs had more lithium detections than large PWSs.



PWS Size	Small	Large
Max Conc. (ug/L)	702	900
90 Percentile Conc. (ug/L	34.3	25.7
Median Conc. (ug/L)	ND	ND
Mean Conc. (ug/L)	11.2	9.1

Occurrence of Lithium – System Sizes (April, 2024)





Overall, small PWSs had more lithium detections than large PWSs. However, the current UCMR5 data also indicated that large PWSs had slightly more lithium detections than small PWSs in a few states (IL, IA, MO, CO, UT, and DE).

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Territories and tribes were detected with lithium at ≥ the MRL.

State	%Occurrence All Systems	%Occurrence Small Systems	%Occurrence Large Systems	%Occurrence GW Systems	%Occurrence SW Systems
5	33	33		33	
6	95	95		95	
8	100	100		100	100
9	58	64	47	62	44
AS	3		3	3	
MP	47		47	47	
NN	88	88		88	
PR	4	3	4	8	0

Lithium at concentrations > HRL was detected in all State 8 samples.

No. of PWSs	4
PWS Size	Small
No. of GW Facility Results	6
No. of SW Facility Results	9
Max Conc. (ug/L)	70
Min Conc. (ug/L)	40

States were detected with the highest % occurrence of lithium.

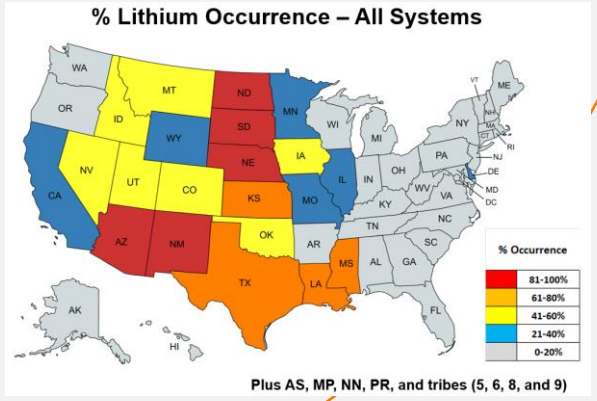
State	%GW PWS	% Detection	Total Results	%GW Results	%SW Results	%GU Results	%MX Results
AZ	96%	82%	624	86%	8%	0%	6%
ND	80%	100%	49	33%	59%	8%	0%
NE	96%	99%	205	93%	2%	4%	0%
NM	94%	89%	238	87%	11%	0%	2%
SD	79%	87%	89	61%	28%	3%	8%

Conclusions

- To date, lithium was detected at or above the MRL of 9 ug/L in 28.4% of the samples and 35% of the PWSs nationwide.
- Lithium was detected at concentrations exceeding the HRL of 10 ug/L in 20% of the samples and 25% of the systems.
- Lithium was generally detected in more GW facilities than SW facilities although there were a few exceptions. It was detected in more SW facilities than GW facilities in ND, KS, MT, WY, NV, and CA.
- Lithium was generally detected in more small systems than large systems. On the contrary, it was detected in more large systems than small systems in a few states such as IL, IA, MO, CO, UT, and DE.

Conclusions (Cont'd)

- The current UCMR5 occurrence data of lithium were generally consistent with the historical occurrence of lithium.
- Lithium contamination was primarily detected in the West North Central, West South Central, Southwestern and Mountain Regions.
- Relatively less lithium contamination was detected in the Eastern/Atlantic, East North Central, East South Central, and Pacific Regions.



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THANK YOU

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