Overview of PFAS Impacts at Power Generation Facilities

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Overview

- PFAS regulations
- Approach
- Case Studies for effluent usage and fire training
- Next Steps

Potential Regulatory Nexus

Drinking Water MCL

- Low benchmark 4 ppt

CERCLA

- Response Action Authority/ Investigations
- Continuous release

NPDES

- Discharges/effluent limits
- Surface water quality standards
- MSGP

RCRA

- Solid waste disposal protocols

Air

- Focus on PFAS Information and measurement techniques

TSCA

- **Section 8(a)7 reporting**

TRI

- **Annual reporting**

State

- Aquifer Water Quality Standards
- Advanced Water Purification Rule

Approach

PFAS Strategy Team

Track regulatory developments

Establish priorities

- Drinking Water
- Inventory and Procurement
- Identify historic activities with potential to have PFAS nexus (fires, fire-training, etc)
- Agency activity

Leveraging time and timing of next steps at APS sites

- Revisit Policy

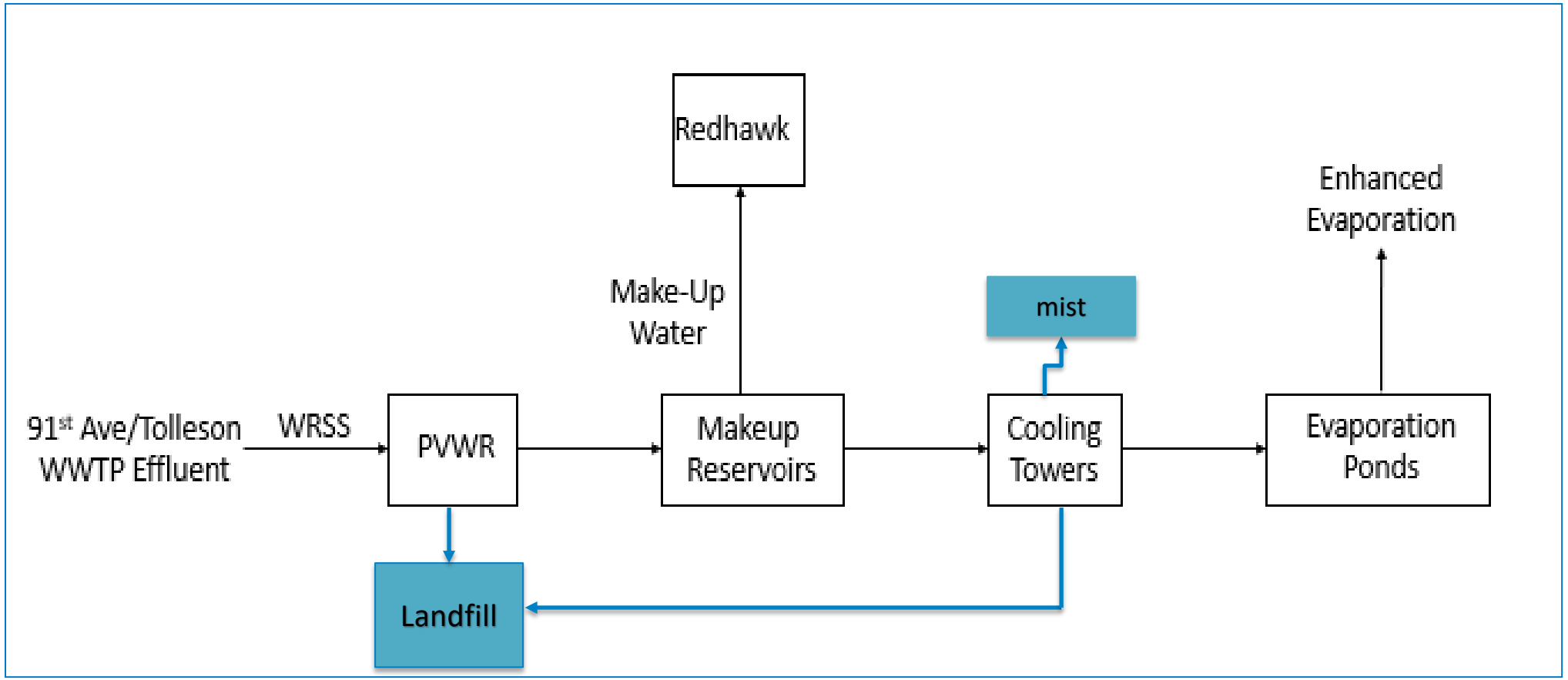
Case Study 1: Nuclear Generation

Treated effluent

- Receives 80,000 AF/year
- 87% of annual water use is reclaimed water
- Water is cycled 15x

B	C	D	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	
detected concentration >RL													
Sample Event		(ppt)	tzsite	Sundance	Gila Bend	Winkelman	Globe - Pinal Creek	Festival Ranch	COP 91st Ave	Bullhead City	Wickenburg Ranch	El Mirage	Toll
Sample Event	CAS	Units	ent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Effl
nX)	13252136	ng/L		<0.89*	<4.6*	<0.93*	<0.95*	<0.95*	<0.92*	<0.96*	<0.92*	<0.91*	<4.6
	4151502	ng/L	*	<0.18*	<0.91*	<0.18*	<0.19*	<0.19*	0.41 B, <0.8**, >0.18	0.19 B, <0.83**, >0.19	<0.18*	<0.18*	<0.9
	2991506	ng/L	0.81	<0.27*	<1.4*	<0.28*	<0.28*	<0.28*	<0.28*	<0.29*	<0.28*	<0.27*	<1.4
	1691992	ng/L	*	<0.96*	<5*	<1*	<1*	<1*	<1*	<1*	<1*	<0.99*	<5*
	151772586	ng/L	*	<0.3*	<1.6*	<0.32*	<0.32*	<0.32*	<0.31*	<0.33*	<0.31*	<0.31*	<1.6
	31506328	ng/L	*	<0.22*	<1.1*	<0.23*	<0.23*	<0.23*	0.65 B, <0.8**, >0.23	0.35 B, <0.83**, >0.24	<0.23*	<0.22*	<1.1
	2355319	ng/L	1.6	0.41, <0.96**, >0.35	<1.8*	<0.37*	<0.38*	<0.38*	0.41, <1**, >0.37	<0.38*	<0.37*	<0.36*	<1.8
	24448097	ng/L		<1.1*	<5.8*	<1.2*	<1.2*	<1.2*	<1.2*	<1.2*	<1.2*	<1.2*	<5.8
anesulfonic acid (PFBS)	375735	ng/L	4.9	3.8	<0.72*	57	15	4.3	8.8	5.2	2.5	5.0	
anoic acid (PFBA)	375224	ng/L	3.6	3.8	<2.4*	3.5	4.5	4.5	8.0	3.4	6.0	1.2, <3.2**, >0.47	<2.4
anesulfonic acid (PFDS)	335773	ng/L	*	<0.16*	<0.82*	<0.17*	<0.17*	<0.17*	<0.16*	<0.17*	<0.16*	<0.16*	<0.8
anoic acid (PFDA)	335762	ng/L	1.6**, >0.39	2.2	<2*	<0.41*	0.55, <1.6**, >0.41	5.3	1.7	1, <1.7**, >0.42	17	1, <1.6**, >0.4	<2*
ecanesulfonic acid (PFDoS)	79780395	ng/L	*	<0.21*	<1.1*	<0.22*	<0.22*	<0.22*	<0.22*	<0.22*	<0.21*	<0.21*	<1.1
ecanoic acid (PFDoA)	307551	ng/L	*	<0.29*	<1.5*	<0.3*	<0.31*	<0.31*	<0.3*	<0.31*	<0.3*	<0.3*	<1.5
tanesulfonic acid (PFHpS)	375928	ng/L	<0.78**, >0.19	<0.19*	<0.99*	<0.2*	<0.2*	<0.2*	<0.2*	0.22, <0.83**, >0.21	<0.2*	<0.2*	<0.9
tanoic acid (PFHpA)	375859	ng/L	1.6	4.9	<1.3*	1.2	1.2	3.0	1.5	1.7	2.8	0.62, <0.79**, >0.25	<1.3
anesulfonic acid (PFHxS)	355464	ng/L	1.4	0.88 i	<0.98*	1.7	1.9	<0.2*	2.7	9.7	1 i	<0.19*	<0.9
anoic acid (PFHxA)	307244	ng/L	11	13	6.9	4.3	16	30	32	13	23	11	
anesulfonic acid (PFNS)	68259121	ng/L		<0.19*	<1*	<0.2*	<0.21*	<0.21*	<0.2*	<0.21*	<0.2*	<0.2*	<1*
anoic acid (PFNA)	375951	ng/L	0.97**, >0.32	0.66, <0.96**, >0.32	<1.6*	0.62, <1**, >0.33	0.35, <1**, >0.34	0.64, <1**, >0.34	0.8, <1**, >0.33	<0.34*	2.0	<0.32*	<1.6
nesulfonamide (PFOSA)	754916	ng/L	*	<0.17*	<0.87*	<0.17*	<0.18*	<0.18*	<0.17*	<0.18*	<0.17*	<0.17*	<0.8
nesulfonic acid (PFOS)	1763231	ng/L	5.5	1.4	1.4, <4**, >1.1	9.0	2.5	0.84	7.8	4.9	3.0	1.5	<1.1
noic acid (PFOA)	335671	ng/L	12	6.8	2.2, <4**, >0.92	4.8	8.9	46	8.6	16	21	5.2	3.4,
tanesulfonic acid (PFPeS)	2706914	ng/L	*	<0.17*	<0.88*	0.28, <0.81**, >0.18	<0.18*	<0.18*	<0.18*	0.78, <0.83**, >0.18	<0.18*	<0.17*	<0.8
tanoic acid (PFPeA)	2706903	ng/L	9.3	25	<1.4*	13	50	53	39	34	25	25	<1.4
adecanoic acid (PFTeDA)	376067	ng/L	*	<0.27*	<1.4*	<0.28*	<0.28*	<0.28*	<0.28*	<0.29*	<0.28*	<0.27*	<1.4
ecanoic acid (PFTrDA)	72629948	ng/L	*	<0.23*	<1.2*	<0.24*	<0.24*	<0.25*	<0.24*	<0.25*	<0.24*	<0.24*	<1.2
ecanoic acid (PFUnA)	2058948	ng/L		<0.29*	<1.5*	<0.31*	<0.31*	<0.31*	<0.3*	<0.32*	0.32, <0.8**, >0.3	<0.3*	<1.5
	113507827	ng/L	*	<0.35*	<1.8*	<0.37*	<0.37*	<0.38*	<0.37*	<0.38*	<0.36*	<0.36*	<1.8

Case Study 1


Redhawk
Enhanced Evaporation
Make-Up Water
mist
91st Ave/Tolleson WWTP Effluent
WRSS
PVWR
Makeup Reservoirs
Cooling Towers
Evaporation Ponds
Landfill

What's next

01

Oversee water delivery contracts

- Monitoring, PFAS limits, etc

02

Develop site characterization Planning/DQOs/ CSM

03

Eye on regulations

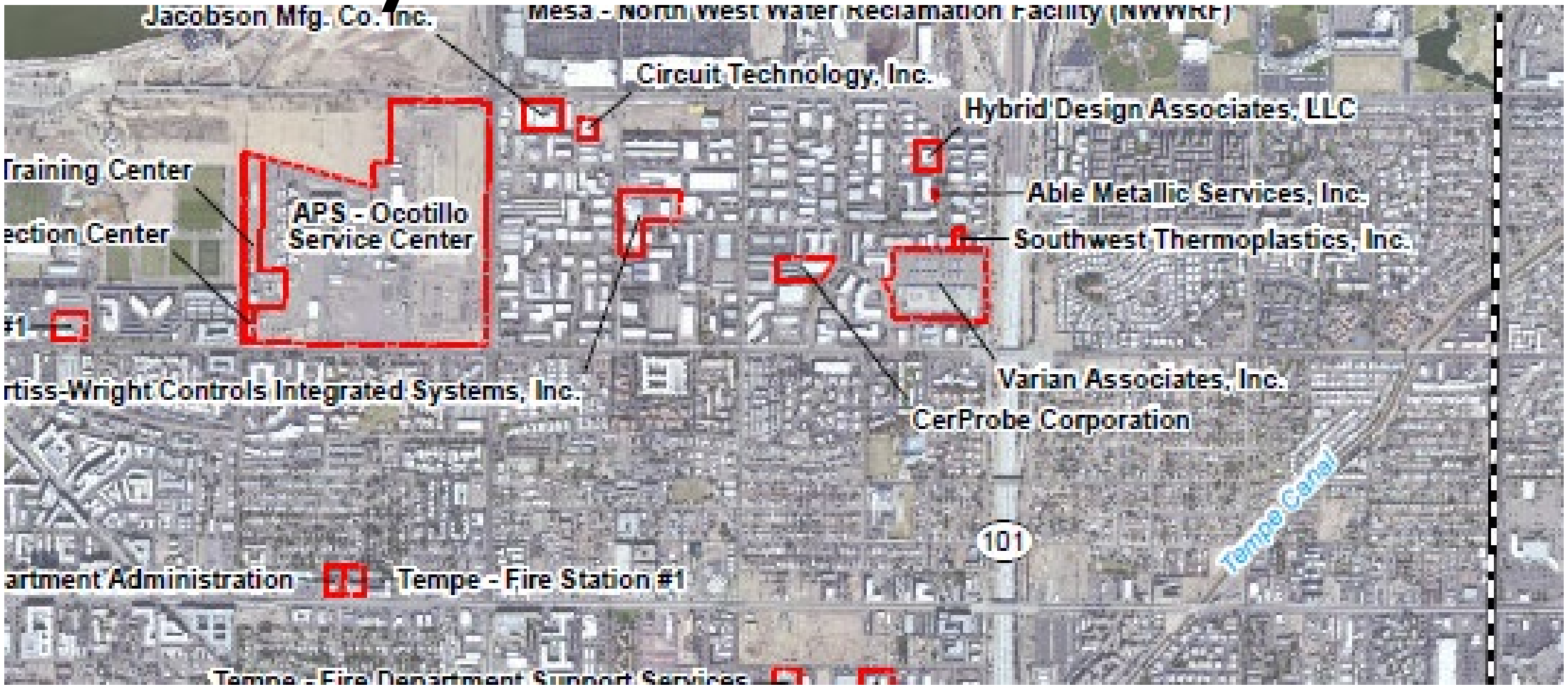
- NPDES and RCRA developments
- AWP Program in AZ – competition for water
- AWQS for PFAS in AZ – 4 ppt MCL proposed
- Surface water quality standards

04

Policy

- APS
- EPA/ Passive Receiver

Case Study 2


Jacobson Mfg. Co. Inc.
Circuit Technology, Inc.
Hybrid Design Associates, LLC
Able Metallic Services, Inc.
Southwest Thermoplastics, Inc.
APS - Ocotillo Service Center
Varian Associates, Inc.
CerProbe Corporation
Tempe - Fire Station #1
101
Tempe Canal

Case Study 2


Tempe/APS Joint Fire Training Center


APS - Ocotillo
Service Center

Sampling and Analysis

EPA Method 1633

Project Action Levels (PALs) based on RSLs set the benchmarks

- Residential soil
- Soil migration to GW
- Tap Water (GW only)

Split Sample Observations

- Based on these data, did I see variation in split samples such that an MCL of 4 ppt might be concerning to me?
  - Upper aquifer/MWs – yes
  - Lower aquifer/PWs – yes
  - Similar variances seen for soil

Analyte	Units	PAL - Tapwater	RPD	APS Split, APS-7		APS Split, APS-7	EPA, APS-7		RPD	APS Split, APS-8		EPA, APS-8		RPD	APS Split, APS-9		EPA, APS-9		RPD
				APS-7-GW-20230921		APS-7-FD-GW-20230920	P1A-MWAPS7-001-20230921			APS-8-GW-2023091		P1A-MWAPS8-001-20230921			APS-9A-GW-20230921		P1A-MWAPS9-001-20230921		
PFHxA	ng/L	990	4.9	**4.7**		**4.2**	**4.4**		6.6	**20**		**15**		28.6	**1**		**1.1**	J	9.5
PFNS	ng/L	--	NC	0.46	U	0.5 U	0.36	UJ	NC	0.48	U	0.35	UJ	NC	0.47	U	0.36	UJ	NC
PFNA	ng/L	5.9	19.0	**1.8**		**1.5**	**2.2**		20.0	**1.9**		**2.4**		23.3	**1.1**		**1.3**	J	16.7
PFOSA	ng/L	--	NC	0.46	U	0.5 U	0.31	UJ	NC	0.48	U	0.3	UJ	NC	0.47	U	0.31	UJ	NC
PFOS	ng/L	4.0	32.3	**35**		**27**	**30**		15.4	**13**		**12**		8.0	**7.5**		**6.2**		19.0
PFOA	ng/L	6.0	18.2	**7.2**		**5.8**	**7.1**		1.4	**17**		**13**		26.7	**2.7**		**2.8**		3.6
PFPeS	ng/L	--	8.7	**0.96**		**0.86 J**	**0.94**	J	2.1	**3.9**		**3**		26.1	**0.54**	J	**0.48**	J	11.8
PFPeA	ng/L	--	12.0	**3.2**		**2.9**	**3.3**	J	3.1	**20**		**17**		16.2	**1.2**	J	**1.4**	J	15.4
PFTeDA/PFTeA	ng/L	2,000	NC	0.69	U	0.75 U	0.5	UJ	NC	0.71 U	U	0.49	UJ	NC	0.7	U	0.5	UJ	NC
PFTrDA	ng/L	--	NC	0.46	U	0.5 U	0.43	UJ	NC	0.48	U	0.42	UJ	NC	0.47	U	0.43	UJ	NC
PFUnA	ng/L	600	NC	0.46	U	0.5 U	0.55	UJ	NC	0.48	U	0.54	UJ	NC	0.47	U	0.55	UJ	NC

Notes:

Bold = detected

Gray highlight= exceeds PAL based on Ha

Qualifiers:

J = estimated

detected

non detect

PAL = protective

Project Overview and Status

- Status
  - Phase 1 sampling complete (2023)
  - Phase 2 Step out sampling (2025)
  - Monitoring wells proposed for next steps
  - Revised CSM has been issued
  - TBD
    - Background
    - EPA Enforcement Guidance applicability

Lessons Learned

- Don’t expect EPA to meet your safety standards
- Be present
  - Marking paint
  - Daily activities – the things you see
  - GW sample collection methods

Challenges

Overall: Inventory control/SDS updates

Site-specific: Ongoing soil management

- Do we test?
- Which standard is appropriate?
- How many samples?
- Disposal restrictions?

Summary

Expect to see more on PFAS

- APS Environmental, Law, Contracting, Procurement, Generation, Insurance/Risk, Community Affairs, etc
- Come to play; not to win

Actions to date:

- Removed AFFF from sites
- Ongoing inventory review
- Proactive DW monitoring of owned systems
- Smarter in our Contracting
- High Level – DQOs/ CSM/ Site Characterization