Dry Wash PFAS and Heavy Metals Evaluations

CITY COUNCIL WORK MEETING 5/16/24

St George Regional Water Reclamation Facility

Goes through multiple steps of treatment.

- Chemical Flocculation
- Primary Physical Settlement
- Secondary Biological Breakdown and Settlement
- Ready for Discharge to the Virgin River
  - 25 ppm of Total Suspended Solids
  - 17 ppm BOD

Reuse Facility

- Traveling Bridge Sand Filter
  - Max 5 ppm of Total Suspended Solids
  - Turbidity 2 NTU
  - 1.0 mg/l of Chlorine Residual, E. Coli not detected in median sample



Heavy Metals Evaluations

St George Regional Water Reclamation Facility is required to test for Heavy Metals as part of their permit to discharge to the Virgin River.

17 Metals were tested in the January sampling that I was given a copy.

8 metals were not detected.

9 metals were detected.

None of the effluent measurements exceeded Drinking Water Standards for these metals.

		1/8/2024	1/9/2024	EPA Drinking Water Standards			% DW Limit
Metals	units	Influent	Effluent	MCL	Secondary	HA	
Cyanide	mg/l	ND	ND	0.2			0%
Aluminum	mg/l	0.3	ND		0.2		0%
Antimony	mg/l	0.0024	0.0022	0.006			37%
Arsenic	mg/l	0.0047	0.0044	0.01			44%
Boron	mg/l	0.43	0.41			5	8%
Cadmium	mg/l	0.0002	ND	0.005			0%
Chromium	mg/l	0.0022	0.0008	0.005			16%
Copper	mg/l	0.0337	0.0032	1.3			0%
Iron	mg/l	0.32	ND		0.3		0%
Lead	mg/l	0.0011	ND	0.015			0%
Mercury	ug/l	24.1	1.3	2,000			0%
Molybedenum	mg/l	0.0035	0.0027			0.04	7%
Nickel	mg/l	0.0025	0.0014			0.1	1%
Selenium	mg/l	0.0006	ND	0.05			0%
Silver	mg/l	ND	ND		0.1		0%
Thallium	mg/l	ND	ND	0.0002			0%
Zinc	mg/l	0.13	0.06		5		1%

PFAS Evaluations

SGRWRF tested for PFAS on August 25, 2023 and March 6, 2024

Samples were analyzed for 40 PFAS Chemicals

8/25/23 samples of effluent were found to contain 10 PFAS chemicals.

3/6/2024 samples of contained 8 PFAS Chemicals.

How does reuse water compare to new EPA PFAS Drinking Water Standards

Chemical	MCLG ppt	MCL ppt	8/25/2023 ppt	3/6/2024 ppt
PFOA	0	4	11.5	10.6
PFOS	0	4	2.1	2.9
PFHxS	10	10	0.99	1.3
HFPO-DA	10	10	0	0
PFNA	10	10	1.2	0
Mixture Criteria	1*	1*	0.22	0.13

Concentration of Contaminants in Reservoir

Analysis assumptions:

- 1500 AF reservoir
- 300 AF dead pool
- Reservoir is 100 percent filled with reuse water (drought year) during a 6 month period October to March.
- Reservoir is drained to dead pool from April to September.
- 7.2 sq mile drainage basin, 10" rain annually, used 5" denoting drought conditions.

Results:

- Started with PFOA concentrations 10 ppt. After 1-year PFOA concentrations dropped to 7.2 ppt using mass balance equations. The evaporation of water in the reservoir did not cause concentration of the PFOA.

Accumulation of PFAS in Reservoir Sediments

Assumptions:

PFOA and PFOS is dissolved into water and does not settle out easily.

It may accumulate in sediment by the fact that when the water recedes, water retained in the soils will evaporate and leave the PFAS residue attached to the soils.

Let's assume that a dust storm from the reservoir would be no worse than the worse day at Black Desert Resort recorded on March 14, 2024 with a purpleair.com device which is located onsite.

- It recorded a PM2.5 six hour concentration of 39 micrograms of dust per cubic meter of air.

Accumulation of PFAS in Reservoir Sediments (cont.)

Calculations:

Using the State of Michigan PFAS Air Quality Standard of August 2019. The air standard was set at 0.07 ug of combined PFOA & PFAS per cubic meter of air.

0.07/39 = 0.0018 or 1.8 grams per kilogram of dust

Thus to exceed this air standard, if there is 39 ug of dust in the air, the composition of the dust must be 1.8 parts per thousand or 1,800,000,000 parts per trillion.

If the soil weighs 100 lbs per cubic foot and the water concentration is 13.5 parts per trillion of PFOA + PFOS. Then the soil will accumulate the chemicals at a rate of 2.9 parts per trillion per year.

It will take 608 million years to accumulate to that level.

Accumulation of PFAS in Reservoir Sediments (cont.)

Alternative Analysis:

Assume that it does precipitate out. Maybe 50% of it settles out (which would be impossible considering the solubility levels of this chemical is much higher than the minute concentration in the reuse water.)

Assume that it only accumulates in the top 5 millimeters of soil.

Then it would take 20,217 years to accumulate to this critical level.

(By the way, this is assuming that there is sedimentation from the watershed.)

Potential for Arsenic Accumulation in the Sediment of the Reservoir

Assumptions:

- Inflow Concentration is 0.0044 mg/l per testing
- 1000 acre-feet is imported to the reservoir every year.
- 50 percent of all arsenic is precipitated out and settles.
- Top 5 mm of the reservoir floor is susceptible to wind erosion.
- The wind event should not exceed the OSHA workplace standard for arsenic in the air which is 39 micrograms per cubic meter of air.

Potential for Arsenic Accumulation in the Sediment of the Reservoir (cont.)

Results:

- 5.43 kg of Arsenic would flow into the reservoir each year.
- If 50 percent precipitates out and settles out evening over 50 acres, it would settle out at a rate of 34 grams per acre.
- If it was concentrated in the top 5 mm of soil then the soil concentration would be 5.2 milligrams per kilogram of sediment.
- This results in an air concentration of 0.000204 ug/m3 of air.
- It would take 49,012 years for the arsenic to build up to the level that it might exceed the OSHA Workplace standard of 10 ug/m3 of air.
- (By the way, this is assuming that there is sedimentation from the watershed.)