Environmental Defense Institute

Troy, Idaho 83871-0220

May 18, 2018

Jeff Zander
Superintendent
Elko County School District
850 Elm Street
Elko, NV 89801

Subject: Comments on the drinking water sampling report prepared by Linkan Engineering from sampling conducted on February 22, 2018 at the Owyhee High School in Duck Valley

Dear Superintendent Zander:

On behalf of the Environmental Defense Institute, I have prepared this letter report documenting my review of the drinking water sampling results reported by Linkan Engineering in a March 20, 2018 memorandum. [1] The water samples collected were analyzed for the following contaminants:

- Fluoride
- Nitrate
- Barium
- Copper
- Lead (a decay product of uranium and thorium)
- Arsenic
- Uranium (a radioactive material)
- Radium-226 (a decay product of uranium-238)
- Radium-228 (a decay product of thorium-232)
- Gross alpha ionizing radioactivity
- Gross beta ionizing radioactivity
- Strontium-90 (a beta emitter)
- Tritium (radioactive hydrogen)

None of the analytes sampled were present in concentrations that exceeded federal maximum contaminant levels (MCLs) for drinking water standards. [2] However, federal MCLs can be set at

[1] Sam Billin, P.E., to Allan Stefka, Memorandum: Water Sampling at Owyhee School, Reference No. 09.07, March 20, 2018.

[2] Federal maximum contaminant levels (MCLs) set the state and federal levels requiring enforcement are based on EPA's 2012 edition of drinking water standards. The public health goals in the table are based on California's State Water Resources Control Board 2016 Groundwater Information Sheet on Radionuclides and are not

high levels because of the pressure exerted by polluter industries. Often, independent studies have found detrimental health effects from contaminant levels below federal MCL levels. In this report, I refer to these concentrations as "public health goals" or "health guidelines." The State of California has published many public health goals based on health studies even though these low contaminant levels are not enforceable. The public health guidelines, do however, allow citizens to understand that children and special populations may be harmed by drinking water with one or multiple contaminants even when the federal MCLs are not exceeded. [3] [4]

Non-tribal public drinking water in the State of Idaho and the State of Nevada can be viewed at their environmental quality websites drinking water "switchboards" for sample data. [5] [6] On tribal land, the federal Environmental Protection Agency rather than the state is involved with drinking water monitoring. [7] [8] The engineers and technicians involved with drinking water sampling, by and large, focus only on the enforceable federal MCLs. Generally, these staff have little or no understanding of the health issues associated with the contaminants. It can also be said that, typically, medical professionals have little understanding of what contaminants are in their patients' drinking water. And certainly, it can be said that people often do not understand what contaminants are in their drinking water or whether those contaminants might be harmful.

Looking first at the nitrate and selected minerals and metals, arsenic, barium, copper and lead have been found to exceed suggested public health goals in water monitoring during monitoring from 2012 to 2018. The sample results for the February 22, 2018 sampling by Linkan Engineering is provided in Table 1, along with sample results from 2012 to 2015.

Lead can be present in metal piping. Lead is also a decay product of uranium and thorium which are present as indicated by radium-226 and radium-228 as well as uranium detections in

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enforceable. See https://oehha.ca.gov/water/public-health-goals-phgs and EWG Drinking Water database at https://www.ewg.org/tapwater/

[3] California State Water Resources Control Board Comparison of federal maximum contaminant (MCLs) and public health goals (PHGs) for contaminants in drinking water. https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.shtml

[4] Environmental Working Group at www.ewg.org and see their tap water database at https://www.ewg.org/tapwater/

[5] Idaho Department of Environmental Quality, http://www.deq.idaho.gov/water-quality/drinking-water/pws-monitoring-reporting/ and http://www.deq.idaho.gov/water-quality/drinking-water/pws-switchboard/ and find sample results for all counties at http://dww.deq.idaho.gov/IDPDWW/ where you select your county or drinking water system, select the specific water system. For the specific water system, it may be helpful to select the link at the left called "Chem/Rad Sample/Result by Analyte." Then select the analyte of interest that the well has data for by clicking on its code. This brings up the applicable lab samples that included that contaminant. Note that non-community wells typically sample fewer contaminants.

[6] Nevada Division of Environmental Protection, https://ndep.nv.gov/water/drinking-water and general contaminants information at https://ndep.nv.gov/water/drinking-water/information-for-public-water-systems/chemical-monitoring . Find sample results for all Nevada counties at https://ndwis.ndep.nv.gov/DWW/

[7] United States Environmental Protection Agency, Safe Drinking Water on Tribal Lands at https://www.epa.gov/tribaldrinkingwater and https://www.epa.gov/enviro/sdwis-search and https://www.epa.gov/enviro/sdwis-search-indian-tribes

[8] Environmental Defense Institute newsletter for December 2017 "Where to Find Out More About Your Drinking Water." http://www.environmental-defense-institute.org/publications/News.17.Dec.pdf

the drinking water. [9] Lead significantly exceeded the public health goal in 2015. Medical sampling for lead in children's bodies could be beneficial given the inconsistent lead monitoring results.

Table 1. Measurements of Nitrate and Selected Minerals and Metals.

Contaminant	MCL (mg/L)	Suggested Health Guide (mg/L)	Measurement (mg/L)		
			Duck Valley Public Water	Duck Valley Area	Mountain City
Nitrate (mg/L)					
	10	5	0.14 (2/22/2018) 0.3 (2015) 0.8 (2015)	 0.07 0.32	 0.74 0.84
Arsenic					
	0.01	0.000004	**0.0026 (2/22/2018)** **0.004 (2013)**	 NS	 Below 0.001
Barium					
	2	0.7	**0.11 (2/22/2018)** **0.07 (2012)** **0.15 (2012)**	 NS	 0.032
Fluoride					
	4	1	**0.19 (2/22/2018)** **0.2 (2012)** **0.25 (2013)** **0.19 (2015)**	 NS	 0.110
Copper					
	1.3 Action Level	0.3	Non-detect 2/22/2018 0.23 (2015) **0.525 (2015)**	 0.03	 0.02
Lead					
	0.015	0.0002	Non-detect 2/22/2018 **0.0115 (2015)**	 NS	 0.001

Table 1 notes: Sources: February 22, 2018 water sampling reported by Linkan Engineering March 20, 2018. Shoshone-Paiute Tribes of the Duck Valley Reservation Public Water System Consumer Confidence Reports issued in 2016 and 2017. Drinking water data for Mountain City, Nevada available at e: https://ndep.nv.gov/water/drinking-water Drinking water data for Mountain City and non-public drinking water supply data highlight maximum values noted. Duck Valley area data from the USGS Mapper and EPA STORET https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=ada349b90c26496ea52aab66a092593b

The radiological sample results for the February 22, 2018 sampling conducted by Linkan Engineering are provided in Table 2, along with sample results from 2012 to 2015. Previous Mountain City results are provided in Table 3 for comparison. Uranium is detected at levels exceeding public health goals, as are radium-226 and radium-228.

[9] For information about uranium and thorium decay series, see Environmental Defense Institute newsletter for February 2018. http://www.environmental-defense-institute.org/publications/News.18.Feb.pdf

Uranium is a radioactive material that can be naturally occurring or non-naturally occurring. There are many radioisotopes of uranium. Uranium can occur in excessive amounts because of uranium mining and milling, nuclear fuel manufacturing, nuclear weapons testing fallout, nuclear accidents, nuclear weapons production waste, and other nuclear waste, including the use of depleted uranium in military artillery and tank armor.

For example, radioactive waste remaining after uranium extraction have been brought to Idaho's US Ecology disposal sites in Owyhee county, at the now closed Bruneau site and at the Grandview site. Depleted uranium has also been disposed of at these the US Ecology sites.

Uranium is often reported in milligrams per liter but also can be reported in terms of activity in picocuries per liter (pCi/L). Human epidemiology studies conducted independently continue to find that inhaled or ingested uranium and other radionuclide in the human body can cause more harm than officially approved government radiation health models predict. [10]

The radium-226 and radium-228 levels exceed suggested public health goals. It can also be noted that when radium-228 is present, radium-224 is also present in a similar picocurie per liter amount, even though sampling programs typically do not monitor the radium-224.

Radium-226 is a decay product of uranium-238. Uranium-238 can be naturally occurring, but it isn't necessarily naturally occurring or in natural amounts. It is also a decay product of certain man-made transuranic nuclides including curium, plutonium, americium, neptunium, and californium. The decay of plutonium-238 to uranium-234 decays to radium-226.

Radium-228 is a decay product of thorium-232. Thorium-232 can be naturally occurring, but it isn't necessarily naturally occurring or in natural amounts. It is also a decay product of certain man-made transuranic nuclides including curium, plutonium, neptunium, and californium. Thorium-232 can also be a decay product of man-made uranium-240 and uranium-236.

More information about transuranic radionuclides and radioactive decay series for uranium and thorium can be found at our factsheet at http://www.environmental-defense-institute.org and also at https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf

Gross alpha results can be reported either with or without an adjustment for the uranium present. I have assumed that the Linkan result is the unadjusted sample value that includes uranium (and radon).

[10] Christopher Busby, *INTECH*, "Aspects of DNA Damage from Internal Radionuclides," http://dx.doi.org/10.5772/53942

Table 2. Radiological sample reporting for public drinking water on Duck Valley Reservation public water supplies.

Contaminant	MCL	Suggested Health Guideline	Measurement	Date Sampled
Combined Uranium				
	30 ug/L 0.030 mg/L 20 pCi/L	0.64 ug/L 0.00064 mg/L 0.43 pCi/L	**1.4 ug/L (est. 0.938 pCi/L)**	2/22/2018
			2 ug/L (est. 1.34 pCi/L)	2015
Gross Alpha including Radon and Uranium (assuming unadjusted gross alpha)				
	*	Zero	**1.7 pCi/L**	2/22/2018
Gross Alpha excluding Radon and Uranium				
	15 pCi/L	Zero	**2.33 pCi/L**	2012
			2 pCi/L	2013
			2.69 pCi/L *	2015
			0.64 pCi/L *	2015
Radium-226				
	(Limits combined radium-226 and -228)	0.05 pCi/L	**< 0.5 pCi/L**	2/22/2018
Radium-228				
	(Limits combined radium-226 and -228)	0.019 pCi/L	**< 0.7 pCi/L**	2/22/2018
Combined radium-226 and radium-228				
	5 pCi/L	Ra-226 0.05 pCi/L Ra-228 0.019 pCi/L	**< 0.7**	2/22/2018
			0.69 pCi/L	2012
			1 pCi/L	2013
			1.10 pCi/L	2015
Gross beta				
	4 mrem/yr, Radionuclide dependent	Zero	**< 2.0**	2/22/2018
Strontium-90				
	8 pCi/L 4 mrem	0.35 pCi/L	**0.5 pCi/L**	2/22/2018
Tritium				
	20,000 pCi/L	400 pCi/L	3.22 pCi/L 0.3 Tritium Units	2/22/2018

Sources: February 22, 2018 water sampling reported by Linkan Engineering March 20, 2018. Shoshone-Paiute Tribes of the Duck Valley Reservation Public Water System Consumer Confidence Reports issued in 2016 and 2017. * Data for gross alpha for 2015 are assumed to be adjusted alpha rather than gross alpha including radon and uranium. Uranium is converted from mg/L assuming 0.67 pCi/ug, where ug is micrograms or 1/1,000,000 grams.

Table 3. Radiological sample reporting for public drinking water in neighboring upgradient Mountain City.

Contaminant	MCL	Suggested Health Guideline	Measurement	Date Sampled
Combined Uranium				
	0.030 mg/L	0.43 pCi/L	<0.001mg/L	2007
	20 pCi/L		0.447 pCi/L	2004
Gross Alpha Including Radon and Uranium				
	(15 pCi/L)	Zero	0.554 pCi/L	2004
			0.7 pCi/L	2016
			0.6 pCi/L	2007
Adjusted Gross Alpha excluding Radon and Uranium				
	15 pCi/L		0.1 pCi/L	2004
Radium-226 (Uranium-238 decay series)				
	Total Ra-226 and Ra-228 less than 5 pCi/L	Ra-226 0.05 pCi/L Ra-228 0.019 pCi/L	0.1 pCi/L	2007
Radium-228 (Thorium-232 decay series)				
	Total Ra-226 and Ra-228 less than 5 pCi/L	Ra-226 0.05 pCi/L Ra-228 0.019 pCi/L	0.2 pCi/L	2007
			0.4 pCi/L	2007
Gross beta				
	Radionuclide dependent	Zero	1.92 pCi/L	2004
			0.7 pCi/L	2007
			1.2 pCi/L	2007

Source: https://ndep.nv.gov/water/drinking-water

Various natural and man-made radioactive materials decay by emitting an alpha particle which consists of two neutrons and two protons and is identical to the nucleus of a helium atom. Alpha particles are a health hazard when inhaled or ingested. Uranium, thorium, plutonium and other radionuclides decay by alpha particle emission.

The gross beta and strontium-90 results exceed suggested public health goals. Gross beta results include any of numerous radioactive materials that decay by emitting a beta particle, which can be either an electron or a positron. Beta particles are a health hazard when inhaled or ingested. Of the gross beta result reported as “less than 2 pCi/L,” 0.5 pCi/L can be attributed to strontium-90. The remaining radionuclides contributing to the gross beta result were not identified.

Strontium-90 is a beta emitter that mimics calcium in the body and is strongly retained in the body. Strontium-90 is a fission product created in a nuclear reaction when a uranium atom splits apart. Nuclear reactor operations and nuclear weapons testing create strontium-90. Nuclear weapons testing at the Nevada Test Site released many kinds of radioactive particles, including

strontium-90. Typically, when strontium-90 is present because of nuclear weapons fallout, cesium-137, a gamma emitter, is also present.

The tritium measurement value was very low, perhaps the lowest I have seen reported. Various reports say that natural levels of tritium in surface water would be 10 to 30 pCi/L. [11] The sample result of Tritium is a radioactive isotope of hydrogen. Its nucleus consists of a proton and two neutrons. An ordinary hydrogen atom consists of a single proton and no neutrons. It is a weak beta emitter that is produced during nuclear weapons testing and operating nuclear reactors.

In summary, many of the sample results reported by Linkan Engineering exceed suggested public health guidelines. The February 22, 2018 mineral results that exceed suggested public health guidelines included arsenic and barium. The non-detect of lead is inconsistent with past sampling. Lead is a decay product of uranium and thorium that are consistently detected. Radioactive sample results for February 22, 2018 that exceed suggested public health guidelines are uranium, gross alpha (assumed unadjusted for uranium content), gross beta, and the fission product strontium-90.

Finally, as noted in my February report [12] about drinking water in Duck Valley, I have not been able to find chemical monitoring data there is typically conducted for drinking water supplies. The EPA has reported many years of violations concerning the absence of reported data for numerous chemicals in the drinking water but I have not found how this was reconciled. This apparent weakness in the drinking water monitoring program is an area of concern because of the significant adverse health effects that small amounts of any one of the chemicals can cause.

Sincerely yours,

Tami Thatcher
Consulting Engineer tzt@srv.net
Environmental Defense Institute
PO Box 220 Troy, ID 83871-0220
208-835-5407
edinst@tds.net

[11] See the tritium factsheet and others at ANL factsheet at https://www.remm.nlm.gov/ANL-ContaminationFactSheets-All-070418.pdf

[12] Tami Thatcher, An Environmental Defense Institute Special Report, "Little Reason for Confidence in the Drinking Water on the Duck Valley Reservation," February 2018. http://www.environmental-defense-institute.org/publications/DuckValleyFeb.pdf