Health Risks Posed by the Proposed Reuse Reservoir in Dry Wash

I. The Proposed Reuse Reservoir Is a Test Case for the Health Risks of Locating a Reuse Reservoir in an Existing Residential Neighborhood.

Despite repeated requests from the Study Group, the Washington County Water Conservancy District ("WCWCD") has been unable to identify any other community that has allowed a reuse reservoir to be located in an existing residential area.[1] This is concerning, because approval of WCWCD's plan would make Ivins residents a test case for long-term exposure to dust particles containing a number of unfiltered toxins from the partially treated wastewater stored in Dry Wash. When the proposed reuse reservoir was emptied every summer and fall, the dust would carry toxic metabolites into the homes and yards of Ivins residents. These toxins would be ingested simply by being in the environment.

Before a decision is made on the unprecedented location of a reuse reservoir in an existing residential neighborhood, an independent study by qualified medical experts should be conducted to assess the health risks presented by these airborne toxins and determine whether, and to what extent, they can be substantially mitigated by imposing conditions on the design and operation of the proposed facility. There is no urgency that could justify approval of this unprecedented use without that assessment.

II. Adding a Source of Dust as Significant as the 47-Acre Drybed of the Proposed Reservoir Would Exacerbate the Already-Heightened Risk of Valley Fever and Other Pulmonary Problems for Ivins Residents.

We know, from examples like the Great Salt Lake, that breathing in particles such as dust can cause direct irritation of the airway. This can lead to exacerbation of conditions such as asthma, emphysema, and COPD. Even those without these conditions report bloody noses, sneezing and coughing, and lung irritation from exposure to dust pollution. This can have a significant impact on the elderly and also the very young in our area. In addition, air pollutants in dust particles can be absorbed into the bloodstream through the

[1] In response to repeated inquiries from the Study Group to identify another reuse reservoir that is located in a residential area, WCWCD's Program Reuse Manager answered as follows: "Reuse water is currently stored in a number of ponds in residential communities throughout the [St. George Reuse] system. The ponds are often located along golf courses and are drawn down and refilled as the reuse water is used for outdoor irrigation." Email dated 3/22/24 from Morgan Drake, WCWCD Reuse Program Manager, to Patricia O'Rorke. A follow-up request for the identity and size of those "ponds" was answered on April 4, stating the District did not have that information. Clearly, water traps on golf courses and similar small ponds bear little resemblance to a reuse reservoir with an exposed drybed of 47-acres in a windy residential area, and may not contain straight reuse water.

lungs, where they have been associated with inflammatory disorders, such as immune diseases and bowel problems.[2]

High winds and dust in our environment have already created a heightened level of pulmonary problems. As Dr. Ginamarie Foglia, an infectious disease specialist, reported at the City Council's February 21, 2024 Work Session, Washington County is considered endemic for coccidioidomycosis ("Cocci", commonly known as Valley, Fever). In fact, 47.5% of the documented cases of Valley Fever in the entire state of Utah over a ten-year period occurred in Washington County. Researchers believe this is due to the combination of dust in our environment and a high rate of construction, a combination that exposes our residents to aerosolized arthroconidia. This increases the risk of contracting Valley Fever, which causes pulmonary infection, meningitis, and nonpulmonary infection.[3] Adding the dust from the 47-acre drybed of a reuse reservoir would exacerbate the incidence of Valley Fever and other pulmonary problems in Ivins.

III. The Reuse Reservoir Will Create Toxic Dust.

A. Toxins Will Remain in the Partially Treated Wastewater.

Although wastewater treatment plants can control conventional pollutants, such as COD, BOD, suspended solids, complex organic material, nitrogen and phosphorous-rich compounds, and pathogenic organisms like bacteria, viruses, and protozoa, there are many harmful toxins that they cannot filter. Some compounds, such as pesticides, pharmaceuticals, personal care products, microplastics, and other chemicals, are difficult to detect and remove from the wastewater stream. There are no specific treatment processes or testing standards for these contaminants. This class of compounds has been termed "contaminants of emerging concern" ("CECs").

Common CEC's include:

- Prescription and over-the-counter drugs, including antidepressants;
- Veterinary drugs;
- Fragrances;
- Cosmetics;
- Sunscreen products;
- Dietary supplements;
- Diagnostic agents (e.g., MRI contrast).

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[2] https://www.sltrib.com/news/environment/2023/09/19/heres-what-great-salt-lakes-dust/; https://www.deseret.com/opinion/2022/6/29/23188005/opinion-the-toxic-tale-of-the-great-salt-lake-drought-water-receding-toxic-metals-arsenic-dust-storm/; https://www.sciencedirect.com/science/article/pii/SO147651323008382#bib17; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7045158.

[3] Adrienne Carey et al, Epidemiology, Clinical Features, and Outcomes of Coccidioidomycosis, Utah, 2006–2015, *Emerging Infectious Diseases* (2021). DOI: 10.3201/eid2709.210751

The partially treated wastewater also contains carcinogens, neurotoxins, and cardiac toxins including:

- Heavy metals, such as arsenic and lead;
- Nitrates from fertilizers and human waste;
- PFAS (Forever Chemicals) from manmade substances such as teflon and waterproofing;
- PCBs from plastics.

B. Sedimentation and Fluctuations in Water Levels Will Concentrate the Toxins in the Reservoir Lakebed.

The reuse water from the St. George Wastewater Treatment Plant ("Plant") may be within human health regulatory standards when the wastewater leaves the Plant. The danger is that the design and operation of the reuse reservoir will concentrate these toxic substances in a way that poses a significant public health threat.

Sedimentation will occur over time in Dry Wash Reservoir, as in any surface reservoir. Even at the Las Vegas Bird Refuge, where the water is not drawn off for irrigation, the staff confirmed that sedimentation does occur in the reuse water ponds.

The proposed use of Dry Wash Reservoir entails large fluctuations in water levels, resulting in large areas of the reservoir bottom lying exposed aerially. When left undisturbed, the soil surface in our desert environment will form a slight "crust" on it by various mechanisms including cryptogamic soil. This crust, along with the presence of native vegetation, keeps the surface material from mobilizing during high wind events. But after the reservoir is filled with wastewater, this crust, as well as the native vegetation, will be gone, dramatically increasing the potential for wind to mobilize the remaining surface material. This phenomenon can be observed any day with moderate to high winds in an area where new construction has removed the surface soils. The surrounding desert acreage will produce very little dust, while the scarified acreage will show an obvious visual dust plume, sometimes extending hundreds of yards from the source.

Sediment contains particles of silts and clays known as PM10 and PM2.5, which are regulated as pollutants due to their size and increased ability to become lodged in the human lung. When combined with the CECs, carcinogens, and neurotoxins that will be present from reservoir sedimentation, the airborne contaminants pose a significant public health hazard. The compounds will increase in concentration over time as the reservoir is filled, and then exposed to evaporation, leaving these contaminants behind as precipitates. This is the same principle that is used to produce salt from salination ponds.

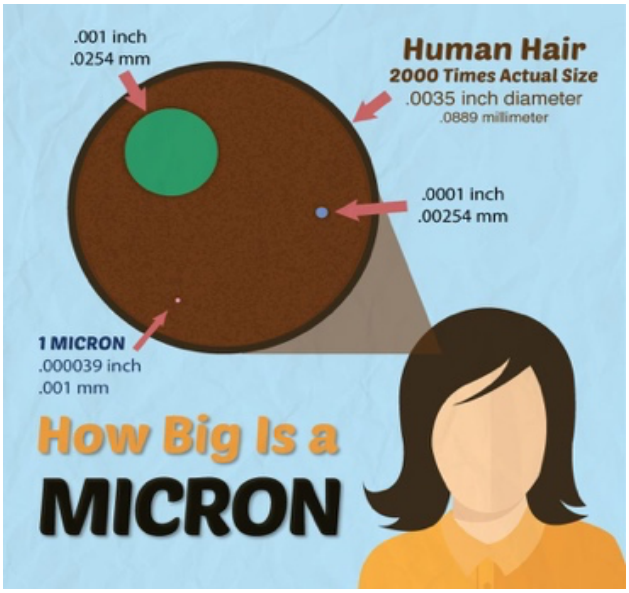
C. The Concentrated Toxins in the Lakebed Will Become Toxic Dust.

When the reuse reservoir is emptied for irrigation every summer and fall, the concentrated mixture of CECs, carcinogens, and neurotoxins will become airborne and be spread through the City by the wind. The areas most affected with be the more moderately-priced residential neighborhoods downwind from Dry Wash, where many young families reside.

IV. Toxic Dust Poses a Serious Public Health Threat.

There is an assumption that ingestion by mouth determines the health risk of various toxins rather than exposure through the skin, eyes, lungs, etc. However, recent studies indicate that inhaled pesticides are many times more toxic than ingested pesticides. It is also important to consider the risk of exposure to a "cocktail" of contaminants in the air, rather than considering each contaminant in isolation. If the Ence Wells become contaminated with the reuse water from the proposed Dry Wash Reservoir, they could be in higher concentrations in the drinking water supply as well as the air we breathe.

Ongoing research on the Great Salt Lake indicates that contaminants in the exposed lakebed are transported by dust particles smaller than ten microns. A micron is a unit of length that is one millionth of a meter or 1/26,000 of an inch (approximately one-fifth the width of a human hair). Particulate matter 10 microns in diameter is called PM10. Anything smaller than PM10 can damage lung tissue, cause lung cancer, and increase the risk of death.[4]



To summarize the research, the health risks posed by the toxins that will accumulate and concentrate in the sediment and be spread in the dust from the proposed reservoir include but are not limited to the following compounds.

Some of the toxins identified in wastewater streams are:

A. Heavy Metals.

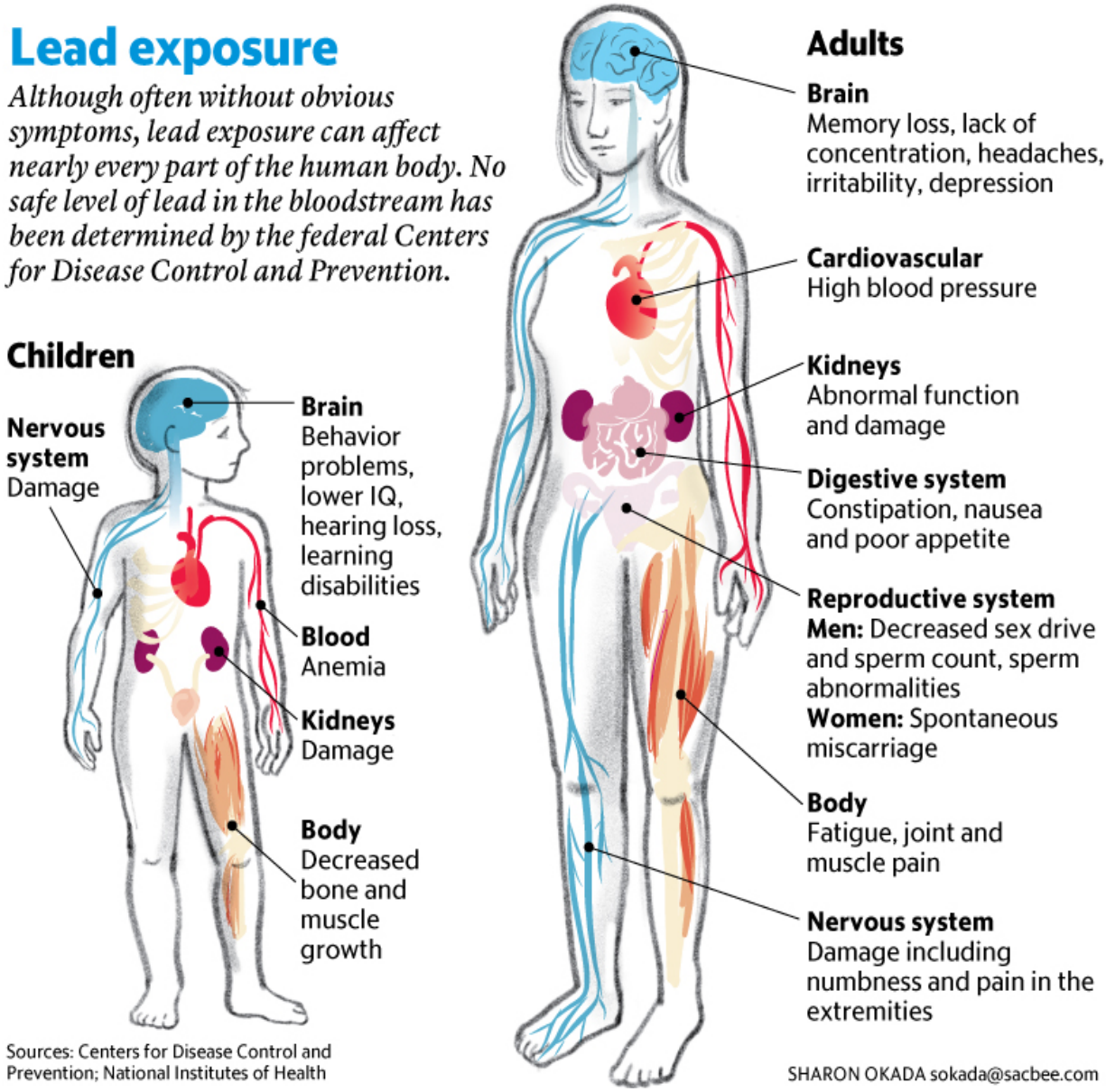
- **Arsenic.** Arsenic is thought to be naturally occurring in the Great Salt Lake, though there is also contribution from industrial waste. Long-term exposure to arsenic in dust has been associated with certain types of cancers, cardiovascular disease, and diabetes, according to researchers at the University of Utah.[5] The higher the dose ingested, the higher the risk.

- **Cadmium.** Cadmium has been recognized as one of the most toxic environmental and industrial pollutants. It is naturally occurring and accumulated from agricultural and

[4] https://www.popsci.com/environment/dust-clouds-dangerous-air-pollution/
[5] https://dceg.cancer.gov/research/what-we-study/drinking-water-contaminants

industrial waste. It is a potent neurotoxin. Exposure has been associated with multiple cancers including breast, lung, prostate, nasopharynx, pancreas, and kidney.[6]

- **Lead.** Lead in the wastewater stream from municipal sewer sludge, fertilizers, and other sources is a neurotoxin. It is also toxic to the cardiovascular system as well as other body systems. Experts agree there is no safe level of exposure to lead, especially for children. The health impacts of exposure to lead are shown in the following illustration.[7]

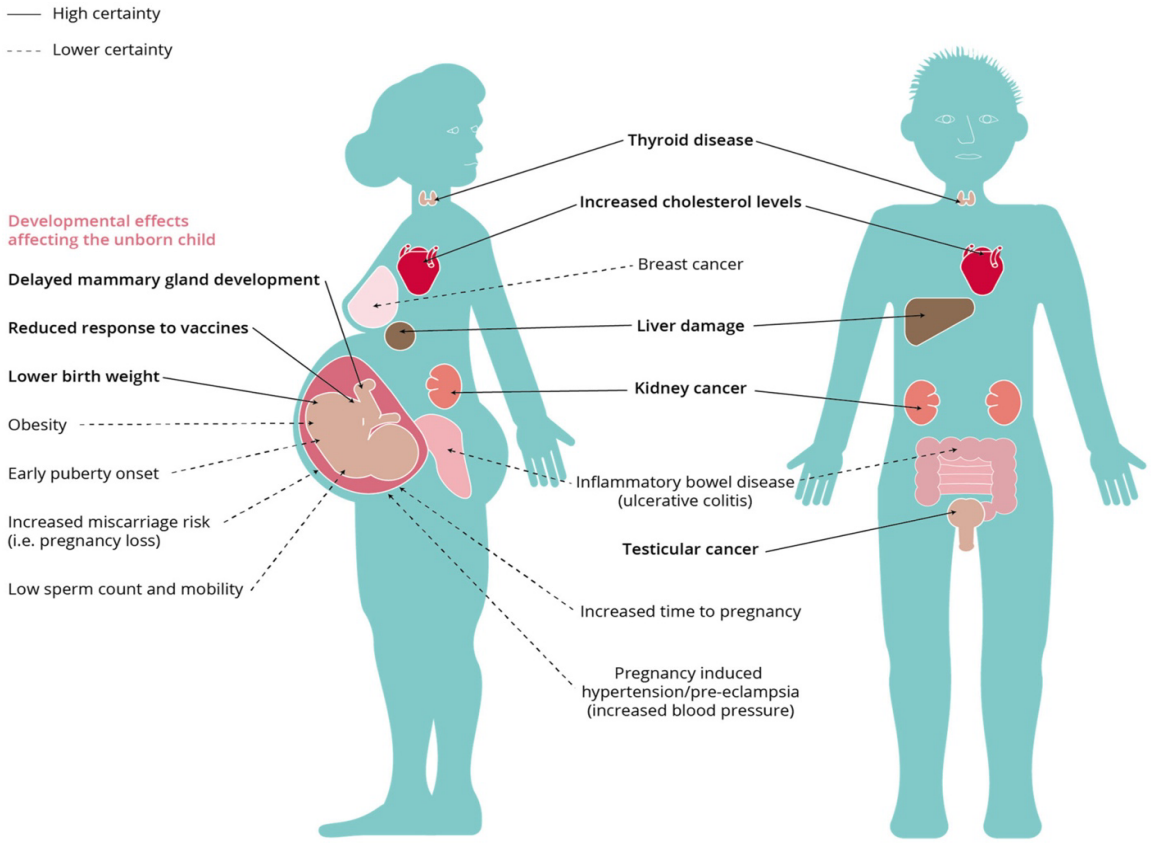


[6] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7312803/
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3753751/
[7] https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health
https://www.medicalnewstoday.com/articles/306601

B. Human Contributions

- **Nitrates.** Higher average nitrate levels in water supplies from municipal sewer sludge and fertilizers have been associated with an increased risk of thyroid, ovarian, bladder, and kidney cancer.[8]

- **PFAS.** We know that PFAS (FOREVER CHEMICALS) are in the wastewater stream and will surely be carried in the dust from the proposed reuse reservoir. Exposure to PFAS has been associated with decreased antibody response and dyslipidemia in both adults and children, decreased infant and fetal growth, and increased risk of kidney cancer. There is evidence suggesting an association with a number of other disorders including, but not limited to, breast and testicular cancer, thyroid disease, and pregnancy induced hypertension and preeclampsia. There may be an association with birth defects of the heart. The EPA recommends that there is no safe level of exposure to PFAS. Seven weeks ago, the CDC advised physicians to start testing individual patients for levels of PFA-PFO compounds. The risks posed by dust contaminated with PFAS are depicted in this illustration from the National Institutes of Health.[9]



[8] https://dceg.cancer.gov/research/what-we-study/drinking-water-contaminants
[9] https://www.ncbi.nlm.gov/pmc/articles/PMC7906952/
https://www.ncbi.nlm.nih.gov/books/NBK584690
https://www.sciencedirect.com/science/article/pii/S0160412021001926

- **BPA.** BPA from plastics can disrupt the endocrine (hormonal) system. Exposure has been associated with abnormal estrogen and testosterone levels, sexual dysfunction and infertility in humans. In animal studies, it has been linked to breast, ovarian, and prostate cancer as well as immune disorders. There are concerns of an effect on the development of the fetal brain. In addition to ingestion and inhalation, BPA can be absorbed through the skin.[10]

- **Disinfection Byproducts.** Long-term exposure to disinfection byproducts, such as chlorine, is associated with rectal and bladder cancers. Studies of the incidence of these cancers and level of these contaminants in the water supply have also shown an increased risk of disease with higher doses.[11]

C. Pharmacologics. Some of the prescription and non-prescription drugs taken by residents throughout Washington County are not easily filtered out of our general water supply and will be more highly concentrated in the partially treated reuse water. While it would be impossible to look at every pharmacologic in detail, the SSRI's (the most commonly used antidepressants and anti-anxiety medications) are the subject of much study. Prenatal SSRI exposure has been associated with an increased risk for autism spectrum disorder in multiple studies. We don't know if this exposure alone is enough to cause autism in any one child. However, metabolites of these drugs seem to act as a growth factor for the developing brain. Medical researchers are just beginning to understand other possible mechanisms, including aggravated oxidative stress altering brain neurochemistry. All SSRI's cross the placenta and are found in high concentrations in the fetus. They have also been associated with a number of other fetal concerns, including reduced head growth, low birth weight, neural tube defects, cardiac malformation, craniosynostosis, pulmonary hypertension, and low Apgar scores. There is evidence that the effects of SSRIs on patients with genetic predisposition to autism or other developmental disabilities make some children more susceptible than others. Research suggests that exposure to anticonvulsant drug metabolites and lithium metabolites during pregnancy play a role in development of both autism and other neurologic disorders, such as Alzheimer. There may be medical reasons to continue these drugs during pregnancy. Risks should be discussed with healthcare providers.

The presence of pharmacologics in our environment is a potential cause of the skyrocketing incidence of autism and Alzheimer in our country. According to the most recent data, one in 40 eight-year-old children in Utah is diagnosed with autism. The addition of dust contaminated with pharmacologics from the proposed reuse reservoir could exacerbate this high incidence of autism in Ivins' children and Alzhiemer in our elders.[12]

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[10] https://www.frontiersin.org/articles/10.3389/fnut.2022.1047827/full

[11] https://dceg.cancer.gov/research/what-we-study/drinking-water-contaminants

[12] https://www.frontiersin.org/journals/psychiatry/articles/10.3389/fpsyt.2020.555740/full
https://www.mdpi.com/2218-1989/13/2/310
https://www.newscientist.com/article/dn21882-antidepressants-in-water-trigger-autism-genes-in-fish/

D. BMAA. Researchers at the Brain Chemistry Lab in Jackson Hole, Wyoming, are looking at a cyanotoxin known as BMAA in dust from the Great Salt Lake. Exposure to BMAA is thought to be a risk factor for developing the neurodegenerative disorder ALS and Parkinson's disease.[13]

V. Possible Means of Mitigation.

A. **Informed Consent.** Because no other community has allowed a reuse reservoir to be located in the middle of an existing residential area, the City Council's approval of the proposed Dry Wash Reservoir would make Ivins residents the unconsenting subjects of a medical experiment. The first requirement for participation in a medical experiment is informed consent. Residents purchased homes in a low-density residential zone without notice or any indication in the City's General Plan that a reuse reservoir might be located upwind. It is doubtful that adults would consent to the health risks posed by the first reuse reservoir located in an existing residential area, and minor children cannot give informed consent.

B. **Notice.** The City could put future residents on notice of the health risks posed by the reuse reservoir through signage and requiring sellers and renters of residential properties to notify prospective purchasers and renters of the health risks. However, this could have a negative impact on property values and the City's tax base and would not mitigate the potential health risks to existing residents.

C. **Warnings.** The City could establish a system to warn residents when the proposed reservoir was emptied for irrigation and when wind caused contaminated dust to spread through the area. During those periods, children and vulnerable adults could be warned to stay inside, wear masks, and take other precautions. Although this would not mitigate the health risks posed by the proposed reservoir, it could lessen their impact to some extent.

D. **Proceeding without Prior Assessment of the Health Risks but Monitoring Toxins.** Allowing the reservoir to be located in Dry Wash, monitoring the contaminants in the sediment and the dust when the reservoir is emptied for irrigation, and tracking the incidence of disease in the surrounding residential area would put residents at risk and document the health consequences rather than assessing the health risks in advance and determining if, and to what extent, it is possible to mitigate them.

E. **An Independent Study of the Health Risks by Qualified Medical Experts.** Dr. Brian Moench, M.D., President of Utah Physicians for a Healthy Environment, is currently leading a study of the toxic effects of the dust from the exposed lakebed of the Great

[13] https://www.mdpi.com/2076-2607/10/12/2418
https://www.sciencedirect.com/science/article/pii/S019745802300043X
https://www.sltrib.com/news/environment/2023/11/16/study-shines-more-light-toxins/
https://www.sciencedirect.com/science/article/abs/pii/S2352554118302080

Salt Lake. Additional studies are being conducted at other research facilities, including the University of Utah School of Medicine, the Abbott Lab at BYU, and the Brain Chemistry Lab in Jackson Hole, Wyoming. Dr. Moench estimates it would take a few months to assess the health risks of the reuse reservoir. He is willing to participate in a Zoom meeting with the City Council. The Study Group stands ready to help the City arrange an independent study of the health risks posed to Ivins residents by the location of the reuse reservoir as proposed by WCWCD or modified to limit the size and wind exposure of the drybed. The Council's decision to approve or deny the application should be deferred pending the results of that study.

VI. Conclusion.

The proposed reuse water will be used to irrigate the parks and playgrounds that young children and pregnant mothers frequent. The dust when the Dry Wash is emptied will carry toxic metabolites into their yards and homes. They will be ingested simply by being concentrated in the environment. Many toxins can be absorbed through the skin - like BPA, dioxins, and furans. The downwind area where moderate-priced housing is being developed and families with young children are likely to live will be at greatest risk.

In light of the potential health risks, including the exacerbation of respiratory diseases and a significant increase of exposure to toxins, carcinogens, and neurotoxins that cause cancers, birth defects, autism, Alzheimer, ALS, pulmonary and cardiovascular diseases, Parkinson's disease, and a whole host of other medical problems, we strongly recommend that the health risks of the proposed reuse reservoir in the midst of an existing residential area should be assessed by qualified medical experts before the City Council decides whether to approve or deny WCWCD's application.