# BDD report inspires comparisons


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I have been flattered by the number of people who have asked my opinion about the report of the ChemRisk LLC Independent Peer Review (IPR) of the Buckman Direct Diversion (BDD) Project and whether the treated water will be "safe." As a concerned citizen, geologist and water purification business owner, I certainly took the time to read the entire IPR. My approach is to point out the facts that can be supported by science and thereby help residents make their own informed decisions.

I do think that there is a lot of projection by geologic analogy and engineering modeling in predicting the extent to which both the naturally occurring and anthropogenic [human-caused] radionuclides will be removed. Very careful research has gone into the development of the treatment array, but the real test will of course be the lab-test results of the processed water.

## Occurrence and EPA standards for the BDD radionuclide COIs

| BDD RADIONUCLIDE COIs | OCCURRENCE | US EPA |
|---|---|---|
| Americium-241 | Anthropogenic | α (15 pCi/L) |
| Lead-214 | Natural | None (β) |
| Plutonium-238, -239 | Nat.(trace) / Anthro. | α (15 pCi/L) |
| Potassium-40 | Natural | None (β) |
| Radium-226, -228 (Combined) | Natural | 5 pCi/L |
| Strontium-90 | Anthropogenic | β (8 pCi/L) |
| Thorium-228, -230, -232 | Natural | α (15 pCi/L) |
| Tritium | Nat.(trace) / Anthro. | β (20k pCi/L) |
| Uranium-234, -235, -238 (Total) | Nat. / Anthro. | 30 ppb |

α = Alpha Particle Activity β = Beta Particle Activity

MCL

One of the driving forces in determining the "safeness" of the processed water supply will be in keeping contamination levels below U.S. Environmental Protection Agency (EPA) standards on an annualized basis. I would argue that complying with EPA's drinking water standards does not in and of itself make the water safe for consumers, since there are not that many direct correlations between the effects of radionuclides, or inorganic chemicals that may be present in water, on human health. But there are an abundance of warnings of the possible risks to human health. Certainly the United States has ample experience in both producing radionuclides and trying to correlate anthropogenic radionuclide levels with human health, but that still does not make the EPA standards adequately protective.

I speculate that most people who read more than the Community Summary or Executive Summary concentrated on the findings regarding radionuclide presence and concentrations in the Rio Grande water samples and on the city's plans to remove the 15 radionuclide "constituents of interest" (or COIs). I did some research on the chosen radionuclides and I found it to be a mix of naturally occurring and anthropogenic substances, as well as some constituents with dual origins in water - see Table 1. Even the naturally occurring radionuclides can become concentrated by human activities, but some radionuclides on this list have an exclusively man-made origin.

Considering the origin of some, but not all, of the contamination, it is not surprising that the most authoritative information sources fall under the federal government umbrella. Only radium and uranium, which are naturally occurring, are found in the main EPA listing of maximum contamination levels (MCLs). By perusing various EPA links, I found some other defined standards based on alpha-particle and beta-particle activity (expressed in pCi/L, or picocuries per liter). The best guidance for monitoring most of these constituents is from other federal agencies that specialize in radionuclide remediation, such as the preliminary remediation goals (PRGs) set by the Oak Ridge National Laboratory's Risk Assessment Information System (RAIS) and the EPA's Superfund program.

We all have some level of background radiation in our hair, urine, blood and saliva just from naturally occurring radiation and from the foods we consume. At least some of the radionuclides detected on Earth are not the result of local surface and groundwater contamination (by either naturally-occurring or anthropogenic radionuclides), but rather by atmospheric testing of nuclear devices. Before 1963, radioactive particles and gases were spread within the atmosphere by more than 500 tests conducted by the United States and other countries. The extent of the contamination depends on the nature, size and location of the testing. Some radionuclides persist in the environment because of their long half-lives.

I am certainly not qualified to comment on the human-health implications of the selected radionuclides. If you want to do your own research on the risks of radionuclides and chemical constituents in water, I suggest that you utilize "the Google" to find the Agency for Toxic Substances and Disease Registry (ATSDR), which is an agency of the U.S. Department of Health & Human Services and a branch of the Centers for Disease Control. There you will find, for each constituent, a summary of its origin and occurrence and its potential effects on human health. Another website I always find informative is that of the Argonne National Laboratory, Environmental Science Division, which provides radiological and chemical fact sheets. The EPA website also provides information on the possible effects of radionuclides on human health.

For many reasons, other developed countries have fewer regulations for radionuclides. I am reminded that EPA regulations are less stringent for uranium than regulations in other countries (30ppb vs. 20ppb in Canada and Australia). And the World Health Organization (WHO) has a guideline of 15ppb for uranium in drinking water. This observation gave me the impetus to finally take the time to pursue a comparison of U.S. drinking water standards with standards and guidelines from other developed countries as well as the WHO guidelines. I selected, from the Buckman Direct Diversion IPR team's 35 chemical COIs, seven non-radionuclide and non-microbiologic contaminants that are known to pose human-health risks and that cause the most concern among residents in our region - see Table 2.

For many constituents, EPA standards are numerically higher and therefore less protective (see shading in red) rather than numerically lower and more protective (see shading in green) compared to the standards for these same contaminants in other developed countries. I think that this comparison begs the question as to whether or not processing regulated, municipal water to meet or exceed the EPA's drinking-water standards adequately protects human health, or simply satisfies the issue of compliance. Water for thought.

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## Comparisons of U.S. Environmental Protection Agency drinking-water standards with those of other nations and organizations

| BDD CHEMICAL COIs | OCCURRENCE | EPA MCL | E.U. | W.H.O. | CANADA | AUSTRALIA | N.Z. | JAPAN |
|---|---|---|---|---|---|---|---|---|
| Arsenic (ppb) | Nat. / Anthro. | 10 | 10 | 10 | 10 | 7 | 10 | 10 |
| Chromium (ppb) | Nat. / Anthro. | 100 | 50 | 50 | 50 | 50 | 50 (Cr VI) | 50 (Cr VI) |
| Copper (ppm) | Nat. / Anthro. | 1.3 | 2 | 2 | None | 2 | 2 | 1 |
| Fluoride (ppm) | Nat. / Anthro. | 4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 0.8 |
| Lead (ppb) | Nat. / Anthro. | 15 | 10 | 10 | 10 | 10 | 15 | 10 |
| Nitrate (ppb) | Nat. / Anthro. | 10 | 11 | 11 | 10 | 50 | None | 10 |
| Selenium (ppb) | Nat. / Anthro. | 50 | None | 10 | 10 | 10 | 10 | 10 |

= EPA Standard is higher and *less* protective

= EPA Standard is lower and *more* protective