Buckman Direct Diversion Project

Independent Peer Review

Presentation of Results and Responses to Comments

December 7, 2010

ChemRisk® amec

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Objectives of Today's Meeting

1. Provide a summary of the independent peer review results
2. Provide an overview of the comments received
3. Respond to key comments
4. Answer additional questions

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Introduction

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Brief Background

- Buckman Direct Diversion Project (BDD) will divert water from the Rio Grande to residents of Santa Fe in 2011
- Water intake is approximately 3 miles downstream of Los Alamos Canyon (LANL)
- In 2007, BDD Board requested that DOE and LANL fund & implement actions & programs to protect public water supplies
  - Independent Peer Review (IPR) initiated upon BDD obtaining DOE funds
- IPR Team selected
  - ChemRisk – expertise in human health risk assessment and evaluation of historical operations at U.S. nuclear weapons plants
  - AMEC – expertise in New Mexico hydrology, hydrogeology and geochemistry

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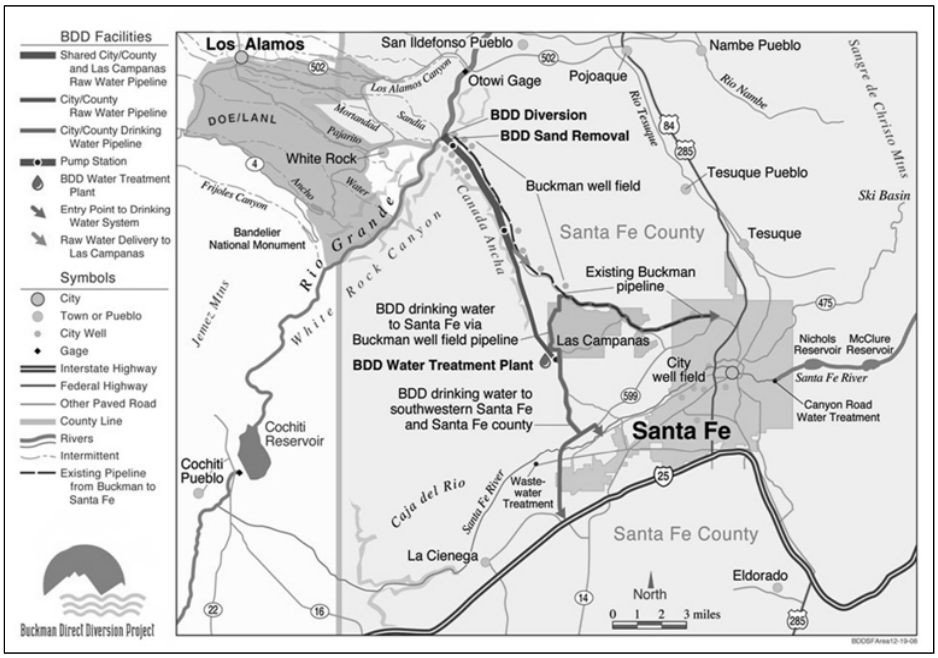

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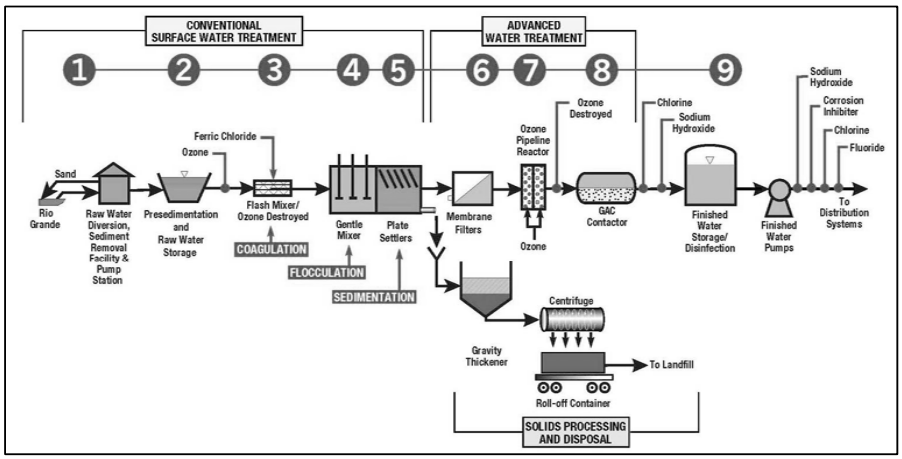
BDD Water Treatment Process:



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Fundamental Goals of the Independent Peer Review (IPR)

- Independent 3rd party analysis of potential health risk
- Consider outside review and comments (Public, BDD Board, LANL)
- Address public concerns
- Transparent process
- High quality technical work

- Use of best methodology (Federal Guidance, USEPA)
- Use of recent data and information
- Public communication

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First Public Meeting - Jan. 14, 2010

- Introduced IPR Team and presented scope of work
- Inquired with public about their concerns
  - Summary of public comments/questions:
    1. What will the BDD Water Treatment Plant remove and will it be efficient?
    2. What are the potential sources and chemicals of concern?
    3. What exposures will be considered and how will they be evaluated?
    4. How will transparency be ensured?

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Specific Objectives of the IPR Analysis

- Evaluate potential tap water-related health risks from chemicals and radionuclides
  - Compare estimated risks to regulatory benchmarks
  - Compare estimated risks to those of everyday life
  - Incorporate public concerns
- Evaluate potential future impacts on Santa Fe tap water from LANL-related constituents in stormwater, sediments and groundwater

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Specific Public Concerns Addressed in the IPR Analysis

- Sensitive sub-populations
- Personal care products and pharmaceuticals
- Synergistic effects
- Endocrine disruptive effects
- Consideration of specific exposure pathways (swimming, vegetable ingestion, etc.)

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Methods & Results

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Information Resources in the IPR

- BDD public and technical communication materials
- Identified relevant information for
  - Data selection
  - Human health risk assessment
- Evaluated reports by NMED and LANL
- Rio Grande water quality databases
  - Risk Analysis, Communication, Evaluation, and Reduction (RACER)
  - LANL
  - USGS
- LANL ground- and surface water databases (storm water impacts)

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Identified Constituents of Interest (COIs)

- Data from RACER: Considered all chemicals and radionuclides measured in surface water at Buckman since 2000
  - 11 events at 2 Buckman locations
  - 22 events at 5 upstream Otowi locations
- Those capable of causing health effects were considered to be COIs
  - 50 COIs: 35 chemicals & 15 radionuclides

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Comparison of Rio Grande COI levels to Drinking Water Criteria

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Drinking Water Criteria

•Drinking water criteria define a quality of water that can be safely consumed by humans throughout their lifetime

•Apply to finished, treated tapwater

Drinking Water Criteria used by IPR

- Hierarchy for criteria selection (per the SOW):
  1. EPA MCLs selected when available (EPA MCLs are enforced by NMED)
  2. If no MCL, lowest health-based *tap water* criteria from NMED or other EPA sources
- Surface and groundwater criteria were not used
  - Don't always apply to public drinking water systems
  - Are not always developed with tap water exposures in mind

Other Drinking Water Criteria

- When MCLs were not available, the lowest value from the following guidelines were used:
  1. NMED Tap Water Screening Levels
  2. USEPA Regional Tap Water Screening Levels (RSLs)
  3. USEPA Preliminary Remediation Goals (PRGs) for Radionuclides
  4. USEPA Drinking Water Equivalent Levels (DWELs)
  5. Lifetime Health Advisories (Lifetime HAs)
  6. USEPA Secondary Drinking Water Regulations (SMCLs)

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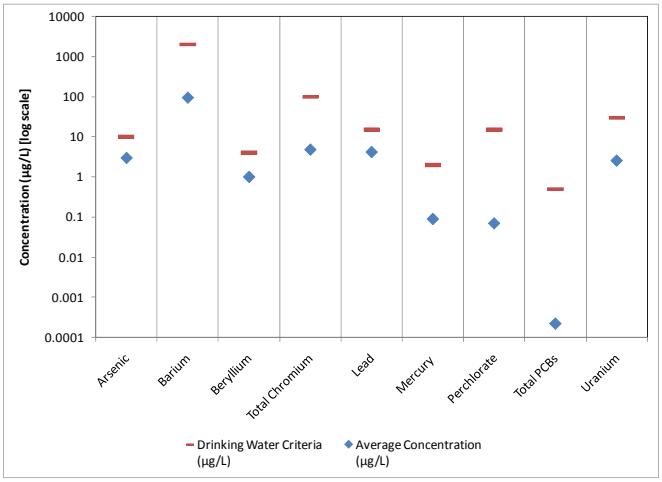
All Chemical COIs in Untreated Water at Buckman are Below Drinking Water Criteria



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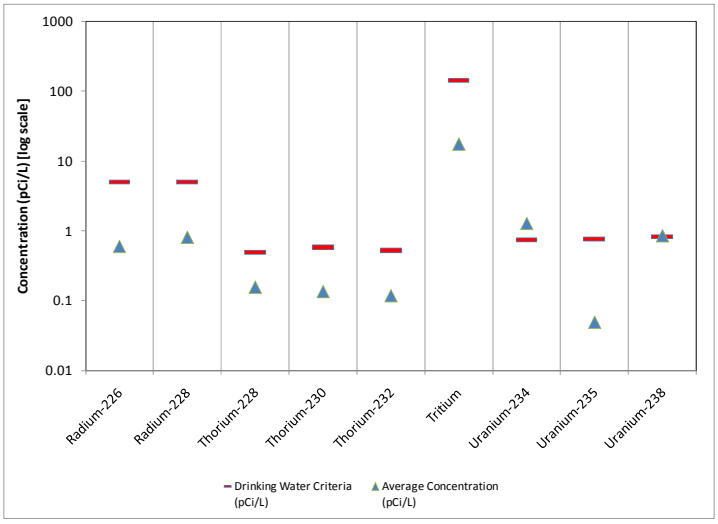
Most (14/15) Radionuclide COIs in Untreated Water at Buckman are Below Drinking Water Criteria



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Public questions related to the use of drinking water standards

- Why weren't the New Mexico surface water criteria for radionuclides used as a basis of comparison?
- Why wasn't the 50 ppb NMED standard for chromium used instead of the 100 ppb EPA MCL?

Point of clarification

- The drinking water standards were not used to calculate risk
- The drinking water standards are only used as a point of comparison with COI levels in untreated Rio Grande water
- Using a different or more conservative drinking water standard does not change the risk estimates

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Why weren't the NM surface water criteria for radionuclides used?

- Because they are not *tapwater* standards and do not apply to *finished, treated* drinking water
- They are *surface water* standards that apply to water bodies that may be used as a source of tapwater
- For monitoring and public disclosure purposes
- The NM criteria are actually *higher* than the drinking water criteria used in the IPR

New Mexico "Surface Water Criteria for the Rio Grande"

- Requested by BDD, developed by NMED
- Became effective December 1, 2010
- Apply to stretch of the Rio Grande that includes the Buckman intake (newly designated as a public water supply source)
- None of the COIs exceeded the NM surface water criteria

Radionuclide	NM Surface Water Criteria (uCi/L)	IPR Drinking Water Criteria (uCi/L)
Americium-241	1.9	0.51
Plutonium-239/240	1.5	0.40
Plutonium-238	1.5	0.39
Strontium-90	3.5	0.94
Tritium	4,000	144
Cesium-137	6.4	0.59

Why wasn't the 50 ppb NMED standard for chromium used instead of the 100 ppb EPA MCL?

Drinking water criteria for chromium

- New Mexico's criterion of 50 ppb is for *groundwater*, not tapwater
- The applicable drinking water criterion for chromium is the EPA MCL of 100 ppb, which NMED enforces
- Chromium levels at Buckman did not exceed 50 ppb
- Maximum chromium level at Buckman = 15 ppb

Evaluation of LANL as a COI Source under Base-flow Conditions

Comparison of COIs at Buckman vs. Otowi

- Otowi = "regional background"
- Buckman = "regional background" + LANL

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"Regional Background"

- Naturally occurring
  -weathering of natural minerals
- Man-made
  -sewage outfalls
  -urban runoff
  -nuclear testing fallout

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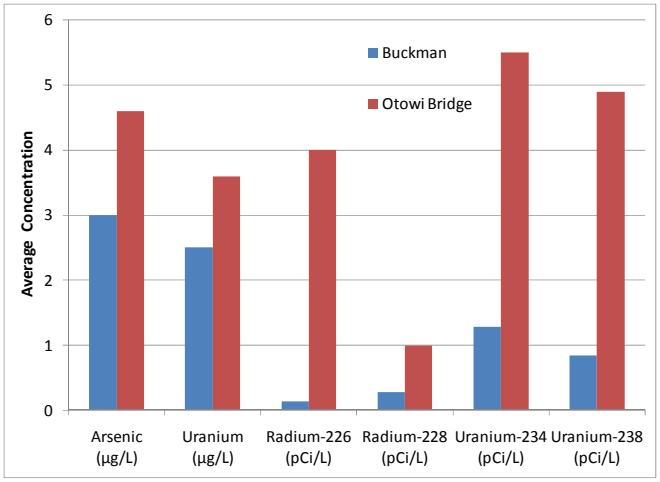
COI levels at Buckman are no higher than at Otowi



These comparisons indicate that LANL does not contribute measurably to COI levels in the Rio Grande during base-flow conditions

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How can there be radionuclides in the Rio Grande if they aren't from LANL?

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Regional background levels of radionuclides: sources

- Naturally occurring
  - U-238, U-235, Th-232 decay chains
  - K-40 – occurs individually in environment
- Man-made
  - Global fallout from nuclear testing

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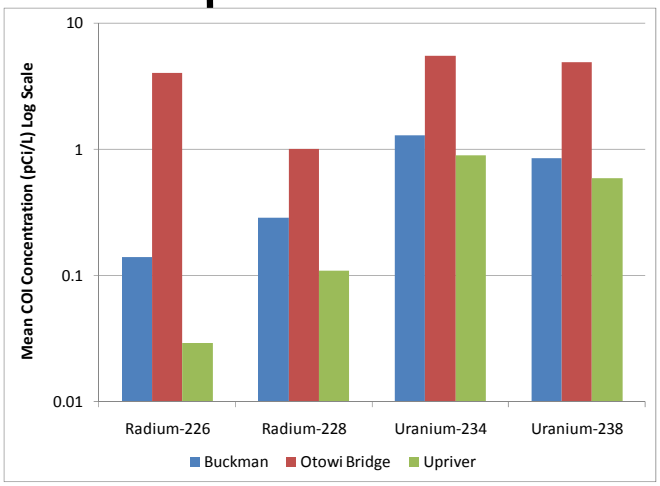
Radionuclides in the Rio Grande: occur upstream of LANL



Upriver locations include Rio Grande at Espanola, Rio Grande at Embudo, and Rio Chama at Chamita

Summary Observations Regarding Base-flow COI Levels in Untreated, Unfiltered Rio Grande Water

- COI levels at Buckman are below drinking water criteria
  - U-234 is only exception
- COI levels at Buckman are the same as those *upstream* from LANL and are consistent with regional background
  - Including U-234
  - Suggests LANL does not contribute measurably to Rio Grande during base-flow conditions

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Exposure and Health Risk Assessment

- **Conducted in accordance with EPA and NMED guidelines**
- **Included all relevant residential tap water exposure pathways and age groups**
- **Used conservative exposure assumptions to calculate doses and risks for each age group**
- **We assumed the tap water was *unfiltered, untreated* water from the Rio Grande**

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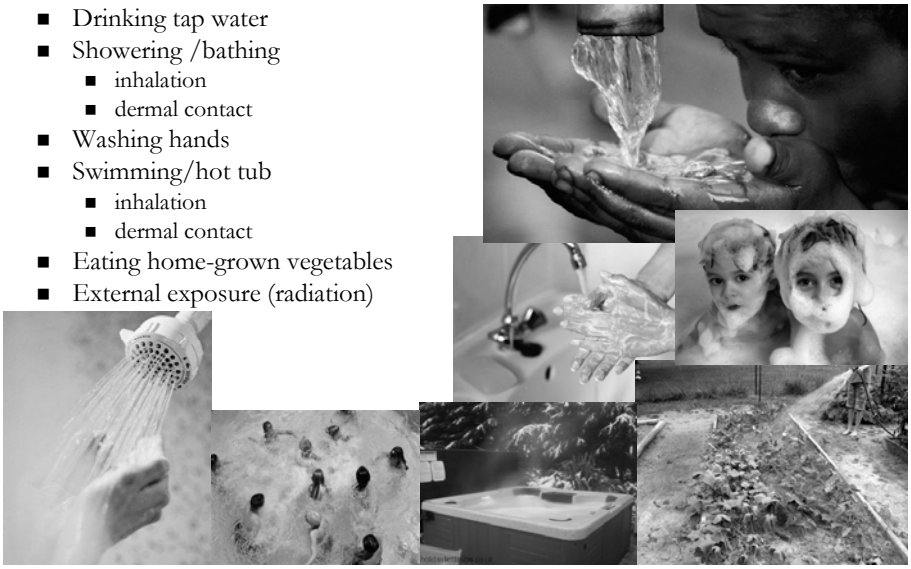
Tapwater Exposure Pathways

- Drinking tap water
- Showering /bathing
  - inhalation
  - dermal contact
- Washing hands
- Swimming/hot tub
  - inhalation
  - dermal contact
- Eating home-grown vegetables
- External exposure (radiation)



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Conservative Exposure Estimates

- To ensure risks were not underestimated:
  - **Used untreated, unfiltered water data**
  - **Assumed a lifetime in Santa Fe**
  - **Assumed all consumed water comes from BDD**
  - **Assumed COIs are present at Buckman even if they have never been detected there**

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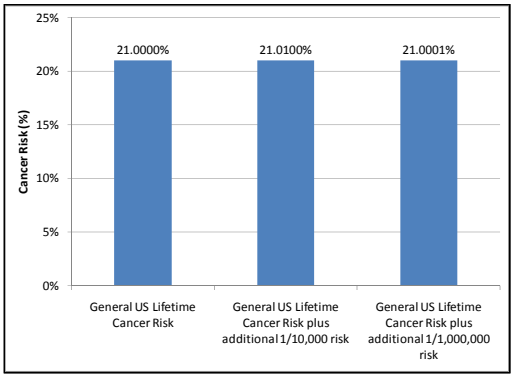
What is an "Increased Cancer Risk"?

- An increase over "background" risk of cancer
- Lifetime cancer risk in the U.S. is about 21%
- By convention, increased risks less than 0.01% to 0.001% are considered negligible by regulatory agencies



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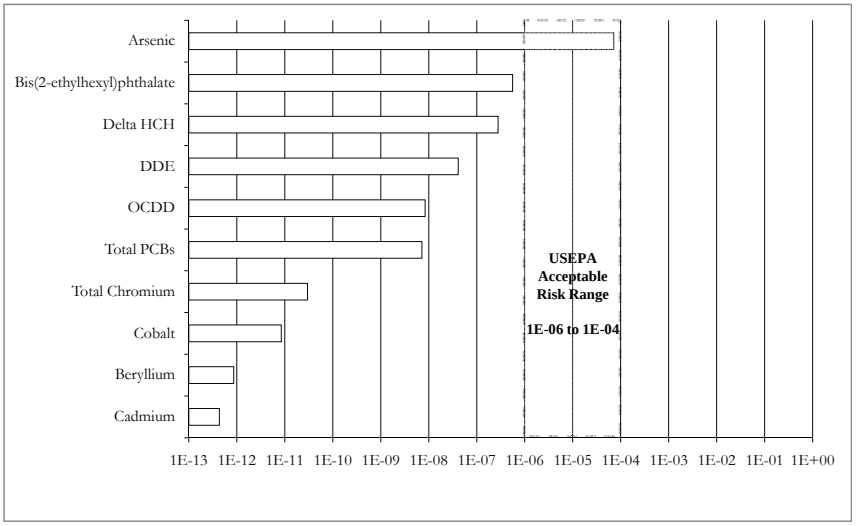
Theoretical Cancer Risks for Chemical COIs in Untreated Water



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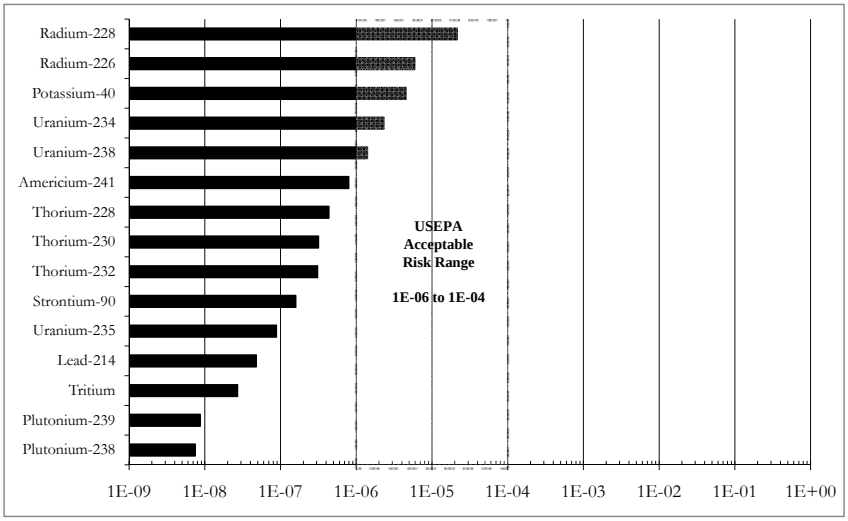
Theoretical Cancer Risks for Radionuclide COIs in Untreated Water



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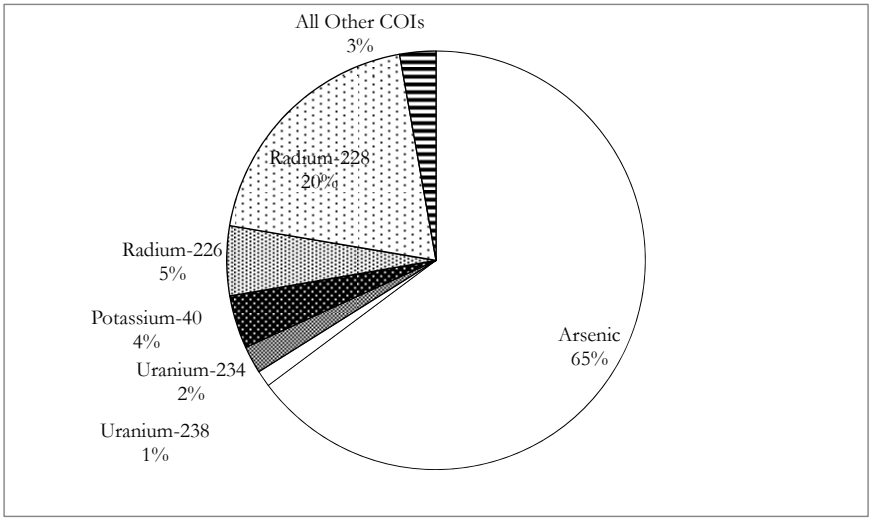
Percent Contribution to Total Cancer Risk



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Arsenic in NM water

- Naturally occurring arsenic is associated with volcanic rock
- The US Geological Survey has compiled data on arsenic concentrations in tens of thousand of wells across the country.

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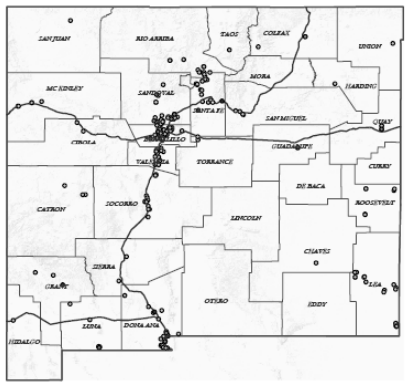
Arsenic Impacted Water System

Wells, Springs & Infiltration Galleries*



Arsenic Concentrations
mg/l
- 0.01 - 0.05
- 0.06 - 0.10
- 0.11 - 0.50
- 0.51 - 1.00
- 1.01 - 3.50

N

* concentrations are the highest measured from each source

December, 2007

http://www.nmenv.state.nm.us/dwb/contaminants/documents/NMArsenicSystems.pdf

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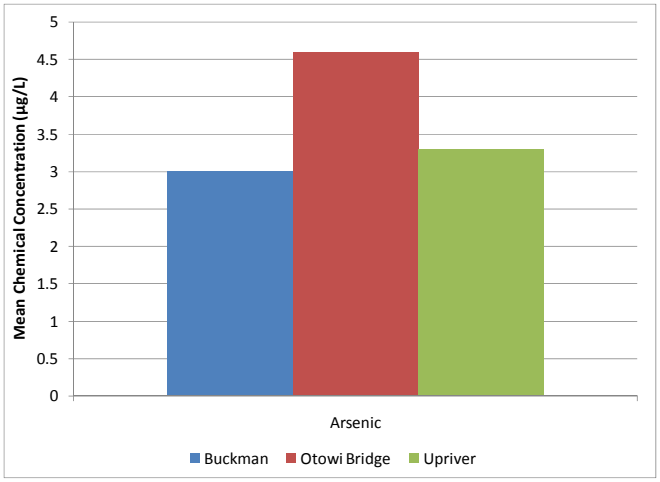
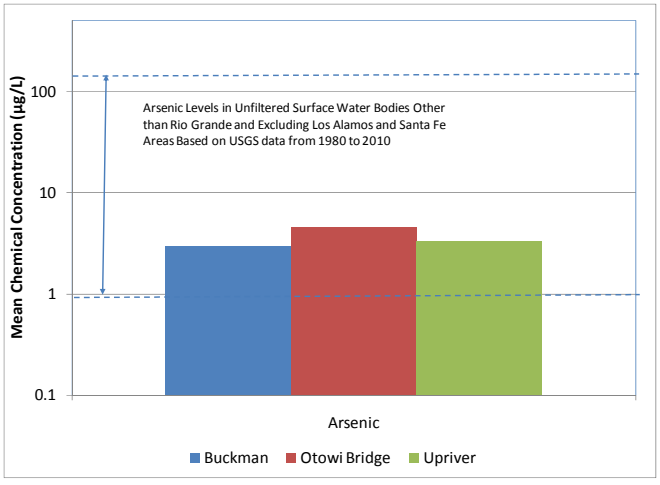
Arsenic levels in the Rio Grande



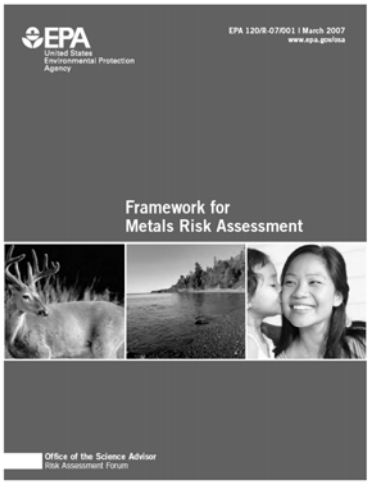
Upriver locations include Rio Grande at Espanola, Rio Grande at Embudo, and Rio Chama at Chamita

Arsenic in the Rio Grande vs Other NM Surface Waters



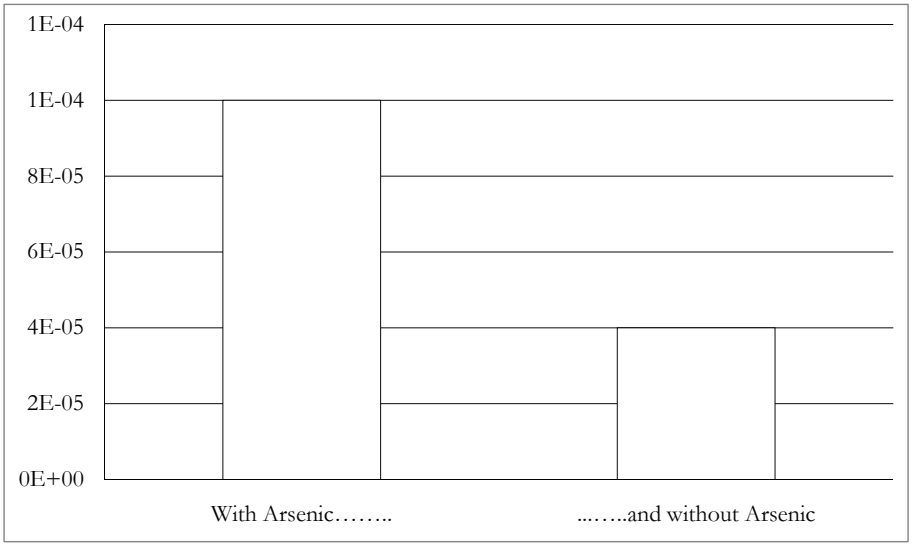
Metals Risk Assessment

"Concentrations of metals in the water column vary over time and are highly responsive to hydrological changes. **In site-specific risk assessments, the risk assessor may quantify background levels by measuring metal concentrations at sites upstream from the area of concern**."



http://www.epa.gov/raf/metalsframework/pdfs/metals-risk-assessment-final.pdf

Risk for Untreated Water



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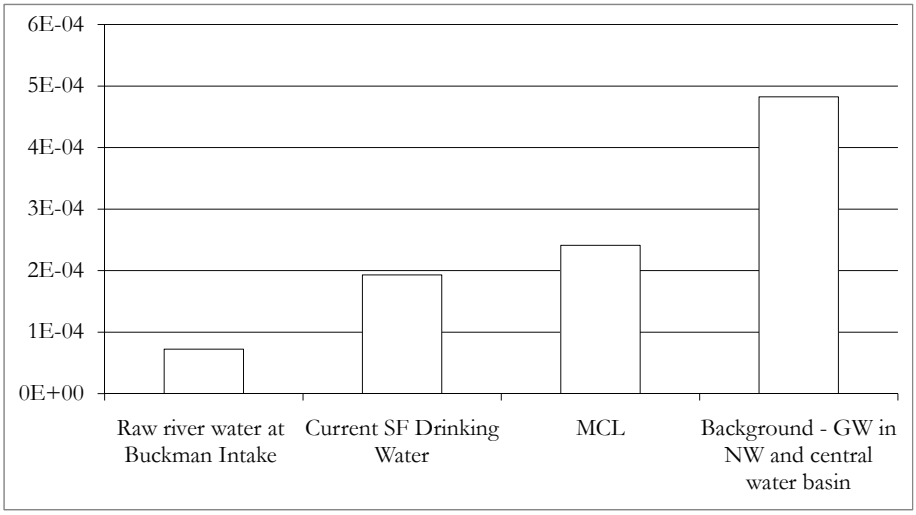
Comparison of arsenic risk from different drinking water sources



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The Theoretical "arsenic risk"

- Exists throughout NM
- Is not unique to the Rio Grande
- Is unrelated to LANL
- Is for untreated water
- The theoretical lifetime cancer risk for the EPA MCL is greater than 1/10,000

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Drinking Treated Buckman Water Could Cause Cancer in More than One Person in 10,000

November 26, 2010

The preliminary draft report of the Independent Peer Review Team states that drinking treated water from the Buckman Direct Diversion Project could result in a lifetime cancer risk in more than one person in 10,000 despite their conclusion that "There will be no health risk to people drinking [Buckman] Project tap water." The Peer Review Team used the Environmental Protection Agency (EPA) range of risk, which is set at one person in one million contracting cancer, a more protective standard, to the less protective of one person in 10,000. The Buckman Project is expected to begin diverting Rio Grande water in January 2011 at a location three miles down river from where contaminants from 67 years of operations at Los Alamos National Laboratory (LANL) continue to flow into the river during storm events.

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Is it true that drinking BDD treated water has a risk greater than 1/10,000?

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No

- We did not evaluate a scenario of "BDD treated water"
- We evaluated a scenario involving 95% removal of *only a few* COIs (Plutonium, Americium, and Uranium)
- All the other COIs were still assumed to be at untreated Rio Grande levels
- We called this a "treated water" scenario in the analysis…should have called it the "95% removal of some COIs scenario"

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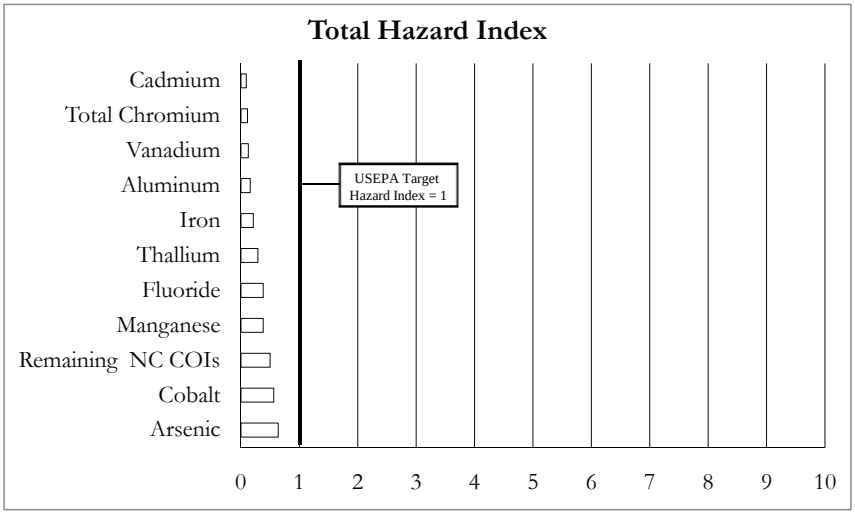
Noncancer Hazards for Untreated Water



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Summary of Risk Assessment Results

- The theoretical cancer risk is associated with COIs that are present at regional background levels and/or below drinking water standards
- Some of these COIs were *rarely or never* detected at Buckman
- The risk estimates assume no treatment of the Rio Grande water
- No significant health risks from use of BDD project tapwater

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Storm Runoff from the LACW

- Storm events will discharge contaminated sediments into the Rio Grande at the LACW – an episodic release
- Few measurements in the RG downstream of the LACW during storms
- However:
  - the BDD intake will shut down if LACW discharges
- Therefore, the IPR team believes that storm-related discharge from LANL is not a health concern

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Contaminated Groundwater at LANL

- Contaminated groundwater exists at LANL and can flow to the west bank of the Rio Grande
- However, even under very conservative assumptions, if the COIs reach the Rio Grande, they would be diluted to negligible amounts
- Hydraulic connection between LANL groundwater & Buckman Well Field is negligible
- Contaminated groundwater at LANL does not impact the water quality at the BDD intake

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Summary of IPR Conclusions

- Chemical and radionuclide levels in the Rio Grande are within acceptable drinking water standards, and/or are at regional background levels
- No measurable contribution from LANL during base flow conditions
- No LANL contributions to Buckman well field
- No significant health risk to people drinking BDD Project tapwater

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Summary of Key Comments

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NMED General Comments

- NMED "generally concurs" with the overall conclusions of the IPR analysis
  - "No significant health risk for BDD water system consumers"
  - COI levels in the Rio Grande "are currently within acceptable drinking water criteria and/or are naturally occurring"
  - "Based on the data received by NMED to date, there is very little if any contribution from LANL to the Rio Grande during normal baseflow conditions"

NMED General Comments (Ctd.)

- NMED "generally concurs" with the overall conclusions of the IPR analysis
  - "Based on the data received by NMED to date, stormwater discharge from LANL does not pose a health risk"
  - "Investigation is being conducted or is planned to determine whether there are contributions from LANL groundwater to the Buckman well field"

NMED General Comment

- NMED believes that

  -proper functioning of the early warning system,

  -response by the BDD operators,

  -continued improvement in the control of contaminated sediment discharges from Los Alamos watershed,

  -proper functioning of the BDD treatment system

..are critical to assure storm water discharges from LANL do not pose a health risk.

Questions and comments regarding age groups and susceptible individuals

- "Reference Man" only considers a 150 pound white male and shouldn't be a basis for the risk assessment
- Why didn't the IPR team evaluate different age groups?
- Why weren't pregnant women and fetuses considered? Or the elderly?
- What about immuno-compromised people?

"Reference Man" and Drinking Water

- Reference Man was NOT used in the IPR risk assessment
  - USEPA Exposure Factors Handbook - 2009
- "Reference man" weighs 70 kg (154 lbs) and ingests 2 liters of water/day
  - Outdated physiological parameters

The IPR risk assessment considered numerous age groups

- Exposure factors were determined for age groupings that best reflect how children's behavioral and physiological factors change with age

General Age Group Classification	Chemical Risk Assessment	Radionuclide Risk Assessment
Infant	<1	
Toddler	1 to 2	
	3 to 5	0 to 4
	6 to 10	
Child	11 to 15	5 to 14
Teen/young adult	16 to 20	15 - 24
Adult	21 to 70	25 - 70
Lifetime	0 to 70	0 to 70

- Age-specific exposure factors are the differentiating variables in the risk assessment

What about susceptible individuals?

The EPA's Reference Dose

- Chemical-specific
- A maximal daily dose that will not cause non-cancer effects over a lifetime of exposure
- Based on most sensitive health endpoint
- Includes numerous safety factors
- Is protective of:
  - -the fetus
  - -children
  - -elderly
  - -pregnant women
  - -immuno-compromised

Use of the EPA reference dose in risk assessment

$$\text{Hazard Index} = \frac{\text{Age-specific COI dose}}{\text{EPA reference dose}}$$

- Hazard index < 1.0 = no hazard
- Example: HI calculation for arsenic, for child1 or 2 years old:

$$0.3 = \frac{0.00008 \text{ mg/kg-day}}{0.0003 \text{ mg/kg-day}}$$

Age Groups & Cancer Potency Adjustment Factors

- Carcinogens: SF * Dose = Risk
- Mutagenic carcinogens = ADAF * SF * Dose = Risk

Exposure Age Group`s	Exposure Duration (years)	Age-Dependent Potency Adjustment Factor
Birth to < 1 year	1	10×
1 to < 3 years	2	10×
3 to < 6 years	3	3×
6 to < 11 years	5	3×
11 to < 16 years	5	3×
16 to < 21 years	5	1×
21 to < 70 yr	49	1×
Lifetime	70	

In Summary

- All age groups and susceptible individuals were accounted for in the risk estimates

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Synergy: what specific analyses were done?

- 2 +2 = 5
- Literature search for any published synergistic effects between any of the COIs
  - -in vitro in cells
  - -in vivo in animals
  - -epidemiology in humans
- No effects were found
- Note: we did not attempt to account for *antagonistic* effects, where 2 +2 = 3

Pharmaceuticals: which ones were measured for and found at Buckman?

- 38 of most common medications tested - 2000 to 2003
- Samples collected from three RG locations, almost all ND. Detects:
  - Phenytoin (Dilantin, anti-epileptic): 300 ng/L at Espanola (upstream from Buckman)
  - Surface water:
    - Nothing detected at Pilar
    - Amitriptyline (Elavil, Endep): 30 ng/L at Buckman Crossing
- Levels similar to or lower than the measured concentrations in *treated* water from other parts of the U.S.

Other studies of pharmaceuticals in the Rio Grande

- US Fish and Wildlife (2004)
  - -multiple analyses at 14 locations in the Rio Grande
  - -29 pharmaceutical analytes
  - -only detection was low levels of cholesterol in 10% of samples
- Albuquerque Water Utility Authority (2004)
  - -San Felipe and Alameda Bridge
  - -no detections

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Do pharmaceuticals in the Rio Grande pose a health risk?

- Pharmaceuticals are commonly found in untreated sewage and effluent from sewage treatment systems
- However, they have rarely been detected in the Rio Grande and only at very low concentrations
  - -dilution? -degradation? -low source levels?
- There are no drinking water standards for these compounds
- The available data do not indicate a risk

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Do personal care products in the Rio Grande pose a risk?

- Shampoos, detergents, perfumes, etc.
- No published data on these compounds from the Rio Grande
- No evidence to indicate that these products in drinking water sources pose a health threat to consumers

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Endocrine disruption: how was this accounted for?

- The noncancer hazards for all age groups were < 1.0 for all COIs
- Endocrine disruption is accounted for in the calculation of the hazard index
- Therefore, there is no risk of endocrine disruption from consumption of Rio Gande water

Nanoparticles

- NP have been around for millions of years (e.g., soot from fires)
- There is recent interest in *man-made* NP

  - used in commercial products such as coatings, foods, sunscreens, medicinals

  -inhalation is the primary pathway of interest (ultrafines)

  -risks, if any, are unclear and are just now being evaluated

Nanoparticles

- Nanoparticles aggregate into larger particles in the environment
- Any nanoparticles would have been captured in the water analyses
- There are no analyses specific for nanoparticles
- There is no evidence to indicate that nanoparticles in sediments and water pose a health threat

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Sediment Chemistry at E110

- NMED and LANL report validated sample results for a single storm, samples taken within an hour of each other, for $Pu^{239/240}$ that differ by 100 fold.
- There is no way to determine why the difference exists.
- Concerns regarding COI's in LACW suspended sediments are valid.
- Early warning to BDD is appropriate.

Question & Answer Session

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