Summary of Qualifications:
Copper Mine Rule

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Summary of Qualifications - 2
- Relevant NM Boards & Committees
  - NM Mining Commission: 2000-2003
  - Underground Storage Tank Committee: 1990-1999, 2009-2010
  - Wastewater Technical Advisory Committee: 2009-Present
- Professional engineering licensure in NM

Areas of Testimony
- Water resources and demand in southwestern NM:
  - Will show the importance of ground water resources to
    region
  - Challenges of treating high salinity ground water:
    - Will show that a large fraction of contaminated water cannot
      be recovered for future use

Summary of Ground Water Resources of Southwestern NM
- 90% of potable supply of water (water for consumption) is
  from ground water sources
- Importance was recognized early by state leaders resulting
  in passage of some of the most comprehensive ground
  water protection laws and regulations in the country
- ~100% of the potable supply in the southwestern NM planning
  region is from ground water
- Grant County ground water use
  - Potable use = 16%
  - Mining use = 69%

Projections for Future Potable Demand
- Projected gap between supply & demand (including evap &
  mining) for 2040 for high & low growth scenarios
- Current Grant Co. demand ~ 5,000 A/yr
Studies to Identify Ground Water Resources for Development

- Johnson et al. (2002) – GW development study to meet future demand
- Romero & Cook (2009) – Study of enhanced recharge to augment supply
- Cudby, A.B., Keyes, E. (2011) – GW model of Mimbres basin
- DBS&A (2005) – Regional water plan

- Many inconsistencies between reports that are summarized by NRC (2010) in their “Supply & Demand Carlsbad Resort” noted by Mr. Bunnell in his rebuttal testimony
- However, all reports show falling water levels in public supply wells throughout region at typical rate of 5 – 75 ft/yr
- Conclusion is that GW resource is limited & new sources of supply are needed

Sources of Supply that Have Been Considered

- New wells and/or improve capacity of existing wells (Johnson, OKE Report 03-04)
- Use of treated mine water (Roeske, 2007)

Impacts of Climate Change

- None of the studies reviewed for this testimony address reduced water supply as result of climate change
- Climate scientists predictions for New Mexico (Guitera 2012; BOR 2011):
  - Little change in annual precipitation
  - Warming of 1 – 2°C by 2050
- Consequences:
  - Earlier spring runoff
  - Longer growing season hence greater urban & ag demand
  - Increased evapotranspiration
- Conclusion: Significant net decrease in water supply by 2050

BOR Projections on Rio Grande

Nature of Contamination from Copper Production

- Principal source of contamination is oxidation of sulfide minerals
  \[ \text{FeS}_2 + \text{H}_2\text{O} + \text{O}_2 = \text{Fe}^{2+} + 2\text{H}^+ + \text{SO}_4^{2-} \]
- Generals acidic low pH water
- Characteristics:
  - High concentrations of TDS, sulfate and other constituents
  - Acid may leach toxic metals from soil minerals if present

Characteristics of Contaminants

- Major contaminants – regulated concentration > 100 mg/L
  Examples:

- Minor (trace) contaminants – regulated concentration < 10 mg/L
  Examples:
Treatment Alternatives - 1
- Minor (trace) contaminants
- Well-established technologies similar to those used for industrial treatment
- pH adjustment
- Chemical precipitation
- Sedimentation and/or filtration
- Cost effective
- Produce small volumes of waste which are easy to manage
- Wastes little water

Treatment Alternatives - 2
- Major contaminants
- Requires desalinization process – RO, distillation, etc.
- Desalinization of ground water is difficult
- Expensive & complicated
- Energy intensive
- Generates a large volume of concentrate (i.e. brine) that is difficult to dispose of
- Recovers only 50 – 75% of feed water
- Example: Kay Bailey Hutchison plant in El Paso, TX
- Treats ground water with TDS = 3,000 mg/l
- Recovers ~60% of feed water
- Concentrate is piped 20 miles to deep well injection field

Consequences of Treatment
- Long term expense
- Permanent loss of large fraction of underlying ground water resource
- Production of high salinity waste stream that is difficult to manage

NM Case Study - 1
Homestake Uranium mill near Grants, NM
- Operated from 1958 to 1990
- Used both acid-leach & alkaline-leach to extract U from crushed ore
- Tailings disposed in unlined pits 200 acres 85–100 ft. high
- 5 nearby subdivisions
- Homestake provided alternate source of water in 1985

NM Case Study - 2
- Homestake site placed on NPL in 1982
- Remediation consists of interceptor wells to capture contaminants and treated water injection wells to modify hydraulic gradient
- Treatment by RO & brine evaporation

NM Case Study - 3
- Q: "Will the community south of the Homestake site ever be able to use the ground water again?"
  A: "It is unlikely that the ground water in the alluvial and Chiricahua aquifers will ever meet the drinking water standards of the State of New Mexico or EPA without adequate water filtration."
  -EPA Fact Sheet (2011)
- Two points
  - The Homestake site demonstrates the impacts of poor management and the difficulty of remediating the problems once created
  - It seems almost certain that if ground water protection criteria are relaxed for coppper production other mining operations will demand and likely receive similar accommodation.
Concluding Remarks

- I believe that mineral extraction and processing can be done safely and cost-effectively. Prevention is critical to success of environmental protection.
- "Consistent with sustainability principles, strategies for dealing with ARD should focus on prevention or minimization rather than control or treatment." - GARD Guide.
- I am concerned that the Copper Mine Rule as proposed for adoption by the WQCC:
  - Is not consistent with the WQA and will allow unnecessary ground water contamination.
  - Establishes precedent that substantially weakens ground water regulations for other industries subject to the WQA.