THE PUERCO RIVER: MUDDY ISSUES RAISED BY A MINE WATER DOMINATED EPHEMERAL STREAM

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Streams and rivers have long been receptacles for the disposal of industrial and domestic wastewaters. These streams generally offer immediate dilution of contaminants carried in the waste stream. With travel downstream, the contaminant load is further reduced by chemical and biological assimilative processing in the stream. Unless the natural assimilative capacity of the stream is exceeded, the wastewater may be discharged to a perennial stream with minimal effects on the environment.

With increased urbanization and industrialization, disposal of wastewater in ephemeral watercourses has increased correspondingly. Due to the naturally dry character of the channels, there is little, if any, recreation or naturally occurring aquatic life to be affected. On the other hand, because there is minimal in-stream dilution of the wastewater, the impacts on ground water may be more severe than from a discharge to a perennial stream.

I will discuss some of the environmental and regulatory problems associated with ongoing uranium mine wastewater discharges to a major ephemeral watercourse in northwestern New Mexico. Specifically, I will focus on discharges from the Church Rock Uranium Mining District to the Puerco River.

The Church Rock Uranium Mining District

The Church Rock Mining District represents one of three major active uranium mining locations in the Grants Mineral Belt--the predominant uranium production area in the United States. The Church Rock Mining District is located approximately 15 miles northeast of Gallup, New Mexico (figure 1). The district has been a significant producer of uranium ore since 1969.

Associated with production of ore is production of water. Because the principal ore-bearing zone (Morrison Formation) is also a regional aquifer, areas to be mined must first be dewatered. Much of the water thus removed is utilized to meet water needs in mines and mills. Excess water is disposed of in the channels of a formerly ephemeral stream--the Puerco River.

The Puerco River Watershed

The Puerco River, at an altitude of 6,000-7,000 feet, drains the southern Colorado Plateau in New Mexico and Arizona. Alternating mesas and broad alluvial valleys dominate the landscape. Upland areas are capped by resistant strata such as sandstone; river valleys have been excavated from less resistant formations such as shale.

Climate is temperate and semiarid. Owing to the aridity, lowland areas can only support a sparse ground cover of grasses and drought-resistant shrubs. At Gallup, annual precipitation is usually less than 15 inches. Most of this falls during the summer thunderstorm season of July through September. Winter frontal storms from December through March produce lesser amounts of precipitation.

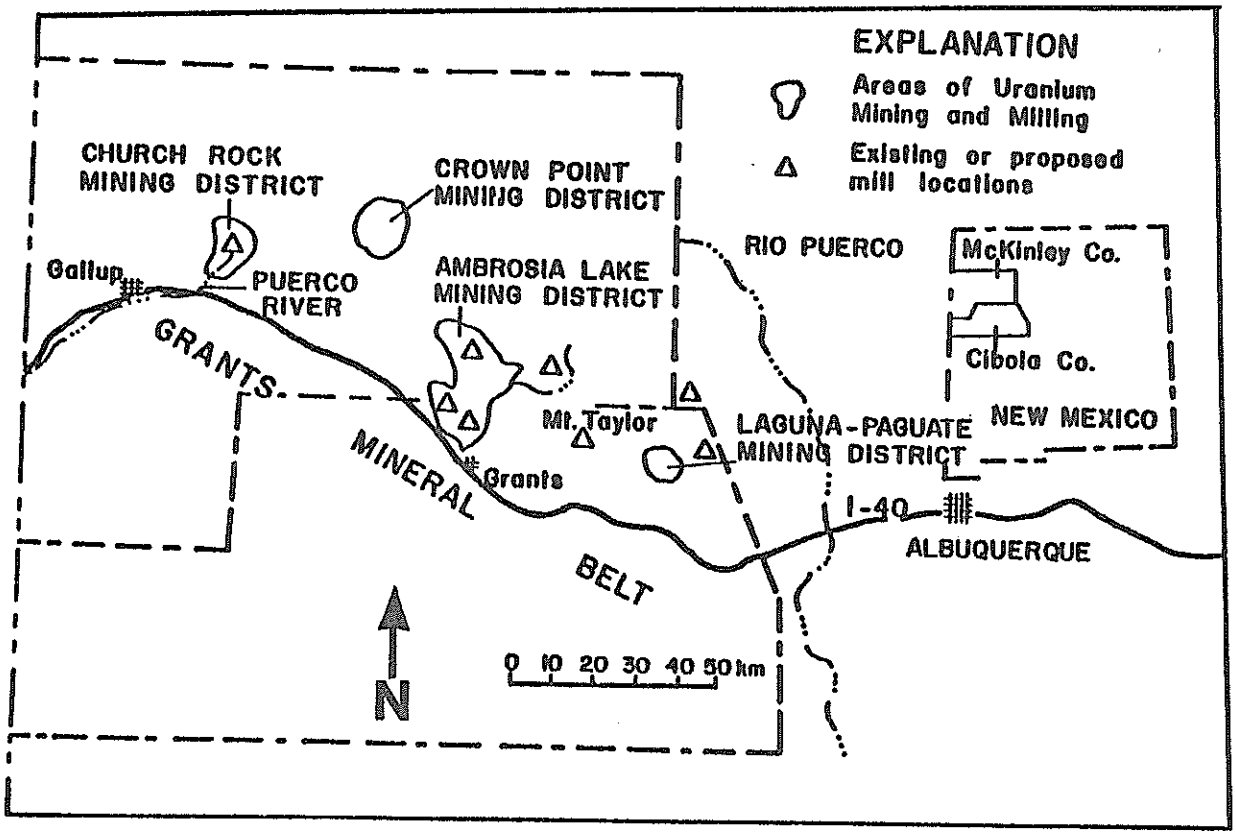

Fig. 1. Map of Grants Mineral Belt

Except for a few isolated springs and mountain streams, the Puerco River Watershed has no naturally perennial surface waters. Available records indicate that prior to uranium mine dewatering, the Puerco River was dry more than 70 percent of the time, flowing only during spring snowmelt and major summer thunderstorms. Since 1968, dewatering of underground uranium mines has caused perennial flow in the Puerco River.

Perennial conditions now exist from above Church Rock to about 15 miles beyond the Arizona border.

Water for livestock use comes from the now perennial Puerco River and from shallow alluvial wells. Prior to dewatering, livestock utilized water pumped from the wells and occasional surface water flows.

Regulatory Control of Uranium Mine Discharges

During 1982, Church Rock mines continuously discharged nearly 5,000 gallons per minute of mine dewatering effluent to the Puerco River. Prior to discharge, the mine water flowed through a series of ponds wherein most of the contaminants settled. Elevated levels of uranium or radium were subsequently reduced by ion exchange treatment.

Before the mid-1970s, none of the mine discharges in Church Rock were effectively regulated. Since 1979 however, all discharges to the Puerco River have been under the regulatory control of the federal National Pollutant Discharge Elimination System (NPDES) administered by the U.S. Environmental Potection Agency. (See discussion of NPDES program in the panel "Protection of Water Quality in Mountain Streams.") The NPDES permit sets concentration limits for some contaminants normally associated with a particular type of discharge. For uranium mine effluents, the concentrations of uranium, radium, total suspended solids and pH are controlled by NPDES. Overall, the mines are in compliance with their NPDES permits.

Although the quality of water discharged from the mines is regulated, the quality of water in the Puerco River itself is subject to little regulatory control in New Mexico. Because of its ephemeral nature, the Puerco River has no designated uses. Therefore, there are no specific

stream standards applicable to that channel except the narrative general standards applicable to all surface waters of the state (1).

Arizona, to the contrary, has determined that the Puerco River in Arizona should be protected for aquatic life, wildlife, irrigation and livestock (2). Eighteen numerical standards have been developed for metals, radionuclides and nutrients. While these are not effluent limits per se, they could be used as such. All in all, the NPDES permit system represents the primary method for regulating the quality of uranium mine discharges. It is of particular importance to note the following points regarding NPDES:

1. NPDES permit limits are adopted based on treatment technoloy considerations rather than on health and water quality considerations. This can cause a situation in which a mine discharge is in compliance with all permit limits, but is not suitable for livestock watering, which routinely occurs along the Puerco River.

2. Only a few of the many radionuclides and metals present in untreated mine waters are regulated under the NPDES permit.

Mine dewatering effluents now constitute the entire flow of the Puerco River during dry weather. However, the contaminants in the flow need not be derived exclusively from the discharges. This is due to the geochemical and geomorphic processes operating within the Puerco River system.

Sediment in the Puerco River Valley is largely comprised of silt and clay sized particles. Due to the lack of vegetation in the valley, these materials are readily eroded and available for transport by streamflow. Silts and clays preferentially attract contaminants such as metals or

radionuclides; the quality of whole water in the Puerco River, therefore, may worsen with increased amounts of suspended sediment.

Figure 2 compares ranges of contaminant concentrations in (1) natural runoff (high suspended sediment load) in areas within the Puerco River Watershed unaffected by industrial activities with (2) mine water dominated flow in the Puerco River during dry weather. The following points deserve highlighting:

1. Lead concentrations in natural runoff usually greatly exceed limits and guidelines established for livestock (3) or drinking waters (4). These concentrations are directly related to the concentrations of sediment carried with the water. In periods of low flow, the amount of lead in the Puerco River is at an acceptable level. Lead levels during low flow, however, are still 10 times greater than levels found in mine waters.

2. The gross alpha radioactivity concentration is a general indicator of the total amount of alpha radioactive emissions from a material. The gross alpha concentrations in natural runoff, while less than in the mine water dominated flow are likewise far greater than some established guidelines. Uranium (represented by crosshatching) is largely absent in natural runoff, but dominates gross alpha radioactivity levels during low flow conditions. The remaining amount of activity is probably derived from natural material present in the Puerco River channel.

Issues

A recent Environmental Improvement Division (EID) report (5) noted that the Puerco River contains levels of radioactivity and certain toxic metals that approach or exceed standards or guidelines designed to protect the health of people, livestock and agricultural crops. Parameters that routinely exceeded one or more criteria were barium, manganese, molybdenum, lead, selenium, radium, and gross alpha and beta radioactivity. As a result, the EID recommended that the Puerco River not be used

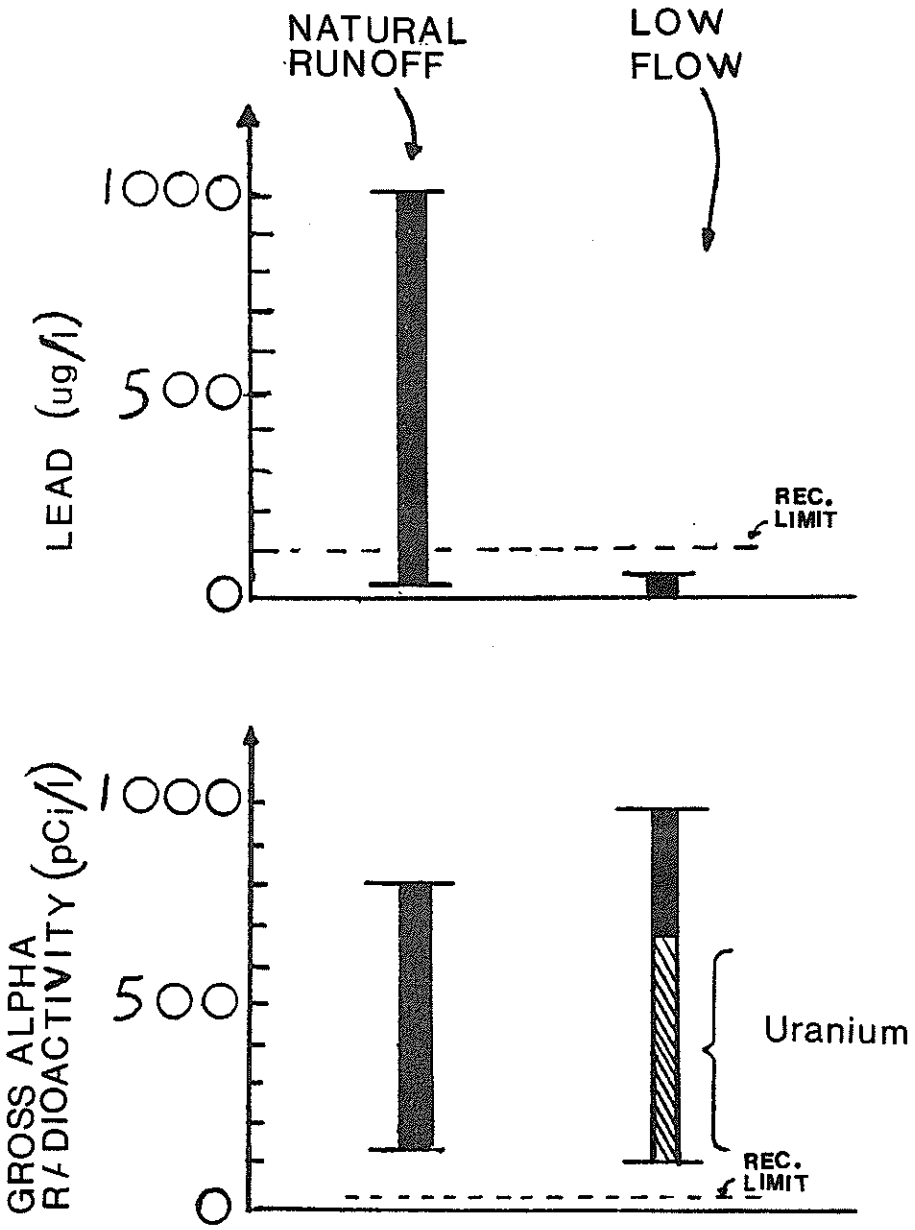

Fig. 2. Ranges in contaminant concentrations within the Puerco River Watershed versus recommended limits (3, 4). Natural runoff in areas unaffected by mining activities; low flow in Puerco River during dry weather mine water dominated condition. Crosshatching represents the range directly attributable to the mine water discharges.

as a primary source of water for human consumption, livestock watering or irrigation.

A conventional approach to rendering a stream suitable for use might be to impose stricter effluent limits on discharges to that stream. However, that approach may have limited value on the Puerco River.

Data collected within the Puerco River Watershed suggest that no level of improvement in effluent quality would render the river totally suitable for livestock watering, the predominant use of the river. In short, the uranium mines could be discharging distilled grade water but the Puerco River still may be unsuitable for livestock watering due to the natural pickup of the contaminant-laden sediment with travel downstream. Livestock drink water directly from the channel and inadvertently ingest these contaminants.

The above factors indicate that water pollution control of effluent dominated ephemeral streams presents unique problems. Perhaps the best that we can hope for in these settings is that the effluent <u>at the point of release</u> is suitable for the predominant downstream use. It may prove more difficult to convince local residents that the water downstream of the discharge point is not suitable as the primary source for livestock watering.

REFERENCES

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