

SOUTHWEST RESEARCH AND INFORMATION CENTER
P.O. Box 4524 Albuquerque, NM 87106 505-262-1862 FAX: 505-262-1864

October 22, 2007

Arthur Kellermann, MD, MPH
Health Policy Fellow
Committee on Oversight and Government Reform
U.S. House of Representatives
2157 Rayburn House Office Building
Washington, DC 20515

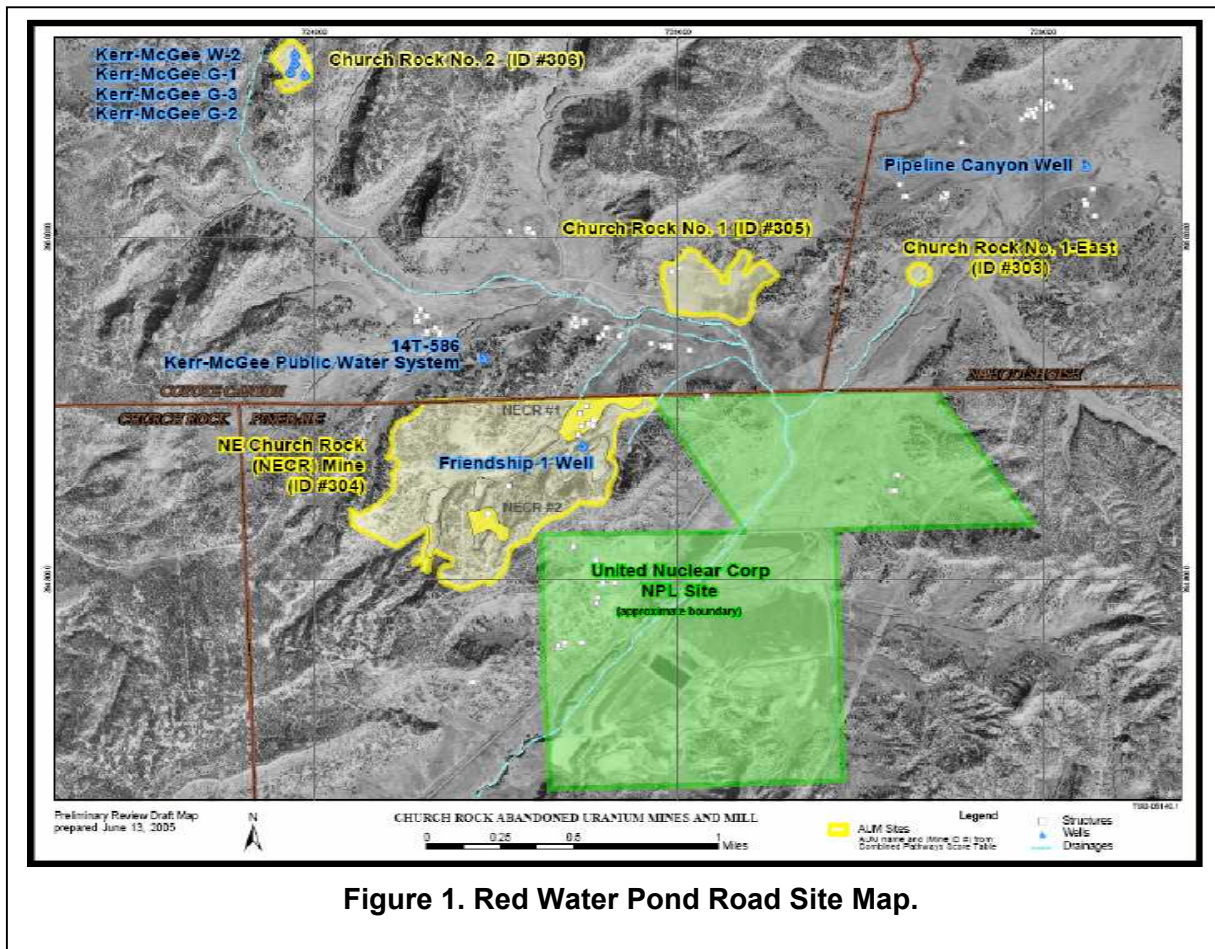
Re: **Summary of Recent Environmental Monitoring Data in the Church Rock Uranium Mining District, Navajo Nation (McKinley County, New Mexico)**

Dear Dr. Kellerman,

You asked that I summarize the results of recent environmental monitoring in the Church Rock Uranium Mining District to supplement the testimonies of the Navajo Nation at the Committee's hearing on Navajo uranium issues on October 23. Specifically, you requested that I provide data on contaminant levels, with comparisons to background, for recent investigations in the residential areas near the homes of Navajo citizens Larry J. King and Edith Hood who are providing testimony at the hearing. The requested information is provided in this letter.

Red Water Pond Road Area

Fourteen residences are located in this V-shaped valley in Coyote Canyon Chapter of the Navajo Nation, immediately north of the 1880 Executive Order Navajo Reservation boundary. The area takes its name from the rural dirt road that bisects the valley, and is shown in the map marked **Figure 1**. The surface facilities associated with two large underground mining complexes occupy sites on both sides of the valley: The Northeast Church Rock (NECR) Mine, which was operated by United Nuclear Corporation (UNC) between 1968 and 1982 and covers about 150 acres on a mesa to the south of the residential area; and the Church Rock 1 (CR-1) Mine, which was operated by Kerr McGee Corporation (KMC) between 1972 and 1986 and covers about 80 acres on a ledge on the northeast side of the valley. In the aerial photo and map of homesites, shown below as **Figure 2**, Ms. Hood's home is Site #1 and is located about 1,300 feet north of the NECR Mine and about 1,000 feet west of the CR-1 Mine.



Closure activities at the UNC/GE mine consisted of removing buildings, sealing shafts, and removing uranium mill tailings that had been brought to the site for disposal from the UNC uranium mill located 1 mile east and southeast of the mine (**Figure 1**). Waste dumps at the site are still uncovered and unreclaimed; they form a bench about 50 feet high and are between 500 and 600 feet from the nearest Navajo residence, which is shown in **Figure 3** below.

Environmental assessments in the residential area were initiated in October 2003 as part of the Church Rock Uranium Monitoring Project (CRUMP), an assessment program sponsored by Churchrock Chapter, coordinated by Southwest Research and Information Center (SRIC), and involving community members and technical staff of the Navajo Environmental Protection Agency (NNEPA), U.S. Environmental Protection Agency (USEPA), Navajo Nation Abandoned Mine Lands Reclamation Department (NNAML), and the Tribal Air Monitoring Support (TAMS) Center, among others. Gamma radiation surveys were performed by personnel from USEPA's Radiation & Indoor Environments laboratory in Las Vegas, Nevada, using truck-amount sodium-iodide detectors that can "scan" the ground surface up to 200 feet from the van. As many as a dozen individuals from organizations and agencies affiliated with CRUMP surveyed the ground surface using Ludlum Corp. Model 19 detectors.

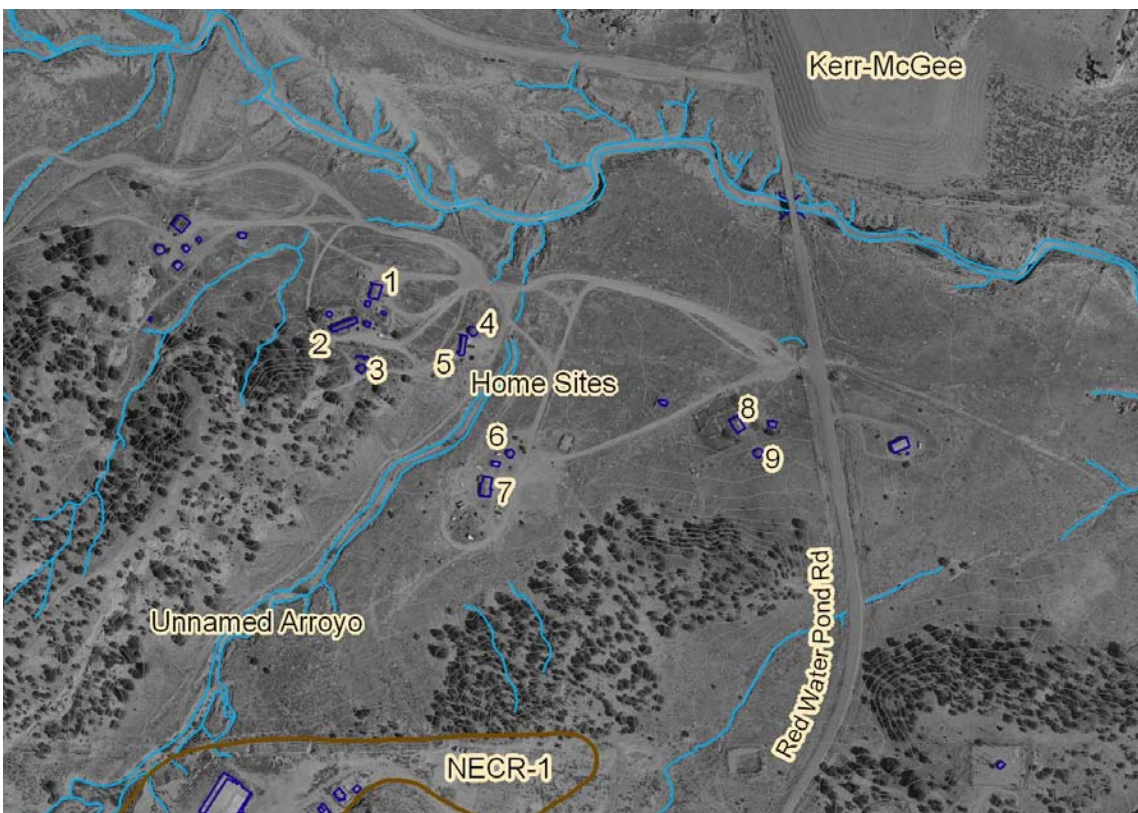


Figure 2. Map of homesites on Red Water Pond Road.



Figure 3. Navajo residence within 600 feet of NECR Mine waste dump, 2005.

During the CRUMP surveys, gamma rates ranged from 10 to 15 microRoentgens per hour ($\mu\text{R/hr}$) in areas of the community not observed to have been impacted from human sources of radiation, particularly uranium ore or uranium mine wastes. Gamma rates increased as the survey teams moved closer to the north face of the NECR Mine waste dump, ranging from 30 $\mu\text{R/hr}$ around the home pictured in **Figure 3** to 300 $\mu\text{R/hr}$ at the base of the waste dump. Gamma rates in an unnamed arroyo that was the conduit for discharges of mine water during the mining operations ranged from about 25 $\mu\text{R/hr}$ 1,000 feet from the waste dump to 120 $\mu\text{R/hr}$ within 150 feet of the dump. This arroyo, which can be seen in Figure 2 between several homes, is the same arroyo that Ms. Hood testifies that she and other children played in during past mining operations.

Based on previous gamma surveys in the Churchrock area, and on standard radiation assessment practices used by USEPA and other federal agencies, the CRUMP team determined that any gamma rate more than two times the upper end of gamma levels determined for non-impacted areas was considered to be impacted by mining activities. Accordingly, the gamma rate at which mining-related impacts were postulated is 30 $\mu\text{R/hr}$. Surface soils in the area between the NECR waste pile and the nearest residence consistently exceeded this rate.

In 2004 and 2005, further soil assessments were performed in the Red Water Pond Road area by collaborators with CRUMP and the Diné Network for Environmental Health (DiNEH) Project, a capacity-building health study funded by the National Institute of Environmental Health Services (NIEHS). Partners in the DiNEH Project are the University of New Mexico's Community Environmental Health Program, the Eastern Navajo Health Board, and SRIC. CRUMP and DiNEH personnel collected more than 50 soil samples in the RWPR area north of the NECR Mine. The samples were analyzed for uranium and other heavy metals at the Stanford University Environmental Engineering laboratory.

Results of the CRUMP/DiNEH uranium-in-soil analyses are shown in **Table 1**. The range of uranium concentrations in soils in the Churchrock area not impacted by uranium mining was 0.3 to 2.61 parts per million (ppm), milligrams per kilogram (mg/kg), and the range of uranium concentrations in non-impacted soils in the Red Water Pond Road area away from the abandoned mines was 0.3 to 1.64 ppm. The averages of these "background" levels were similar — 0.87 ppm and 0.81 ppm, respectively — and are easily within the range of published literature values for the average crustal concentrations of uranium.

By comparison, uranium levels in soils in the Red Water Pond Road impacted area were considerably higher than both the average concentrations and upper ends of the ranges of regional and local background values. As shown in **Table 1**, average uranium concentrations in the RWPR impacted area were 26 to 40 times *greater than* the average of both regional and local background. Maximum concentrations of uranium were up to 100 times greater than local background and occurred within 100 feet of the nearby Navajo residence. Of the 50 soil samples tested in the impacted area, 56 percent exceeded the USEPA's Preliminary Remediation Goal (PRG) for uranium (16 ppm) in residential areas and 72 percent exceeded the upper end of the regional background value of 2.61 ppm. Clearly, the soils near Navajo residences in the

Table 1.
Comparison of Uranium-in-soil Concentrations (mg/kg, or ppm)
in Red Water Pond Road Residential Area with Local and Regional Background
(from George, et al., 2006 and CRUMP, 2007)

Area	No. Samples	Range U concentrations	Average U \pm Std. Dev.
Non-impacted sites in Churchrock area	68	0.3 – 2.61	0.87 \pm 0.43
Non-impacted sites in RWPR area	9	0.3 – 1.64	0.81 \pm 0.47
Impacted RWPA area: surface soils <12" deep	38	0.3 – 88.7	21.4 \pm 21.7
Impacted RWPA area: subsurface soils, 18"-36"	12	0.48 – 72.0	32.8 \pm 23.1
USEPA residential PRG for uranium (ppm)		16	
% samples > residential PRG		56%	
% samples > regional "background"		72%	

Red Water Pond Road area were contaminated with much higher-than-normal levels of uranium.¹

The CRUMP and DiNEH Project results were communicated to NNEPA and USEPA. In January 2006, USEPA Region IX announced that it was initiating a "time-critical" removal action under federal Superfund authority (formally, the Comprehensive Environmental Response Compensation and Liability Act, as amended) to conduct remediation at the NECR Mine site. Pursuant to provisions of an administrative consent order, contractors to UNC, in collaboration with NNEPA and USEPA staffs, conducted additional soil testing in the Red Water Pond Road residential area and on the NECR Mine site in November 2006, and reported the reports in March and May of this year. Results for Radium-226 soil concentrations, converted from static gamma radiation surveys, are shown in **Table 2** below.

Table 2.
Ra-226 Soil Concentrations Calculated from Static Gamma Surveys
Northeast Church Rock Mine Site and Off-Mine Site/Residential Area
(Source: MWH, 2007)

	Mine Site	Off Mine Site/Residential Area
# Locations	10	9
# Samples	853	45
Range Ra-226 (pCi/g)	<0.6 – 498.3	<0.6 – 11.0
Range Ave. Ra-226 by location (pCi/g)	5.6 – 45.8	<0.6 – 5.3
Range of local "background" for Ra-226	NA	<0.6 – 1.0
USEPA residential screening level for Ra-226	2.24	2.24

¹ These data also show that uranium concentrations increase with depth in the soil column. This finding is consistent with result studies by DiNEH Project collaborator Jamie deLemos (DeLemos, et al., 2007) indicating that uranium is highly soluble in water and therefore downwardly mobile in the soil column.

High concentrations of radium-226 — which has been documented to cause bone cancer in humans — were detected on both the mine site and in the residential area. Based on the radium concentration of soils around local homes, USEPA initiated an emergency soil removal action around several homes in the area in May (USEPA, 2007). More than 5,000 cubic yards of contaminated soils up to 12 inches deep were excavated and replaced with clean topsoil. Four affected families spent 7 to 10 days in hotels in Gallup while crews conducted cleanup work in their neighborhood.

UNC's consultant's sampling also revealed high concentrations of uranium and arsenic in soils on the mine site and in the residential area. Average uranium concentrations in surface and surface samples exceeded local background by more than 100 times and exceeded the residential PRG by more than five times.

Collectively, the environmental investigations in the Red Water Pond Road since 2003 have demonstrated what many of the residents have known for decades and what we in public health organizations have suspected for many years — that environmental contaminant levels are pervasive and unsafe for human exposure. USEPA's soil removal in May and June helped to mitigate exposures, but it was not a comprehensive response to the problem that exists in the community. In essence, many residents are still living in a contaminated environment.

Old Churchrock Mine Area

As indicated in his written testimony for the October 23 hearing, Mr. King's home and grazing lands are located in Churchrock Chapter adjacent to an abandoned uranium mine called the Old Churchrock Mine (OCRM). Environmental investigations were conducted on and around this facility in 1987 by Hydro Resources, Inc. (HRI), which has since been licensed by the U.S. Nuclear Regulatory Commission (NRC) to construct and operate a uranium *in situ* leach (ISL) mine on the mine property (Section 17) and on an adjacent quarter section of land (Section 8). Investigations by CRUMP in 2003 and by NNEPA's Superfund Program in 2006 confirmed Mr. King's suspicion that releases from the mine site have increased surface radiation levels on both sides of a public highway and on his grazing land.

Table 3 below shows gamma radiation levels on and around the OCRM site, partitioned into "non-impacted" and "impacted" areas. CRUMP's 2003 surveys established that gamma radiation levels in non-impacted areas ranged from 10.7 to 13.2 $\mu\text{R/hr}$, based on extensively monitoring in two areas not affected by uranium mining. These rates are slightly lower than the average background rate of 16.7 $\mu\text{R/hr}$ derived from data HRI's 1993 environmental report (HRI, 1993). By comparison, average gamma rates on both sides of State Route 566 and on Mr. King's grazing land were more than two times the background rates, and maximum gamma rates were more than 16 times background. Analyses by CRUMP investigators (CRUMP, 2007) indicate that spillage of ore from trucks during the operational periods of the mine (1960-62 and 1977-1982) may explain the elevated gamma levels along Highway 566. And wind deposition of contaminated materials from the mine site is the likely cause of the high gamma rates on Mr. King's grazing land.

Table 3.
Comparison of Results of Gamma Radiation Surveys
Around Old Churchrock Mine, T16N, R16W, Sections 8 and 17
Churchrock Chapter, Navajo Nation

Area	Survey Year	# Data Points	Range of Gamma Rates (uR/hr)	Average Gamma Rate
Non-impacted areas (“background”)				
Outside of mine site fence	1987 (HRI, 1993)	19	10-21	16.7±2.9
Church Rock Chapter House and vicinity	2003 (CRUMP, 2007)	63	8-15	10.7±0.21
Springstead Housing area	2003 (CRUMP, 2007)	326	8-25	13.2±2.0
Areas impacted or likely impacted by uranium mining				
Mine site (Sec. 17) and downwind area (Sec. 8)	1987 (HRI, 1993)	9	20-350	87.3±110.2
Arroyo bounding mine site on west	2006 (NNEPA, 2006)	At least 100	15-30 West bank 30-460 East bank	Data unavailable
Outside of mine fence, along SR 566	2003 (CRUMP, 2007)	321	12-120	34.5
On King grazing land, east of SR 566	2003 (CRUMP, 2007)	222	18-180	28

The extent of contamination on and around the site is still unclear. An August 2006 survey by NNEPA personnel revealed a maximum gamma rate of 460 μ R/hr on the mine side of a publicly accessible arroyo that borders the western side of the OCRM site (NNEPA, 2006). This level was more than 35 times the upper end of regional background. Further assessment of the site by NNEPA was conducted earlier this year, and the results are pending.

HRI’s 1987 investigation also revealed the presence of high levels of uranium, radium-226, lead-210 and thorium-230 on the OCRM site and on parts of adjoining Section 8. Data in Table 4, derived from HRI’s 1993 environmental report, show a wide range of both uranium and radium-226 concentrations on the mining-impacted portions of both properties. Average concentrations in the impacted areas reflect large variances in the data due to this spread. Nonetheless, the average impacted-area concentrations exceed the average levels for the non-impacted areas by nearly two orders of magnitude for uranium and more than 40 times for radium-226.

Like the data for the Red Water Pond Road area, environmental data for the area around Mr. King’s residence clearly indicate that Mr. King, his two sisters and dozens of Navajo families who live within two miles of the OCRM site also live in a contaminated environment. Their individual and collective exposures to the contaminants at these abandoned mines are chronic. No public health study has ever been conducted in the Church Rock Uranium Mining District. The DiNEH Project’s health study will help address this gap in knowledge, but its primary

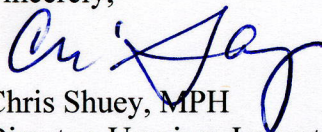
Table 4.
Uranium and Radium-226 in Soils
Around Old Churchrock Mine, T16N, R16W, Sections 8 and 17
Churchrock Chapter, Navajo Nation
(all data collected in 1987, reported in HRI, 1993)

Area	Statistics	Uranium (ppm)	Ra-226 (pC/g)
Non-impacted (Sections 8 & 17 combined)	N	23	23
	Ave. ± Std. Dev.	2.9±0.8	1.1±0.3
	Minimum	1.7	0.5
	Maximum	5.3	1.8
Impacted (Sections 8 & 17 combined)	N	11	11
	Ave. ± Std. Dev.	160.8±213.3	48.4±77.2
	Minimum	5.5	2.4
	Maximum	650.0	241.0

outcome of interest is kidney disease because of uranium's well-established renal toxicity. As such, the DiNEH study may provide insight into part of the public health problem that affects Edith Hood, Larry King and their neighbors. Congress should appropriate funds and enact legislation that ensures that a complete picture of the public health impacts of 60 years of uranium development in Navajo Indian Country is achieved as quickly as possible.

Attached hereto are references cited in this letter. Please do not hesitate to call me for more information or to obtain copies of the documentation cited herein. I appreciate the opportunity to assist the Committee in this important initiative to obtain justice for the Navajo people.

Sincerely,



Chris Shuey, MPH
 Director, Uranium Impact Assessment Program
 Southwest Research and Information Center

REFERENCES

CRUMP, 2007. Church Rock Uranium Monitoring Project. Report of the Church Rock Uranium Monitoring Project, 2003-2007. Principal authors: C. Shuey and M. Battista. Churchrock Chapter and Southwest Research and Information Center. May 2007.

DeLemos, et al., 2007. DeLemos JL, Menache M, Brugge D, Durant J, Bostick B, Rock T, George C, Lewis J. Powerpoint presentation: Geochemical controls on uranium mobility to inform human health exposure assessment in the Church Rock Mining District: Navajo Nation, NM. August 2007.

George, et al., 2006. George C, Lewis J, Shuey C. Powerpoint presentation: Church Rock Report — Soil Sampling Assessment. DiNEH Project and Church Rock Uranium Monitoring Project. August 20 and 27, 2006; revised March 2007.

HRI, 1993. HRI, Inc. Churchrock Project. Revised Environmental Report (Sec. 2.9, Figure 2.9-1, Table 2.9-1). March, 1993.

MHW, 2007. Removal Site Evaluation Investigation Results. Northeast Church Rock Mine Site, United Nuclear Corporation. Powerpoint presentation, May 22, 2007.

USEPA, 2007. Allen H. Memorandum: Request for a Time-Critical Removal Action at the Northeast Church Rock Residential Site, McKinley County, New Mexico, Navajo Nation Indian Reservation. U.S. Environmental Protection Agency, Region IX (San Francisco). April 18, 2007.