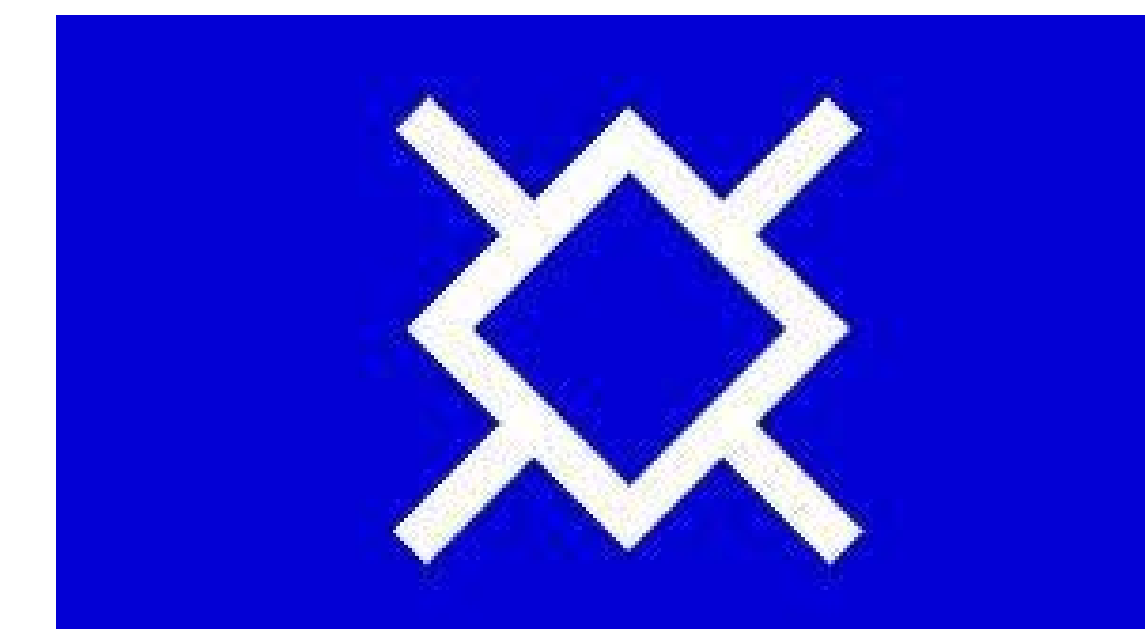


Perceptions of Water Quality on the Northern Cheyenne Indian Reservation

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Introduction:

Water contamination was often heard as a concern during conversations with Northern Cheyenne who lived on the Reservation in 2011 and 2012. A survey was suggested to determine perceptions of water of the Northern Cheyenne. Two different water issues surfaced on the Reservation. In two districts on the Reservation there is excessive calcium in the water, and in the other districts there is excessive iron in the water. Also many people use private wells and/or get drinking water from a different part of the Reservation than their place of residence. Awareness of these issues came about through use of the holistic process with contacts at Chief Dull Knife College in Lame Deer, Montana. Conversations were continued mainly through email and a Polycom conference. Further information was gathered from databases mainly focused on Environmental Sciences (Table 1). This project also initially built on previous work by former AGSC 465 student, Grant Neuens. Focus later shifted to use of asbestos cement (AC) pipes on the reservation in parts of the water distribution system.

Hypothesis:

Perceptions of water quality on the Northern Cheyenne Indian Reservation can be determined using a survey and will likely reveal widespread knowledge within the Reservation of multiple significant water contaminants in different geographical areas despite passing EPA standards.

Materials and Methods:

Through in-depth interviews with Northern Cheyenne living on the Reservation and a Polycom conference, we together determined that a survey of perceptions of water quality among the Northern Cheyenne community at Chief Dull Knife College would be helpful. A survey instrument was designed to gather perceptions. Peer refereed journals were used to supplement their information and learn from water quality issues experienced in other places.

Table 1. Search Matrix:

Databases	Key Words	Number of Hits
Water Resources Abstracts	water contamination	1754
	iron	28503
	calcium	19850
	contamination and iron	3166
	contamination or water and iron	19674
CSA Environmental Sciences	water contamination and iron and calcium	15
	ac pipe	11
Web of Science	ac pipe	128
Biological Abstracts	ac pipe	20
ToxNet	ac pipe	97



Figure 1. At Chief Dull Knife College (CDKC), Fred Blackwolf Jr., (Northern Cheyenne, CDKC water technician) showing experimental zeolite filters to Chris Preuninger, AGSC 465R student.

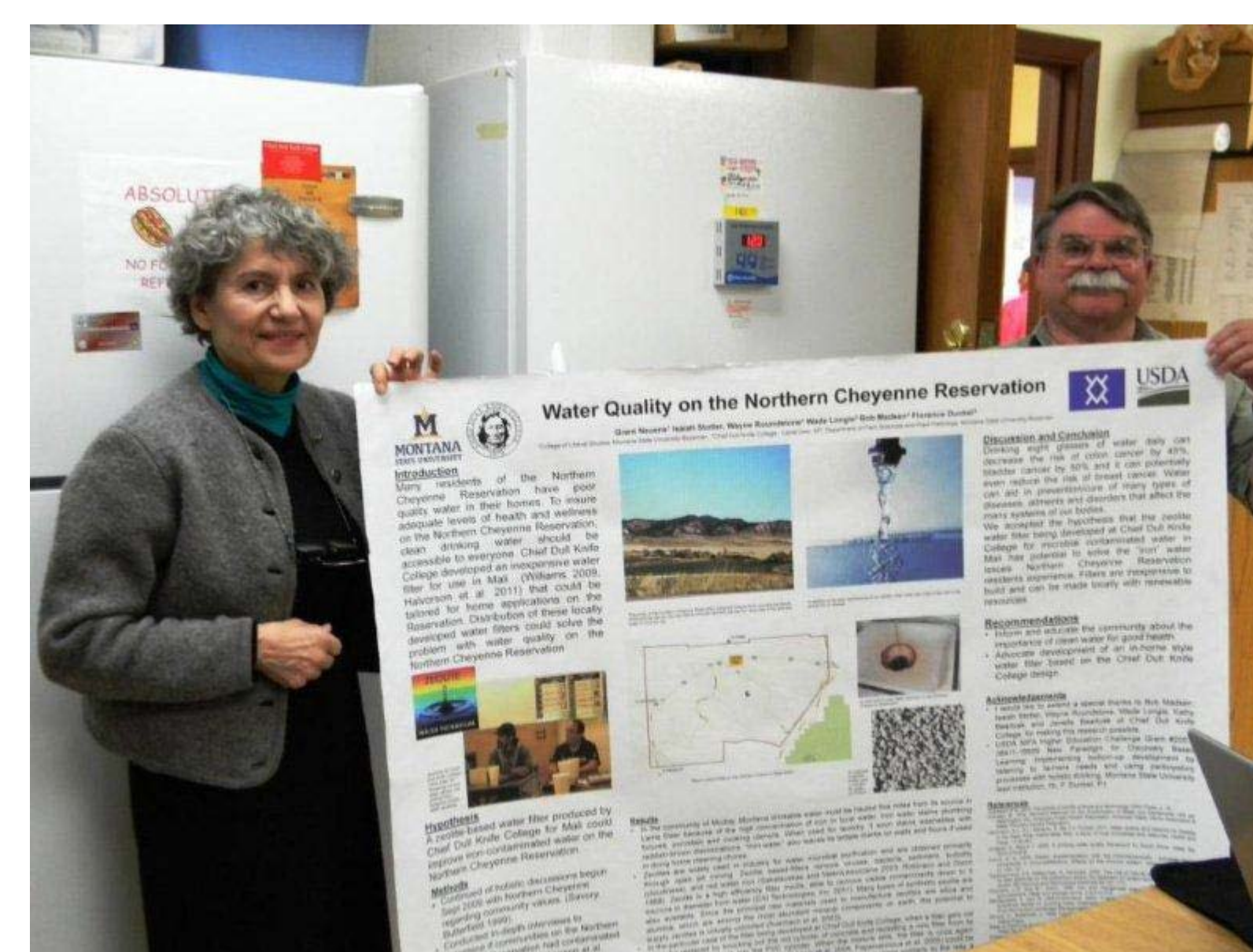


Figure 2. Bob Madsen receiving from Florence Dunkel co-authored poster of former AGSC 465 student Grant Neuens about possible application of CDKC zeolite filter research on the Reservation.

Survey Questions:

Demographics:

Please circle your age group:

Less than 18 years

18 - 25 years

25 - 30 years

Over 30 years

Do you live on the Northern Cheyenne Indian Reservation?

In which district do you live?

What is your profession?

Are you in school?

- Do you have a private well?
- How important to you is having access to clean water (for drinking and/or for other purposes)? (on a scale from 1 to 10, 10 being most important)
- Are you aware of any water contamination problem on the reservation?
- If so, what is in the water?
- Do you how this contaminant got into the water? If so, how?
- Is this problem specific to a district within the reservation?
- How did you become aware of what was in the water? (Who or what informed you?)
- Has contaminated water, caused you any inconvenience(s)? (What inconvenience(s)?)
- How concerned would you be by a water contamination problem on the reservation? (on a scale from 1 to 10, 10 being most concerned)
- Is contaminated water one of your top 3 concerns on the reservation with respect to the quality of life? one of your top 5 concerns? top 10?
- If concerned, do you feel steps should be taken to remove the contaminant(s) from the water?
- How would you rate the importance of removal of any potential contaminants in the water? (on a scale from 1 to 10, 10 being the highest importance)
- Is there a cultural aspect to water that should be considered?
- Is there a spiritual aspect to water in Northern Cheyenne tradition that should be considered?
- Where do you get your drinking water? i.e. from a different location than your place of residence, and/or a different location than your water for other purposes?
- How clean do you think the water you use for drinking is? (on scale from 1 to 10, 10 being cleanest)
- How clean is water you use for other purposes? (on scale from 1 to 10, 10 being cleanest)
- Do you feel these are relevant, useful, or important questions to be asking? (And/or is there a question with respect to water on any part of the reservation you think should be asked or considered that hasn't already been?)



Figure 3. A failed AC pipe (Edwards 2005)

Results:

- Calcium deposits damage coffee makers and water heaters over time. Dishes at the college must be rinsed with store bought water (Madsen 2012, Blackwolf Jr. 2012).
- Iron is noticeable to taste, so some people drive to springs east of Lame Deer to get drinking water (Blackwolf Jr. 2012).
- Experiments with AC pipe and ingested asbestos are ultimately inconclusive due in part to flawed experiment techniques and to difficulties with "long-term surveillance of exposed populations considered at risk of environment cancer" (Condie 1983, p. 8; Sigurdson 1983, p. 61).

Discussion:

Before survey responses were gathered my contact on the Reservation, Bob Madsen, biology faculty member at Chief Dull Knife College, passed away unexpectedly. Speculation of potential results was trivialized in these circumstances. Without survey data, it was necessary to focus on the AC pipe which was first mentioned in an interview as a personal concern (Blackwolf Jr. 2012). It is important to reiterate that, according to our Northern Cheyenne collaborators, water on the Reservation passes EPA standards. Valuable future experiments should investigate differences in how inhaled and ingested asbestos are processed (DHHS Committee to Coordinate Environmental and Related Programs. 1987, p. 253).

Conclusions:

There are no conclusions to be drawn at this point from the survey obviously, and the AC pipe is difficult to summarize other than to say there are many conflicting reports, and both risks and possibly effective solutions to guard against perceived risks. And that begs the question of what are perceptions of the risks/benefits of AC pipe in water distribution systems on the Northern Cheyenne Reservation?

Recommendations:

- Further study and cooperation should be undertaken between MSU students and the students and faculty of Chief Dull Knife College regarding issues of water quality on the Reservation.
- AGSC 465R students have a responsibility to: listen to their counterparts on the Reservation; learn the holistic process; use effective research methods; and provide assistance in whatever way possible.
- After some time passes, possibly continue the study of perceptions of water quality on the Reservation, including the AC pipe.

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