RESPONSES TO STATEMENTS FROM
NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY HEARING
CBR CLASS III PERMIT - NTEA
June 22, 2011

On June 22, 2011, the Department held a public hearing in Crawford, Nebraska regarding the Department's preliminary decision to issue a Class III Underground Injection Control permit to Crow Butte Resources, Inc (CBR). The purpose of the hearing was to listen to public comment about the proposed permit to allow Class III injection wells and mineral production wells to operate in an area north of Crawford, called the North Trend Expansion Area (NTEA). Eight individuals provided oral testimony, and three written comments were received. Below are responses to all questions and comments received.

1) ***How are baseline monitoring wells monitored in the North Trend area? Have any incidences occurred recently (i.e. breach of integrity of any wells within the month)? Does CBR know where their baseline monitoring wells are located? If they do, why did they supposedly not know that a monitoring well was leaking, nor know where it was located?***

   For the purpose of the application, CBR installed monitoring wells in the NTEA to determine groundwater quality. These are not baseline wells as defined in the permit. These wells were only used to gather data for the application submission. Baseline wells are installed once a mining plan has been developed, and are used to determine pre-mining water quality. Baseline wells are not monitored during mining. Monitoring wells are used during the mining process to ensure that mining fluids do not migrate laterally or vertically outside the permitted area.

   There are not currently any baseline wells located in the NTEA. Once the permit is issued, baseline wells will be identified before mining begins. After delineation of a mine unit, monitoring wells, including baseline wells, will be installed no farther than 300 feet from the wellfield boundary, and no farther than 400 feet apart, in accordance with the permit requirements. One baseline well will be installed every four acres within the mine unit. After drilling is completed, the wells will be washed out and developed, either by air flushing or pumping, until water quality stabilization parameters (pH and specific

conductivity) are stable and consistent with the anticipated quality of the area. After development, wells will be sampled to obtain baseline water quality. For baseline sampling, wells will be purged before sample collection to ensure that representative water is obtained.

Baseline wells are used to determine the pre-mining water quality of a mine unit; therefore, all baseline water quality samples are collected prior to any mining activities in the mine unit. Initial samples from baseline wells will be collected three times, at least 14 days apart. Baseline water quality samples will be analyzed for the following parameters: arsenic, barium, cadmium, chloride, copper, fluoride, iron, mercury, manganese, nitrate as nitrogen, lead, radium, selenium, uranium, sulfate, zinc, pH, calcium, total carbonate, potassium, manganese, sodium, total dissolved solids, ammonia, molybdenum, nickel, and vanadium. The results of these samples will be used to set the restoration values for the mine unit.

Once the permit is issued, shallow (Brule Formation) and deep (Basal Chadron Formation) monitoring wells will be installed to monitor the movement of mining fluids both laterally and vertically. Pre-mining sampling of shallow and deep monitoring wells will be used to calculate upper control limits (UCLs). The wells will also be sampled three times at least 14 days apart. These will be analyzed for chloride, conductivity, and total alkalinity. Results from the samples will be averaged arithmetically to obtain a baseline value, as well as a maximum value, for determination of UCLs for parameter exceedance (formerly termed excursion) detection.

The exact location of baseline wells has not yet been determined for the NTEA; however, once permitted, CBR will have to submit plans and locations of proposed baseline monitoring wells for NDEQ approval prior to activating a mine unit. All wells will be surveyed using GPS equipment or acceptable land surveying equipment, and a database of all wells and their locations will maintained by CBR. This is the same practice used at CBR's currently operating facility southeast of Crawford.

Each well is tested for mechanical integrity after initial construction before it can be placed into service, after any work-over with a drill rig or servicing with equipment or procedures that could damage the well casing, and at least once every five years during

the life of the well, as required in Title 122, Chapters 18 and 20. This mechanical integrity test (MIT) is performed using a pressure-packer test method. To assure accuracy of the integrity tests, the field pressure gauges and a calibrated test gauge are periodically compared. Procedures for testing mechanical integrity are outlined in the permit. The MIT procedures have been approved by NDEQ for CBR's currently operating facility, and the same procedures are to be used at NTEA.

If a well fails the MIT, isolation techniques are used to determine where the leak occurred. When possible, a well that fails the integrity testing is repaired and the testing repeated. If the casing leakage cannot be repaired or corrected, the well is plugged and abandoned as required in Title 122, Chapter 35. All MIT records are submitted to NDEQ for review after the initial construction of a mine unit or wellfield.

In the past month, two wells at the existing Crow Butte Uranium Facility failed their MIT: Well I-968 in Well House 18, Mine Unit 5; and 3096 in Well House 36, Mine Unit 8. Well I-968, an injection well, failed approximately 20 feet below ground surface. Notification via telephone was made to the Department on July 18, 2011. A records review indicated that well I-968 was last tested for mechanical integrity on September 2, 2006, and had been last operated in February of 2011. Three monitoring wells were drilled using air within 20 feet down-gradient of the failed well. The monitoring wells were drilled to a depth of approximately 30 feet. No mining fluids were identified, and it was determined that there was no release to the environment. Furthermore, water sampling results from the nearest Shallow Monitor Well (SM5-4), which is approximately 150 feet from I-968, did not show any trends in water quality during or after the well was last operated. On July 27, 2011, a 10 foot long sleeve was set using a drilling rig to isolate the failure. The patch used a two packer assemblies on the bottom and one packer on the top of the sleeve. The well was then re-tested for mechanical integrity on August 1, 2011 to check the entire well interval. The well successfully passed the MIT. The Department did not require any further corrective action efforts.

Well 3096, a production well, failed approximately 40 feet below ground surface. Notification via telephone was made to the Department on July 18, 2011. A records review indicated that well 3096 was last tested for mechanical integrity on August 4, 2006, and it has been in service as a production well during a portion of the time since it

last passed the MIT. The water level of the production (Basal Chadron) formation is lower than the water level of the Brule Formation; therefore, if there was a leak in the casing of the well, water from the Brule Formation would enter the well, rather than Chadron Formation waters impacting the Brule Formation. The Department determined there could not have been a release to the environment, based on the water levels of both geologic formations. On July 26, 2011, a 30 foot long sleeve was set using a drilling rig to isolate failure. The patch used two packer assemblies on the bottom and one packer on the top of the sleeve. The well was then re-tested for mechanical integrity on July 28, 2011 to check the entire well interval. The well successfully passed the MIT. The Department did not require any further corrective action efforts.

The well failure event described by the Commenter as a leaking monitoring well involved a leak in injection well I-196 that was identified on March 29, 1996 at the existing Crow Butte Uranium Facility. During this event, lixiviant (mining fluid) went into the Brule Formation through a leak in the well casing of I-196 (an injection well), which constituted a violation of CBR's Class III UIC permit NE0122611. CBR calculated that approximately 300,000 gallons of fluid would have flowed down that well between the time the well was last tested for mechanical integrity and the time the leak was discovered, based on operation records. It is unknown exactly how much fluid actually escaped through the leak in the well casing. Most of the fluid would have taken the most conductive path, which is down the well and into the intended injection zone, and been recovered in the normal mining process.

On April 23, 1996, CBR sent a letter to the Department providing information about the leak, and describing the remediation efforts undertaken by CBR. The Department set up a delineation drilling and recovery process to determine where the fluids had moved. As part of the CBR-initiated remedial response effort, 16 wells were drilled radially from the well: four in each cardinal direction, spaced 50 feet apart. These wells were sampled to determine if lixiviant had impacted the Brule Formation. Based on water quality samples, the lateral extent of the affected area extended less than a 100 ft from the well. On May 28, 1996, CBR submitted an update to the Department on the drilling and recovery process. During the recovery process, the 16 wells were repeatedly evacuated to dryness, recovering 100,000 gallons over the course of the three-year drilling and recovery program.

The assistance of the University of Nebraska – Lincoln Conservation & Survey Division (CSD) was enlisted to determine whether the remedial response to the situation was appropriate and consistent with the general hydrogeologic nature of the Brule Formation. In their review, CSD looked at all of the technical documents submitted to the Department between the April 23, 1996 and October 24, 1996 concerning the contaminated area of the Brule Formation associated with the leak from I-196. They concluded, based on water quality data and geologic information, that the response was appropriate. The Brule Formation, which consists primarily of siltstone, is an aquitard with relatively low hydraulic conductivity in most of the area. Although the Brule Formation can have localized zones of higher hydraulic conductivity (channel sands and fracture zones), none of the data from the contaminated area suggested that higher conductivity type material (mining fluid) was present at this site. The CSD performed research on the Brule Formation at other sites, where they noted that vertical hydraulic conductivity can be much less than horizontal hydraulic conductivity. As a consequence, migration of fluid through the Brule Formation is even slower in the vertical direction. On August 19, 1999, the Department determined the area was returned to baseline conditions, and the remediation activities associated with this leak were ceased.

2) ***Where does the water in the aquifer come from? Why was the water coming out [of a well] without any outside pumping action? Is it an artesian well from the Chamberlain Pass (Basal Chadron) Formation, the same level as where the uranium is found?***

Monitoring wells within the NTEA area of review indicate that groundwater in the basal sandstone of the Chadron Formation generally flows from northwest to southeast. This aquifer contains the uranium mineralization proposed for mining in the NTEA. Monitoring wells screened in the basal sandstone of the Chadron Formation are known to be artesian, with flow at the surface at many locations within the NTEA. The permit includes a requirement for collection and disposal of any and all fluids escaping a well any time it is opened for any testing or servicing. Please see the response to Comment 3 regarding management of wastewater.

3) ***How does the facility contain their waste?***

The permit requires that all liquid waste streams shall be collected and retained in lined evaporation ponds, or disposed of in a permitted deep disposal well as approved by the Department. Well development water[1] will be captured in water trucks, specifically labeled for such purpose, and equipped with signage indicating that these trucks may only discharge their contents to the lined evaporation ponds. Water resulting from well discharge during mechanical integrity testing[2] shall be collected in portable pits. Water trucks labeled for development may be used to transport this water from the portable pit to the waste disposal system for disposal of the mechanical integrity test/well servicing water. The permit does not authorize any wastewater discharge to the land surface, surface water, or shallow groundwater of the State of Nebraska. Land application or surface discharges of wastewater are regulated through a separate permit.

Radioactive solids must be disposed of as described in CBR's NRC License SUA-1534. Non-radioactive solids or semisolid wastes must be disposed of at a licensed landfill site in accordance with Neb. Rev. Stat. 81-1516.

4) ***How are the cultural and natural resources within the 7500 foot radius of influence going to be protected?***

The area of review for cultural and natural resources is not limited to this 7500 foot radius and is much broader in scope. To clarify, the 7500 ft radius of influence identified in the permit is the radius of influence of the pumping test conducted in 2006. The influence was on groundwater levels in the Basal Chadron Formation during a 2006 aquifer stress test in which pumping at a rate of 16.4 gpm for 357 hours (14.9 days) produced significant drawdown in wells screened in the Basal Chadron Formation. Please see the response to Comment (18) for further discussion of the pumping test.

Previous cultural resource investigations in the general area surrounding Crawford indicate that a variety of prehistoric and historic resources of potential significance exist in the vicinity. Resources include the Hudson-Meng prehistoric bison kill site, several prehistoric camps and artifact scatters in the general areas, fur trade period sites

[1] Well development water is defined as water generated during the development of wells screened within the Chadron Formation.

[2] Mechanical integrity test/well servicing water is defined as water discharging from a well during the process of testing the well for mechanical integrity, performing work-overs, or any other well service.

associated with the early history of Chadron, Fort Robinson west of Crawford, the Sidney-Deadwood Trail, the two historic railroads that cross where the City of Crawford emerged, and the City of Crawford itself. There has been extensive farming around Crawford, which may have disturbed many earlier sites, but has also created historic farming sites.

The proposed NTEA is on private lands north of the City of Crawford. A total of 1,190 acres within and around the NTEA was surveyed for the presence of cultural resources in August of 2004 by a third party, Greystone Environmental Consultants (now ARCADIS), from Greenwood Village, Colorado. The objective of the cultural resource inventory was to locate and record any cultural resources that may be within the area of potential effects of the NTEA, and to provide recommendations of eligibility to the National Register of Historic Places (36 CFR 60.4 a-d). Register eligibility is evaluated in terms of the integrity of the resource and:

- Its association with significant events, or patterns in history or prehistory;
- Its association with the specific contributions of individuals significant in our past;
- Its engineering, artistic, or architectural values;
- Its information potential for important research questions in history or prehistory.

An architectural and structural properties search was completed at the Nebraska State Historic Preservation Office (SHPO), and an archaeological site search was completed at the Archaeology Division of the Nebraska State Historical Society in July of 2004. No previous cultural resources inventories have been documented for the area, and the State Historic Preservation Office has no record of documented standing structures in the area.

The 2006 cultural resource survey of the NTEA was conducted on foot. Three historical sites and three isolated prehistoric/early historic artifacts were located and documented. In addition to the recorded cultural resources, two small wooden power poles were noted at the north end of the survey area. No additional poles were seen near the survey area to speculate on the trend or destination of the line. Each was a peeled, untreated pole about 10 to 12 feet high. Near the top of each were bolt holes through the pole and flattened areas about four inches wide on each side where three sets of cross members had been bolted. One of the poles also had a single threaded wooden dowel for

attachment of a glass or ceramic insulator. No insulator fragments were found. The historic sites included the ruins of an abandoned farm core complex, one occupied farm core complex with an adjacent schoolhouse foundation, and a small refuse disposal area. The prehistoric artifacts consisted of a metal trade point (early historic), a chert core, and a chert point fragment[3]. The occupied farm complex has been remodeled, and no longer has the appearance of its historic period of use. However, this site may potentially yield information regarding rural farming of the 1920s through 1960s. Because the farm is occupied, it is unlikely that there will be direct disturbance in the immediate future. The remaining sites and isolated artifacts are not likely to yield information important in prehistory or history, and are not considered eligible for the National Register of Historic Places.

Specific information included in cultural resource investigations falls under the confidentiality requirement for archaeological resources under the National Historic Preservation Act, Section 304 (16 U.S.C. 470w-3(a)). Additionally, disclosure of such information is protected under Nebraska State Statute Section 84-712.05 (13-14).

Impacts to natural resources outside the boundary of the NTEA identified in Figure 1 of the permit are not anticipated. No impacts to cultural resources, either in or out of the NTEA, are anticipated.

5) ***The facility failed to involve and consult with the Oglala Sioux Tribe through the application process.***

Through letters sent in April of 2004 by Dr. Carl Späth, Senior Archaeologist with Greystone Environmental Consultants (now ARCADIS) in Greenwood Village, Colorado, contacted the following tribes/tribal organizations on behalf of CBR: Commission on Indian Affairs, Lincoln, Nebraska; Apache Tribe of Oklahoma, Anadarko, Oklahoma; Cheyenne River Sioux Tribe, Eagle Butte, South Dakota; Cheyenne & Arapaho Tribes of Oklahoma, Concho, Oklahoma; Crow Creek Sioux Tribe, Fort Thompson, South Dakota;

[3] Chert is a hard, dense, microcrystalline or cryptocrystalline sedimentary rock, consisting chiefly of interlocking crystals of quartz less than 30 µm in diameter. It has conchoidal fracture, and may be white or variously colored. Chert occurs principally as nodular or concretionary segregations, or nodules, in limestone and dolomite, and less commonly as layered deposits or bedded chert. The term *flint* is essentially synonymous (Dictionary of Geological Terms, 3rd Edition, Anchor Books, 1984.). A chert core is a large nodule of chert from which flakes are knocked off of to make chert points, or arrowheads.

Kiowa Tribe of Oklahoma, Carnegie Oklahoma; Lower Brule Sioux Tribe, Lower Brule, South Dakota; Northern Arapaho Tribe, Fort Washakie, Wyoming; Northern Cheyenne Tribe, Lame Deer, Montana; Oglala Sioux Tribe, Pine Ridge and Kyle, South Dakota; Rosebud Sioux Tribe, Rosebud and Mission, South Dakota; Standing Rock Sioux Tribe, Fort Yates, North Dakota; Crow Nation, Crow Agency, Montana; Pawnee Nation of Oklahoma, Pawnee, Oklahoma.

These tribes are recognized as tribes with traditional interests in northwest Nebraska. The cross-reference for the Native American Consultation Database included the following counties:

- Nebraska
    - Banner, Box Butte, Dawes, Garden, Morrill, Scotts Bluff, Sheridan, and Sioux
- South Dakota
    - Fall River, Shannon
- Wyoming
    - Goshen, Niobrara

The tribes were asked for input and assistance in identifying and planning for any areas of traditional concern or value to the tribe or any areas of current use by the tribe that might be located within the project area. The letters sent to tribal contacts in April of 2004 identified the nature and location of the proposed project and asked for input. Follow-up telephone calls were made in June of 2004 to verify that the information had reached the appropriate persons in each tribe and to ask whether the tribes had any concerns about the project or were aware of any traditional concerns in the immediate vicinity of the project. Harvey Whitewoman of the Oglala Sioux called Greystone Environmental Consultants before the follow-up calls were begun to ask what effect the proposed project might have on water quality. Greystone recommended that Mr. Whitewoman contact someone at CBR for details regarding the mining process and water quality concerns. No other tribal concerns were identified. Additional information is available in the Environmental Report to the NRC for the NTEA.

6) ***The applicant's (CBR's) statement that "the well is not located on Indian lands" is inadequate, a false statement, and fails to recognize that Tribes must be consulted and involved in the permit process.***

Item 7 on the application form for a Class III Underground Injection Control (UIC) Permit asks the applicant: *Is the facility located on Indian lands, historic and/or archaeological sites?* The applicant's response was "yes", in reference to historic and/or archaeological sites within the NTEA. "Indian lands" means "Indian country" (40 CFR 144.3), which is defined in 18 U.S.C. 1151 as:

- All land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation;
- All dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a State; and
- All Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.

Under this definition, the NTEA is not in Indian lands.

Please see the response to Comment (5) regarding consultation with tribal organizations during the permit application process.

7) ***A wildlife study should be conducted for the area proposed, adjacent to, and other affected areas.***

In 1982, a baseline wildlife survey identified 36 species of mammals, and determined that another 28 species (mostly bats and small rodents) were deemed likely to occur in the region. These include but are not limited to: pronghorn antelope, white-tailed deer, mule deer, elk, bighorn sheep, coyotes, red fox, long-tailed weasel, bobcat, badger, striped skunk, deer mouse, white-footed mouse, thirteen-lined ground squirrel, meadow jumping mouse, northern pocket gopher, meadow vole, muskrat, beaver, porcupine, fox squirrel, white-tailed jackrabbit, black-tailed jackrabbit, and eastern cottontail.

Common bird species likely to occur within the cultivated fields of the NTEA include: the American robin, red-winged blackbird, mourning dove, house wren, violet-green swallow,

and horned lark. Birds associated with riparian and woodland habitats include: pine siskin, red crossbill, black-capped chickadee, rufous-sided towhee, yellow warbler, and house wren. Upland game birds that may be found within the NTEA include: wild turkey, ring-necked pheasants, and sharp-tailed grouse. Waterfowl may occur throughout the region, primarily during both the spring and fall migrations; however, because of the lack of wetlands and their associated habitats within the NTEA, the diversity and abundance of these types of birds is extremely low. Raptors, including the golden eagle, red-tailed hawk, American kestrel, northern harrier, prairie falcon, turkey vulture, great horned owl, and rough-legged hawk, may occur within the NTEA.

Of the 22 species of reptiles and amphibians recorded in Dawes and Sioux counties, 13 were documented during the 1982 baseline investigation. Documented toads and frogs included: Woodhouse's toad, Great Plains toad, plains spadefoot, western striped chorus frog, northern leopard frog, and bullfrog. Two species of turtles observed were the snapping turtle and painted turtle. Snakes identified included the bullsnake, plains garter snake, red-sided garter snake, and yellow-bellied racer.

As part of the review process, the Department contacted the Nebraska Game & Parks Commission (NGPC) in regards to threatened & endangered species that may be found within the NTEA. Through a technical consultation with NGPC, the following threatened or endangered species were identified within the North Trend Expansion Area: Swift fox (*Vulpes velox*). In order to ensure that this endangered species is not impacted, CBR is required to conduct surveys according to NGPC protocol. Based on consultations with NGPC, the Department does not feel another wildlife study is warranted at this time.

8) ***This mining operation will contaminate the groundwater and surface water.***

As required in the permit, water quality sampling will be conducted bi-weekly at all monitoring well locations, which would indicate a parameter exceedance (i.e. the presence of mining fluids). Water level measurements in the Basal Chadron Formation and the overlying water-bearing zones will also be monitored bi-weekly. Sudden changes in water levels within the production zone may indicate that the wellfield flow system is out of balance. Pumping and injection rates will be adjusted to correct this situation; often injection wells are shut off and production is increased to draw fluids toward the mining area. If mining solutions were to be detected in the overlying Brule

Formation, which is a drinking water aquifer, groundwater remediation would be required of CBR. Remediation measures would include, but not be limited to, excavation of contaminated soils and recovery and treatment of contaminated groundwater.

Groundwater restoration is also a requirement outlined in the permit. The goal of restoration is to return the mined aquifer parameters to calculated baseline mean concentrations, which are established before mining begins. Within each mine unit, a minimum of one injection or production well per acre is designated as a baseline restoration well. The designation of the baseline restoration wells must be included with the Notice of Intent to Operate for the mine unit. Details of this process are described in the response to Comment (1). Prior to any mining, CBR must submit baseline water quality values to the Department for approval. The restoration values for each mine unit will be based on current Title 118 – Ground Water Quality Standards and Use Classification and the wellfield averages at the time the notice of intent to operate the mine unit is submitted to the Director. There are 27 parameters identified as restoration parameters, and CBR must sample for all of the parameters to establish baseline restoration values. The table below lists the baseline water quality parameters:

CURRENT TITLE 118 NUMERICAL STANDARDS		PARAMETERS SET ON WELLFIELD AVERAGES	OTHER PARAMETERS	
Parameter	**Standard**	**Parameter**	**Parameter**	**Value**
Arsenic (As)	0.01 mg/l	Calcium (Ca)	Ammonia (NH_4 as N)	10.0 mg/l
Barium (Ba)	2.0 mg/l	Total Carbonate	Molybdenum (Mo)	1.0 mg/l
Cadmium (Ca)	0.005 mg/l	Potassium (K)	Nickel (Ni)	0.15 mg/l
Chloride (Cl)	250 mg/l	Magnesium (Mg)	Vanadium (V)	0.2 mg/l
Copper (Cu)	1.3 mg/l	Sodium (Na)		
Fluoride (F)	4.0 mg/l	Total Dissolved Solids (TDS)		
Iron (Fe)	0.3 mg/l			
Mercury (Hg)	0.002 mg/l			
Manganese (Mn)	0.05 mg/l			
Nitrate as N (NO_3)	10.0 mg/l			
Lead (Pb)	0.015 mg/l			
Radium (Ra)	5.0 pCi/l			
Selenium (Se)	0.05 mg/l			
Uranium (U)	0.030 mg/l			
Sulfate (SO_4)	250.0 mg/l			
Zinc (Zn)	5.0 mg/l			
pH	6.5 – 8.5 S.U.			

After mining is complete in each mine unit, CBR must notify the Department in writing, and must proceed to establish the post-mining water quality for all the parameters listed in the table above. The samples may be split between a lab of CBR's choice and a lab of the Department's choice.

CBR must also submit, in writing, a restoration plan including a stabilization period of at least six months for that mine unit. The mine unit cannot enter restoration until the Department has approved the restoration plan. Prior to approval of the restoration plan, the Department may require the installation of additional wells to evaluate the success of

the restoration efforts. When CBR determines restoration is complete, they must sample and complete an analysis of all the designated restoration wells for all the parameters listed in the table above. These samples must be split between a lab of CBR's choice and a lab of the Department's choice. Results of these samples must be submitted to the Department.

Wellfields at the currently operating facility south of Crawford are installed with berms or dikes to prevent spilled solutions from entering surface water features. Process buildings are constructed with secondary containment, and a regular program of inspections and preventative maintenance is in place. Similar methods for surface water protection will be required at the NTEA.

The NTEA is in the watershed of the White River, which flows northeast along the southern boundary of the proposed permit area. Spring Creek flows west to east through the northern portion of the NTEA. Little Cottonwood and Sand Creeks flow from west to east to the north of NTEA, where they join the White River. Squaw, English, and White Clay Creeks flow northward into the White River south of the NTEA. Deadman's, Cherry, and Bozle Creeks are all located outside the NTEA and flow northward toward the White River.

The Department has had an ambient surface water monitoring network in place since the early 1970s to monitor the water quality of surface water bodies across the state. The primary objective of the ambient stream network is to provide long-term information on the status and trends of water quality in rivers and streams within Nebraska.

The Department collects water samples of the White River at three locations: one in the Crawford City Park (Lat. 42.68663, Long. -103.41772); one upstream of Fort Robinson approximately 2 miles (Lat. 42.6277, Long. -103.51752) ; and one northeast of Chadron, approximately 2 miles from the South Dakota border (Lat. 42.94828, Long. -102.90054). The water samples are collected once a month. Temperature, oxygen, pH, conductivity, turbidity, and flow are measured in the field. The samples are sent for laboratory analysis for: total suspended solids (TSS), chloride, ammonia, nitrate-nitrite, Kjeldahl nitrogen, and total phosphorus. Water samples collected April through September are analyzed for pesticides (Atrazine, Acetochlor, and Metolachlor) in addition to the

abovementioned parameters. Each quarter (four times a year) the surface water samples are analyzed for metals including: total selenium, total mercury, sodium, magnesium, calcium, arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc.

On a six-year rotation, rivers, streams, and lakes from two or three river basins each year are more intensively monitored. This "basin rotation network" monitoring provides the quality and quantity of data necessary to effectively characterize and evaluate surface water quality across Nebraska. Data from this network also adds to the database for watershed assessments including the status and trends of water quality in rivers, streams and lakes. In 2008, the White-Hat-Niobrara basin was monitored under the basin rotation program. This year, 2011, the White-Hat basin is again being monitored under this program.

The Department also has a fish tissue monitoring program and a stream biological monitoring program. The objective of the fish tissue monitoring program is to assess toxic pollutant trends, identify potential problem areas, and assess the suitability of fish for human consumption and issue fish consumption advisories. The stream biological monitoring program is in place to evaluate the health of aquatic life populations and make beneficial use support statements using a unique randomized sample design that allows for water quality status and trend assessments to be determined with a known level of confidence. These programs also monitor water bodies in the White-Hat basins during basin rotation monitoring program years.

None of the data gathered by the Department through these surface water sampling programs suggests contamination of the White River by uranium mining activities. General information about all of NDEQ's water monitoring programs is available at www.deq.state.ne.us.

9) ***I object to a process where it takes seven months to find out what happened to the questions that were raised at a hearing.***

Responses to comments for the August 23, 2010 hearing, held in regard to the Department's decision to exempt a portion of the Chadron Formation, were sent out on March 22, 2011. All responses to comments were carefully reviewed and researched. The Department puts forth every effort to ensure that each comment is addressed to the

fullest extent practicable with all available resources to ensure that all considerations have been addressed.

10) ***The material [contributing to the Department's preliminary decision to issue the Class III permit] is very hard to get.***

Notification of the June 22, 2011 public hearing regarding the NTEA Class III permit was published in the legal notices section of the following newspapers on the following dates:

Lincoln Journal-Star – May 9, 2011
Crawford Clipper – May 11, 2011
Alliance Times-Herald – May 11, 2011
Scottsbluff Star-Herald – May 12, 2011
Chadron Record – May 18, 2011

As stated in the public notice, copies of the fact sheet and all information pertaining to the preliminary decision to issue the permit were made available for viewing and copying both at the Department's Lincoln office and at the Department's Chadron Field Office. Furthermore, the public notice stated that copies could be mailed upon request. The Department placed the fact sheet and the public notice document on its webpage, but the documents supporting our preliminary decision are too numerous to place on the internet. All of the Department's records are public information, unless they are determined to be confidential pursuant to Title 122, Chapter 28 and Neb. Rev. Stat. Section 81-1527. Copies of documents can always be requested by contacting our Records Management staff.

11) ***The process whereby a preliminary decision is made prior to a public hearing, and an individual has to prove the State wrong is a bad procedure.***

Title 122 – *Rules and Regulations for Underground Injection and Mineral Production Wells*, Chapter 32 states what actions require public notice:

- A permit application has been tentatively denied;
- A draft permit has been prepared;
- A hearing has been scheduled; or
- A petition has been made for designation of an exempted aquifer.

The purpose of a public notice is to give the public the opportunity to provide written comment on a Departmental activity. The purpose of a public hearing is to provide the

public the opportunity to comment in person on a Departmental activity. In this case, the Departmental activity for which comments were sought was the draft permit, to be issued to CBR for the NTEA.

12) ***It was difficult to find out about the hearing, and the Department website did not place it in a prominent place. There was a legal notice published on May 11th in the Crawford paper, but no story. This is something worth having more people know about than just fulfilling the legal letter of the law.***

Title 122, Chapter 32 outlines the public notice process for the Department, including the method of notification. Title 122, Ch. 32, Section 003 requires publication of a notice in a daily or weekly newspaper within the area affected by the facility or activity. The Department also publishes information on its webpage to aid in eliciting public participation. Oftentimes, press releases are also sent out to newspapers. Publication of a press release is at the discretion of the newspaper.

13) ***Crow Butte should establish a GIS database for the mapping of existing geological units and features. This would allow computer modeling of the regional geology, hydrology, and structure, and would present the most complete picture of the data for final evaluation. Data acquired during subsequent investigations would be incorporated into the database.***

CBR maintains a database of all exploration holes drilled and the associated geophysical logs. As part of the aquifer exemption petition, CBR provided 3-dimensional model output of the NTEA that showed the stratigraphy from various perspectives. The 3-dimensional stratigraphic mapping was modeled using borehole information, and included the White River alluvium, the Brule Formation, the Upper Chadron Formation (Big Cottonwood Creek Member (Terry & LaGarry, 1998)), the Upper/Middle Chadron Formation (Big Cottonwood Creek Member (Terry & LaGarry, 1998)), the Middle Chadron Formation (Peanut Peak Member (Terry & LaGarry, 1998)), and the Basal Chadron Formation (Chamberlain Pass Formation (Terry & LaGarry, 1998)). The top of the Pierre Formation was also modeled in 3-dimensions.

This type of computer modeling provides an aid for complete visualization of the local geology and structure; however, one cannot rely on computer generated images alone for final evaluation of the regional structure. Please see the discussion in Comments

(17) and (18) regarding other tests and information that pertains to the interpretation of regional structural features.

14) ***Crow Butte should map the White River alluvium in order to characterize its potential as a conduit for radioactive contaminants.***

Within the NTEA, CBR has mapped the White River alluvium, shown in cross sections and provided as part of the application. Alluvium deposits occur from the surface to the top of the Brule formation, and vary in thickness depending on topography, from 0 to 60 feet. In general, the alluvium consists of reworked Oligocene-Miocene age rock fragments, sand, gravel, and sandy soil horizons that originated from the Gering and Monroe Creek Formations that form the nearby Pine Ridge Escarpment. It may also include weathered portions of the underlying Brule Formation.

A review of available geophysical logs revealed that the bottom of the alluvium was indicated by the transition from meandering or "chattering" of the geophysical curves to a consistent curve pattern. Portions of the log "chatter" represent the varying lithology, saturation, and porosity of the alluvial materials.

These alluvial deposits are not typically considered to be a reliable source of water due to varying and ephemeral recharge.

15) ***Crow Butte should sample water from the White River at regular intervals, for example, two miles, between Crawford and Pine Ridge to locate a plume of contaminated water or sediments, if present.***

The Department collects water samples of the White River monthly at three locations: one in the Crawford City Park (Lat. 42.68663, Long. -103.41772); one upstream of Fort Robinson approximately 2 miles (Lat. 42.6277, Long. -103.51752) ; and one northeast of Chadron, approximately 2 miles from the South Dakota border (Lat. 42.94828, Long. -102.90054). Please see the response to Comment (8) for more information on NDEQ's surface water sampling program. The permit does not require CBR to collect ambient surface water samples.

16) ***If contaminants are detected, Crow Butte should convert sampling wells to monitoring wells.***

All routine water quality samples from the wellfields are taken from monitoring wells within the currently operating CBR facility southeast of Crawford. The permit would require CBR to monitor all wells designated as monitoring wells from the initiation of injection in the mine unit, lasting through restoration and stabilization of the mine unit. Routine bi-weekly monitoring of shallow monitoring wells is required to begin prior to the installation of deep monitoring wells or mining wells.

Monitoring wells are sampled every other week for the following parameters: chloride, conductivity, alkalinity (as $CaCO_3$), water level, and barometric pressure. Baseline water quality monitoring, as described in Comment (1), is used to calculate upper control limits (UCLs) for chloride, conductivity, and alkalinity. If a UCL is exceeded for a particular well, CBR is required to collect a verification sample within 24 hours from the time the first analysis is available. If the second sample does not indicate exceeded UCLs, a third sample shall be taken within 48 hours of the time the first sample was taken. If the second or third samples indicate an exceeded UCL, the well in question shall be placed on parameter exceedance status and monitored on a weekly basis. CBR is required to notify the Department by telephone within 24 hours from the time the confirmation sample was taken. CBR also must mail the Department the laboratory data from all the samples and a plan of corrective action. This data must be postmarked within five calendar days from the time the confirmation sample was taken. In the event neither the second nor third samples indicate exceeded UCLs, then the well shall be returned to its regular sampling frequency.

At such a time as three consecutive one-week samples are below the exceeded UCL, the parameter exceedance status shall be removed from the well. Weekly sampling of the well on parameter exceedance status shall continue for an additional three weeks. If the UCL is not exceeded, biweekly sampling of the well on parameter exceedance shall resume. Should a parameter exceedance occur, a formal report shall be submitted with the quarterly mining monitoring report containing all laboratory data and the results of the corrective actions taken. If corrective actions have not been effective within 90 days, of the parameter exceedance confirmation, the injection of fluid shall be terminated in the affected area. Resumption of injection shall require a written approval by the Director. If an excursion should occur, (see response to Comment (1)), the Department

may require installation of additional monitoring and recovery wells as may be necessary.

When designating restoration wells in mine units, any monitoring well that has had a parameter exceedance will automatically become a restoration well, as described in the permit for NTEA. The permit also requires a minimum of ten restoration wells per mine unit.

17) ***Crow Butte should map the network of faults present in northwestern Nebraska and southwestern South Dakota.***

Drilling activities at the existing Crow Butte Uranium Facility and at the NTEA identified a structural feature referred to as the White River Fault, located between the current facility and the proposed NTEA boundary. The White River Fault generally follows the drainage of the White River north of Crawford. Evidence of the fault was identified during the exploration drilling phase of this initial Crow Butte mine in 1984. The fault is manifested as a significant northeast-trending, subsurface fold.

In order to decipher whether geologic units are disrupted by the White River Fault, one would expect to see at least one of the following, regardless of how the fault moved:

- less stratigraphic section than expected (i.e. structural thinning);
- repeated stratigraphic sections (i.e. structural thickening);
- missing stratigraphic sections; or
- linear features associated with a fault rupture.

Three-dimensional modeling of geophysical logs indicates that none of the above conditions were observed that could not be associated with other geological processes (e.g. erosional denudation or paleotopographic highs associated with fold development). Instead, all of the stratigraphic units within the NTEA are well-correlated southward across the structure with no apparent offsets or truncated units on the north limb of the fold structure, with the exception of the Upper/Middle Chadron (correlated to the lower portion of the Big Cottonwood Creek Member as described by Terry & LaGarry, 1998). There are 300-500 vertical feet of structural relief existing across the fold structure, depending on the location. Given all of this information, the observed thinning of

individual members[4] of the Chadron Formation is likely related to either a localized reduction in sediment accommodation along the north limb of the fold structure as part of the developing basin (folding at the same time as deposition), localized thinning within the fold limb[5] as a result of flexural bending (post-depositional folding) associated with fault-propagation folding above a blind reverse fault, or highly distributed normal faulting with no apparent fault offsets.

Drilling data within the NTEA suggest that, while a fault may cut the Pierre Formation at depth along with stratigraphically lower units, there is no evidence that a fault offsets the geologic contact with the Pierre Formation and overlying White River Group, nor individual members of the White River Group (i.e., Brule and Chadron formations).

The area of review is defined in 40 CFR Part 144.3 as the area surrounding an injection well, or in the case of an area permit, the project area plus a circumscribing area the width of which is either ¼ of a mile or a [calculated radius]. Title 122 – Rules and Regulations for Underground Injection and Mineral Production Wells Chapter 1, Section 007 further states that the area of review shall not be less than 2 miles in radius, and must include the zone of endangering influence. Title 122, Chapter 14 provides more information regarding the calculation of both the zone of endangering influence and the area of review. CBR provided all of the information required for an area permit application.

18) ***Crow Butte should conduct a pumping test on the faults to determine their permeability and the rate of water flow among them. If water flow is detected among faults, Crow Butte should convert sampling wells into monitoring wells.***
In 2006, CBR performed a pumping test in association with preparation for the Class III UIC permit application for the NTEA. The pumping test was used to evaluate the hydrogeologic conditions in the vicinity of the NTEA. Specifically, the test was designed to assess: 1) the degree of hydrologic communication between the Basal Chadron Formation at the pumping well and the surrounding Basal Chadron monitoring wells; 2)

[4] Geologic members are defined as a division of a [geologic] formation differentiated by separate or distinct lithology or complex of lithologies. (Dictionary of Geologic Terms, Revised Edition. Anchor Press, 1976.)

[5] A fold limb is defined as one of the two parts of a [fold] on either side of the axis. (Dictionary of Geological Terms, Revised Edition. Anchor Press, 1976.)

the presence or absence of hydrologic boundaries within the Basal Chadron Formation over the test area; 3) the hydrologic characteristics of the Basal Chadron Formation within the test area; and 4) the degree of hydrologic isolation between the Basal Chadron Formation and the overlying aquifers (i.e. the Brule Formation. NOTE: the Arikaree Group is absent within the proposed NTEA).

During the 2006 pumping test, 13 wells were monitored using automated equipment. The test was conducted by pumping one well at 16.4 gallons per minute for 357 hours (14.9 days). More than 110 feet of drawdown was achieved at the pumping well, and all Basal Chadron Formation wells showed at least 1.3 feet of drawdown, which confirms hydrologic communication within the Basal Chadron Formation. No significant water level changes were observed in wells installed in the Middle Chadron Formation or the Brule Formation, indicating no significant connection between the Brule Formation and the Basal Chadron Formation or the Middle Chadron Formation and the Basal Chadron Formation.

The test results demonstrate that: 1) the Basal Chadron Formation monitoring well network is in hydraulic communication throughout the proposed NTEA; 2) the hydrogeologic conditions of the Basal Chadron Formation have been adequately characterized within the test area; 3) there is adequate confinement between the Basal Chadron Formation and the overlying Upper/Middle Chadron and Brule formations throughout the NTEA; and 4) transmissivity of the Basal Chadron Formation in the NTEA is relatively consistent, but the thickness and hydraulic conductivity vary with direction and location.

The data from the pumping test was evaluated for apparent boundary conditions that would indicate structural folding of the Basal Chadron Formation. A groundwater model was used to simulate a no-flow boundary at a distance that correlates to the midpoint of the fold limb south of the NTEA, and near one of the monitoring wells used in the pumping test. The simulations predict that more drawdown should have been observed at that monitoring well if there was a no-flow boundary at that location than what was actually observed. The simulated boundary was then moved to a distance of 7,500 feet (the extent of the radius of influence for the test). This simulation also predicted increased drawdown at the monitoring well nearest the fold structure. Since this

predicted increased drawdown was not observed during the actual pumping test, it is likely that a hydraulic boundary does not exist within the fold structure.

All available data indicate an upward hydraulic gradient between the Basal Chadron Formation and the Brule Formation, which results in artesian pressures within the Basal Chadron Formation. The magnitude of the hydraulic head difference between the Basal Chadron and the Brule formations, coupled with no observed drawdown in the Brule Formation related to pumping in the Basal Chadron Formation during the 2006 pumping test, further indicates adequate hydraulic confinement and therefore hydraulic isolation between the two water-bearing units.

19) ***Crow Butte should color the water used in all underground stages of production. This will allow future leaks to be detected, even [if] they manifest far from the mined area.***

The current mining operation southeast of Crawford is permitted under Permit Number NE0122611. CBR employs a rigorous monitoring program (Permit NE0122611, Part II.B.; Part III.) to detect the unintended movement of mining fluid within the permitted boundary. Monitoring wells within the permitted boundary are sampled every two weeks. These samples are analyzed for chloride, conductivity, and alkalinity concentrations to identify any unintended movement of mining fluids. These parameters were chosen as the monitoring parameters for excursions because they move through the subsurface faster than other constituents (Potter et al., 1979). The Department feels that chloride concentrations, specifically, provide an adequate indicator of how fluids move in the subsurface because chloride ions are conservative. Chloride has been used as a conservative tracer in environmental studies for decades because it is not removed or supplied significantly by reaction with rocks or sediment, and it is not precipitated as salt until very high salinities are reached. Some sources of chloride in the subsurface are anthropogenic (i.e. road deicer), and must be accounted for when considering the use of chloride as a conservative tracer in shallow environments.

A similar monitoring program is required under the permit for the NTEA satellite mining facility.

References:

Bates, R.L., and J.A. Jackson, 1984, *Dictionary of Geological Terms, 3rd Edition*: Prepared under direction of the Americal Geological Institute, Anchor Books, A Division of Random House, Inc., New York, NY. 571 pp.

Matthews, W.H.,and R.E. Boyer, 1976, *Dictionary of Geological Terms, Revised Edition*: Prepared under direction of the Americal Geological Institute, Anchor Press/Doubleday, Garden City, NY. 472 pp.

Potter, II, R.W., M.A. Clynne, J.M. Thompson, V.L. Thurmond, R.C. Erd, N.L. Nehring, K.A. Smith, P.J. Lamothe, and J.L. Seeley, 1979, *Chemical monitoring of the in-situ leaching of a south Texas uranium orebody*: U.S. Geological Survey, Menlo Park, California, 94025. p. 58.

Terry, D.O., Jr., and H.E. LaGarry, 1998, *The Big Cottonwood Creek Member: a new member of the Chadron Formation in northwestern Nebraska*, in D.O. Terry, Jr., H.E. LaGarry, and R.M. Hunt, eds., Depositional Environments, Lithostratigraphy, and Biostratigraphy of the White River and Arikaree Groups (Late Eocene to Early Miocene, North America): Geological Society of America Special Paper #325, p. 117-141.