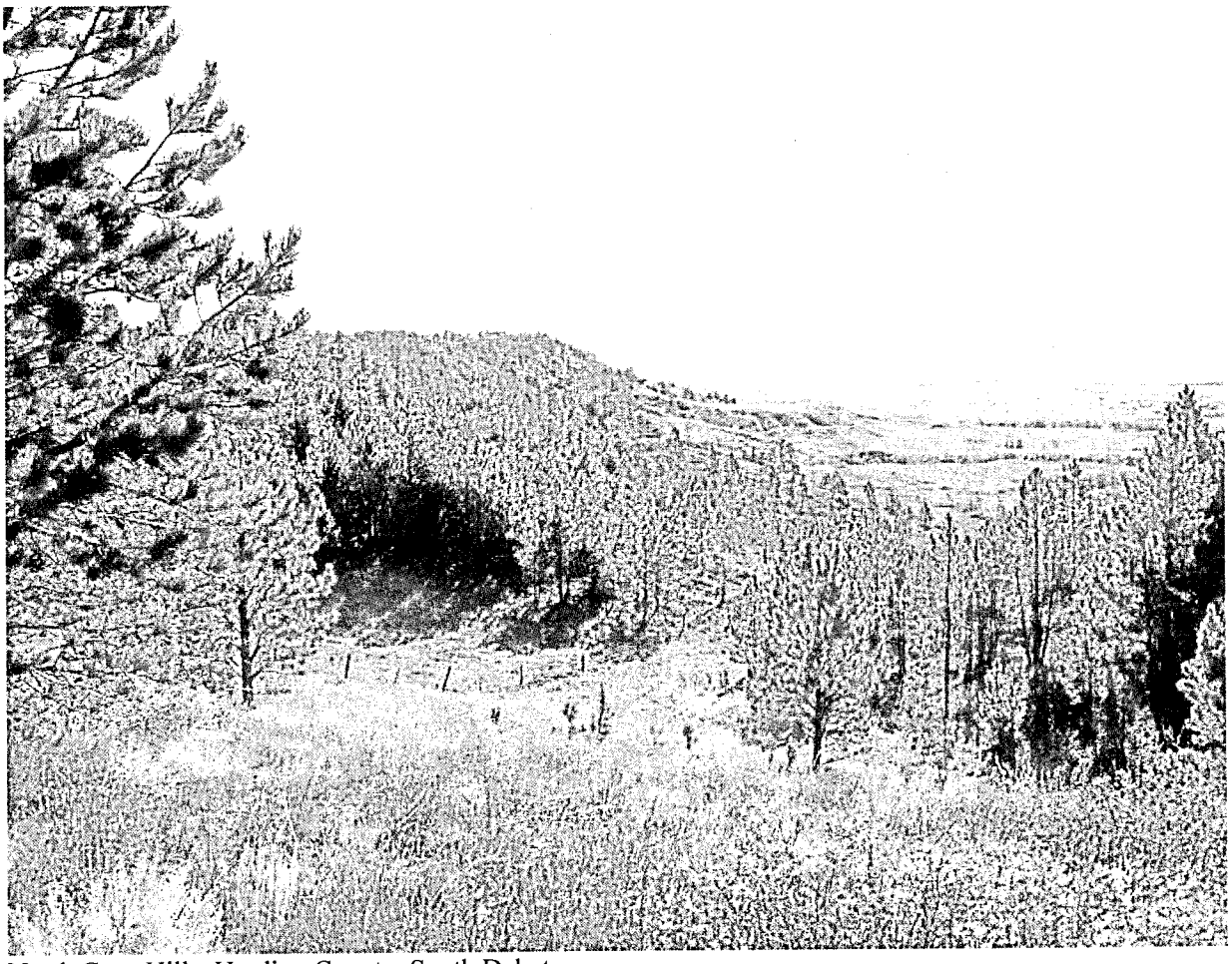
Ludlow Community Air Monitoring Study
Impacts from Historical Uranium Mining
2006 to 2007



North Cave Hills, Harding County, South Dakota

South Dakota Department of Environment and Natural Resources

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Executive Summary

The South Dakota Department of Environment and Natural Resources (DENR) collected air quality samples near the Ludlow School in Harding County, South Dakota from July 2006 through the end of October 2007. A second site was operated at the same time in Pierre, South Dakota serving as a background comparison. The purpose of the sampling project was to follow-up on concerns that windblown dust from unreclaimed historical open pit uranium mines was transporting radioactive dust and causing a health risk to school children, teachers, and the Ludlow community. There are unreclaimed uranium mines all around Ludlow with the closest approximately one mile to the northeast of the monitoring site.

DENR collected air quality samples of particulate matter from the two sites and had the samples analyzed for Uranium ^{234}, Uranium ^{235}, and Uranium ^{238} isotopes. A total of 94 samples were collected at each site. The Pierre Site had four samples that had detectable levels of uranium. The Ludlow Site had three samples with detectable levels of uranium. All the samples with levels of uranium had low concentrations just above the detection level for the test method. Tony Harrison, Colorado's Department of Health, stated in an email that the highest uranium level found in the samples had an exposure rate that was 1,000 times less than a maximum annual does for a non-uranium mining person.

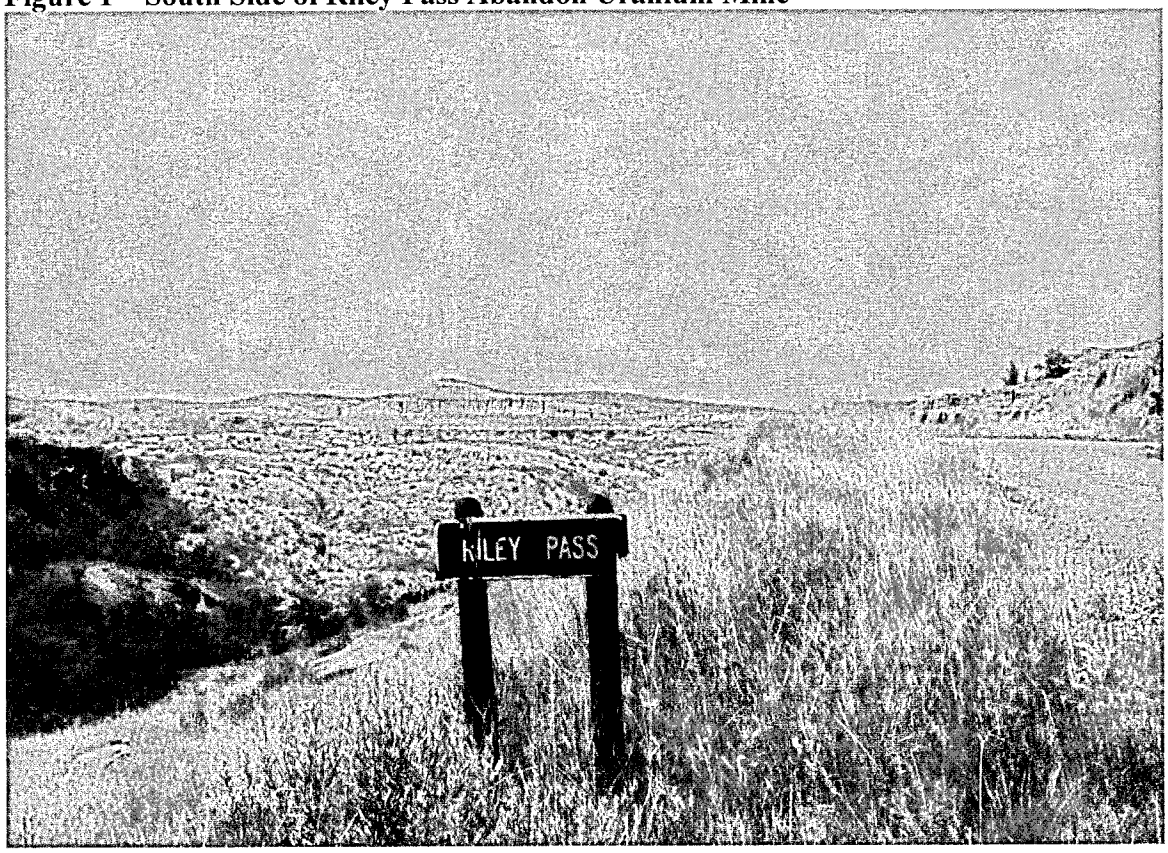
The Ludlow air monitoring study demonstrated that the radioactivity levels in the Ludlow area are similar to what is experienced in the Pierre area. Based on the monitoring results, DENR concludes that windblown dust from the unreclaimed open pit mines is not transporting radioactive dust to the Ludlow area.

1.0 Study Purpose

The South Dakota Department of Environment and Natural Resources (DENR) conducted an air quality monitoring study in Ludlow, South Dakota from July 2006 through October 2007. The air quality monitoring study was prompted by concerns raised with Senator Adelstein, Chair of the State-Tribal Relations, by Charmaine White Face. DENR committed to conduct the air quality monitoring study in a letter to Senator Adelstein dated May 15, 2006 (see Appendix A), to determine if windblown dust from unreclaimed uranium mines in Harding County was transporting radioactive dust to the Ludlow area. The air quality monitoring study consisted of collecting airborne particulate matter in Ludlow and comparing the data to a control site in Pierre.

Ludlow is located in north central Harding County. Abandon uranium mines are located around the Ludlow area including Riley Pass (see Figure 1), which is located west of Ludlow, in the North Cave Hills. The Ludlow area should have the greatest potential for concentrations of uranium from windblown dust because it is close and downwind of the historical uranium mining areas. DENR chose an air quality monitoring site near the school in Ludlow to determine if there was any windblown contamination affecting the health of school age children, which was one of Charmaine White Face's concerns in an article, "*Shortsightedness in a Sacred Place*", she wrote on June 6, 2005.

Figure 1 – South Side of Riley Pass Abandon Uranium Mine



1.1 Background on Uranium

Uranium is a natural element that occurs in small amounts in virtually all rock and soils. The presence of uranium contributes to low level background radiation. Significant concentrations of uranium occur in volcanic ash deposits, coal seams, and phosphate rock, which is a main element in plant fertilizers. About 99% of the naturally occurring uranium is in the form of the isotope Uranium ^{238} with the remaining 1% as isotopes Uranium ^{234} and Uranium ^{235}. As uranium undergoes radioactive decay it gives off alpha particles accompanied by weak gamma particle radiation.

1.2 History of Mining Activities in Harding County

Prior to 1950, there were virtually no mining claims in Harding County. In 1954, the first major uranium mining claim activity began in the Slim Buttes and Cave Hills areas. In 1962, major uranium mining operations were developed under U.S. Atomic Energy Commission contracts. Mining activities were permitted under the General Mining Law and Public Law 357. These laws required no form of restoration.

Companies began active mining in 1962 on both public and private lands. During operation, overburden was pushed off on the outer edges of the pit floors resulting in steep high walls and exposed uranium laced lignite coal. The coal was mined, piled and burned to isolate the uranium. The ash from the burned lignite coal was sent to mills for processing. Mining operations ceased in 1964, after extracting approximately 156,657 pounds of uranium oxide. At that time, the mines were abandoned leaving the steep high walls and exposed uranium laced lignite coal behind (see Figures 2 and 3).

Figure 2 – Eastern Side of Riley Pass Abandon Uranium Mine

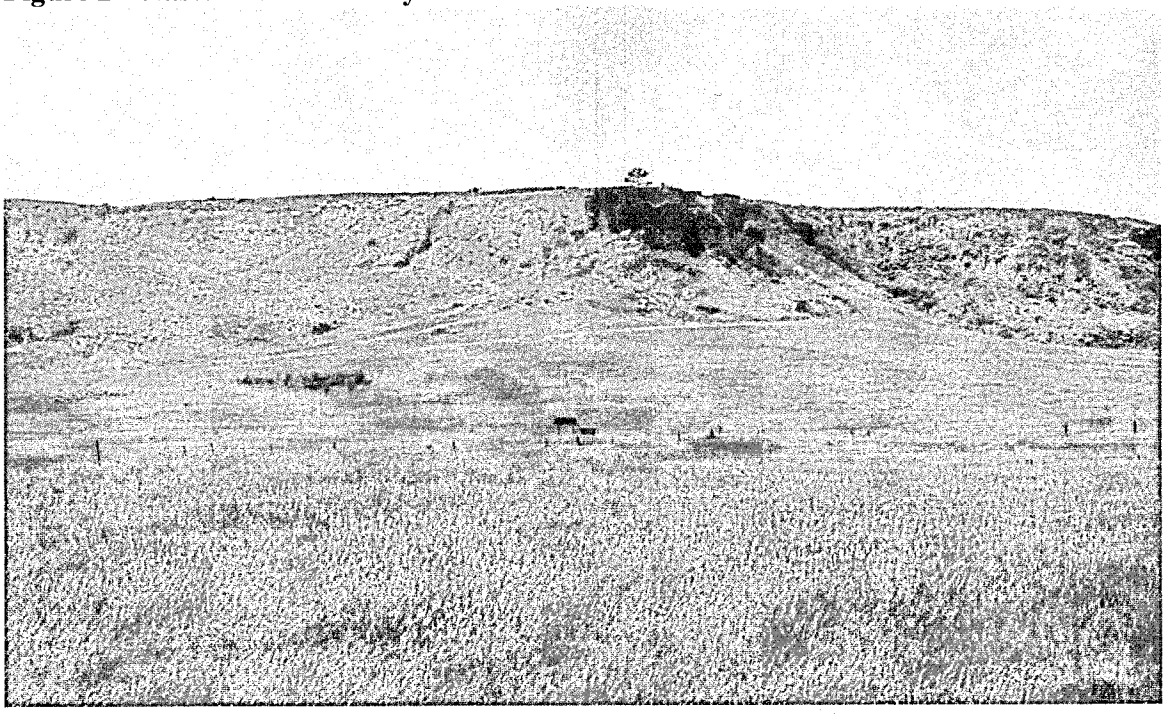
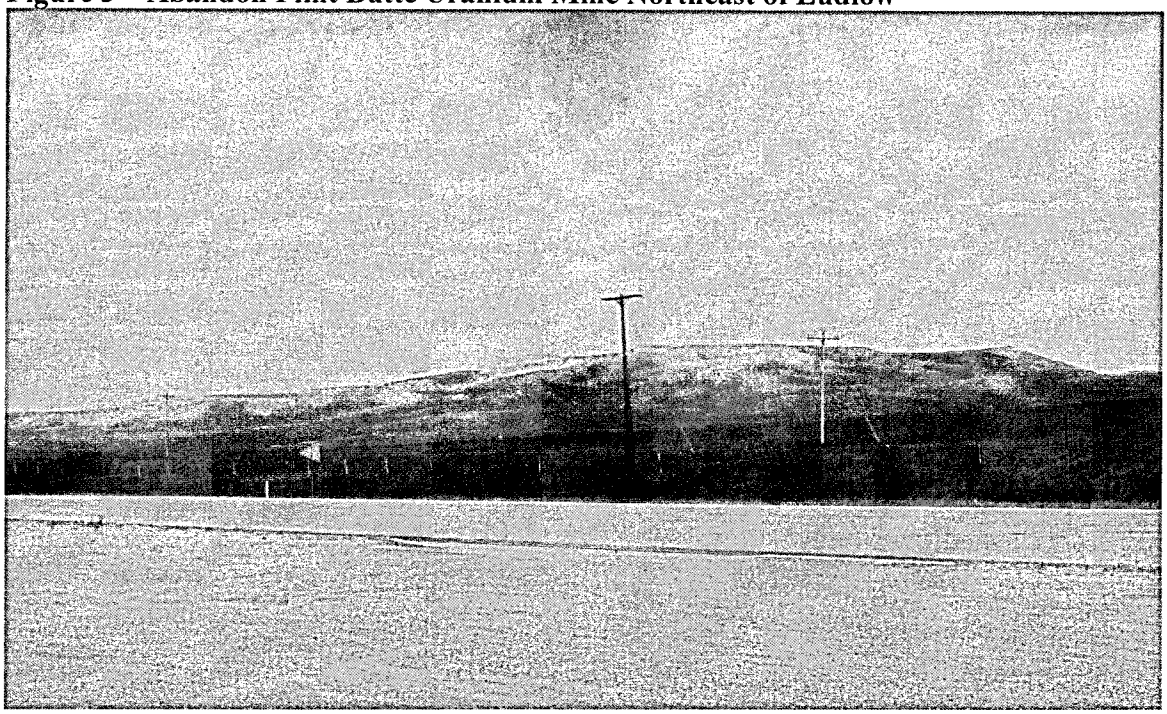


Figure 3 – Abandon Flint Butte Uranium Mine Northeast of Ludlow



2.0 Uranium Air Quality Monitoring Sites

A *"Sampling Plan for Uranium and Radionuclide Levels in Ambient Air in Harding County, South Dakota,"* was developed for this project to outline the procedures DENR would follow in determining if windblown dust from the unreclaimed uranium mines were impacting the Ludlow area (see Attachment A). The air quality monitoring sites in Ludlow and in Pierre were operated on the same sampling schedule, samples were analyzed for the same parameters, and the same sampling equipment was used. Both monitoring sites met the minimum EPA location requirements for the collection of particulate matter samples.

The plan specified that samples involved the collection of dust as Total Suspended Particulates on a glass fiber filter over a 24-hour period. On February 5, 2007, the 24-hour sampling period was expanded to 72-hours based on the recommendation of the Colorado State Health Lab. The longer sampling period increased the accuracy of the analysis and provided a higher confidence level in the results of the testing.

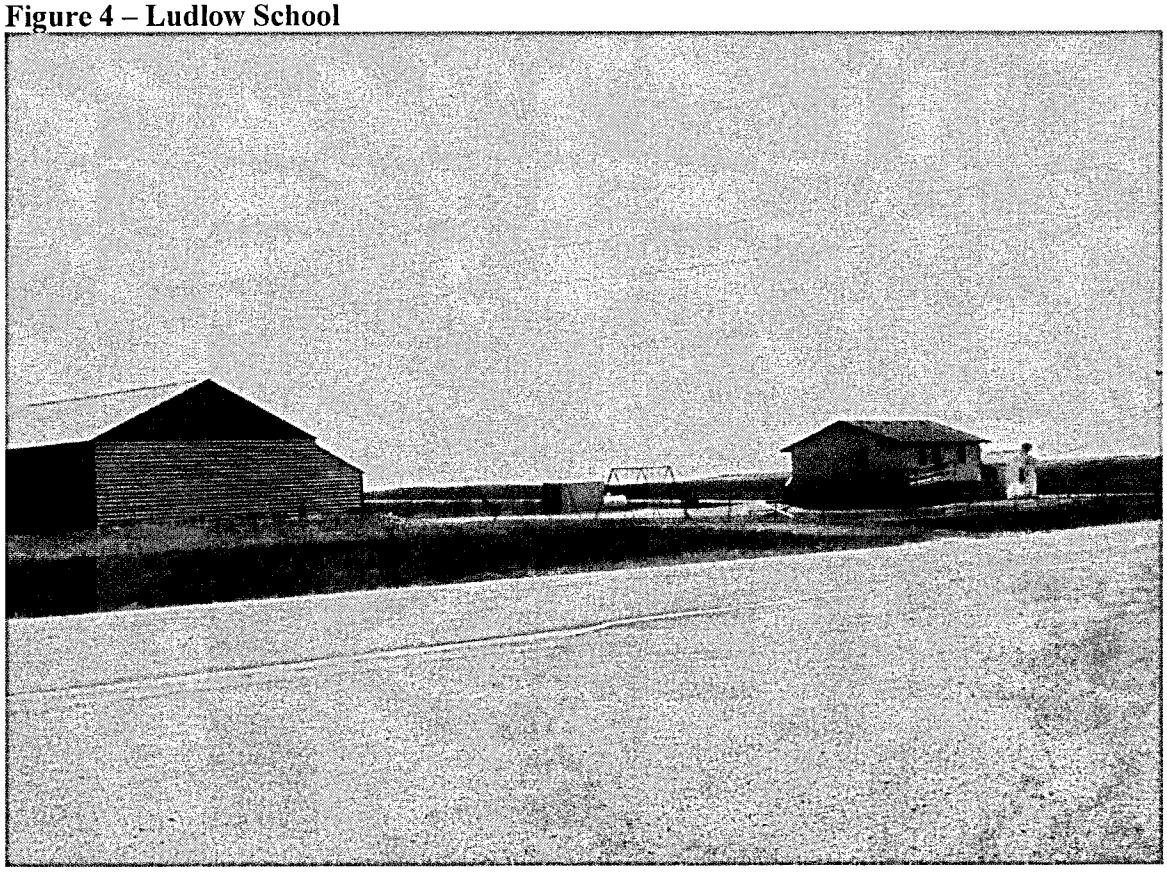
The flow rate of each monitor was controlled using a volumetric throat to approximately 1.13 cubic meters per minute. Samples were collected on an every sixth day sampling schedule. A schedule of this type provides random sampling and gives a good idea of the exposure to the people living in the surrounding area. The air quality monitors were operated following EPA requirements in 40 CFR Part 50, Appendix G; Part 58; and the standard operating procedures for a High Volume monitor.

Air quality testing began at both sites on July 4, 2006 and continued until October 27, 2007. A total of 81 sampling pairs were collected during the sampling period.

2.1 Ludlow Site

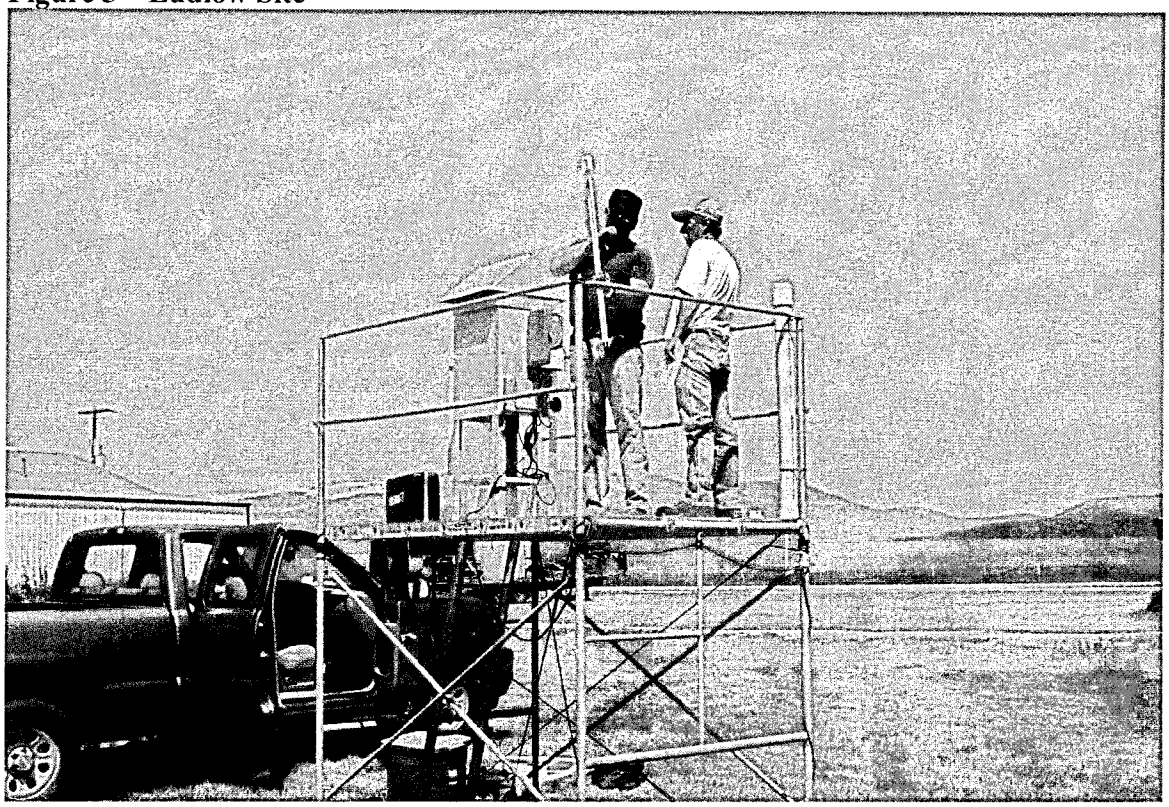
The plan for the air quality monitoring study involved the setup of two air quality monitoring sites. One air quality monitoring site was located east of the North Cave Hills in the Ludlow community and near the school in Harding County. The Ludlow school, pictured in Figure 4, is located east of Highway 85 and the air quality monitoring site was located just across the road west of the school by the Crooked Creek Bar/Restaurant.

Figure 4 – Ludlow School



The predominant winds in the area are out of the north to northwest in the fall and winter months and out of the south to southeast during the spring and summer months. The Ludlow Site location provides an assessment of concentrations in the area used by the children attending school and for the residents and visitors in the community. Figure 5 shows a picture of the Ludlow Site. The butte shown in the background behind the monitoring site is the abandon Flint Butte Uranium Mine.

Figure 5 – Ludlow Site



A map generated from the departments GIS system shows the Ludlow community on the west side of Highway 85 and the school on the east side of the highway can be seen in Figure 6. The top of Figure 6 is north. The upper right hand corner of Figure 6 shows part of the Flint Butte un-reclaimed uranium mine in Harding County.

Figure 6 – Ludlow Site Map

2.2 Pierre Site

The second air quality monitoring site was located in Pierre to provide a background comparison to the site in Harding County. Figure 7 contains a picture of the Pierre Site. The Pierre Site is located at DENR's equipment storage lot in the southeast part of the city at the corner of Sioux and Monroe Avenues. A satellite map showing the location of the Pierre Site is in Figure 8.

Figure 7 – Pierre Site

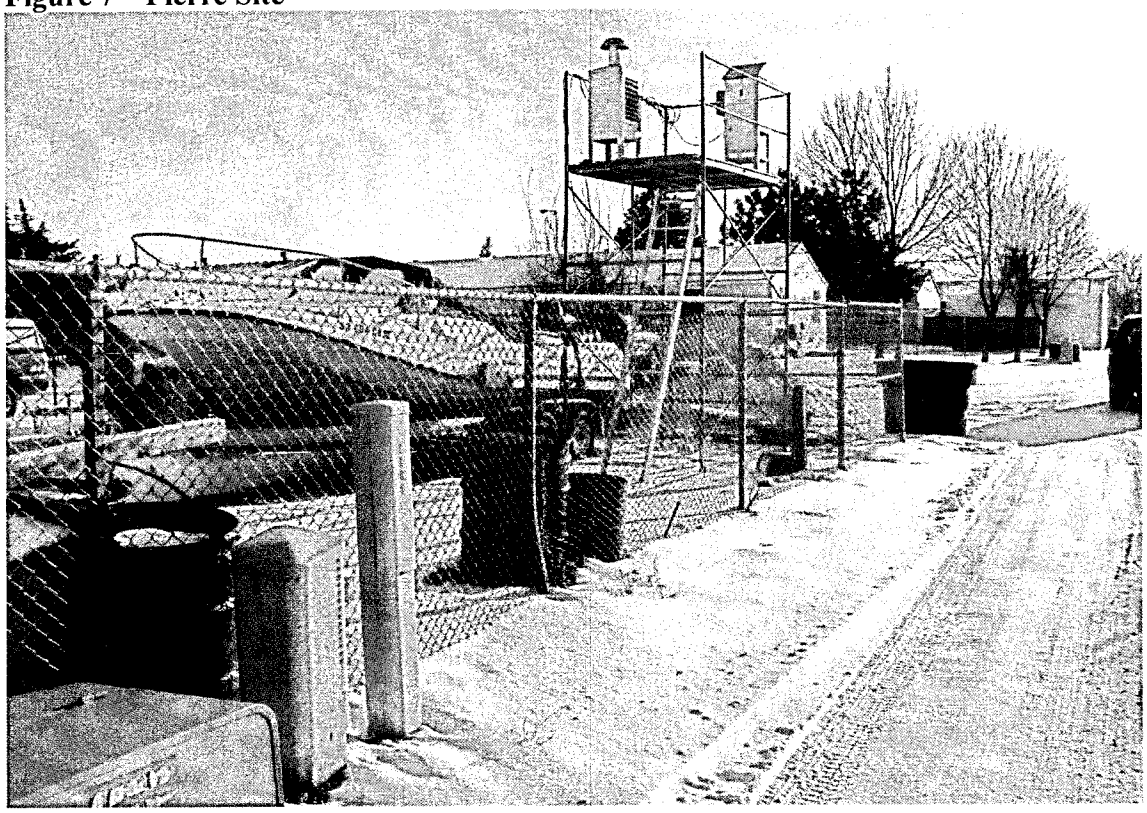
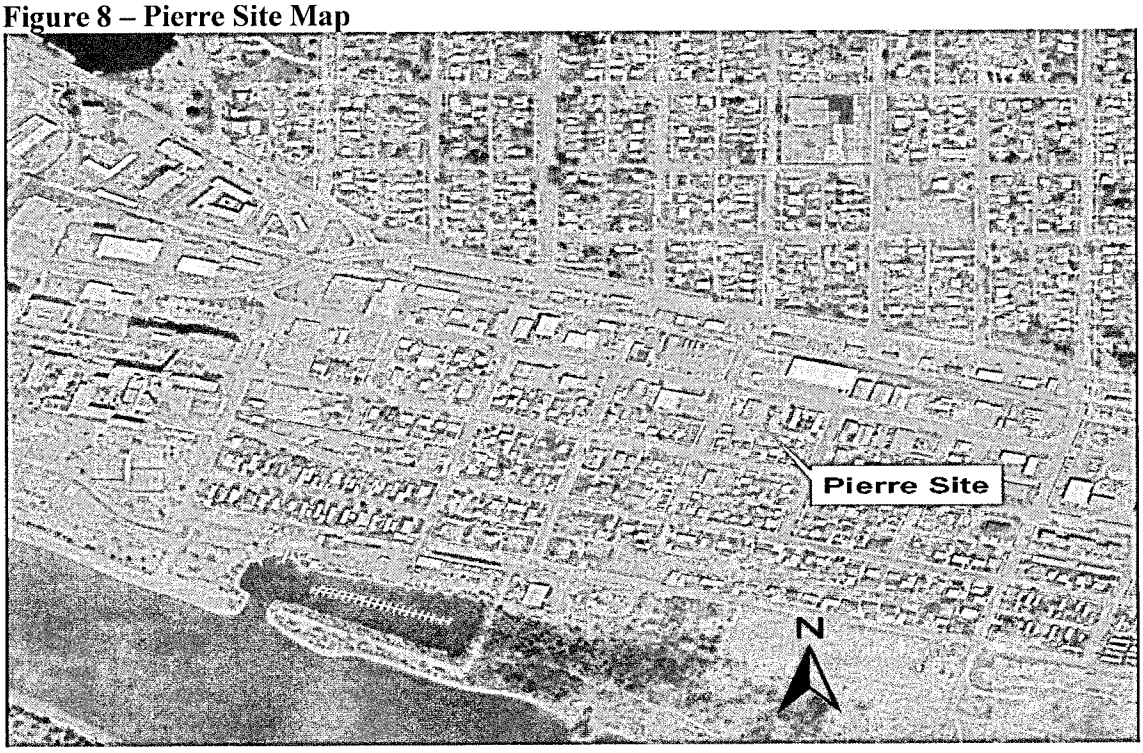


Figure 8 – Pierre Site Map



3.0 Sample Analysis

3.1 Screen Sampling

The plan for the air quality monitoring study called for two types of sample testing. First the samples were tested by the South Dakota State Health Lab for gross alpha and beta radiation. The test was meant to serve as a screening tool to help determine if there were sufficient amounts of radioactive materials present to be analyzed for uranium. An action level of 1.0 pico Curies per cubic meter (pCi/m^3) of gross alpha or beta radiation was established to be an indication when further testing for uranium would be completed by the department. If a collected sample from the Ludlow or Pierre sites measured a 1 pCi/m^3 level or higher, the filters from both sampling sites would be sent to the Colorado State Health Lab for the testing of uranium concentrations.

The results of the screening test found that none of the samples collected during the study had gross alpha or beta radiation levels that exceeded the 1 pCi/m^3 screening level. The graphs in Figures 9 and 10 show the results of the gross alpha and beta testing from both the Ludlow and Pierre Air Quality Monitoring Sites. Appendix B contains a table of the gross Alpha and Beta testing results. All gross Alpha and Beta test results are in pCi/m3.

Figure 9. Gross Alpha Testing Results Ludlow Study

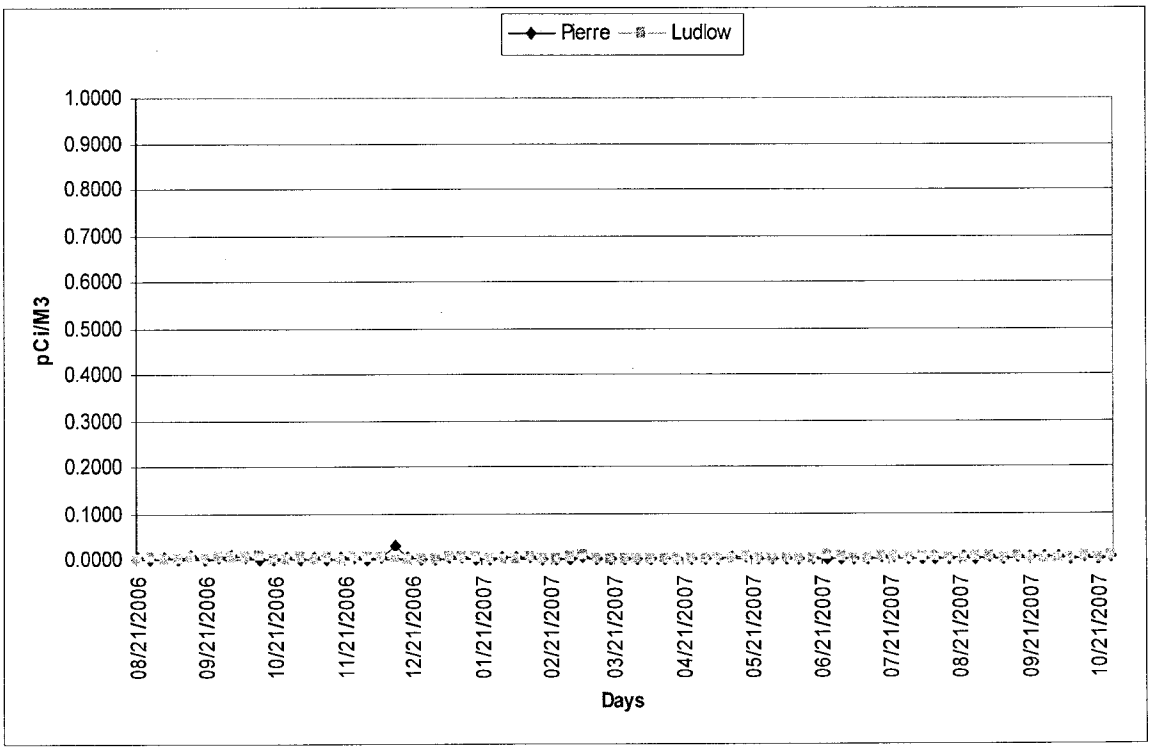
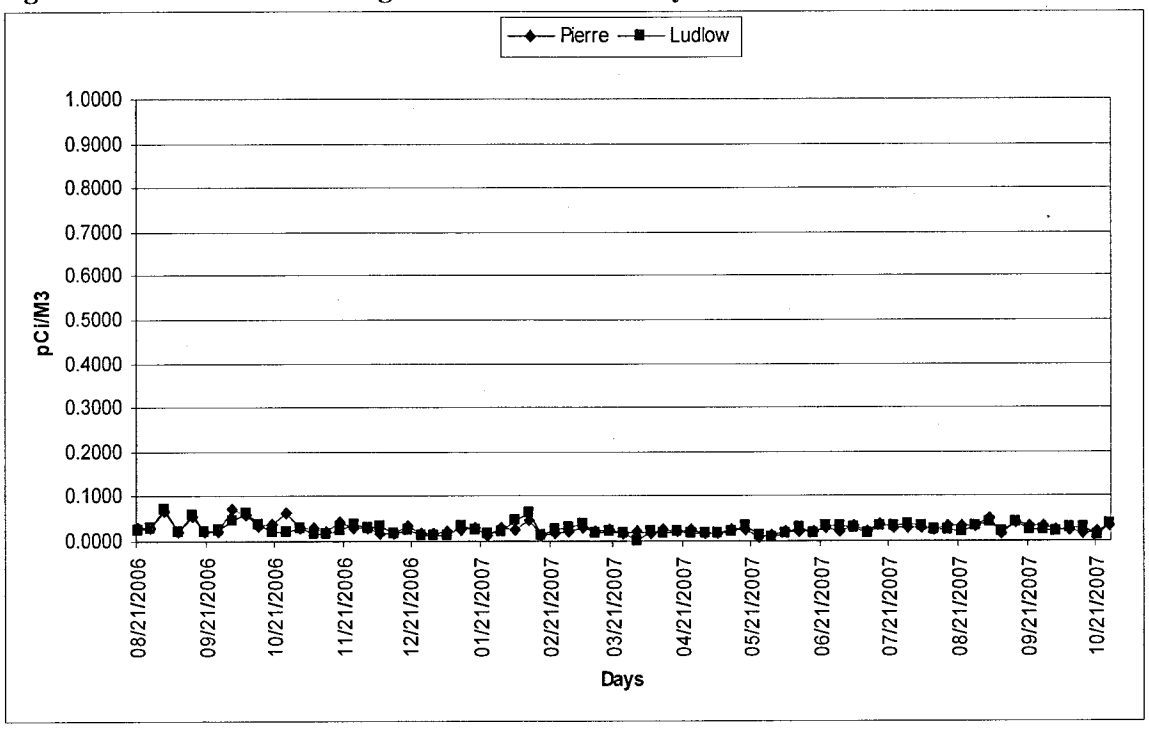


Figure 10. Gross Beta Testing Results Ludlow Study



The testing results for gross alpha and beta indicated low and maybe no uranium present on the particulate samples collected at either site. The South Dakota Health Lab and DENR were certain the screening test was working, but to verify there were low or no uranium concentrations collected on the samples, the samples for the 4th quarter of 2006 were sent to the Colorado State Health Lab for uranium testing.

3.2 Uranium Testing

The second type of analysis included sending the sample pairs to the Colorado State Health Lab to be tested for Uranium ^{234}, Uranium ^{235}, and Uranium ^{238} isotopes using an Alpha Spectrometer. These isotopes represent the natural forms of uranium in the environment. Uranium ^{238} isotope is the most abundant form in nature at around 99% with Uranium ^{234} and Uranium ^{235} isotopes making up the other one percent.

The Colorado State Health Lab followed the same Quality Assurance/Quality Control (QA/QC) program setup during the Rocky Flats air monitoring project in Colorado. One blank and one duplicate test were run with each batch of filters which included 8 sample filters per batch. The Colorado State Health Lab retained the QC records and copies can be obtained from the lab. The testing results were sent from the Colorado State Health Lab to the South Dakota State Health Lab and then to DENR.

The analytical results from the two sampling sites were compared to determine if there was a significant difference in the uranium concentrations collected at the two sampling locations.

The first group of sample filters sent to the Colorado State Health Lab for uranium testing came from the group collected during the 4th quarter of 2006. Only one sample collected at the Ludlow Site in the 4th quarter of 2006 had detectable concentrations of Uranium ^{234} and Uranium ^{238}. But the concentrations for both Uranium ^{234} and Uranium ^{238} were low, almost 1,000 times less than the derived air concentration maximum annual dose of 0.4 pCi/m^3.

DENR continued to have the State Health Lab screen each of the samples for levels of gross Alpha and Beta radiation through the end of the study. With the finding of one sample having detectable levels of uranium, DENR decided to have all sampling pairs collected in 2007, sent to the Colorado State Health Lab to be tested for concentration of uranium. Doing the extra testing would assure that no samples would be missed that had uranium concentrations.

One additional change was made to the sampling study. The sample duration was increased during the study because the Colorado State Health Lab determined the amount of dust collected on the sample filters was to small to provide an accurate analysis. Also by increasing the number of hours collected on each sample, DENR would have a higher confidence level that the testing would collect any uranium concentrations coming from the wind erosion of the unreclaimed uranium mines. DENR changed the sample duration at both sites from a 24 hour sample to a 72 hour sample beginning on February 5, 2007 and continued the 72 hour sampling duration to the end of the study on October 27, 2007.

A total of 66 sampling pairs were analyzed by the Colorado State Health Lab for uranium concentrations. Only three or 4.6% of the samples collected at the Ludlow Site had detectable levels of uranium. Four or 6.1% of the samples at the Pierre Site had detectable levels of uranium. All levels were low well under the derived air concentration maximum annual dose of 0.4 pCi/m^3.

On one sampling day, October 3, 2007, detectable levels of Uranium ^{238} were measured at both Ludlow and Pierre Sites. The concentrations were low and both sites recorded the same concentration level.

One sample collected in Pierre on June 6, 2007 showed a detectable level of Uranium ^{235}. This is very unusual as Uranium ^{235} would come from the industrial use of uranium. Tony Harrison from the Colorado State Health Lab had the following comments on this sample. "I wondered about that positive result for U-235 for the Pierre Site sample collected on September 21, 2007. If it is accurate, the results for U-234 and U-238 should be much higher than they are. I don't expect to find enriched Uranium in Pierre air, but I suppose it's not impossible. My best guess is that it's a false positive that got past our QC."

Appendix B contains a table of the testing results for Uranium ^{234}, Uranium ^{235}, and Uranium ^{238} isotopes. All parameter results are in pCi/m^3. Sample parameter results of "ND" indicate results were non-detectable for that day.

3.3 Data Evaluation

Tony Harrison, Master's of Science in Public Health (MSPH) with the Colorado Department of Public Health and Environment, Laboratory Services Division provided DENR with an interpretation of the uranium testing results. Mr. Harrison was the principle contact with the Colorado State Health Lab and provided technical assistance throughout the project. Mr. Harrison provided the following interpretation of the uranium testing results:

"Consulting EPA Federal Guidance Report No. 11 shows that the Derived Air Concentration (DAC) for the Uranium isotopes in question is 2e-11 uCi/cm^3.

(Uranium DACs can be found here: http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/appb/#U look for table 1, column 3 of the appropriate nuclide. More recent cancer risk coefficients can be found in FGR 13. Both Federal Guidance documents are here: http://www.epa.gov/radiation/federal/techdocs.html)

That's equal to 20 pCi/m^3. The DAC is calculated so that a radiation worker breathing that air for 2000 hours per year (40 hours/week X 50 weeks per year) would receive the maximum allowable dose, 5 REM / year. Since we're interested in members of the public, not radiation workers, the maximum annual dose is 0.1 REM /year, so the DAC is a factor of 0.02 less, or 0.4 pCi/m^3. The highest numbers we found were approximately 1000 times less than that, and would give a dose of 0.0001 REM if a person breathed that concentration for 2000 hours per year, something that obviously didn't happen. There are a lot of assumptions built into this sort of calculation, but it seems likely that the annual dose in both locations from Uranium in air is much less than 1 mrem per year. Average background exposure in the US is estimated to be 200-600 mrem per year, depending on radon exposure from indoor air."

4.0 Conclusions

The Ludlow Community Air Monitoring Study was conducted to determine if windblown dust from unreclaimed uranium mines in Harding County was transporting radioactive dust to the Ludlow area. The air monitoring project demonstrated that the radioactivity levels in the Ludlow area are similar to what is experienced in the Pierre area. The uranium concentrations on the few days that had detectable levels were very low and overall will add little risk to the health of the general public. Based on the monitoring results, DENR concludes that windblown dust from the unreclaimed open pit mines is not transporting radioactive dust to the Ludlow area.

Appendix A

Letter from DENR to Senator Adelstein

May 15, 2006

DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES
PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

May 15, 2006

The Honorable Stan Adelstein
South Dakota State Senator
500 East Capitol Avenue
Pierre, SD 57501-3851

Dear Senator Adelstein:

Thank you for your letter (copy enclosed as Attachment I) regarding concerns about radioactive pollution in the state and for the opportunity to address the State-Tribal Relations Committee. Since that hearing, we have spent considerable time researching this issue. We have also enlisted the assistance of the South Dakota Department of Health to evaluate cancer rates in South Dakota as you requested. As we promised at the committee hearing, the following is a summary of what we have learned about the issue, including background information, and our responses to the specific concerns outlined in your letter and the issues discussed during the State-Tribal Relations Committee meeting on February 27.

BACKGROUND

Historic Uranium Mining

Uranium mining began in the state during the 1950s and continued to the early 1970s. There were two main mining areas (see map enclosed as Attachment II). The first and most important in terms of production was the Edgemont District in Fall River and Custer counties. This district accounted for about 85 percent of the 3.2 million pounds of uranium produced in the state, the majority of it being extracted from sandstones in the Fall River and Lakota formations through open pit mines and several small underground mines.

The second uranium mining area was in Harding County in the Cave Hills and Slim Buttes and accounted for about 15 percent of the total production. The uranium there occurred primarily in thin lignite coal deposits located near the top of the buttes and was mined using surface mining methods. To concentrate the uranium, the lignite was burned on-site or hauled to special burning sites, and the ash was subsequently hauled to mills for processing.

All of the uranium mining done during this time occurred before there were state or federal reclamation laws and reclamation bonding requirements. Therefore, generally speaking, none of the mines were reclaimed and no reclamation bonds were submitted to guarantee reclamation.

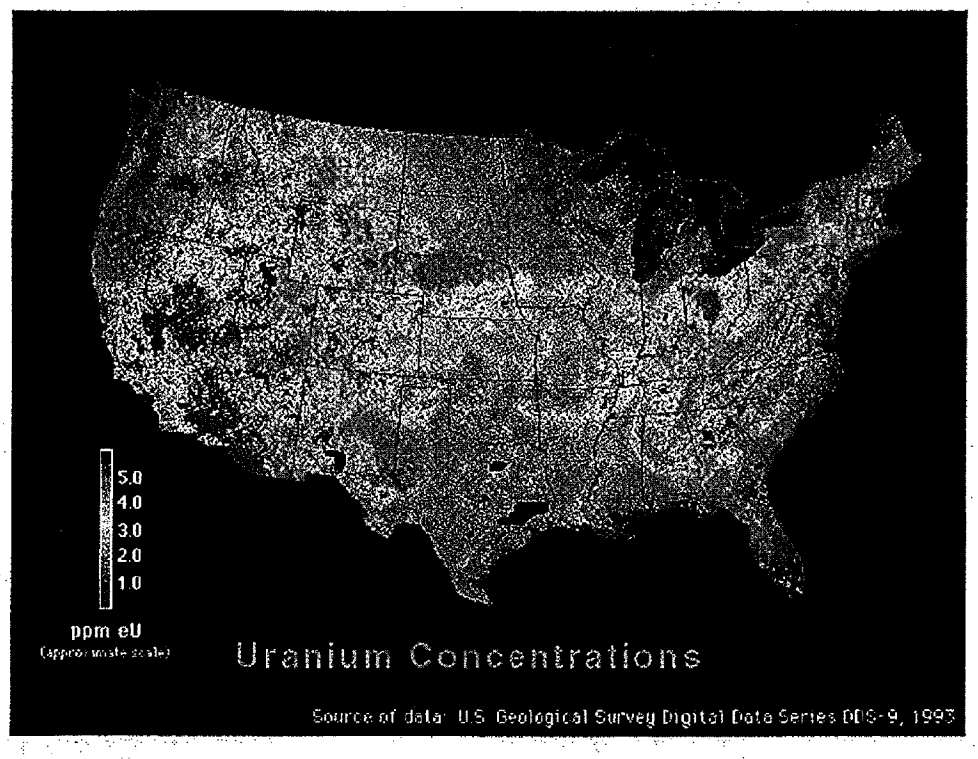
Recent Cleanup of Abandoned Uranium Mines
Many of the abandoned uranium mine sites are located on property managed by the U.S. Forest Service (Forest Service). In the 1990s the Forest Service began to take steps to minimize impacts at some of these sites by constructing ponds to capture sediment, notably at the Riley Pass mine in the North Cave Hills. These ponds were cleaned periodically and the material stored in an on-site repository. The Forest Service also commissioned site evaluation and characterization studies in both uranium mining areas. Based on those studies, the Forest Service began working to reclaim a number of the sites through the federal Superfund laws. Some sites have already been reclaimed, such as the Blue Lagoon, Gladiator and Dead Horse mines in Fall River County,

The Forest Service is currently developing a plan to reclaim the abandoned uranium mines in the North Cave Hills in Harding County. In addition, we recently learned the Forest Service and the South Dakota School of Mines and Technology have entered into an agreement (enclosed as Attachment III), funded by the U.S. Environmental Protection Agency (EPA), to investigate off-site environmental impacts of the abandoned uranium mines in the North Cave Hills. The Oglala Lakota College will also be involved in the investigation as a subcontractor to the School of Mines and Technology. The purpose of the investigation is to evaluate impacts to air, water and soil resources, as well as potential impacts to human health stemming from the migration of contaminated material from past mining activities on or adjacent to lands in the North Cave Hills that the Forest Service administers. The investigation is scheduled to be complete by December 31, 2006.

Historic Uranium Mill at Edgemont
In addition to the uranium mine areas, a uranium mill was constructed at Edgemont in the 1950s. The mill operated until 1974, when it was closed by the owner, the Tennessee Valley Authority (TVA). The U.S. Nuclear Regulatory Commission (Nuclear Regulatory Commission) approved TVA's closure plan for the mill, with work beginning in 1986 and reclamation completed by 1989. TVA removed contaminated uranium mill buildings, removed tailings sands and slimes, and removed the contaminated soil from the mill site and nearby areas. The areas excavated during mill site cleanup were backfilled with clean soil, graded for proper drainage, and revegetated. During this same time, the U.S. Department of Energy began a project to clean up 137 local properties at Edgemont. All the low level radioactive materials, including mill debris, tailings, and soil were impounded in an engineered disposal cell located about two and one-half miles southeast of Edgemont.

Natural Background Uranium in Western South Dakota
Uranium and its associated radioactive decay products are naturally occurring and there are trace amounts in most rock types, stream sediments and soils in the United States. The average uranium concentration in soils in the United States is about three parts per million (U.S. Department of Health and Human Services, 1999), ground water probably averages from one to two parts per billion (Webb and Rahn, 1994) and most natural waters range from one-tenth to ten

parts per billion (U.S. Geological Survey, Heakin, 2000). Some parts of the country, especially in the west, have higher than average uranium levels due to the geology. The U.S. Geological Survey map below shows this variation in uranium levels throughout the United States.



Generally speaking, the elevated natural uranium levels in the west are the result of volcanic activity and related mountain building in the geologic past. Both volcanic ash and granitic rock produced during this process contain uranium above average concentrations that can be mobilized into the environment through natural weathering processes.

The map shows several areas in western South Dakota that have elevated natural uranium levels including the Badlands area, the Black Hills, and several small areas in Harding County that correspond to the Cave Hills and Slim Buttes. The elevated uranium levels in the Badlands area and in Harding County can be attributed to beds of rock containing volcanic ash. These beds, which make up the topography of the Badlands, were deposited roughly between 20 and 40 million years ago as the result of intense volcanic activity to the west. These beds, known by geologists as the Arikaree and White River groups, have been largely removed by erosion in Harding County, but some remnants remain in the higher elevations. The elevated uranium in and around the Black Hills probably has several sources including the granitic core, metamorphic

rocks such as the uranium containing conglomerates near Nemo, volcanic ash, and secondary enrichments in the Inyan Kara group, the geologic formation mined historically near Edgemont.

It is no coincidence that the known uranium deposits mined historically near Edgemont and in Harding County occur in these areas of above average background levels. These deposits are the result of the weathering and release of uranium from parent materials, such as granite and volcanic ash, and subsequent transport by ground water to sites with favorable geochemical conditions that allowed for the precipitation and concentration of uranium over time.

It is also not surprising that ground water in these areas often contains elevated levels of naturally-occurring uranium. For example, a U.S. Geological Survey study by Bowles (1967) on using ground water as a guide to finding uranium deposits in the southern Black Hills, noted uranium concentrations in ground water were reduced from 12 to 13 parts per billion to 3 to 4 parts per billion as the water migrates from the Minnelusa and Lakota formations through the Lakota and Fall River formations, demonstrating ongoing deposition of uranium. Another U.S. Geological Survey report by Heakin (2000) on the water quality of springs and public supply wells on the Pine Ridge Indian Reservation found median values of uranium in nine springs ranged from 2.1 to 13 parts per billion. The study also found uranium levels in 44 wells that ranged from less than detection to 59 parts per billion, with an average of 15 parts per billion for all the wells. Three wells exceed the current EPA drinking water standard for uranium of 30 parts per billion. A study by Gill and Moore (1955) on the uranium deposits in the Slim Buttes of Harding County, found that uranium bearing lignites were associated with natural springs containing uranium in concentrations of 30 parts per billion or more and suggested ground water could be a useful tool to explore for such deposits.

In summary, the geologic history of western South Dakota has resulted in naturally elevated levels of uranium in soils and water in several areas. Natural weathering processes have released and mobilized uranium from parent materials into the environment. Oxygenated ground water containing this uranium is responsible for creating the known deposits of uranium and can contain concentrations higher than the current drinking water standard of 30 parts per billion. With that as background, the following responses are provided to the specific concerns contained in your letter that is enclosed as Attachment I.

(1) Radioactive isotopes in the Grand and Moreau rivers.
While DENR operates a surface water quality monitoring network on streams statewide, analyzing radioactive elements is not included in the laboratory analyses that are routinely performed on those samples. However, because the price of uranium has quadrupled during the last three years and that market increase has the potential to result in new uranium exploration and development projects in southwestern South Dakota, we developed a plan for additional monitoring on west river streams to document radioactive element concentrations. This plan, including sampling and testing protocols and the selected sites to be sampled, is enclosed as Attachment IV.

DENR also regulates public drinking water supply systems that have been delegated to us by EPA. These drinking water systems are required to periodically sample for radioactive substances in the drinking water they provide, including gross alpha, radium ^{226}, radium ^{228} and uranium. We reviewed the most recent sampling data available and found that, of the approximately 270 systems in the state required to monitor for radioactive substances, two exceed the standard for gross alpha, six exceed the standard for radium ^{226} and radium ^{228}, and only one exceeds the standard for uranium (see Attachment V for maps and tables that identify these systems). After you look at the maps, you will note that none of these systems are in the Grand or Moreau river basins. DENR has also provided in Attachment V the most recent radiological data from the drinking water systems that we regulate in the proximity of the Moreau, Grand, Cheyenne, and White rivers.

The only DENR regulated drinking water system in the state that exceeds the uranium standard of 30 parts per billion is Buffalo Gap. The source of the system's water is a well in the Fall River formation of the Inyan Kara aquifer, which is the same geologic formation mined historically for uranium near Edgemont. Due to the distances involved and the hydraulic gradient, DENR's geologists have concluded the higher level of uranium in Buffalo Gap's well is a result of naturally high concentrations that occur in the Inyan Kara aquifer and were not caused by historic mining activity..

(2) Is an active mine in Nebraska polluting the White River?
The mine being referred to is the Crow Butte mine, which is an active in situ uranium leach mine located near Crawford, Nebraska. In situ leach mining involves injection of substances through wells into an ore body that will leach the uranium out of the rock into a solution, then collecting the fluid through recovery wells, and processing it on the surface to remove the uranium. To answer this question, DENR staff first contacted the Nebraska Department of Environmental Quality. The Nebraska department told us they have no record of uranium contamination of the White River from the Crow Butte uranium mine, or any past uranium operation for that matter.

Next, DENR staff called Michael Griffin, the environmental manager at the Crow Butte mine. He told us that an extensive surface water quality monitoring program is required under their Source Materials License from the federal Nuclear Regulatory Commission. While the mine is not located on the White River, their permit area is within the White River drainage. Therefore, the company is required by the Nuclear Regulatory Commission to collect upstream and downstream surface water and sediment samples from all streams and impoundments in the active mining area on a quarterly basis and conduct analyses for radionuclides. Mr. Griffin told us that no downstream samples of any tributaries of the White River collected since the mining operation began in 1986 have ever shown any detectable radiological impact. The results of all environmental monitoring are reported to the Nuclear Regulatory Commission in semiannual reports as required under federal law.

As part of its initial licensing process in the early 1980s, Crow Butte was required to collect extensive baseline radiological data before the permit and license could be issued. This baseline sampling included at least one year of quarterly surface water quality samples. The baseline samples ranged from <0.001 to 0.008 mg/L natural uranium, which is consistent with natural background concentrations noted elsewhere in the western United States. In 2004 and 2005 the company collected samples from two locations on the White River in connection with potential expansion permitting. These samples ranged from 0.005 to 0.007 mg/L natural uranium, again within natural background range expected in the western United States.

We also discussed with Mr. Griffin the list of license violations at the Crow Butte mine that came up during the State-Tribal Relations Committee meeting. He told us this list, which we found in an Internet search on a Web site devoted to identifying issues at operating uranium mines in the United States, is a mischaracterization. The majority of the violations listed are monitoring well excursions, which means there is an indication in a monitoring well that injected process solutions may be moving outside the mining or in situ zone. To remedy excursions, Crow Butte's permits require them to begin recovery operations by over-pumping production wells. If they do not complete recovery operations within 90 days, they are required to cease mining in the area. According to Mr. Griffin, they have never had to shut down mining due to an excursion and excursions have never affected ground water outside the permit area. He said these are required to be reported to the Nuclear Regulatory Commission and the state of Nebraska, but do not represent violations of state or federal licensing or permitting requirements.

Based on this information, DENR found no evidence of current radiological contamination being contributed to the White River by the Crow Butte uranium mine in Nebraska.

(3) Are aquifers being polluted with radioactive isotopes that have come out of mines in Wyoming and are there overlapping areas of responsibility?
There has been considerable uranium mining in Wyoming over the past half century, including both open pit and underground mines. However, those mines have been mostly reclaimed. More recently uranium production in Wyoming has come from in situ leach mines. The primary concern of contamination occurring from these in situ mines comes from the reinjection of the waste product after uranium is removed from the recovered solution. This waste product is injected into a deep formation that is subject to strict federal regulations and is monitored to prevent contamination of ground water that may be used as drinking water supply.

To answer this question, we asked the geologists and hydrologists in our Geological Survey Program to evaluate the possibility of radioactive contamination in Wyoming impacting aquifers in South Dakota. Their evaluation included past and current uranium mining in Wyoming within the Powder River basin northeast of Casper, Wyoming. A map referred to as the "Geologic Map of the Powder River Basin and Surrounding Area" (Ellis and Colton, 1994), shows several sedimentary units in that area of the Powder River basin. These geologic formations are underlain by numerous, relatively thick formations (thousands of feet collectively) containing

significant quantities of low-permeability shale that would prevent hydrologic connection between uranium mining operations at or near land surface, and the first significant subsurface aquifer (the Inyan Kara aquifer) that could affect water quality in South Dakota. Furthermore, South Dakota aquifers are protected even more because the hydraulic gradient from the elevated strata in the Black Hills would prevent ground water movement toward the east. Therefore, our geologists and hydrologists conclude there is no evidence that these uranium operations in Wyoming threaten any aquifers in South Dakota.

While we have no reason to believe aquifers in South Dakota are being impacted by uranium mining in Wyoming, we do not see a problem with overlapping areas of responsibility. We have developed an excellent working relationship with the Wyoming Department of Environmental Quality. Even so, it is South Dakota's responsibility to protect water resources within our borders. While the uranium mining in the Powder River basin is not seen as a possible threat to aquifers in South Dakota, the surface water quality monitoring plan mentioned previously includes monitoring stations on both the Cheyenne and Belle Fourche rivers that will provide information on the levels of certain radioactive elements as these streams enter South Dakota.

(4) With the recent new drilling permits for oil, were there hazardous radioactivity warnings given in connection with the drilling?

While drilling for oil in Harding County has been ongoing since the 1950s, it is true; DENR and the Board of Minerals and Environment have recently issued a number of new drilling permits for oil wells. However, we are not aware of any radioactivity warnings in connection with these new wells, nor do we believe any are necessary. We base this on the following:

- Oil wells in Harding County generally are not located in the same areas where the uranium bearing lignite occurs and, therefore, the likelihood of an oil rig drilling through such a formation is low.
- Even if a drill rig did drill through such a formation, only a small amount of rock from the formation would be produced in the cuttings because the uranium bearing lignite beds are only a few feet thick.
- State requirements are that cuttings from drilling an oil well be contained in a lined pit.
- To ensure protection of fresh water aquifers in the area, all the oil wells are required by DENR to be cased and cemented.
- If a well is unproductive or no longer produces, it must be plugged with cement in accordance with state requirements.
- Any water produced from deep oil bearing formations is generally reinjected into the formation from which it came or into another formation that is not a potential source of drinking water.
- Reinjection is regulated through state and federal underground injection control permits.
- Continental Resources, Inc., the largest oil and gas operator in Harding County, responded to DENR that they have never had any problems with uranium or radium in water or sediments produced from their operations.

During the State-Tribal Relations Committee meeting, we learned that Ms.White Face's concern about radionuclide contamination associated with oil well drilling in Harding County stemmed from an Environmental Impact Statement the Forest Service prepared in 2004. The subject of the Environmental Impact Statement was oil and gas leasing in the Sioux Ranger District including the Cave Hills, Slim Buttes and Short Pine Hills in Harding County. She said the document indicated that oil well workers in these areas could not eat or drink in the area due to the radiation hazard and they had to wear full-body protective clothing.

DENR staff found the Environmental Impact Statement that Ms. White Face referenced and reviewed those portions that address radiation issues related to drilling for oil and gas in the areas of the Cave Hills and Slim Buttes where abandoned uranium mines exist. The analyses of the effects of oil well drilling in the areas of abandoned uranium mines does conclude that workers in these areas could be exposed to increased health risks. However, this conclusion was based primarily on the assumption that high levels of naturally-occurring radium will be entrained in water produced during drilling, but no samples were ever collected from any oil field water produced in Harding County. Because we question if this type of analysis is appropriate, we contacted the Forest Service to find out why the analysis was done this way. The Forest Service told us our concern is valid, and the analysis should either have been removed from the document or a reference should have been made that it was based only on this assumption.

Because DENR staff have been through the Cave Hills area many times and have never seen Forest Service or oil field workers wear protective clothing, we also asked the Forest Service about the conclusion that oil workers in these areas should wear full-body protection to protect them from radiation hazards. The Forest Service told us that their contractor who performed the recent site investigation of the abandoned uranium mines in the North Cave Hills identified the affected areas as Class D sites under federal regulations. A Class D site does not require workers to wear full-body protection, but instead a work uniform providing minimal protection to include coveralls, work gloves, hard hats, steel-toed boots, safety glasses, and other equipment appropriate to site conditions. The Forest Service also said the Class D designation only applies to the abandoned mine areas and does not apply to the entire Cave Hills.

Finally, the Forest Service told us about air and radiation monitoring it performed during a 2004 removal action at the Riley Pass abandoned uranium mine that involved cleaning out sediment ponds. During the project, personal air monitoring of construction workers was done for a 24-hour period to determine employee exposure to airborne arsenic, molybdenum, and radiation while they were excavating the sediment ponds. The monitoring determined that "personnel exposure to airborne arsenic and molybdenum were below the currently established applicable permissible exposure limits established by the Occupational Safety and Health Administration." Forest Service employees at the site also wore radiation dosimeter badges to determine levels of exposure. The badges were worn 100 percent of the time while on-site and doses were below permissible exposure limits.

Based on this information, we continue to believe that oil well drilling in Harding County poses very little, if any, radiation contamination risk. However, to further document if there is a concern to workers in the oil fields, we have developed a sampling plan in Attachment VI for documenting if there are radionuclides or radiation levels of concern at oil well operations in Harding County.

Additional Issues Raised at the State Tribal Relations Committee Meeting
(1) Uranium contamination from the abandoned uranium mines is causing increased cancer rates
After the State-Tribal Relations Committee meeting, DENR brought those concerns related to cancer rates back to the Department of Health. Secretary Doneen Hollingsworth asked her staff to conduct a review of cancer rates in nine counties in western South Dakota and the results of their review is enclosed as a separate report (See attachment VII).

(2) SB 62 will open up the state to additional uranium mining.
The historic mining that left the abandoned uranium mines occurred before there were state or federal requirements for mine permits, reclamation plans, or reclamation bonds. However, the 1982 Legislature passed bills that established permits and reclamation bonds for both uranium exploration and mining (see South Dakota Codified Laws 45-6B and 45-6D). Therefore, those activities can now be permitted under state law.

Although uranium mining or exploration has not been conducted in the state for many years, the recent rise in the market value of uranium has caused increased interest in the uranium resources in the Edgemont area that was mined from the 1950s to the early 1970s. Because we identified two regulatory gaps in existing state laws permitting exploration and mining of uranium, DENR decided to be proactive and ask the legislature to close those gaps before any new uranium exploration or mining applications are submitted. Senate Bill 62 was drafted to close those two gaps by requiring 100 percent bonding for uranium exploration operations; current law only requires bonding for plugging ten percent of test holes. Second, it gives the Board of Minerals and Environment authority to draft rules to address uranium and other types of in situ leach mining, a process that has never been used in the state before. Therefore, we do not view Senate Bill 62 as being an incentive to opening up the state to new uranium exploration and mining. Instead, we view it as a bill to close regulatory gaps in existing state law to ensure the state can regulate uranium exploration and in situ mining if those activities do come to South Dakota as a result of improved market conditions for uranium.

(3) Wind picks up uranium contaminated dust from the abandoned mine areas and spreads it downwind, creating a potential public health hazard.
While we believe that the potential impact of windblown dust from the abandoned uranium mine areas is localized as shown by Forest Service air and radiation monitoring at the Riley Pass mine mentioned above, we have no air quality monitoring data to confirm it. Therefore, DENR has

developed an air quality monitoring plan (see Attachment VIII) to collect data on airborne particulates in the North Cave Hills area, and compare that data to a control site in Pierre.

Summary:
In summary, after thoroughly researching this subject, DENR is taking the following actions in response to your inquiry:

1. Continue to provide staffing and resources to assist the Forest Service in its efforts to reclaim abandoned uranium mine sites in Harding and Fall River counties,
2. Implement Attachment IV which is the sampling plan for metals and radionuclides in surface waters in western South Dakota,
3. Continue to track water quality data collected by regulated drinking water systems throughout South Dakota to ensure all drinking water standards are met,
4. Implement Attachment VI which is the radiation and radionuclide sampling plan for oil and gas sites in Harding County,
5. Implement Attachment VIII which is the air quality monitoring plan for the North Cave Hills area, and
6. Begin implementation of Senate Bill 62 by drafting the regulations for in situ leach mining for eventual public hearing before the Board of Minerals and Environment.

I hope you and your committee agrees with DENR's review and proposed responses to follow up on the uranium concerns brought before the committee. We will share results as our follow-up actions are completed. Thank you, again, for allowing us to respond.

Sincerely,

Steven M. Pirner
Secretary

Enclosures

cc w/o enc: Robert E. Roberts, Regional Administrator, EPA Region VIII
Laurie Walters-Clark, On-Scene Coordinator, U.S. Forest Service

ATTACHMENT I

Letter from Senator Adelstein to DENR

STATE OF SOUTH DAKOTA
SENATOR STAN ADELSTEIN
STATE SENATE - DISTRICT 32

16 February 2006

Steven M. Pirner, P.E., Secretary
Department of Environment & Natural Resources
PMB 2020
Joe Foss Building
523 East Capitol Avenue
Pierre, South Dakota 57501

Dear Steve:

Charmaine White Face met with me to discuss a problem of radioactive pollution in this state. She came to me not only because I am a state senator, but also because I am Chair of the State-Tribal Relations Committee. A radioactive pollution problem would certainly affect our relationships with the tribes.

Frankly, a problem of radioactive pollution in South Dakota is something I had not heard of before. I was aware that the uranium mines had created a problem in Fall River County but, as far as I knew, all of them been sealed.

Ms. White Face told me there is evidence of high concentrations of radioactive isotopes in the Grand and Moreau Rivers that run through villages in the Cheyenne River and Standing Rock reservations. I also understand there is an active uranium mine in Nebraska that is polluting the White River.

Apparently, too, there is a problem with the possibility of aquifers being polluted with radioactive isotopes that have come out of mines in Wyoming. Ms. White Face believes the state has information about these problems and has not been able to do anything because of overlapping areas of responsibility.

I would very much appreciate your sharing what you know about this problem at your earliest convenience. Let's find out what needs to be done and what health hazards we are now facing.

I was given to understand that in connection with the recent new drilling permits for oil, that there were hazardous radioactivity warnings given in connection with the drilling, and the possibility of contaminants. I would appreciate any information you might have with regard to this as well.

Very truly yours,

Senator Stan Adelstein

FEB 2006
Dept. of Environment and Natural Resources, Environmental Services

STATE CAPITOL
500 E. CAPITOL AVENUE
PIERRE, SD 57501-5070
TELEPHONE: 605-773-3851

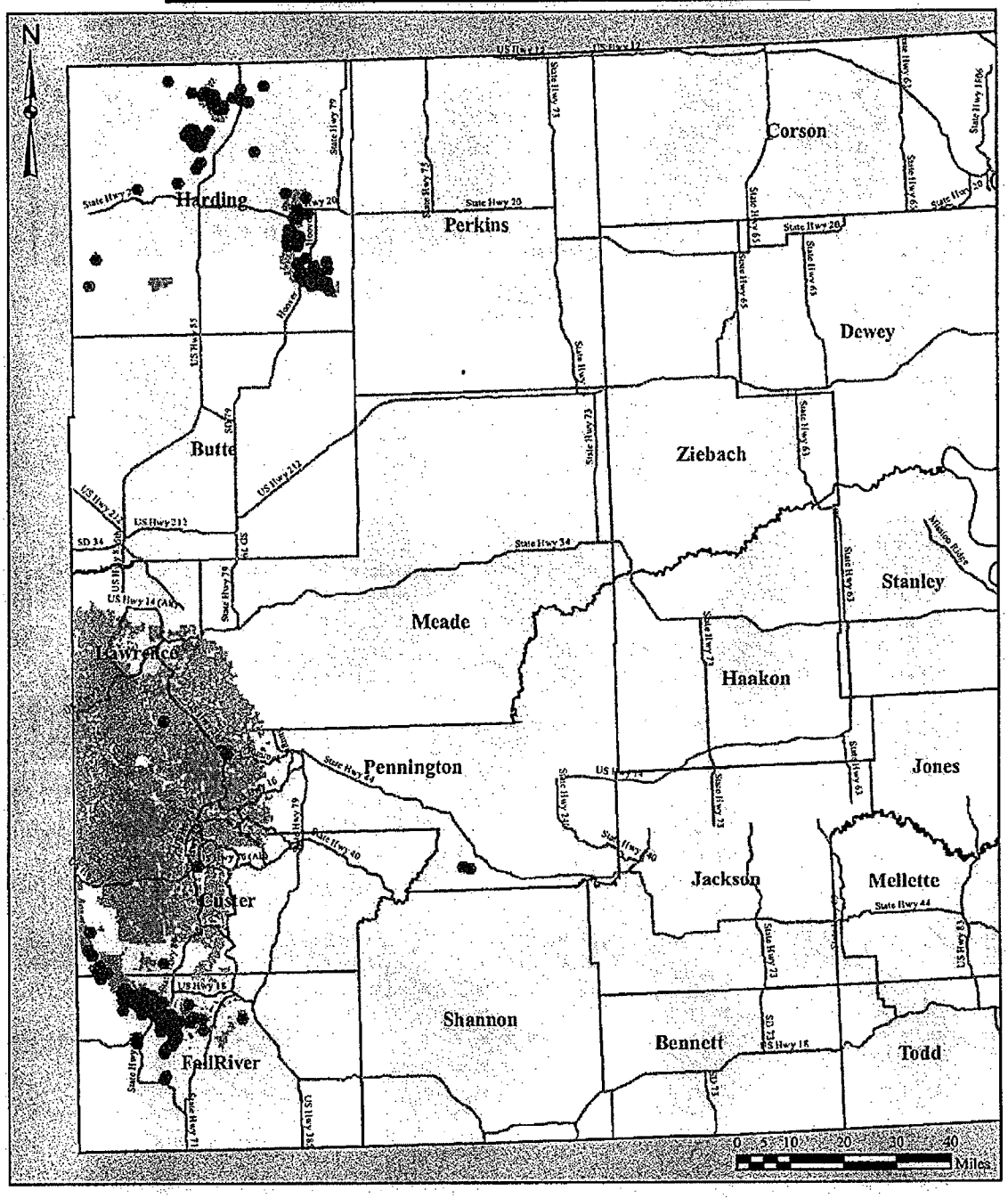
1999 WEST BOULEVARD • PO BOX 2624
RAPID CITY, SD 57709-2624
TELEPHONE: 605-394-3310 EXT. 11
E-MAIL: sen.adelstein@state.sd.us

Not printed at Taxpayer Expense

ATTACHMENT II

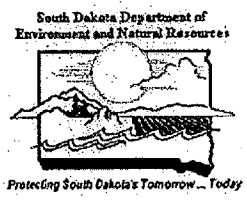
Map of Western South Dakota Historic Uranium Mines and Prospects

Western South Dakota
Historic Uranium Mines and Prospects



Legend

- Uranium Mines & Prospects
- Primary Roads
- U.S. National Forest



ATTACHMENT III

JOINT VENTURE AGREEMENT
between the
USDA FOREST SERVICE, NORTHERN REGION, REGIONAL OFFICE
and the
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

06-JV-11015600-019

JOINT VENTURE AGREEMENT
between the
USDA FOREST SERVICE,
NORTHERN REGION, REGIONAL OFFICE
and the
SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

This JOINT VENTURE AGREEMENT is hereby made and entered into by and between the USDA Forest Service, Northern Region, hereinafter referred to as the Forest Service, and the South Dakota the School of Mines and Technology, hereafter referred to as the School of Mines and/or the Cooperator, under the provisions of the National Agricultural Research, Extension and Teaching Policy Act of 1977 (Pub.L. 95-113), as amended by the Food Security Act of 1985 (7 U.S.C., 3318 and3319, Pub. L. 99-198).

BACKGROUND: During the late 1950s and early 1960s a substantial amount of prospecting and mining of uranium resources occurred in western South Dakota, southeastern Montana, and northeast Wyoming. These lands are located in the Grand, Moreau, and Belle Fouche/Cheyenne watersheds of the Missouri River drainage. As a result of this historic activity degradation of both land and water resources have occurred as a result of the migration of the contaminated material by water and wind erosion. In addition, the remnants of these impacts pose a risk to human health. Over the past eight years the Forest Service has completed a number of Preliminary Assessments and Site Investigations at locations on lands administered by the Forest Service. However, the overall extent of the impacts to the Upper Grand and Moreau River drainages from these sites, as well as, sites adjacent to lands administered by the Forest Service need to be further investigated. In order to meet its responsibilities under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended, CERCLA, (42 U.S.C. 1251) Region One of the Forest Service looking to other partners, including universities, to help in the evaluation of human health and environmental impact resulting from the past mining and prospecting of Uranium resources in the watersheds.

A. PURPOSE:

The specific purpose of this Agreement is to work cooperatively with the School of Mines to improve the ability of the Forest Service to evaluate impacts to air, water and soil resources, as well as, potential impacts to human health stemming from the migration of contaminated material from past mining activities on or adjacent to lands in the North Cave Hills that it administers. It is anticipated that the North Cave Hills project shall be completed by December 31, 2006. Other areas, such as South Cave Hills and Slim Buttes, may be added to this agreement as mutually agreed to (*ref provisions E-8 & E-12*). It is also the intent of this endeavor to: (1) develop a technical process for the evaluation of mining related impacts associated with historic uranium mining; (2) evaluate the physical and chemical characteristics at a limited number of sub-drainages near the Forest Service Administrative boundary; (3) develop educational opportunities

for students and Forest Service personnel pertaining the remediation of historical mine and milling sites.

B. STATEMENT OF MUTUAL BENEFIT AND INTERESTS:

1) The Forest Service is responsible for the mitigation of human health and negative impacts to the environment as the result of historic activities that have occurred on or adjacent to lands that it administrators. Through this agreement the Forest Service will develop and implement better and more effective remediation efforts on lands that it administers in western South Dakota and provide education and training opportunities related to this topic for existing employees, potential future employees, partners, and interested members of the general public.

2) The School of Mines is responsible for creating knowledge, providing an active learning environment for students, and offering programs and services responsive to the needs of the people of South Dakota. The Institution's dedication to education for and throughout life reflects the commitment to service learning and community building on and off the School of Mines campus. The Institution's interest in this agreement is: to develop or improve coursework that would serve primarily students of South Dakota involved in the study of the natural sciences and engineering; to engage students in the theoretical and practical issues surrounding the development of reclamation protocols; sampling and testing criteria as well as evaluation methodologies for the identification, prioritization and monitoring of abandoned and inactive mines sites within the Region.

3) The parties mutual benefit and interest is: to evaluate and assess impacts stemming from historically mined sites; identification of background water, soil and air conditions within the western South Dakota area; sharing of this information with other agencies, students, and the public-at-large; and to train students and others on the extent of impacts stemming from historic uranium mining and prospecting.

C. FOREST SERVICE SHALL:

1. Provide leadership for planning and technical expertise in the implementation of the Statement of Work.

2. Have final approval of selected sites and or areas for study.

3. Provide the Cooperator information and materials pertaining to the impacts associated with past uranium prospecting and mining, including data bases, electronic information, paper records, public documents, aerial photographs, remote sensing imagery, maps, and when available, access to Forest Service Specialists.

4. Review courses proposed and/or developed by the School of Mines that are pertinent to the issue of the effectiveness of evaluating impacts on the natural resources watersheds where the Forest Service has administered lands.

5. PAYMENT/REIMBURSEMENT. Reimburse the cooperator for the Forest Service's proportionate share (80 percent) of actual expenses incurred, not to exceed $175,000, reduced by program income, and other Federal and nonfederal cash contributions, as shown in the incorporated Financial Plan. The cooperator is approved to submit monthly billing(s). The Forest Service will make payment for its share of project costs upon receipt of an invoice. Each invoice shall display the cooperator's actual expenditures to date of the invoice (not just the Forest Service share of actual expenditures), displayed by separate cost elements as documented in the Financial Plan, less other Federal and nonfederal cash contributions and previous Forest Service payments. The invoice should be forwarded as follows:

a. Send an original to: Bob Wintergerst
USDA Forest Service, Northern Region RO
P.O. Box 7669
Missoula, MT 59801

b. Send a copy to: Elaine Hilliard
USDA Forest Service, Northern Region RO
P.O. Box 7669
Missoula, MT 59801

D. THE SCHOOL OF MINES SHALL:

1. Perform in accordance with the Statement of Work for Calendar year 2006 for the North Cave Hills area, **(SEE APPENDIX A).**

2. Bill the Forest Service for their share of actual costs incurred to date, including those cost incurred by the Cooperator through sub-contracts to other entities such as the Oglala Lakota College. Such billings will exclude any previous Forest Service payment(s) made on this instrument to the date of the invoice.

E. IT IS MUTUALLY AGREED AND UNDERSTOOD BY ALL PARTIES THAT:

1. PRINCIPAL CONTACT. The principal contacts for this instrument are:

Forest Service Project Contact	Cooperator Project Contact
Bob Wintergerst	Dr. James Stone
USDA Forest Service, Region 1 RO	Department of Civil and Environmental Engineering
P.O. Box 7669	South Dakota School of Mines and Technology
Missoula, MT 59801	501 E. St. Joseph St. Rapid City, SD 57701

Phone: 406 329-3036	Phone: 605 394-2443
FAX: 406 329-3198	FAX: 605 394-5171
E-Mail: rwintergerst@fs.fed.us	E-Mail: james.stone@sdsmt.edu

Forest Service Administrative Contact	Cooperator Administrative Contact
Roger Henderson	Sharon Reid
USDA Forest Service, Region 1 RO	Office of Sponsored Programs
P.O. Box 7669	South Dakota School of Mines and Technology
Missoula, MT 59801	501 E. St. Joseph St. Rapid City, SD 57701
Phone: 406 329-3264	Phone: 605 394-1205
FAX: 406 329-3682	FAX: 605 394-5360
E-Mail: rmhenderson@fs.fed.us	E-Mail: sharon.reid@sdsmt.edu

2. FOREST SERVICE ACKNOWLEDGED IN PUBLICATIONS AND AUDIOVISUALS. Forest Service support shall be acknowledged in any publications and audiovisuals developed as a result of this instrument.

3. COLLECTION OF AMOUNTS DUE THE FEDERAL GOVERNMENT. Any funds paid to a cooperator in excess of the amount to which the cooperator is finally determined to be entitled under the terms and conditions of the award constitute a debt to the Federal Government. If not paid within a reasonable period after the demand for payment, the Federal awarding agency may reduce the debt by:

(1) Making an administrative offset against other requests for reimbursements.

(2) Withholding advance payments otherwise due to the cooperator

(3) Taking other action permitted by statute.

Except as otherwise provided by law, the Federal awarding agency shall charge interest on an overdue debt.

4. TAXPAYER IDENTIFICATION NUMBER The cooperator's number is 46-6000364.

5. FUNDING EQUIPMENT. Federal funding under this instrument is not available for reimbursement of Cooperator's purchase of equipment.

6. FREEDOM OF INFORMATION ACT (FOIA). Any information furnished to the Forest Service under this instrument is subject to the Freedom of Information Act (5 U.S.C. 552).

7. RETENTION AND ACCESS REQUIREMENTS FOR RECORDS. The Forest Service, Inspector General, or Comptroller General, through any authorized representative, shall have access to and the right to examine all records related to this instrument. As used in the provision, "records" includes books, documents, accounting procedures and practices, and other data, regardless of type and regardless of whether such items are in written form, in the form of computer data, or in any other form. All records pertinent to the award shall be retained for a period of 3 years.

8. MODIFICATION. Specific items to be completed will be developed annually and incorporated into this Agreement through an attached Annual Operating Plan (AOP) that is signed by both parties. Modifications within the scope of the instrument shall be made by mutual consent of the parties, by the issuance of a written modification, signed, and dated by all parties, prior to any changes being performed. The Forest Service is not obligated to fund any changes not properly approved in advance.

9.NONDISCRIMINATION. The Cooperator shall comply with all Federal statutes relating to nondiscrimination and all applicable requirements of all other Federal laws, Executive orders, regulations, and policies. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d, 2000e-16), which prohibits discrimination on the basis of race, color, disability, or national origin; (b) Title IX of the Education amendments of 1972, as amended (20 U.S.C. 1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; and Section 504 of the Rehabilitation Act of 1973 as amended (29 U.S.C. 794) which prohibits discrimination on the basis of disabilities. The nondiscrimination statement which follows shall be posted in primary and secondary Cooperator offices, at the pubic service delivery contact point and included, in full, on all materials regarding such Cooperators' programs that are produced by the Cooperator for public information, public education, or public distribution:

> "In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability. (Not all prohibited bases apply to all programs.)
>
> To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer."

If the material is too small to permit the full statement to be included, the material will at minimum include the statement, in print size no smaller than the text, that "This institution is an equal opportunity provider."

10. LEGAL AUTHORITY. The Cooperator has the legal authority to enter into this instrument, and the institutional, managerial and financial capability (including funds sufficient to pay nonfederal share of project costs) to ensure proper planning, management, and completion of the project.

11. PARTICIPATION IN SIMILAR ACTIVITIES. This instrument in no way restricts the Forest Service or the Cooperator(s) from participating in similar activities with other public or private agencies, organizations, and individuals.

12. AVAILABILITY OF FUNDS. Funds in the amount of 175,000.00 are currently available for performance of this instrument through December 31, 2006. The Forest Service's obligation for performance of this instrument beyond this date is contingent upon the availability of appropriated funds from which payment can be made. No legal liability on the part of the Forest Service for any payment may arise for performance under this instrument beyond December 31, 2006, until funds are made available to the Forest Service for performance and until the Cooperator receives notice of availability by written modification by the Forest Service.

13. DAVIS-BACON OR SERVICE CONTRACT ACT. Federal wage provisions (Davis-Bacon or Service Contract Act) are applicable to any contract developed and awarded under this instrument where all or part of the funding is provided with Federal funds. Davis-Bacon wage rates apply on all public works contracts in excess of $2,000 and Service Contract Act wage provisions apply to service contracts in excess of $2,500. The Forest Service will award contracts in all situations where their contribution exceeds 50 percent of the costs of the contract. If a cooperator is approved to issue a contract it shall be awarded on a competitive basis.

14. ELECTRONIC FUNDS TRANSFER. The Cooperator shall designate a financial institution or an authorized payment agent through which a Federal payment may be made in accordance with U.S. Treasury Regulations, Money and Finance at 31 CFR 208, which requires that Federal payments are to be made by electronic funds transfer (EFT) to the maximum extent possible. A waiver may be requested and payment received by check by certifying in writing that one of the following situations apply:

1. The payment Cooperator does not have an account at a financial institution.

2. EFT creates a financial hardship because direct deposit will cost the payment recipient more than receiving check.

3. The payment recipient/cooperator has a physical or mental disability, or a geographic, language, or literacy barrier.

To initiate receiving your payment(s) by electronic transfer, contact the National Finance Center (NFC) on the worldwide web at www.nfc.usda.gov, or call the NFC at 1-800-421-0323, or (504) 255-4647. Upon enrollment in the program you may begin to receive payment by electronic funds transfer directly into your account.

15. PROGRAM PERFORMANCE REPORTS. A final performance report shall be submitted either with your final payment request, or not later than 90 days from the expiration date of the instrument.

16. ALTERNATE DISPUTE RESOLUTION. In the event of any issue of controversy under this Agreement, the parties may pursue Alternate Dispute Resolution procedures to voluntarily resolve those issues. These procedures may include, but are not limited to conciliation, facilitation, mediation, and fact finding.

17. DUNS NUMBER (5/04): The cooperator shall furnish their DUNS number upon execution of this instrument. You may obtain a DUNS number by contacting Dun and Bradstreet at 800-234-3867 or 866-794-1580. A DUNS number will be provided immediately by telephone at no charge.

18. TERMINATION. Any of the parties, in writing, may terminate the instrument is whole, or in part, at any time before the date of expiration. Neither party shall incur any new obligations for the terminated portion of the instrument after the effective date and shall cancel as many obligations as possible. Full credit shall be allowed for each Party's expenses and all non-cancelable obligations properly incurred up to the effective date of termination

19. COMMENCEMENT/EXPIRATION DATE. The instrument is executed as of the date of the last signature and is effective for **five (5) years after the date of the execution by both parties** at which time it will expire unless extended.

20. AUTHORIZED REPRESENTATIVES: By signature below, each Cooperator certifies that the individuals listed in this document as representatives of the individual Cooperator are authorized to act in their respective areas for matters related to this agreement.

The authority and format of this instrument has been reviewed and approved for signature.

ROGER M. HENDERSON DATE
Grants and Agreements Specialist

In WITNESS WHEREOF, the parties hereto have executed this agreement as of the date listed below.

_____

TIMOTHY G. HENDERSON DATE
Vice President, Business and Administration
South Dakota School of Mines and Technology

_____

ABIGAIL R. KIMBELL DATE
Regional Forester
USDA Forest Service, Region 1

Forest Service Use

Job Code:_____

APPENDIX A

USFS-SOUTH DAKOTA SCHOOL OF MINES and TECHNOLOGY Agreement
Statement of Work for 2006
NORTH CAVE HILLS

Scope of Work

The following tasks were identified by the Forest Service in the Draft Statement of Work provided to the School of Mines in mid-November of 2005 and have been modified based on discussions occurring after the notification of the Scope of Work. Direct quotes from the Request for Proposal (RFP) are reiterated in *italic* text. Implementation of some of these tasks maybe considered optional (designated "**") and would be implemented only if funding remains after the execution of the primary tasks specified (reference Availability of Funds Clause- Item E12) .

Goal of Work

The goal of the work to be completed under this agreement is to collect and analyze field data from the North Cave Hills area of Custer National Forest within northwestern South Dakota. Note, should additional funding become available and it is mutually agreed to, South Cave Hills and Slim Buttes may also be added as projects (*ref provision E-8 & E-12 of the agreement*). The data for each project will be assessed to determine the offsite impacts onto private lands due to soil and water erosion and to wind transported dust originating from abandoned uranium mining sites on Forest Service administered lands. Data collection procedures and analytical methods will be adjusted as necessary during the project to best reflect true contaminant dispersion and concentrations, and this study will also serve as proof-of-concept investigation for future work.

The project will be completed through collaboration between the School of Mines and the Oglala Lakota College with each institution having an integral role in the development of project objectives and outcomes.

Task #1 - Review of Information

This task will require the review of all environmental documents and technical reports pertaining to past uranium mining activities that have occurred in western South Dakota, as well as, all water, soil, and air monitoring reports and monitoring data related to western South Dakota.

The School of Mines concurs that existing information must be utilized prior to an evaluation of each watershed. The chemical makeup of the water, the mineral composition and physical characteristics of the elements designated as contaminates moving through a watershed, as well as, the natural background of the same elements will vary by locations within the watersheds. The seriousness of the contaminates migrating form each of the historic mining sites through the watersheds and air sheds must therefore

be compared to the natural or established background (if available), as well as, risk-based and legislated values for specific contaminates. Some situations, (i.e., air quality) may have issues related solely on human health exposure assessments, while others may have issues related jointly on human health, as well as, environmental concerns. The evaluation of each watershed and airshed needs to be referenced to the proper decision making end points.

Task #2a – Development of a Technical Process for the Evaluation of the Migration of Contaminants by Water within a given Watershed.

This task will require the development of a technical methodology for the evaluation of the movement of contaminant streams generated from historic uranium mining sites through a watershed and to a point where the elements making up the contaminant stream can not be distinguished form the same elements that are found within the natural background. This developed methodology will give the Forest Service and other entities direction to evaluate the extent and effectiveness of future cleanup response actions that maybe taken in the region.

The School of Mines will create a field sampling protocol for the study areas based on pre-existing scientific, engineering, and legislated processes. From this protocol, quantitative and qualitative measurements of surface water will be collected in order to characterize the changing chemical composition of the water resources that flow through a watershed from areas historically mined for uranium to areas were the elements considered contaminates cannot be distinguished from natural background. During 2006, the primary focus of this investigation will be the North Cave Hills watershed. The South Cave Hills and Slime Buttes watersheds may be included dependant upon funding availability.

Task #2b - Development of a Technical Process for the Evaluation of the Migration of Contaminated Sediment within a given Watershed.

This task will require the development of a technical methodology for the evaluation of the movement of contaminated sediment generated from historic uranium mining sites through a watershed and to a point where the elements making up the contaminant sediment can not be distinguished form the same elements that are found within the natural sediment within the watershed. As with Task #2a, this developed methodology will give the Forest Service and other entities direction to evaluate the extent and effectiveness of future cleanup response actions that maybe taken in the Region.

The School of Mines will create a field sampling protocol based on pre-existing scientific, engineering, and legislated processes. From this protocol quantitative and qualitative measurements will be collected in order to characterize the changing chemical composition of the sediment that is moving through a watershed from areas historically mined for uranium to areas were the elements considered contaminates cannot be distinguished from natural background. During 2006, the primary focus of this investigation will be the North Cave Hills watershed. The South Cave Hills and Slime

Buttes watersheds may be included dependant upon funding availability.

Task #2c - Development of a Technical Process for the Evaluation Air Quality within a given Airshed.

This task will require the development of a technical methodology for the evaluation of the airborne movement of contaminated sediment generated from historic uranium mining sites through an air shed. This task will allow for the measure of air quality so that the Forest Service and other entities can determine the extent of movement of sediment by wind and the its potential impact to human health within the region.

The School of Mines will create a field sampling protocol for the air shed based on pre-existing scientific, engineering, and legislated processes. From this protocol, quantitative and qualitative air measurements will be collected in order to characterize the movement of sediment by wind from areas historically mined for uranium to areas down wind of these sites. During 2006, the primary focus of this investigation will be the North Cave Hills watershed. The South Cave Hills and Slime Buttes watersheds may be included dependant upon funding availability.

Task #3a - Field Sampling and Testing of Water and Sediment

This task will involve traveling to various mining areas and watersheds within the Riley Pass area agreed to by the Northern Region of the Forest Service and the School of Mines (See enclosed list of sites and watersheds-Table 1) in order to gather various scientific and engineering data, measurements, and observations pertaining to the variation of water quality and sediment composition.

The School of Mines concurs that site-specific observations and analyses are required to more fully understand the movement of chemical contaminants through a watershed identified by the Forest Service. The number of and type of samples collected will necessarily conform with the number and complexity of historic uranium mining sites within a given watershed. Further refinement of the scope of this task will occur at the direction of the Forest Service as the mining areas and watersheds are prioritized.

Task #3b – Air Monitoring within the Airshed

This task will involve traveling to various mining areas agreed to by the Northern Region of the Forest Service and the School of Mines in order to gather various scientific and engineering data, measurements, and observations pertaining to air quality.

The School of Mines concurs that site-specific observations and analyses are required more fully understand the movement of contaminated sediment by wind erosion. The number of samples collected and type of air monitoring conducted will necessarily conform with the number and complexity of historic uranium mining sites within a given air shed. Definition of the air sheds will determine sampling methodology. Further refinement of the scope of this task will occur at the direction of the Forest Service as the

historic uranium mining areas are prioritized.

Task # 4 - Documentation and Reporting on the Field Findings

This task consists of documenting the various findings noted during the field evaluation of the water, soil, and air resources within the various watersheds and air sheds. This includes an interpretation of the analytical results generated from the samples taken during the field evaluation portion of this project. The focus of the report is to determine if the human health and environmental impacts associated with the historic uranium extend for great distances within and area.

The School of Mines will generate a report describing the findings of the field evaluation including an interpretation of the results in the context of the goals stated for this project. It is the intent of the project PIs that the research performed will provide a basis upon which to evaluate 1) the efficacy of the methods employed in determining offsite uranium impacts from the North Cave Hills air and water sheds; 2) the best scientific approach to expand the study into the other old mining areas in the region; and 3) a preliminary assessment of the potential impact that the historic uranium sites in the North Cave Hills area have had on human health and the environment. In addition to the field evaluation, findings contained in the report will also include supporting analytical data. The report will be provided as a hard copy with backup electronic version. The electronic version will also include images taken at the site during the field evaluation.

The PIs plan to provide opportunities for graduate students to complete theses which would be completed by May 2007. A copy of these theses, bound and electronic, will be provided to the Forest Service.

Task #5 - Educational Integration

Communication of the findings resulting from this project to a larger audience is necessary. Education of Forest Service employees and others will provide a broader knowledge base of those conditions required to achieve effective mine land remediation with a context for integration of these elements into future project work. Learning from this endeavor is fundamental to future reclamation work within the area. A number of possibilities exist that allow for communication of the project outcome that is consistent with the educational mission of the Forest Service and School of Mines. Each of the educational concepts is presented below:

1. ***University Education*** – Various aspects of the project will be incorporated into undergraduate and graduate courses at both the School of Mines and Oglala Lakota College.

    a. The School of Mines will integrate the project within *CEE 733: Techniques of Surface Water Resource and Water Quality Investigations.* CEE 733 is a graduate level Water Resources Engineering course that focuses on the theory, design and techniques used in hydrologic and water

quality investigations. The project will be included within a field-sampling module where water quality and sediment loading measurements and data analysis will be performed. The course will be offered during the Fall 2006 academic term;

b. **Oglala Lakota College faculty will integrate suitable parts of this project as modules into the appropriate environmental courses offered during the Spring and Fall semesters 2006. These modules will emphasize hands-on learning of various field methods commonly employed within the environmental sciences;

2. ***Graduate Student Project/Thesis*** - This project includes funding for at least one graduate student from the School of Mines and at least one undergraduate student from Oglala Lakota College. This student team will become integral members of the scientific effort and be responsible for collection of substantial portions of the data and interpretation of the findings under the guidance of the project PIs. The graduate student projects will occur from January 2006 through May 2007 at which time an engineering thesis will be produced;

3. ***Project Website*** - Several web-based approaches exist for serving as a community educational tool. The project website will be hosted and periodically updated by Oglala Lakota College staff. The website will contain site history, maps, sampling procedures, current water and airshed sampling results, relevant literature and presentations, and contact information;

4. ***Outdoor Classroom*** - The individual water and airsheds will be used as an outdoor classroom to provide tailored learning opportunities to Forest Service staff, students or interested community participants. Project learning opportunities will be provided through the following efforts:
   a. **Utilizing this project as part of a continuing education workshop for regional geologists and engineers;
   b. **Providing 6-12th grade science teacher educational opportunities by utilizing this project within the School of Mines NSF-Research Experience for Teachers (RET) program (http://ret.sdsmt.edu). We plan to host at least one science teacher from rural South Dakota schools during July 2006 to activity participate in the sampling, analysis and evaluation components of this project. In turn, the teacher participants will integrate their research experience within their 6-12th grade science curriculum to better instill science and engineering fundamentals within their classroom;

5. ***Conference Participation and Publications*** – The PIs plan to present relevant research findings from this study at regional or national scientific conferences and will produce at least 1 peer-reviewed journal publication as a result of this research. All data included in these efforts will be cleared by the project sponsor prior to submission;

6. ***Community Outreach*** – The PIs plan to lead field trips for interested citizens to

demonstrate field sampling techniques and to educate the public on the project monitoring program. Informational brochures or fliers will be printed and distributed within the local community providing monitoring objectives and results.

Work Schedule

The work tasks described above will be completed over a one year period (January 1, 2006 through December 31, 2006) and will primarily focus on the abandoned uranium mines within the North Cave Hills water and air sheds. The project will consist of collaboration between the School of Mines and Oglala Lakota College, with both institutions having an active role in the development of project objectives and outcomes. This initial study will produce significant scientific data on the generation and off-site migration of uranium from the old mining claims. This study will also provide a proof-of-concept for the various sampling and analytical techniques that can or will be employed for future studies. Based on these initial findings, it is the intent of the School of Mines to enter into a longer-term Joint Venture Agreement with the Forest Service, dependant upon the number of watersheds evaluated, Forest Service management recommendations, availability and interest of additional research partners, and available funding, to perform similar and expanded research across the entire area of abandoned uranium mines in northwestern South Dakota. The Joint Venture Agreement between the Forest Service and School of Mines will expire 5 years after signature by both parties, unless extended. During the January 2006 to December 2006 work period, the project will focus on the tasks identified above. A brief description of each task and scope of work for the 2006 work period is presented below.

Task #1 - Review of Information

This task will be completed during January and February 2006. The Forest Service will provide all information at its disposal pertaining to this endeavor. Additional information will be gathered from other sources including relevant local, regional, and national governmental and tribal agencies including the South Dakota Department of Environment and Natural Resources, South Dakota Geological Survey, the U.S. Geological Survey, the U.S. Environmental Protection Agency, and non-governmental consultant studies (e.g., Pioneer Technical Services, Knight Piezold). Previous School of Mines theses will also be reviewed.

Task #2a–Development of a Technical Process for the Evaluation of the Migration of Contaminants by Water within a given Watershed

A Sampling and Analysis Plan (SAP) will be developed prior to field activities pertaining to water monitoring and sampling. This SAP will be developed specifically for those mining sites and watersheds that will be sampled during the 2006 field season at the North Cave Hills area. It is envisioned that this document will be developed in February 2006. The Forest Service will review the SAP prior to implementation.

Task #2b - Development of a Technical Process for the Evaluation of the Migration of Contaminated Sediment within a given Watershed

A Sampling and Analysis Plan (SAP) will be developed prior to field activities pertaining to sediment sampling. This SAP will be developed specifically for those mining sites and watersheds that will be sampled during the 2006 field season within the North Cave Hills area. It is envisioned that this document will be developed during February 2006. The Forest Service will review the SAP prior to implementation.

Task #2c - Development of a Technical Process for the Evaluation Air Quality within a given Airshed

A Sampling and Analysis Plan (SAP) will be developed prior to any field activity pertaining to air monitoring and sampling. This SAP will be developed specifically for those mining sites and air sheds that will be sampled during the 2006 field season and will be focused in the North Cave Hills area. It is envisioned that this document will be developed starting January 2006. The Forest will review the SAP prior to implementation.

Task #3a - Field Sampling and Testing of Water and Sediment

It is anticipated that the field sampling program for water and sediments will begin in April 2006, weather conditions allowing, and will continue through October 2006. Sampling will be based on developed SAP. Multiple trips to the designated areas will be necessary to capture samples and collect data during various water flow conditions as part of a continuous and discrete watershed monitoring program.

Water and sediment monitoring will occur within the local drainages adjacent and/or downstream of the abandoned uranium mines located within the North Cave Hills watershed. It is anticipated that the focus within the North Cave Hills area will include Devils Canyon, Schleichart Draw, Pete's Creek, with the intent of monitoring physical and chemical contaminant concentrations entering private lands adjacent to Forest Service administered land boundaries. Specific monitoring locations will be developed as part of the SAP and will be coordinated and prioritized in concert with the Forest Service.

Organic, inorganic, and radionuclide content of both water and sediments will be determined using both field and laboratory-based techniques, including: X-ray fluoresce spectroscopy (XRF), inductively coupled mass spectrometry (ICP-MS), flame atomic adsorption spectroscopy (AAS), and other analytical methods specified within the SAP.

Task #3b – Air Monitoring within the Airshed

The airshed sampling and monitoring program for the North Cave Hills area will commence January 2006, and will continue through October 2006. Data will be collected on a specific time line as specified by the SAP and will consist of background and down-

gradient sampling during natural wind events. Multiple trips to the designated areas will be necessary to collect samples and monitor conditions for different weather conditions and patterns.

Air quality sampling will involve the use of aspirated samplers that collect aerosol dusts $<PM_{10}$ on a filter that is subsequently analyzed for mass and composition. Sampler locations will depend on the air shed analysis and location access. Sampling times will follow established EPA methodology to define natural background air quality and aerosol composition. In addition, samplers will be run during natural wind events, or storms, to collect data used to define natural loading and changes in aerosol composition between natural and storm events. All filter analysis from the PM samplers will be performed at the School of Mines using existing instrumentation.

Complementary soil sampling activities will also be performed to evaluate the wind erosion potential of the various soils through particle size analysis as well as monitoring ambient dust-fall using field samplers. Wind tunnel tests at critical soil sampling sites will also be conducted beginning April 2006.

Task # 4 - Documentation and Reporting on the Field Findings

An interim report will be written describing the data collection procedures and observations accrued during the 2006 field season. The report will include all data and interpretations applicable to the water, sediment, and air activities that occurred during this time period for the areas identified by the Forest Service. This report will subsequently be augmented in following years by new evaluations and assessments that are derived as the research continues into other abandoned mine areas.

Task #5 - Educational Integration

The six educational components described above will be integrated into the project during 2006. Discussions between the School of Mines and the Forest Service to further refine the project educational components will be on-going.

Budget

The total budget amount for the January 1, 2006 (estimated) – December 31, 2006 period is $175,000. A spreadsheet has been attached providing the detailed budget itemization for the School of Mines and the sub-award to Oglala Lakota College, Lakota Center for Science and Technology, for the work activities proposed.

Deliverables

Work products resulting from tasks identified above principally include both an interim and final technical report describing the development of the evaluation protocol (Tasks 2a through 2c, and 4). In addition, MS theses will be provided by May 2007 and a journal manuscript will be produced after the data analysis has been completed.

TABLE #1-
Historic Uranium Mines and Prospects within the North Cave Hills Area

DEP_ID	SITE_NAME	Drainage	Sub-Drainage
10128980	Mink Group	North Fork Grand	Pete's
10129724	Darky Claims	North Fork Grand	Pete's
10153869	Riley Group	North Fork Grand	Pete's
10202259	Last Chance	North Fork Grand	Pete's
10202298	Cedar Butte Claims	North Fork Grand	Pete's
10226144	Susan, Becky	North Fork Grand	Pete's
10226272	Lars Group	North Fork Grand	Pete's
10226378	Jim Claims	North Fork Grand	Pete's
10232709	Table Mountain Claims	North Fork Grand	Pete's
10250296	Riley 1 & 3 Claims	North Fork Grand	Pete's
10250396	Riley Spring Mine	North Fork Grand	Pete's
10250726	Mccurdy Lease	North Fork Grand	Pete's
10250744	L And L Claims	North Fork Grand	Pete's
10274857	Bone Group	North Fork Grand	Pete's
10299641	Snake Eye	North Fork Grand	Pete's
10177556	Windy Claims	North Fork Grand	Pete's
10129612	Last Chance Group	North Fork Grand	Crooked
10202174	Jack Claims	North Fork Grand	Crooked
10250811	Hoop And Holler	North Fork Grand	Crooked
10274970	Jones Claims	North Fork Grand	Crooked
10055405	Pickpocket Mine	South Fork Grand	Bull
10099358	Relf Mine	South Fork Grand	Bull
10177509	Hawk Eye No. 1	South Fork Grand	Bull
10202226	Jayhawk Group	South Fork Grand	Bull
10250702	Lindahl	South Fork Grand	Bull

ATTACHMENT IV

Sampling Plan for Metals and Radionuclides in Surface Water in Western South Dakota

South Dakota Department of Environment and Natural Resources
Surface Water Quality Program
Sampling Plan for Metals and Radionuclides in Surface Water in Western South Dakota

Purpose

The price of uranium has more than tripled during the past several years and that market increase has the potential to result in new uranium exploration and development projects in southwestern South Dakota. The purpose of this sampling plan is to collect additional water quality data from streams in western South Dakota to establish current levels of radioactive elements and metals concentrations. This will not only document current conditions, but also allow us to track long-term trends in surface water quality.

Task and Objective

Excluding the Black Hills, the Department of Environment and Natural Resources (DENR) will sample the other 42 existing state water quality monitoring (WQM) sites listed in the chart below. DENR already regularly collects water quality samples from water quality monitoring sites that are established on streams statewide. This data is used to track long-term trends in surface water quality, and is used by DENR to supply the U.S. Environmental Protection Agency with the Integrated 305(b) and 303(d) water quality reports as required by the federal Clean Water Act. However, radioactive elements and metals were not previously included in the laboratory analyses of these samples. Therefore, this sampling plan included those laboratory analyses during the next two rounds of collecting water samples from our west river water quality monitoring stations. The first sampling round was done in mid-March 2006 and the second in late April 2006.

Surface Water Sampling Protocol

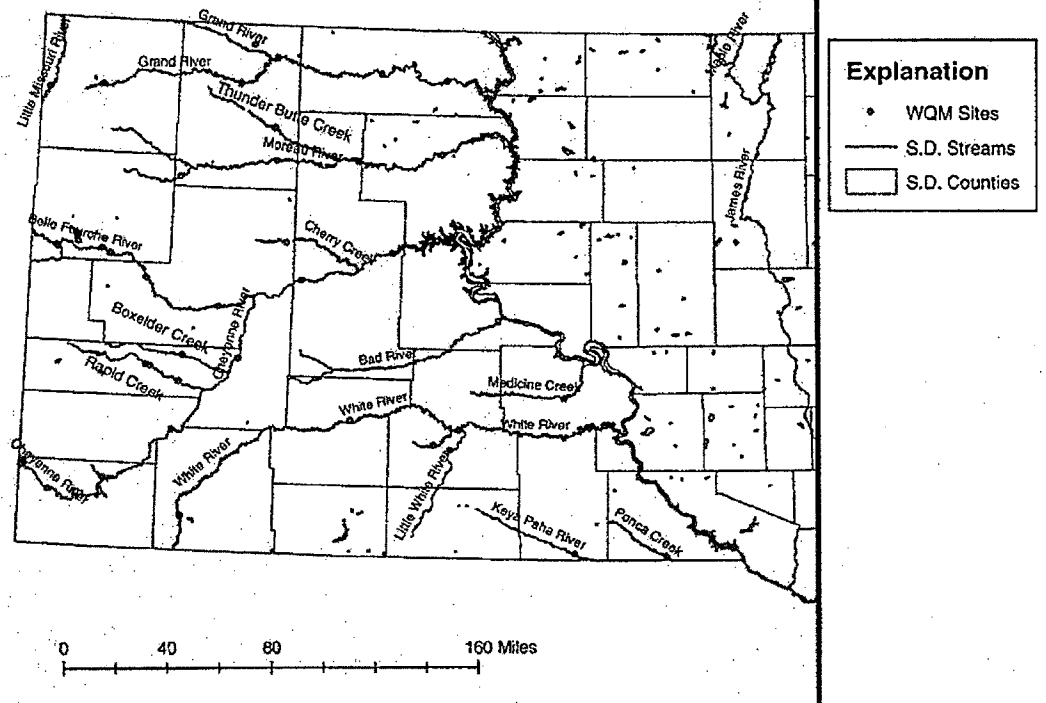
Samples will be gathered from each of the 42 water quality monitoring sites listed below for metals and radioactive analysis. Each sample bottle will be labeled and preserved (if needed). Water will be gathered by placing the sample bottle approximately six inches under the surface of the water in the deepest area of the river/stream. For dissolved metals analyses, sample water will be filtered through a 0.45 micron filter and preserved (pH<2) with nitric acid. For the radium analyses and total metal analyses, sample water will be placed in a one-gallon cubitainer. The samples will be immediately placed on ice and delivered to the laboratory as soon as possible. DENR samplers will follow department standard operating procedures in obtaining and handling the samples and quality assurance. A sample from each water quality monitoring location from both sampling episodes will be analyzed by a certified laboratory using EPA approved methods. The samples will be analyzed for total and dissolved metals including arsenic, vanadium, molybdenum, selenium, copper, lead, antimony, barium, beryllium, cadmium, chromium, mercury, nickel, thallium, and uranium. A sample from each location from both sampling episodes will also be analyzed for radium ^{226} and radium ^{228} isotopes.

Data Analysis

Results from the two sampling episodes will be analyzed by DENR personnel to determine if metals and/or other elements are present above levels of concern.

Site Name	River Stream Name	County
WQM 10	Keya Paha River	Tripp
WQM 11	White River	Jackson
WQM 110	Rapid Creek	Pennington
WQM 12	White River	Lyman
WQM 13	Little White River	Mellette
WQM 14	Cheyenne River	Fall River
WQM 15	Cheyenne River	Pennington
WQM 16	Cheyenne River	Haakon
WQM 19	Rapid Creek	Pennington
WQM 21	Belle Fourche River	Meade
WQM 23	Redwater River	Butte
WQM 24	Moreau River	Dewey
WQM 25	Grand River	Corson
WQM 29	Bad River	Stanley
WQM 39	Moreau River	Perkins
WQM 40	Grand River	Perkins
WQM 42	White River	Shannon
WQM 77	Grand River, N Fork	Perkins
WQM 78	Grand River, S Fork	Perkins
WQM 79	Box Elder Creek	Pennington
WQM 81	Belle Fourche River	Butte
WQM 82	Whitewood Creek	Butte
WQM 83	Belle Fourche River	Butte
WQM 92	Rapid Creek	Pennington
WQM 26	Little Missouri River	Harding
WQM 139	Grand River, S Fork	Harding
WQM 147	Thunder Butte Creek	Perkins
WQM 138	Grand River	Corson
WQM 130	Belle Fourche River	Butte
WQM 143	Moreau River	Ziebach
WQM 133	Cheyenne River	Haakon
WQM 76	Belle Fourche River	Meade
WQM 132	Cheyenne River	Custer
WQM 57	Fall River	Fall River
WQM 131	Cherry Creek	Meade
WQM 144	Moreau River, S Fork	Perkins
WQM 128	Beaver Creek	Fall River
WQM 141	Medicine Creek	Lyman
WQM 153	Cottonwood Creek	Mellette
WQM 152	White River	Mellette
WQM 156	Cheyenne River	Lawrence
WQM 70	Ponca Creek	Gregory

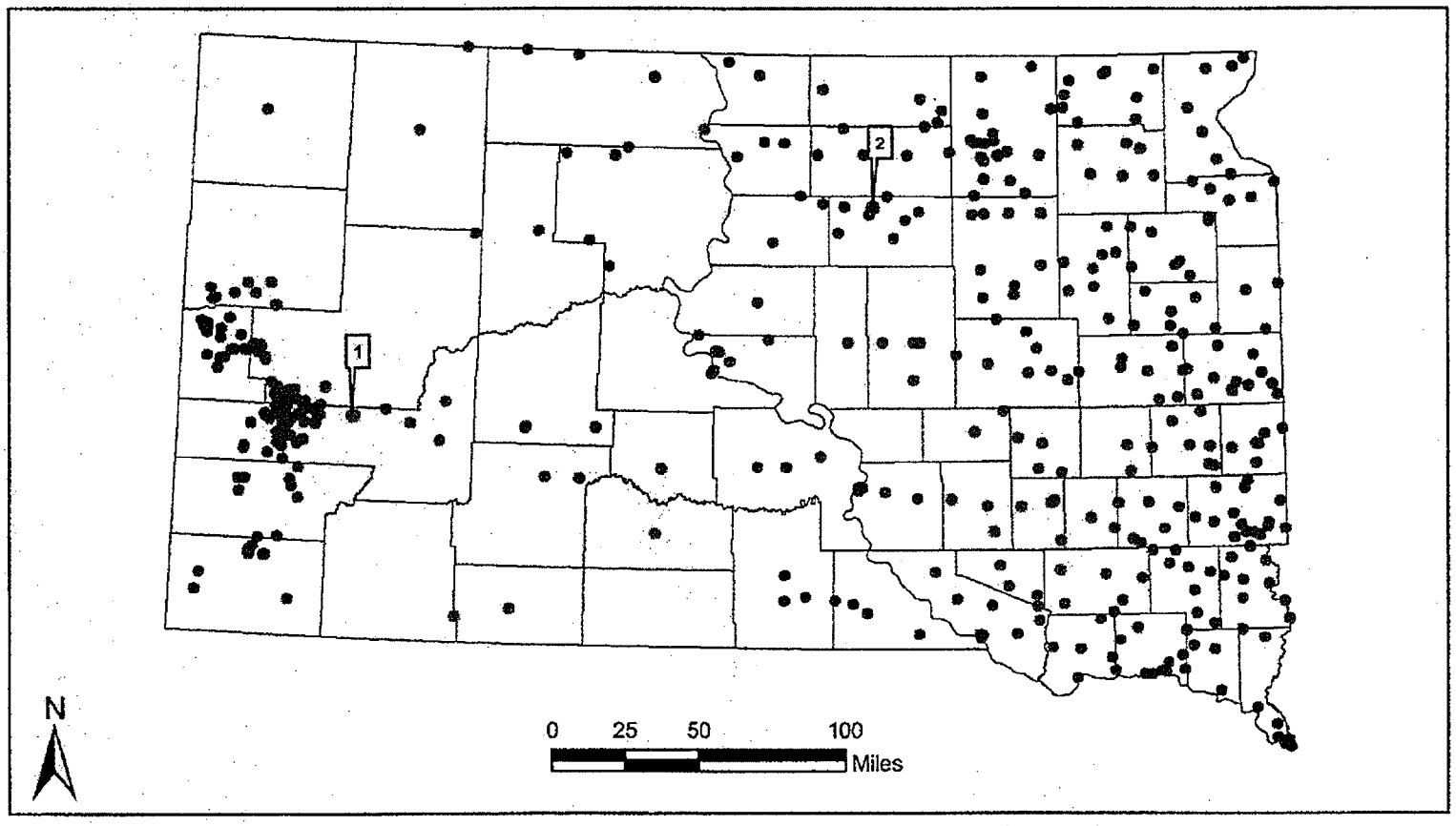
Radiation Monitoring Sites



ATTACHMENT V

SUMMARY OF DRINKING WATER DATA FROM SYSTEMS REGULATED BY DENR

Gross Alpha Violations

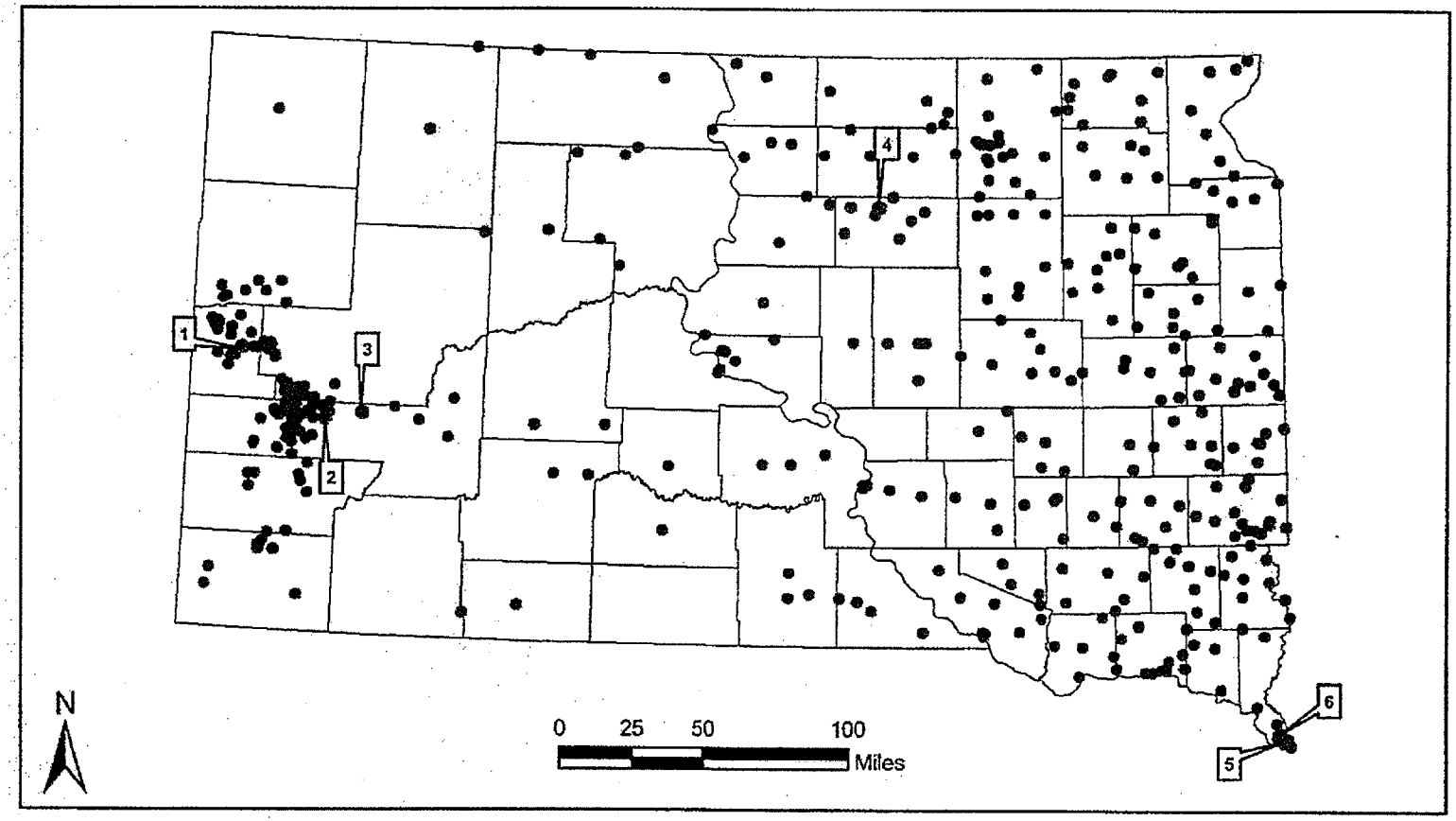


Number	System	Level(pCi/L)	Standard(pCi/L)	Population	Aquifer
1	New Underwood	17	15	616	Lakota
2	Thunderbird HB Inc	16	15	120	Dakota

Legend

- Community Water Systems
- Gross Alpha Violations
- Counties - CENSUS

Radium 226-228 Violations

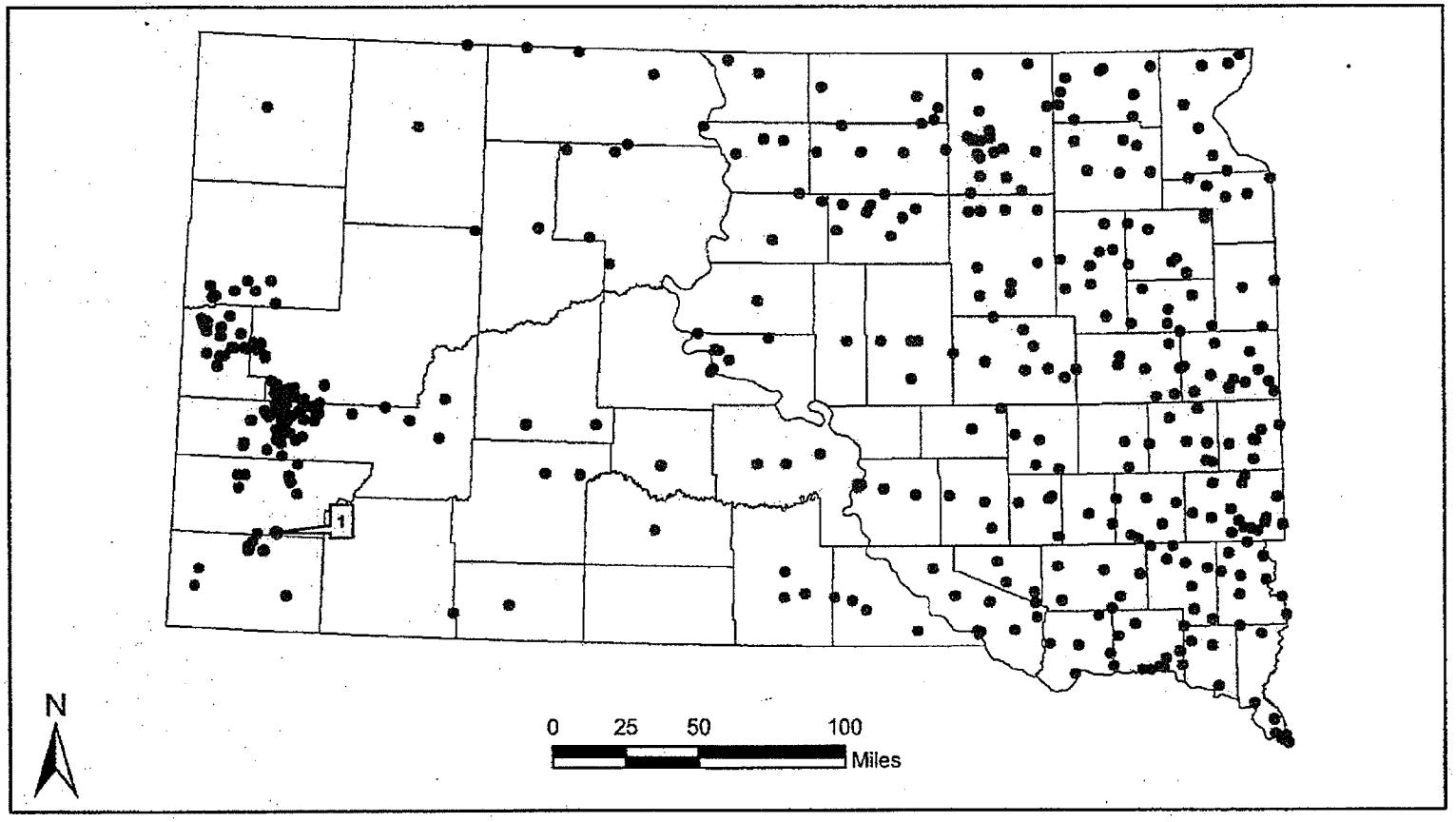


Number	System	Level(pCi/L)	Standard(pCi/L)	Population	Aquifer
1	Shirt Tail Gulch	10	5	25	Deadwood
2	Rainbow Water Co	6	5	162	Inyan Kara
3	New Underwood	7	5	616	Lakota
4	Thunderbird HB Inc	6	5	120	Dakota
5	Riv-R-Land	10	5	175	Missouri
6	Deer Run	14	5	65	Dakota Sandstone

Legend

- Community Water Systems
- Radium 226-228 Violations
- Counties - CENSUS

Uranium Violations



Number	System	Level(ug/L)	Standard(ug/L)	Population	Aquifer
1	Buffalo Gap	46	30	164	Fall River

Legend

- Community Water Systems
- Uranium Violations
- Counties - CENSUS

Drinking Water Systems
Radiological Chemical Data
Proximity of Grand River

Source	Sample Date	Parameter		
		Gross Alpha pCi/l	Radium 226/228 pCi/l	Uranium µg/l
Buffalo, SD				
Well #3	3/4/2002	1.8	0	0
Well #4	3/4/2002	0	2.3	0
Well #5	4/21/2005	1.2	0	0
Well #6	4/21/2005	7.7	0	0
Bison, SD				
Well	4/22/2002	1.1	0	NT
Well	7/9/2001	3.5	NT	NT
Lemmon, SD				
Well #5	7/16/2002	0.8	0.4	NT
Well #8	7/17/2002	0.9	0	NT
Well #9	7/16/2002	0	0	NT
Well #10	7/16/2002	1.6	0.8	NT
Well #11	7/16/2002	2.6	0	NT
McLaughlin, SD				
Well #5	6/10/2002	2.1	0	0
Public Health	6/10/2002	0.9	0	0
Well #4	6/10/2002	0.6	0.3	0
Well SW#2 & SW#3	6/10/2002	1.4	0	0
McIntosh, SD				
Well #1	3/1/2002	0.4	0	0
Well #2	3/1/2002	0	1.3	0
Well #3	3/17/2005	1.5	0.8	0

Drinking Water Standards:		
Gross Alpha:	15	pCi/l
Radium 226/228:	5	pCi/l
Uranium:	30	µg/l

*Note - NT means not tested

Drinking Water Systems
Radiological Chemical Data
Proximity of Moreau River

Source	Sample Date	Parameter		
		Gross Alpha pCi/l	Radium 226/228 pCi/l	Uranium µg/l
Faith, SD Served by Tri-County RWS				
Dupree, SD Served by Tri-County RWS				
Eagle Butte, SD Served by Tri-County RWS				
TC&G Rural Water System				
Well #1 & #2	7/15/2002	0	0.5	0
Well #4	12/20/2004	0.5	0	0
Well #5	9/14/2005	1.7	0	0
Drinking Water Standards:				
	Gross Alpha:	15	pCi/l	
	Radium 226/228:	5	pCi/l	
	Uranium:	30	µg/l	

Drinking Water Systems
Radiological Chemical Data
Proximity of Cheyenne River

Source	Sample Date	Parameter		
		Gross Alpha pCi/l	Radium 226/228 pCi/l	Uranium µg/l
Edgemont, SD				
RR/BN Well	12/14/2005	11	3	0
TVA Well	12/14/2005	13	2	0
Well #2 & #4	12/14/2005	14	3	9
Provo, SD				
Well #2	6/27/2005	12.6	4	0
Hot Springs,SD				
Hot Brook	12/15/2005	4	0	0
Evans Well	5/6/2002	3.1	0.8	0
Oelrichs, SD				
Served by Fall River RWS (same as Hot Springs)				
Buffalo Gap, SD				
Well #1	12/6/2004	14.4	0.4	45.7
Wasta, SD				
Springs	10/6/2003	9.1	0.7	0
Tri-County RWS				
Plant (Missouri River)	11/19/2002	5.7	0	0
Drinking Water Standards:				
	Gross Alpha:	15	pCi/l	
	Radium 226/228:	5	pCi/l	
	Uranium:	30	µg/l	

Drinking Water Systems
Radiological Chemical Data
Proximity of White River

Source	Sample Date	Parameter		
		Gross Alpha pCi/l	Radium 226/228 pCi/l	Uranium µg/l
Kadoka, SD				
Plant	6/14/2005	1.3	3.4	0
Belvidere, SD				
Served by Mni Wiconi RWS				
Murdo, SD				
Served by Mni Wiconi RWS				
Drinking Water Standards:				
Gross Alpha:		15	pCi/l	
Radium 226/228:		5	pCi/l	
Uranium:		30	µg/l	

ATTACHMENT VI

Sampling Plan for Radiation and Radionuclides from Oil and Gas Sites in Harding County, South Dakota

South Dakota Department of Environment and Natural Resources
Minerals and Mining Program

Sampling Plan for Radiation and Radionuclides from Oil and Gas Sites in Harding County, South Dakota

Purpose

The following sampling plan was developed in response to concerns over whether oil and gas development in Harding County, South Dakota, is causing radiation or radionuclide contamination. The purpose of this plan is to obtain and document radiation and radionuclide levels at representative oil and gas sites, and to sample and analyze stored and produced water at these sites to determine if there are levels above concern present.

Levels at Land Surface

The Department of Environment and Natural Resources field inspectors will use an Integral Spectrometer to obtain and document radiation levels at the following representative sites and locations:

1) **Producing oil and gas wells:** wellhead, tanks, heat treaters, and any pipe or equipment that may be stacked or stored on-site.
2) **Water injection wells:** wellhead, tanks, and any pipe or equipment that may be stacked or stored on-site.
3) **Centralized tank batteries:** tanks, heater treaters, pumps, piping, and other equipment.
4) **Pipe storage yards:** new and used pipe and any other equipment that may be on-site.

Levels in Stored and Produced Water

DENR field inspectors will obtain water samples from the following representative sites and have them analyzed for radionuclides at a certified lab.

1) Produced water from operating oil wells.
2) Water to be injected in operating injection wells.
3) Drilling mud/water from reserve pits (if available).
4) Water from permitted surface water evaporation and discharge pits and facilities.

ATTACHMENT VII

Sampling Plan for Uranium and Radionuclide Levels in Ambient Air in Harding County, South Dakota

South Dakota Department of Environment and Natural Resources
Air Quality Program
Sampling Plan for Uranium and Radionuclide Levels in Ambient Air in Harding County, South Dakota

Purpose

This past year has seen an increase in public concern about the potential for contamination in the form of radioactive dust blowing from areas in Harding County where uranium mining has occurred in the past. Most of the mining was on public land and occurred before there were state or federal reclamation requirements. Some of these locations have no or minimal vegetative cover and have the potential to erode during high wind conditions.

Task and Objective

The Department of Environment and Natural Resources (DENR) will locate an air quality monitoring site east of the North Cave Hills in Harding County. It is anticipated the site will be located near the school at Ludlow. This location would provide an assessment of concentrations in an area children use. The monitoring site, still to be determined, will be located following guidance documents from the U. S. Environmental Protection Agency (EPA).

DENR will locate a second air quality monitoring site in Pierre that will be used to provide a background comparison site to the air quality site in Harding County. At both sites, monitors will operate on the same sampling schedule, samples will be analyzed for the same parameters, and the same sampling equipment will be used.

Dust samples will be collected on a glass fiber filter over a 24-hour period. Flow rates of the monitors will be controlled using a volumetric throat that will control the flow rate of 1.13 m^3/ minute. Samples will be collected on an every sixth day sampling schedule for one year. A schedule of this type will provide random sampling and give an indication of exposure to the people attending school at Ludlow and living in the surrounding area. The air monitors will be operated following EPA requirements in 40 Code of Federal Regulations Part 50 Appendix G and the standard operating procedures for a high volume monitor for total suspended particulate method.

Meteorological data for wind speed and wind direction will be obtained from the U.S. Forest Service Camp Crook site or National Weather Service site in Hettinger, North Dakota.

Sample Analysis and Sampling Parameters

Samples from each air monitoring site will be analyzed by a certified laboratory using EPA approved methods. The samples will be analyzed for uranium ^{235}, uranium ^{238}, radium ^{226}, and radium ^{228} isotopes.

Data Analysis

Results from the two sampling sites will be compared to determine if there is a significant difference in the uranium and radionuclide concentrations of suspended particulates. A comparison of concentration to wind direction and speed will also be completed.

Appendix B

Table of Test Results

Gross Alpha and Beta Testing
And
Uranium ^{234}, Uranium ^{235}, and Uranium ^{238} Testing

Table 1. Ludlow Uranium Study Data Sheet July 2006 to October 2007

ND – Non-detectable Levels

Results are in pico Curie per Cubic Meter (pCi/m3)

	Pierre	Ludlow	Pierre	Ludlow							
	Gross	Gross	Gross	Gross	Pierre	Ludlow	Pierre	Ludlow	Pierre	Ludlow	
Date	Alpha	Alpha	Beta	Beta	U - 234	U - 234	U - 235	U - 235	U238	U238	Comments
07/04/2006	0.0046	0.0054	0.0178	0.0183							24-hr/samples
07/12/2006	0.0000	0.0033	0.0069	0.0226							
07/16/2006	0.0117	0.0050	0.0368	0.0258							
07/22/2006	0.0069	0.0033	0.0329	0.0377							
07/28/2006	0.0089	0.0056	0.0468	0.0327							
08/03/2006	0.0027	0.0049	0.0345	0.0305							
08/09/2006	0.0009	0.0027	0.0425	0.0257							
08/15/2006	0.0036	0.0035	0.0007	0.0317							
08/21/2006	0.0052	0.0007	0.0286	0.0245							
08/27/2006	0.0009	0.0029	0.0295	0.0312							
09/02/2006	0.0040	0.0011	0.0699	0.0701							
09/08/2006	0.0020	0.0017	0.0209	0.0226							
09/14/2006	0.0088	0.0040	0.0572	0.0609							
09/20/2006	0.0006	0.0017	0.0209	0.0222							
09/26/2006	0.0023	0.0026	0.0202	0.0234							
10/02/2006	0.0085	0.0056	0.0726	0.0461	ND	ND	ND	ND	ND	ND	72-hr/samples
10/08/2006	0.0033	0.0060	0.0596	0.0628	ND	ND	ND	ND	ND	ND	
10/14/2006	0.0018	0.0104	0.0327	0.0398	ND	ND	ND	ND	ND	ND	
10/20/2006	0.0021	0.0009	0.0373	0.0228	ND	ND	ND	ND	ND	ND	
10/26/2006	0.0030	0.0015	0.0650	0.0218	ND	ND	ND	ND	ND	ND	
11/01/2006	0.0000	0.0033	0.0276	0.0300	ND	ND	ND	ND	ND	ND	
11/07/2006	0.0042	0.0007	0.0305	0.0181	ND	ND	ND	ND	ND	ND	
11/13/2006	0.0009	0.0024	0.0211	0.0154	ND	ND	ND	ND	ND	ND	
11/19/2006	0.0036	0.0012	0.0426	0.0238	ND	ND	ND	ND	ND	ND	
11/25/2006	0.0032	0.0042	0.0299	0.0366	ND	ND	ND	ND	ND	ND	
12/01/2006	0.0012	0.0029	0.0291	0.0281	ND	ND	ND	ND	ND	ND	
12/07/2006	0.0024	0.0047	0.0184	0.0329	ND	ND	ND	ND	ND	ND	
12/13/2006	0.0310	0.0058	0.0178	0.0179	ND	ND	ND	ND	ND	ND	
12/19/2006	0.0040	0.0015	0.0347	0.0259	ND	ND	ND	ND	ND	ND	

	Pierre	Ludlow	Pierre	Ludlow							
	Gross	Gross	Gross	Gross	Pierre	Ludlow	Pierre	Ludlow	Pierre	Ludlow	
Date	Alpha	Alpha	Beta	Beta	U - 234	U - 234	U - 235	U - 235	U238	U238	Comments
12/25/2006	0.0000	0.0000	0.0169	0.0147	ND	ND	ND	ND	ND	ND	
12/31/2006	**0.0000**	**0.0009**	**0.0177**	**0.0133**	**ND**	**0.000377**	**ND**	**ND**	**ND**	**0.000446**	
01/06/2007	0.0024	0.0024	0.0201	0.0147	ND	ND	ND	ND	ND	ND	
01/12/2007	0.0031	0.0032	0.0275	0.0347	ND	ND	ND	ND	ND	ND	
01/18/2007	0.0014	0.0028	0.0309	0.0250	ND	ND	ND	ND	ND	ND	
01/24/2007	0.0017	0.0004	0.0143	0.0181	ND	ND	ND	ND	ND	ND	
01/30/2007	**0.0038**	**0.0000**	**0.0296**	**0.0232**	**0.000133**	**ND**	**ND**	**ND**	**0.000159**	**ND**	
02/05/2007	0.0025	0.0018	0.0271	0.0471	ND	ND	ND	ND	ND	ND	
02/11/2007	0.0035	0.0034	0.0485	0.0639	ND	ND	ND	ND	ND	ND	
02/17/2007	0.0000	0.0008	0.0142	0.0123	ND	ND	ND	ND	ND	ND	
02/23/2007	0.0015	0.0005	0.0174	0.0274	ND	ND	ND	ND	ND	ND	
03/01/2007	0.0016	0.0039	0.0233	0.0306	ND	ND	ND	ND	ND	ND	
03/07/2007	0.0031	0.0086	0.0304	0.0372	ND	ND	ND	ND	ND	ND	
03/13/2007	0.0015	0.0009	0.0209	0.0152	ND	ND	ND	ND	ND	ND	
03/19/2007	0.0018	0.0011	0.0256	0.0222	ND	ND	ND	ND	ND	ND	
03/25/2007	0.0006	0.0014	0.0164	0.0179	ND	ND	ND	ND	ND	ND	
03/31/2007	0.0010	0.0000	0.0215	0.0000	ND	ND	ND	ND	ND	ND	
04/06/2007	0.0016	0.0017	0.0187	0.0216	ND	ND	ND	ND	ND	ND	
04/12/2007	0.0015	0.0011	0.0238	0.0188	ND	ND	ND	ND	ND	ND	
04/18/2007	0.0017	0.0019	0.0210	0.0198	ND	ND	ND	ND	ND	ND	
04/24/2007	0.0018	0.0013	0.0238	0.0158	ND	ND	ND	ND	ND	ND	
04/30/2007	0.0015	0.0016	0.0149	0.0190	ND	ND	ND	ND	ND	ND	
05/06/2007	0.0013	0.0008	0.0189	0.0175	ND	ND	ND	ND	ND	ND	
05/12/2007	0.0024	0.0020	0.0271	0.0228	ND	ND	ND	ND	ND	ND	
05/18/2007	0.0022	0.0023	0.0255	0.0323	ND	ND	ND	ND	ND	ND	
05/24/2007	0.0006	0.0004	0.0102	0.0128	ND	ND	ND	ND	ND	ND	
05/30/2007	0.0005	0.0003	0.0133	0.0076	ND	ND	ND	ND	ND	ND	
06/05/2007	0.0017	0.0016	0.0204	0.0156	ND	ND	ND	ND	ND	ND	
06/11/2007	0.0020	0.0020	0.0202	0.0285	ND	ND	ND	ND	ND	ND	
06/17/2007	**0.0016**	**0.0004**	**0.0218**	**0.0185**	**0.000060**	**ND**	**0.000014**	**ND**	**0.000041**	**ND**	
06/23/2007	0.0020	0.0090	0.0301	0.0339	ND	ND	ND	ND	ND	ND	
06/29/2007	**0.0011**	**0.0025**	**0.0215**	**0.0318**	**ND**	**0.000039**	**ND**	**ND**	**ND**	**0.000037**	

	Pierre	Ludlow	Pierre	Ludlow							
	Gross	Gross	Gross	Gross	Pierre	Ludlow	Pierre	Ludlow	Pierre	Ludlow	
Date	Alpha	Alpha	Beta	Beta	U - 234	U - 234	U - 235	U - 235	U238	U238	Comments
07/05/2007	0.0016	0.0014	0.0346	0.0276	ND	ND	ND	ND	ND	ND	
07/11/2007	0.0014	0.0008	0.0191	0.0175	ND	ND	ND	ND	ND	ND	
07/17/2007	0.0028	0.0023	0.0380	0.0341	ND	ND	ND	ND	ND	ND	
07/23/2007	0.0027	0.0026	0.0288	0.0328	ND	ND	ND	ND	ND	ND	
07/29/2007	0.0014	0.0018	0.0289	0.0366	ND	ND	ND	ND	ND	ND	
08/04/2007	0.0013	0.0031	0.0306	0.0332	ND	ND	ND	ND	ND	ND	
08/10/2007	0.0013	0.0042	0.0240	0.0263	ND	ND	ND	ND	ND	ND	
08/16/2007	0.0019	0.0012	0.0338	0.0269	ND	ND	ND	ND	ND	ND	
08/22/2007	0.0023	0.0007	0.0329	0.0205	ND	ND	ND	ND	ND	ND	
08/28/2007	0.0019	0.0027	0.0322	0.0319	ND	ND	ND	ND	ND	ND	
09/03/2007	0.0032	0.0029	0.0491	0.0435	ND	ND	ND	ND	ND	ND	
09/09/2007	0.0004	0.0009	0.0154	0.0193	ND	ND	ND	ND	ND	ND	
09/15/2007	0.0028	0.0026	0.0415	0.0414	ND	ND	ND	ND	ND	ND	
09/21/2007	**0.0024**	**0.0008**	**0.0327**	**0.0246**	**ND**	**ND**	**ND**	**ND**	**0.000091**	**ND**	
09/27/2007	0.0024	0.0019	0.0327	0.0254	ND	ND	ND	ND	ND	ND	
10/03/2007	**0.0022**	**0.0019**	**0.0253**	**0.0230**	**ND**	**0.000103**	**ND**	**ND**	**0.000067**	**0.000067**	
10/09/2007	0.0013	0.0010	0.0252	0.0280	ND	ND	ND	ND	ND	ND	
10/15/2007	0.0023	0.0031	0.0155	0.0295	ND	ND	ND	ND	ND	ND	
10/21/2007	0.0006	0.0007	0.0193	0.0127	ND	ND	ND	ND	ND	ND	
10/27/2007	0.0025	0.0039	0.0353	0.0379	ND	ND	ND	ND	ND	ND	