

Table ES-1.

Changes in Economic Conditions on the Northern Cheyenne Reservation						
During the Energy Boom 1970-1990						
Economic Indicator	1970 Census	1980 Census	1990 Census	Northern Cheyenne as % of Rosebud County		
				1970	1980	1990
<u>Employment Status</u>						
% Working Age Not Employed	54.6%	53.7%	56.2%	127%	143%	147%
Official Unemployment Rate	5.9%	8.6%	16.9%	216%	243%	206%
<u>Real Income (\$2014)</u>						
Median Family Income	\$32,300	\$28,883	\$26,834	90%	47%	45%
Per Capita Income	\$7,062	\$7,771	\$9,002	52%	41%	48%
<u>Poverty Rate</u>						
% of All Persons below Poverty	40.7%	41.8%	48.2%	158%	232%	236%
% of All Families below Poverty	39.8%	41.7%	43.8%	220%	318%	302%
<u>Home Ownership Rate</u>	77.7%	63.8%	58.7%	137%	94%	85%
Source: Census of Population						

- vi *During the 1972-1990 coal boom in the region surrounding the Northern Cheyenne Reservation, Reservation residents had very limited access to the energy-related jobs.*

While the labor force on the Northern Cheyenne Reservation was about a quarter of the total labor force in Rosebud County, workers on the Reservation never received anywhere near 25 percent of the energy-related jobs that were created. Between 1970 and 1990 Reservation residents received about 4 percent of the new mining jobs and 8 percent of the public utility jobs created in Rosebud County.

- vii *Many of the barriers that kept the Northern Cheyenne from sharing proportionately in the benefits associated with the previous energy boom remain. Those projecting that a new coal boom will benefit the Northern Cheyenne have to explain how those barriers will be reduced or eliminated.*

In the past the economic status of the Northern Cheyenne did not significantly improve despite significant coal development for several reasons:

- a. The lack of access by Northern Cheyenne workers to the higher-paid energy jobs;²
- b. The limited number of local businesses on the Reservation to capture and recirculate the new income associated with coal development;

² In September 2015, The Northern Cheyenne TERO office estimated that 56 Tribal members were working at the Western Energy Coal mines and about 35 were working on the Colstrip electric power plants now managed by Talent Energy (previously PPL Montana). Personal communication with Stephanie L. Fisher, TERO Director, Northern Cheyenne Tribe, September 11, 2015. In 2013 employment in mining in Rosebud County was 646. Employment in utilities was 411. (U.S. BEA REIS data on employment by industry by county.) Northern Cheyenne appear to fill about 8.6 percent of these two types of coal-related jobs in Rosebud County. If we look at the total employment in Rosebud County in mining and public utilities generating electricity, the total came to 1,820 in 2013. The TERO reported 91 Northern Cheyenne working in the energy industry, which represents 5 percent of this total energy-related employment.

- c. The lack of access to mineral revenue to support public services and infrastructure on the Reservation to ameliorate the pressures associated with the expanded coal development; and
- d. The impact of the Northern Cheyenne commitment to place which discourages the out-migration of Tribal members as the primary way to bring labor supply into balance with labor demand.

All of these problems still expose the Northern Cheyenne to the negative socioeconomic impacts of coal development and continue to limit the Northern Cheyenne's ability to share significantly in the benefits.

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Introduction

For a half-century, the Northern Cheyenne Tribe has sought to protect its Reservation, members, culture, and social well-being from the negative impacts of energy development on lands in the immediate vicinity of its Reservation. In communications with the Surface Transportation Board it has expressed its concerns about the potential impacts on Northern Cheyenne interests of the proposed Tongue River Railroad (TRRR) and the construction and operation of the coal mines in the Tongue River Valley that the TRRR could make feasible.³

The Northern Cheyenne Tribe asked Power Consulting to review the *socioeconomic analysis* found in the TRRR Draft Environmental Impact Statement (DEIS) to determine whether it adequately and accurately analyzed the potential impacts of the TRRR and its associated coal mines on the Northern Cheyenne Reservation and Tribal members.

This report contains Power Consulting's analysis and conclusions about the adequacy and accuracy of the socioeconomic analysis contained in the TRRR DEIS. In addition, since the DEIS did not provide information on the socioeconomic characteristics of the Northern Cheyenne and their Reservation, the report also provides that basic socioeconomic information. Also, since the TRRR DEIS did not analyze the impact of the last coal boom in the region adjacent to the Northern Cheyenne Reservation on socioeconomic conditions for lessons on how new coal development might impact the Tribe, this report also provides that analysis.

I. Natural Resource Development and Its Socioeconomic Impacts on Vulnerable Populations

1. Inaccurate Assumptions Underlying the DEIS Socioeconomic Analysis

As will be discussed in Section III below, the socioeconomic analysis in the TRRR DEIS makes almost no attempt to look specifically at socioeconomic conditions on the Northern Cheyenne Reservation and how new coal development is likely to specifically impact the Northern Cheyenne. The Northern Cheyenne are mentioned only once in the Socioeconomics chapter (referring to the potential temporary impact of the influx of construction workers) and not at all in the Socioeconomics Appendix T. The Cumulative Impacts chapter's *socioeconomic discussion* does not mention the Northern Cheyenne

³ See "The Northern Cheyenne Tribe and Its Reservation: 2002," a report to the U.S. Bureau of Land Management and the State of Montana Department of Natural Resources and Conservation, April 2002. It was attached as Appendix A to the January 9, 2013, scoping comments of the Northern Cheyenne Tribe.

at all, and the Cumulative Impacts Appendix U does not mention the Tribe in the socioeconomic discussion. That Cumulative Impacts Appendix U does mention potential impacts on Lame Deer and Busby, two towns on the Reservation, from incoming workers and transient populations.⁴ As a result of this virtual invisibility of the Northern Cheyenne in the TRRR DEIS socioeconomic analysis, the Northern Cheyenne are implicitly included with all the other residents of the rural region in which the Reservation is embedded. In general, the socioeconomic analysis in the TRRR DEIS simply *assumes* that expanded employment, payroll, and local government tax revenues due to the construction and operation of the TRRR and the coal mines it is intended to make feasible, will improve socioeconomic conditions for all residents of the affected region including the Northern Cheyenne.⁵

That socioeconomic assumption is not supported by the professional socioeconomic literature that has developed over the last half-century that has specifically analyzed the impacts of natural resource development on vulnerable populations. There are two errors here. First, the Northern Cheyenne are largely treated as just part of the overall population of the study area, with no socioeconomic analysis identifying the Northern Cheyenne's unique socioeconomic characteristics that distinguish them from other residents. Second, the Northern Cheyenne are not identified as a vulnerable population whose specific socioeconomic characteristics may lead to impacts from coal development that are quite different from those experienced by the non-Indian population in the region surrounding the Reservation.

Section III of this report will document the unique socioeconomic characteristics of the Northern Cheyenne that distinguish them from other residents of the study area and establish them as a vulnerable population that may be particularly exposed to the negative impacts of coal development while facing roadblocks that reduce the likelihood that they will participate in the positive impacts of that development.

An extensive research literature dealing with the socioeconomic impacts of energy and other natural resource booms in rural areas, including in rural areas where Native Americans or other indigenous people make up a significant part of the population, has developed over the last half-century.⁶ The STB did not consider that research literature.

⁴ The TRRR DEIS also discusses the impact of the noise associated with the operation of the TRRR on minority populations in Chapter 16 on Environmental Justice. Even in that discussion the Northern Cheyenne are mentioned only once in the more general discussion of disproportionate health or environmental impacts on poor minority groups. Census blocks that have high percentages of minority groups are identified, but the one that makes up the Northern Cheyenne Reservation is not identified as such in the discussion. The only such disproportionate health or environmental impact on minority groups identified was noise. For the Tongue River Alternative, the one closest to the Reservation, there would be no disproportionately high and adverse noise impact on minority populations under the medium and low coal production scenarios. (p. 16-17) In addition, Cumulative Impacts Appendix U discusses the impacts on visual resources and air pollution and many other environmental issues on the Reservation.

⁵ See, for instance, the TRRR DEIS pp. 15-1, 15-31, and 18-49.

⁶ Federal agencies have recognized the importance of incorporating potentially negative socioeconomic impacts into the land use decisions since at least 1980. In that year the U.S. Bureau of Land Management contracted with Mountain West Research to carry out a review and synthesis of the social science literature related to the social effects of coal development. See "BLM Social Effects Project:

2. Potential Socioeconomic Impacts that the TRRR DEIS Did *Not* Discuss

Except for the loss of agricultural land to the TRRR right-of-way, the TRRR DEIS projects primarily positive socioeconomic impacts from the proposed TRRR opening up development of new coal mines in a currently undeveloped coal basin.⁷ Because the construction and operation of the railroad and the coal mines will boost employment, payroll, and tax revenues, the DEIS simply assumes that a positive socioeconomic impact has been demonstrated. But equating the quantitative expansion of economic activity in a rural area with uniform improvements in socioeconomic well-being is not warranted in light of a half-century of research about the actual impacts of energy booms on local economic well-being in relatively isolated rural areas and particular vulnerable populations.

Energy booms can lead to major socioeconomic breakdowns. The widely discussed socioeconomic problems associated with the development of the Bakken oil and gas fields in North Dakota and Montana demonstrate that the socioeconomic impacts of energy development in rural areas are almost never as simple as treating the additional jobs, payroll, and population as pure benefits.

The national press has run articles dealing with the Bakken energy boom with titles such as:

- “Dark Side of the Boom: North Dakota’s oil rush bring cash and promise to reservation, along with drug-fueled crime.”⁸
- “North Dakota’s Oil Boom Is a Blessing and a Curse: The state’s oil boom is bringing unmatched growth and unanticipated problems.” ***Governing***, August 2011, Ryan Holeywell.⁹
- “Dark Side of Oil Development: Bakken Oil Boom Pumping Sexual Violence into Fort Berthold Reservation,” Nikke Alex, ***The Lakota Law Project Report***, March

Literature Review, Contract Number AA851-CTO-46,” December 1980.

<https://ia600306.us.archive.org/28/items/blmsocialeffects7211bran/blmsocialeffects7211bran.pdf> .

For a contemporary look back at that natural resource boom socioeconomic literature and its applicability to energy booms today, see “Energy Boomtowns & Natural Gas: Implications for Marcellus Shale Local Governments & Rural Communities,” Jeffrey Jacquet, 2009, The Northeast Regional Center for Rural Development, The Pennsylvania State University, NERCRD Rural Development Paper No. 43.

<http://energy.wilkes.edu/PDFFiles/Issues/Energy%20Boomtowns%20and%20Natural%20Gas.pdf> .

For a discussion of the impact of coal development on the Northern Cheyenne Reservation between 1980 and 1990, see “The Importance of Context in Explaining Human Capital Formation and Labor Force Participation of American Indians in Rosebud County, Montana,” Carol Ward, ***Rural Sociology*** 63(3): 451-480, 1998.

⁷ The TRRR DEIS *does* very briefly identify one socioeconomic impact on the Northern Cheyenne Reservation: The possibility that the influx of construction workers could temporarily degrade the character of two Reservation communities. Other environmental impacts, such as on air quality, noise, and visual resources, are also discussed in the DEIS. Our point is that in the *socioeconomic analysis* of the DEIS, the Northern Cheyenne are largely ignored.

⁸ ***Washington Post***, September 28, 2014, Sari Horwitz

<http://www.washingtonpost.com/sf/national/2014/09/28/dark-side-of-the-boom/> .

⁹ <http://www.governing.com/topics/energy-env/north-dakotas-oil-boom-blessing-curse.html> .

10, 2015. <https://lakotalawproject.wordpress.com/2015/03/10/bakken-oil-boom-brings-grave-issues-to-native-communities/> .

- “Murder, Mayhem and Mexican Mafia Stalk the Bakken Oil Fields,” **Huffington Post**, March 26, 2014, Georgianne Nienaber, http://www.huffingtonpost.com/georgianne-nienaber/murder-mahem-and-mexican-b_4646552.html .

The popular media, of course, tends to sensationalize problems in order to attract readers, but the problems associated with energy boom towns are real and have attracted the attention of law enforcement professionals at the local, state, and federal levels. In addition, academic researchers have been drawn to the particularly dramatic problems associated with energy boom towns. Dickinson State University in western North Dakota, for instance has drawn together researchers to analyze the impacts of energy boom-and-bust cycles.¹⁰ Researchers from North Dakota State University have also analyzed the socioeconomic effects of the rapid growth of the oil and gas industry in western North Dakota, confirming that the ongoing growth expected over the 2014-2019 period would lead to social disruptions associated with growing populations, high housing costs and cost of living, increased demands for medical, law enforcement, schools, and other public/private services, and strained community resources.¹¹

A separate North Dakota State University study titled the “Quality of Life in the Oil Country: Perceptions, Perspectives, and Future Implications”¹² lists the negative quality of life conditions the Bakken energy boom has produced thus far. These impacts include increased crime, deteriorating perceptions of safety, loss of small town environment, the overwhelmingly male character of the in-migration, the rapid influx of people, the out-migration of longtime residents, the low degree of acquaintance and trust, the rapid pace of change, the increased cost of living, the overtaxed community infrastructure and amenities, inaccessible services such as health care, and the transient nature of the workforce.¹³

Other recent studies of the socioeconomic impact of energy booms in rural areas have focused on the impact on inequality and, not coincidentally, community cohesiveness. The construction phase of energy development and, to a certain extent, the production phase, tends to lead to the in-migration of single males who come to take very high paying jobs. These temporary residents tend to have interests and values that do not closely coincide with those of existing residents. This leads to divisions within the communities along income and cultural lines. In addition, the lure of the high paying jobs brings other transients who do not have the skills or work histories that allow them to qualify for the higher paid jobs. The result is a heterogeneous influx of “outsiders,” many

¹⁰ See **Dickinson Press**, May 18, 2015, Andrew Wernette, <http://www.thedickinsonpress.com/news/local/3747894-researching-bakken-academic-gathering-highlights-bakkens-social-economic-trends> .

¹¹ “Socio-Economic Effects of Oil and Gas Industry in Western North Dakota, 2014-2019, Dean A. Bangsund and Nancy M. Hodur, July, 2014, p. 42, Department of Agribusiness and Applied Economics North Dakota State University.

¹² Felix Fernando, Natural Resources Management Doctorial Program, August, 2014.

¹³ Ibid. Figure 1, p. 2.

of whom were marginalized individuals in the communities from where they moved. Many existing residents also will not qualify for the high paying construction and mining jobs. They too may find their socioeconomic status decline relative to many of the immigrants who do obtain the new jobs. Rising rents and overall cost of living and competition from the new residents and businesses that move into these small communities may “squeeze out” existing residents from what had been their community.¹⁴ These are not new concerns. The same concerns were expressed by researchers during the 1970s and 1980s.

As one recent analysis of the impacts of energy development on rural communities and indigenous populations warned:¹⁵

Strains are placed on local entrepreneurs and residents as the economy heats up (and cools down) and inflation puts pressure on those unable to keep up. At the same time that there are rising costs, which benefit some and marginalize others and their livelihoods, day-to-day living expenses generally increase and competition is heightened as new enterprises spring-up or arrive in search of profits. For those able to keep pace with the spiraling pressure and turbulent market forces and participate fully in the growth that the energy sector brings, the benefits—at least as measured financially—will be substantial; for others, the result will be marginalization where they will be left to sit on the sidelines. (p. 123)

One of the common problems associated with energy boom towns is substance abuse. Researchers have linked this problem to some of the most common social characteristics of resource-based communities:¹⁶

- i The exacerbated income disparity and social inequality associated with the high paid natural-resource-related jobs and the bulk of the other jobs in the community.
- ii The highly transient population that has few local connections and little or no local social support.
- iii The 24-hour-a-day mine and transportation operations and isolated rural location that leads to a structure of work shifts that is not consistent with productive family and community relationships.
- iv Unusually high incomes for many workers that leads to a focus on material consumption and resulting financial stress. Young people are encouraged to drop

¹⁴ See, for instance, “Community Impacts from Large Oil and Natural Gas Ventures in Rural and Remote Areas,” Andrew Taylor and Gertrude Eilmsteiner-Saxinger, *Journal of Rural and Community Development*. 2014. 9(1): i-iv. Also, “Natural Resource Exploration and Extraction in Northern Canada: Intersections with Community Cohesion and Social Welfare,” Prescott C. Ensign et al., *Journal of Rural and Community Development*, 9(1): 112-133, 2014.

¹⁵ “Natural Resource Exploration and Extraction in Northern Canada: Intersections with Community Cohesion and Social Welfare,” Prescott C. Ensign, Audrey R. Giles, and Jacquelyn Oncescu, *Journal of Rural and Community Development* 9(1): 112-133, 2014, p. 123. Citations in the original deleted.

¹⁶ “Linking social structure, fragmentation, and substance abuse in a resource-based community,” John R. Parkins and Angela C. Angell, *Community, Work & Family*, 14(1): 39-55, 2011.

out of high school or forego post-secondary education and rely on what tends to be an unstable labor market.

The socioeconomic impacts of the proposed new coal development in the Tongue River Valley that would be made possible by the building of the TRRR, especially the socioeconomic impacts on local vulnerable populations, cannot be adequately summarized by a mere reference to expanded employment, payroll, and local government revenues. Such conclusions without any analysis fail to take into account the much more conflicted and nuanced reality that the existing professional literature on energy development socioeconomic analysis has revealed.

Later in this report (section IV) we will discuss the experience of the Northern Cheyenne in the earlier coal-based energy boom in the region. That, too, indicates that there are both serious threats of deteriorating socioeconomic conditions during an energy boom as well as the possibility of improved socioeconomic conditions for various groups of residents and participants. The central question is what the likely *net* impacts on different groups will be and what public policies can increase the likelihood that vulnerable groups such as the Northern Cheyenne are not disproportionately negatively impacted and that the level of inequality in the distribution of positive impacts is reduced.

II. The Incomplete Character of the DEIS Socioeconomic Analysis

As mentioned above, the Northern Cheyenne and their Reservation are hardly mentioned at all in the TRRR DEIS socioeconomic sections. In addition, the organization of the socioeconomic analysis in the TRRR DEIS results in some conclusions about the overall socioeconomic impacts of the TRRR project on the total population of the study area that are inaccurate understatements. Where the TRRR DEIS does provide a more accurate accounting of the impacts, the discussion of those impacts is very brief and incomplete.¹⁷

1. The Socioeconomic Conclusions of the TRRR DEIS

Chapter 15 of the TRRR DEIS presented the “Socioeconomics” analysis. Appendix T, “Socioeconomics Methods and Tables” provided more detail and technical discussion. The primary socioeconomic conclusion of the TRRR DEIS is summarized in the second paragraph of that DEIS chapter: “Project-associated increases in population and in the

¹⁷ In the TRRR DEIS Cumulative Impacts chapter, only two pages (18-48 and 18-49) out of the chapter’s 50 pages are devoted to socioeconomic impacts of the coal mines the TRRR would bring into existence. That discussion was in general, qualitative terms. The technical appendix for the Cumulative Impacts chapter of the DEIS, begins its discussion of the coal mines that are intended to be “induced into existence” by the building of the TRRR. That discussion begins on p. 228 of the 247 page appendix on the Cumulative Impacts. The DEIS Cumulative Impacts appendix provides about 7 pages of tables laying out quantitatively the projected socioeconomics impacts associated with the mines,

demand for housing and public services would not be sufficient to alter the current population and economic trends in the study area.”¹⁸

The quantitative detail provided in the TRRR DEIS included the following:

- The population increase in the four-county study area would be 0.6 percent. In the nine-county study area, the population increase would be only 0.3 percent. (pp. 15-16)
- Housing for this new population would use only 39 percent of the vacant housing units for rent in 2015. (pp. 15-16)
- The small population increase would not place a sustained stress on law enforcement, fire protection, schools, or other public services. (pp. 15-17)
- The impacts on communities and social groups, including Indian tribes, on average would be small and, in any case, would be temporary. (pp. 15-17)
- The effect on county tax revenues would be minor. (pp. 15-18)
- The operation of the TRRR would have almost no socioeconomic impacts because it would employ only 24 people. Even with multiplier impacts considered the increase in employment would be 54. The expected increase in population would be up to 70 new residents in the four-county study area. “The impacts of rail operation on employment and earning for any build alternative would be a small fraction of total labor and earnings in the study area.” (pp. 15-18 and 15-19) The most significant negative socioeconomic (“moderately adverse”) impact would be the loss of productive agricultural land to the right-of-way for the TRRR even though that agricultural productivity loss would represent only about one-tenth of one percent of the total annual agricultural output. (pp. 15-1, 15-24, and 15-31) The impact on employment, income, and government revenues would be positive (pp. 15-1)

If these conclusions represented an accurate depiction of the likely socioeconomic impacts associated with the TRRR, it would seem unlikely that even small rural communities would be negatively impacted or disrupted in any significant way by the proposed TRRR. Unfortunately, as the TRRR DEIS ultimately documents, these conclusions represent a gross understatement of the socioeconomic impacts associated with the proposed TRRR.

2. The Source of the Understatement of TRRR Socioeconomic Impacts in the TRRR DEIS

The STB reached its conclusions about the minimal socioeconomic impacts of the TRRR by focusing the “Socioeconomics” Chapter 15 analysis and Appendix T “Socioeconomics Methods and Tables” **only** on the construction and operation of TRRR. That socioeconomic analysis excluded the impacts associated with the building and operation of the several coal mines that are the purpose of building the TRRR.

¹⁸ DEIS Chapter 15, p. 15-1.

The TRRR DEIS recognized at the start (the first page of the Summary, S-1) that “the main purpose of the proposed project is to...transport coal from mine sites that could be developed in Rosebud and Powder River Counties, Montana...Rail access to these mines would make it possible to transport coal from the area, which is among the largest remaining undeveloped reserves of low sulfur, subbituminous coal in the United States.”

In the “Questions and Answers: Draft Environmental Impact Statement for the Tongue River Railroad,” the STB was equally direct and emphatic about the purpose of the TRRR: “[The TRRR] would be constructed primarily to move coal from Otter Creek Mine...Currently, however, the transportation of coal from the proposed Otter Creek Mine is the primary proposed use of the rail line.” (Q&A-2)

The TRRR has no economic purpose if coal mines are not developed in the Tongue River Valley. The railroad’s purpose is to facilitate the profitable construction and operation of those coal mines. If they are not constructed and operated, there would be nothing for the TRRR to carry and it would not operate.

This is important because most of the socioeconomic impacts associated with the TRRR are not tied to its construction and operation, but to the impacts of the several large coal mines that the TRRR will allow to be constructed and operated indefinitely into the future. The socioeconomic impact associated solely with the construction of the TRRR would be temporary, about two years. The socioeconomic impact associated only with the operation of the TRRR would be trivial. In fact, it would be near zero if no coal is mined since there would be no need for any employees for the TRRR since that railroad would not operate. It would permanently sit idle and could not have any “operational” impacts.

The TRRR DEIS segments the discussion of the socioeconomic impacts by focusing the Socioeconomics chapter exclusively on the construction and operation of the TRRR in a context that makes no economic sense, namely where no coal mines are constructed, no coal is mined, and the TRRR carries no coal anywhere. Then, after demonstrating the trivial socioeconomic impacts associated with that incomplete and purposeless scenario, at the very end of Chapter 18, “Cumulative Impacts,” the DEIS discusses the socioeconomic impacts of constructing and operating the coal mines which are the very purpose and economic justification of the TRRR. This artificial separation of the TRRR from its purpose of making new coal mining in the Tongue River Valley economically feasible makes no economic sense and makes the Socioeconomics chapter and the socioeconomic technical appendix (Appendix T) seriously incomplete.

The TRRR DEIS discusses the socioeconomic impacts associated with the coal mines that the TRRR is intended bring into existence in Chapter 18, “Cumulative Impacts,” and Appendix U, “Cumulative Impacts Analysis.” As the TRRR DEIS explains, “cumulative impacts analysis” is intended to look at what other changes are expected to take place in approximately the same geographical area and in about the same time period, so that

the potential that the proposed action, the development of the TRRR and its associated coal mines, might add significantly to a set of changes and impacts that will already be disturbing the region can be evaluated. The general idea is to see if the incremental impact of the TRRR and its associated coal mines when added to what is likely to be taking place anyway, would significant contribute to a *cumulative* impact that was much greater than just the impact associated with the proposed action.¹⁹

Since the development of coal mines in the Tongue River Valley is the purpose of the TRRR, from an economic point of view, those mines are part of the proposed action and their socioeconomic impacts should be included in the TRRR DEIS Socioeconomic chapter and technical appendix. Not placing the discussion of the socioeconomic impacts of the coal mines the TRRR is intended to bring into existence allows that Socioeconomic chapter to significantly understate the actual impacts that the TRRR is intended to bring about.

What “cumulative impact” analysis is supposed to describe is how the “incremental consequences of the proposed action” would add to “past, present, and reasonable foreseeable future actions” in the study area. That is, given what would otherwise be taking place in the study area in the same time frame without the proposed action, how might the proposed action compound (or ameliorate) the impacts associated with what is already taking place.²⁰

3. The Socioeconomic Impacts of the TRRR Set Forth in the DEIS

The TRRR DEIS provided its estimates of the socioeconomic impact of the construction and operation of the coal mines that the TRRR is intended to make economically feasible in Chapter 18, “Cumulative Impacts.” Two pages at the very end of Chapter 18 (section 18.5.13 “Socioeconomics”) are devoted to the socioeconomic impacts associated with the coal mining that the TRRR is expected to “induce.”

Appendix U, “Cumulative Impacts Analysis,” is cited as providing more detail in support of Chapter 18. Appendix U is 264 pages long, of which about five pages are devoted to the cumulative socioeconomic impacts associated with the construction and operation of the coal mines that are the purpose of the TRRR.

When the coal mines that are the purpose of the TRRR are included as part of the impacts assessment for the proposed project, the estimated socioeconomic impacts are quite large and enduring. There are two aspects to the socioeconomic impacts of these TRRR-induced coal mines: the initial construction impacts and the extended impacts associated with the ongoing operation of the mines.

The mine construction impacts are assumed to be about three years in the DEIS. However, since the mines are likely to come on line at different dates, spread over a

¹⁹ TRRR DEIS Chapter 18, Cumulative Impacts, p. 18-1.

²⁰ Ibid.

decade or more²¹, the construction impact of building the mines could persist with considerable fluctuation over those extended and overlapping construction periods.

The mine operations and the employment associated with them would extend over the life of the mine. The DEIS assumed that would be 20 years. This assumption was made primarily because “operations beyond the 20-year analysis period are speculative” and, therefore, “not reasonably foreseeable.”²² The difference between the short-term mine construction jobs and the longer-term mine operations jobs leads to a difference in how the socioeconomic impacts are projected. The mine construction workers are assumed to already be living in the study area, or, if the local construction worker supply is insufficient, construction workers are assumed to move into the four-county region without their families. The result is that the migration of new people into the four-county study area is higher for the coal mine long-term production jobs than for the coal mine construction period.²³ The impact on schools is also significantly higher during coal mine operations since the construction workers are assumed to not bring families with them.²⁴ There may also be a difference in the “spill-over” or “multiplier” effects associated with short-term construction workers and long-run operations workers. The construction workers that are temporary residents can be expected to be sending a substantial portion of their paycheck back to where their families are living. However, for the production jobs, which are assumed to be filled by workers permanently moving into the mining area with their families, more of the pay check will be spent in the local area.

For all of these reasons, the DEIS’s assertions²⁵ that the biggest socioeconomic impact would be during the construction periods for the coal mines is incorrect. It is the coal mine permanent operations workers and their families that dominate the population impact and accompanying socioeconomic impacts. Figure 1 below shows the aggregate projected growth in the population of the four-rural-county study area according to the brief socioeconomic analysis in Chapter 18 and Appendix U of the TRRR DEIS.²⁶ The construction periods for the TRRR and the coal mines that it would serve are shown on the bottom axis. It will be noted that it is the in-migrating coal mine operational workforce and their families that primarily boosts the population by about 7,000 or 19 percent under the high mine production scenario compared to the 2014 population.²⁷

²¹ TRRR DEIS Appendix U, Cumulative Impacts Analysis, Table U-71, p.U-231.

²² TRRR DEIS Appendix C, Coal Production and Markets, p. C.3-22. The DEIS points out that beyond 20 years, additional permits would be required from the Montana Department of Environmental Quality.

²³ Compare Tables U-71 and U-72 with Tables U-73 and U-74.

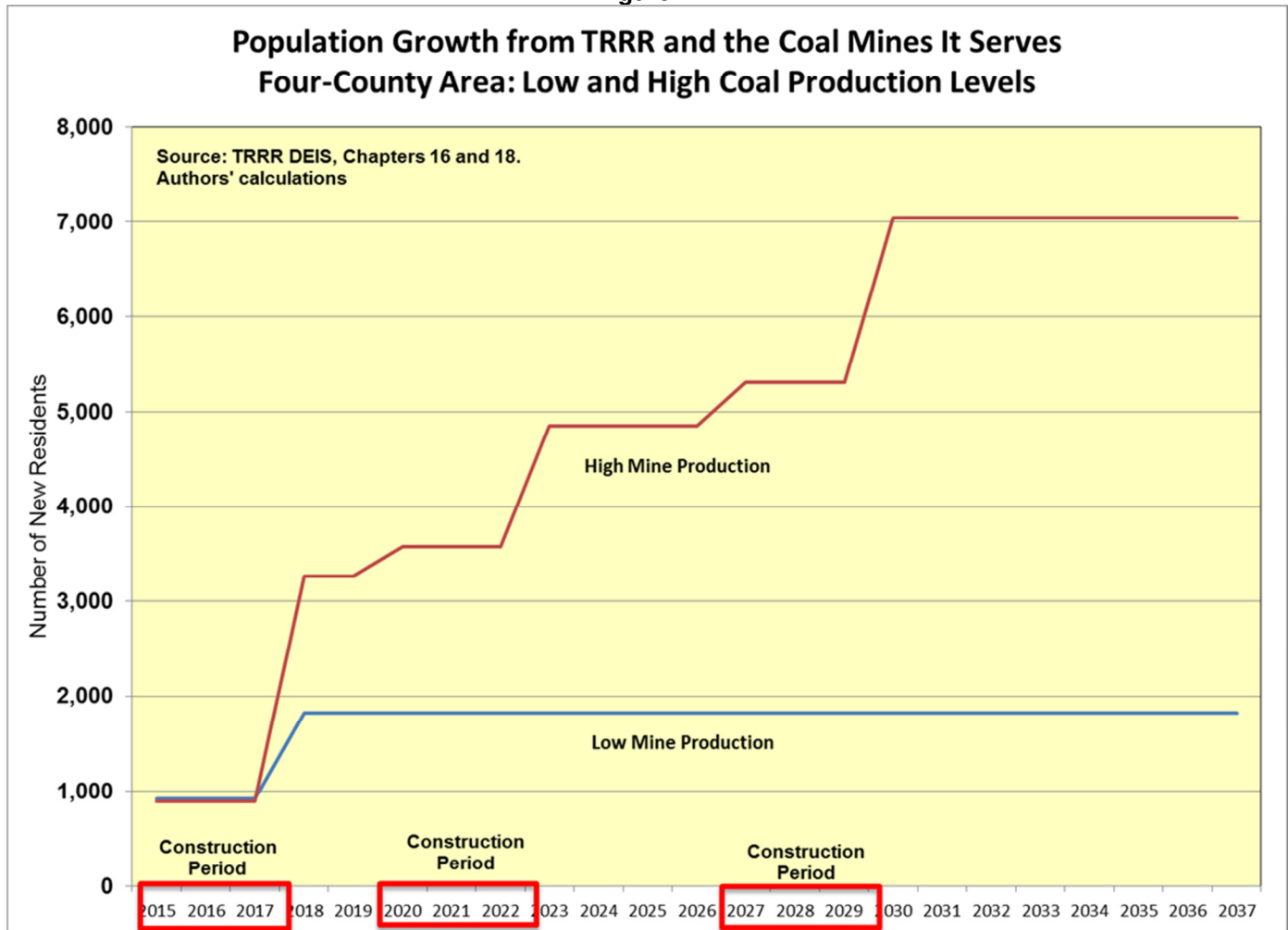
²⁴ Ibid.

²⁵ TRRR DEIS Chapter 18, pp. 18-48 and 18-49.

²⁶ The DEIS makes use of two different study areas. One is a four-county rural area surrounding the Tongue River Valley (Big Horn, Rosebud, Powder River, and Custer Counties). The DEIS also makes use of a larger nine-county study area that includes the regional trade centers of Billings, MT, and Sheridan, WY. The additional counties in the nine-county area are Yellowstone, Treasure, Carter, and Fallon Counties in Montana and Sheridan County in Wyoming. Pages 15-3 and 15-4, Chapter 15, TRRR DEIS.

²⁷ The TRRR DEIS provides similar results in Appendix U, Tables U-75 through U-78. Those tables provide the impact on employment and population in percentage terms. The percentages, however, are not the percentage increase over “current” employment or population but the percent of the projected employment or population in a future year. As a result, the percentages are somewhat lower.

Figure 1.



For the low mine production scenario (only the Otter Creek Mine at 20 million tons per year), the population in the rural four-county area is expected to rise by about 1,800 or 5 percent. The population impact for the whole of the nine-county study area, including the Billings area, is about twice as large: 14,400 as opposed to 7,000 in the four-county area, and 3,600 as opposed to 1,820 in the four-county area. Those represented 6.4 and 1.6 percent of the nine-county study area population in 2014 for the high and low mine production scenarios, respectively.²⁸

The TRRR DEIS Chapter 18, “Cumulative Impacts,” discusses the socioeconomic impacts of the construction and operation of both the TRRR and the coal mines it supports in very general qualitative terms. In that short narrative (section 18.5.13, “Socioeconomics,” pp. 18-48 and 18-49), not a single quantitative estimate or projection was provided. This stands in contrast to Chapter 15, “Socioeconomics,” which claims to have presented the socioeconomic impacts associated with the TRRR. That chapter provides 32 pages of tables and quantitative statements about the socioeconomic

²⁸ The Census Bureau’s 2014 estimates of county population were used to calculate the percentage values.

impacts. However, that analysis focused only on the socioeconomic impacts associated with the construction and operation of the TRRR and excluded consideration of the impacts associated with the coal mines that the TRRR is intended to make feasible.

The TRRR DEIS Appendix U on the “Cumulative Impacts Analysis” *does* provide more detailed and quantitative information on “Proposed and Potentially Induced Coal Mine Impacts on Socioeconomics” (section U.4.13.2). The conclusions of that socioeconomic analysis of the TRRR and its associated mines contradicts the previous DEIS Socioeconomics chapter (Chapter 15) that described the impact of the TRRR project as immeasurably small, temporary, or a continuation of current trends.²⁹ Those are not accurate statements.

Appendix U of the TRRR DEIS identifies the following significant socioeconomic impacts when the construction and operation of the coal mines are treated as an integral part of the proposed TRRR project: (p. U-240)

- Just the inclusion of the Otter Creek Mine as part of the TRRR project would significantly increase the impact of in-migrating construction workers. Even without families accompanying them, those construction workers could not be housed in the existing housing stock: “The excess demand would be expected to be addressed either by temporary housing, such as construction camps or use of existing hotels, motels and camp sites, or by long-distance commuting, or by a combination of both...”
- “The use of temporary housing increases the demand for public services in the communities...This includes demand for trash collection, sewer and sanitation services, police and fire services, among others....Long-distant commuting increases traffic on roads and associated needs for maintenance and risk of accidents.”
- “Communities located along Highway 212...may also be impacted, either by incoming workers or by increased transient population: communities such as Ashland, Lame Deer, Muddy, Busby and Crow Agency.”
- The workers filling the permanent jobs associated with the operation of the mines and TRRR will be “more likely to move with their families and demand a broader range of public services, such as schooling, recreation and cultural opportunities...[T]he larger communities in the four county area [are] more likely [to be] impacted by long-term increases in demands for housing and public services...”

This is just the beginning of the list of potential socioeconomic impacts associated with the full TRRR project, including the construction and operation of the coal mines that are the purpose of building the proposed railroad. Unfortunately, the DEIS contains almost no analysis of the full socioeconomic impacts of the TRRR project.

²⁹ Pp. 15-1, 15 and 18.

The TRRR DEIS indicates that except for the loss of agricultural land and a few homes to the TRRR right-of-way, the other socioeconomic impacts, namely the creation of new employment opportunities and the income associated with them as well as increased tax revenue flows to local governments, would be positive:

“Construction and operation of the proposed rail line would have positive impacts on employment and earning opportunities and add to counties and local jurisdictions’ fiscal revenues.” Chapter 15, “Socioeconomics,” p. 15-1.

“These impacts [of the TRRR] could include an increase in employment during the construction period...Rail construction and operation workers could move to the four-county area, causing local communities to face an increase in demand for housing and public services. Impacts would be greatest, but also temporary, during construction.” Chapter 15, “Socioeconomics,” p. 15-31.

“OEA concludes that the direct impacts from the proposed rail line when combined with impacts from past, present, and reasonably foreseeable projects and actions would range from positive cumulative impacts on socioeconomics by contributing to employment and migration of workers into the cumulative impacts study area—mostly during the 3-year construction period—to moderate to highly adverse cumulative impacts on socioeconomics by displacing economic activities such as farming.” Chapter 18, Cumulative Impacts, p. 18-49.

These statements inadequately describe the socioeconomic impacts resulting from the thousands of workers and their families relocating into a largely rural area to construct and then staff a whole set of new coal mines in a valley currently dedicated to agriculture and rural living.

III. Socioeconomic Conditions on the Northern Cheyenne Reservation: A Vulnerable Population Facing Additional Pressure

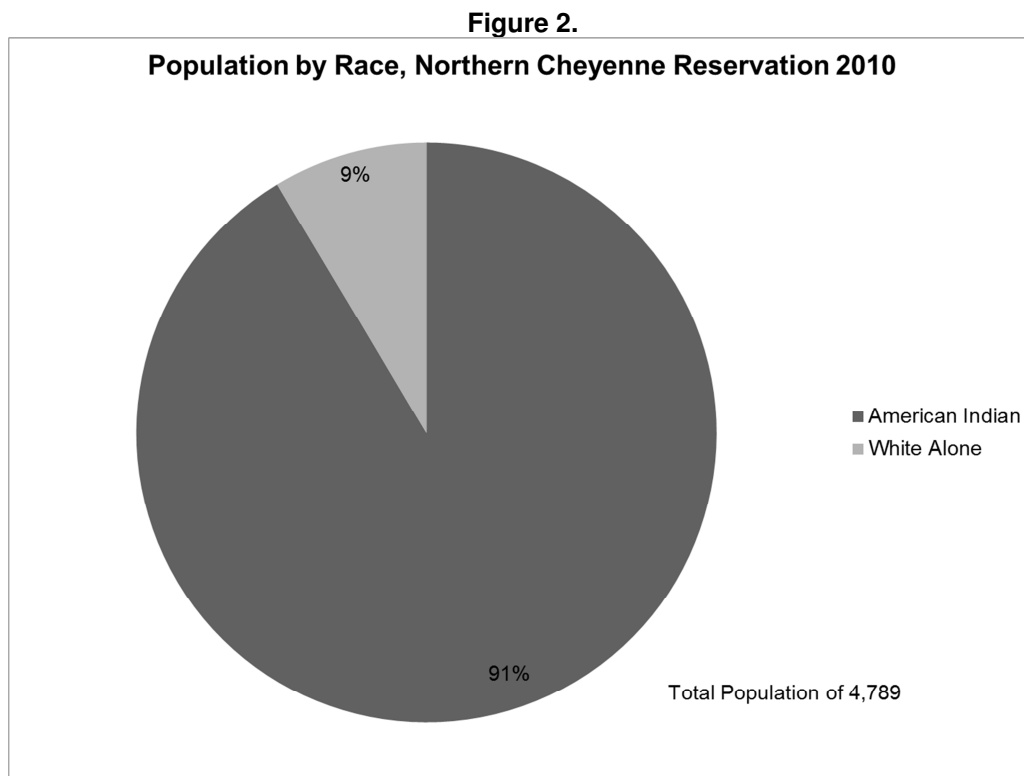
This section of our report on the TRRR DEIS seeks to describe the baseline social and economic conditions on the Northern Cheyenne Reservation. It does this by updating the socioeconomic analysis in a report on the Northern Cheyenne Reservation that the Northern Cheyenne submitted to the U.S. Bureau of Land Management and the State of Montana in 2002. The Northern Cheyenne attached that report to its environmental impact process scoping comments as Appendix A, “Northern Cheyenne Narrative Report.”³⁰

³⁰ The original report was titled “The Northern Cheyenne Tribe and Its Reservation,” dated April 2002. Power Consulting assisted in the research that supported parts of Chapter 3 of that report.

The socioeconomic data makes clear that the Northern Cheyenne Tribe represents a distinct cultural, social, political, and economic entity within the Northern Plains region. Nevertheless, data relating specifically to the Northern Cheyenne Reservation or Tribe is often not broken out from county-wide or region-wide analyses. That is dramatically demonstrated in the TRRR DEIS where the socioeconomic discussion barely mentions the Northern Cheyenne. This represents a continuation of a federal government pattern. For instance, Indian reservations were not broken out in decennial census counts until 1990. Also, until 2007 the Census of Agriculture did not break out Indian reservation data for all reservations.³¹

1. Reservation Population

According to the 2010 Census, the population of the Northern Cheyenne Reservation is 4,789 persons, of whom 4,406 are Native American (Figure 2).



Source: 2010 Census Data

³¹ The 2012 Census of Agriculture, in its American Indian Reservations report (Volume 2, Subject Series, Part 5, AC-12-S-5, Issued August 2014) stated that “This is the third report NASS has published that focuses on agricultural activity on American Indian reservations based on individual farm and ranch reports...NASS conducted the 2002 Census of Agriculture pilot project in Montana, North Dakota, and South Dakota. NASS expanded this effort during the 2007 Census of Agriculture to include all reservation in all states and continued it for the 2012 census.” p. v.

Tribal enrollment data indicates that the current number of enrolled Tribal members is 11,041 persons, of whom 4,677 live on or near the Reservation as of July 2015.³² Thus, more than half of the enrolled population lives off the Reservation.

However, the Reservation boundary is open and the on-Reservation and off-Reservation populations of Tribal members are somewhat fluid. The Reservation and its surrounding area remain the homeland and anchor for most Tribal members. As a community, and as individuals and families, Northern Cheyenne are generally less mobile than non-Indians; they less readily pick up their roots and put them down somewhere else. Family members may leave for a while, but they often return. Despite extremely limited housing and other necessities, changing conditions can bring more Tribal members back to the Reservation.

The relatively high population density of the Reservation reflects the importance of the lands in and surrounding the Northern Cheyenne Reservation to the Northern Cheyenne people. That even more of the Tribal membership does not live on the Reservation reflects the lack of employment and other economic opportunities, as well as extremely limited housing stock and other public services and facilities. It is likely that the on-Reservation population of enrolled Tribal members would increase if economic conditions improve, or even if there is a perception that conditions are improving.

2. Social Geography

Geographically, the Northern Cheyenne Reservation's most immediate social environment consists of Big Horn and Rosebud Counties, which it spans, the Crow Reservation which borders it on the west, and Powder River County immediately to the east. Below, the Reservation's demographic characteristics are examined in relation to neighboring non-Indian populations in Rosebud County. These populations live in the same region, are similarly rural, share a common history to some degree, and are subject generally to many of the same larger economic and social forces as the Northern Cheyenne. Local non-Indian populations also make up the immediate social and economic environment with which the Reservation community is in dynamic interaction. These social and economic dynamics between the Reservation and the surrounding region help perpetuate the present social and economic baseline conditions on the Reservation.

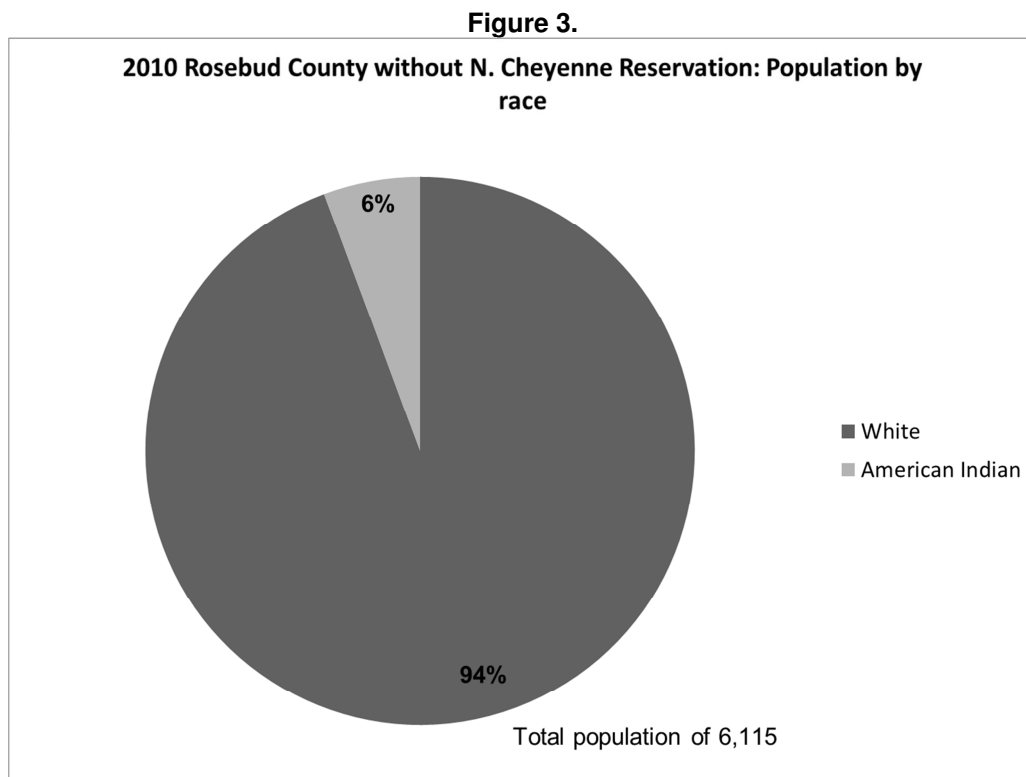
Rosebud County's population is a little more than one-third Northern Cheyenne³³. By contrast, Powder River County, which unlike Big Horn and Rosebud Counties does not contain a portion of an Indian Reservation, has less than 2 percent that identify as

³² Personal communication with Wallace Bearchum, the Director of Tribal Services for the Northern Cheyenne Tribe on August 28, 2015.

³³ Thirty-five percent of the people in Rosebud County identified as "American Indian." U.S. Census. Profile of General Population and Housing Characteristics: 2010. DP-1 for Rosebud County, Montana.

American Indian.³⁴ Nevertheless, Native Americans, overwhelmingly Crow and Northern Cheyenne, make up nearly half (48%) of the population of all three counties as a whole in the 2010 Census.

As noted above, the Northern Cheyenne Reservation is itself overwhelmingly American Indian (Figure 2) while Rosebud County outside the Northern Cheyenne Reservation is overwhelmingly white. Subtracting the Rosebud County part of the Northern Cheyenne Reservation from Rosebud County leaves the county 96 percent white and 4 percent American Indian. The demographics are actually a little more complicated than this, but this is a relatively accurate representation of the racial makeup of the Reservation and the non-Reservation part of Rosebud County. If one assumes that the people that identify as two or more races are Native Americans (two thirds identify as a mix of white and American Indian) then the population of Native Americans could be as large as 6 percent (Figure 3). The important pattern is that the Northern Cheyenne Reservation is overwhelmingly Native American and Rosebud County outside of the Reservation is overwhelmingly white.



Source: 2010 Census data for Rosebud County without the Northern Cheyenne Reservation.

According to the 2010 Census, people that identified as American Indian make up 64 percent of Big Horn County, more than a third of Rosebud County, and nearly half of the two-county area. In short, American Indians, just in terms of numbers, are a significant presence. It should be noted that these are the most conservative figures. If one adjusts

³⁴ U.S. Census. Profile of General Population and Housing Characteristics: 2010. DP-1 for Bighorn County, Montana.

for the census undercount and also includes people in the 2010 census who identified themselves as being "two or more" races (most of whom in this area will be part American Indian) then the figures would be even higher. By comparison, in the 2010 census, 62,555 Indians made up only 6 percent of Montana's overall population, which is similar to the situation in Rosebud County outside of the Reservation.

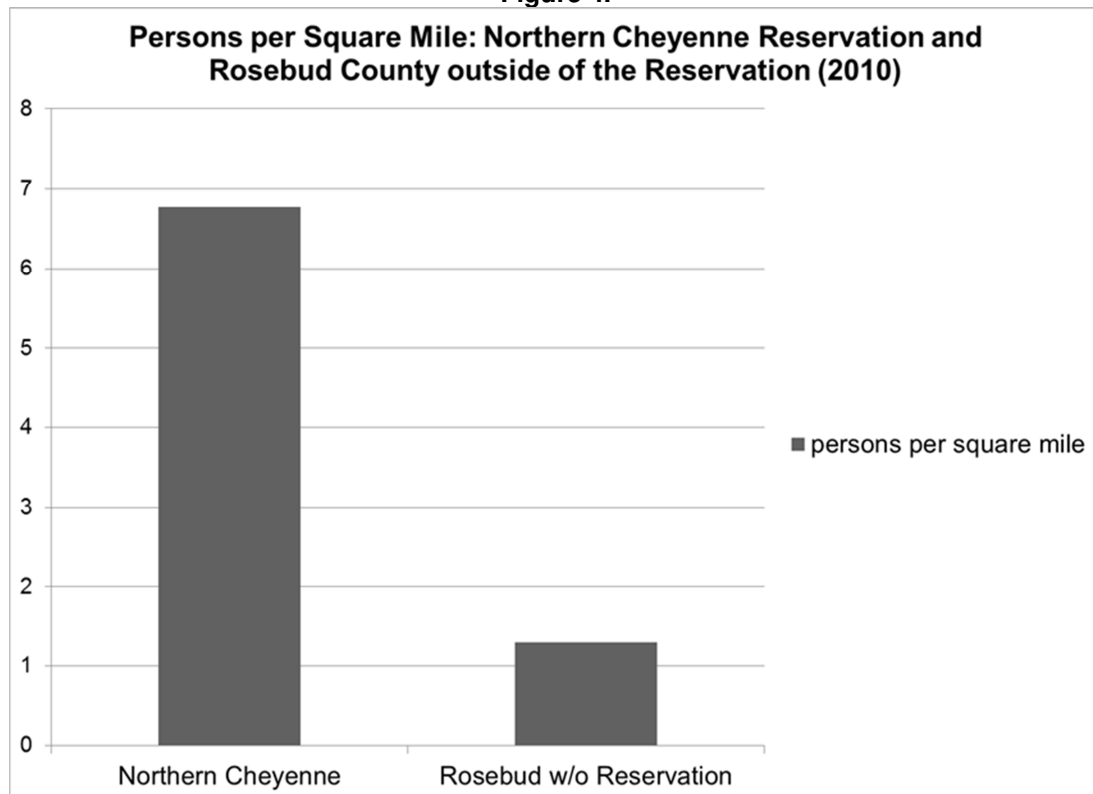
3. Population Density

Until the mid- to late-1960s, the area of southeastern Montana that surrounds the Northern Cheyenne Reservation remained highly rural and relatively isolated. Often described as the last and least settled region of the United States, it supported an agricultural economy based primarily on large ranches owned and operated by families with deep roots in the land, many of whom were (and are) descendants of the original settlers. With its agricultural economy, the area remained by and large an economic "backwater," and the relatively stable Euro-American communities were content to let many of the changes that occurred elsewhere pass them by. Socially, and in some respects economically, the Northern Cheyenne Reservation constituted an even more isolated pocket within this highly rural Northern Plains region.

This changed to some degree in the 1960s, with the advent of coal development. But except for specific "boom" conditions, localized in time and space, energy development did not drastically change the region's overall basic population. With an economy still based in resource extraction, the area remains sparsely populated. However, industrial energy production changed the character of the region in other ways, and continues to affect established local communities, including the Northern Cheyenne Tribe, economically, socially, and culturally.

The population density of the region reflects its economy. Euro-Americans are relatively mobile. If a local economy will not support them with jobs or livelihoods, they go somewhere else. This is often true of the children of established families in rural areas, as well as whole families who may be subject to currents of economic change. In southeastern Montana, as Figure 4 below illustrates using data from the 2010 Census, the rural ranching and mining economy of Rosebud County supports only a little over one person per square mile (PPM). This figure represents the non-Reservation areas of Rosebud County. The average of 1.3 PPM includes all of Rosebud County except for the portion that is the Northern Cheyenne Reservation.

Figure 4.



Source: 2010 Census data. Northern Cheyenne Reservation and Rosebud County without the Northern Cheyenne Reservation.

As compared to the non-Reservation areas with only 1.3 persons per square mile, the Northern Cheyenne Reservation has a population density of 6.8 persons per square mile. As a community, the Northern Cheyenne Tribe has its homeland in the Northern Cheyenne Reservation. The Reservation community as a whole is not very mobile within the larger U.S. social economy; in general, Northern Cheyenne families and individuals are far less mobile than their local Euro-American counterparts, even though the latter also may be representative of established communities with deep local ties.

The powerful rootedness of the Tribe in its homeland, the value of its traditions and culture to its members, and the pull of the tribal community on its members, mean that people remain on the Reservation in numbers greater than the local and regional economy supports. Because they are so much less mobile, many Northern Cheyenne Tribal members endure poverty and joblessness to remain on their homeland and within their community.

The presence of the Reservation as a unique, irreplaceable, and non-fungible land base for the Northern Cheyenne Tribe is one reality that distinguishes the Cheyenne from local Euro-Americans. One measurable consequence of this difference is that the population density of the Reservation land area already is more than five times that of the adjacent non-Reservation Rosebud County. Northern Cheyenne respond more to place and community and (for several reasons) less to economic imperatives than do

many non-Indians. On the one hand, there may be many reasons for people to leave the Reservation, since life on the Reservation can be hard and available resources are entirely inadequate even for the 42 percent of the Tribal membership that live there.³⁵ But on the other hand, Northern Cheyenne often feel a strong pull to return and live with their own community on their own land. The relatively high population density of the Reservation reflects this pull of land and community. That even more of the Tribal membership does not live there reflects the economic limitations we have been noting, as well as an extremely limited housing stock.

Thus, many Northern Cheyenne Tribal members who live off of the Reservation at a given time will return, while some of those who are on the Reservation now will leave for a while. This also means that the numbers of people on the Reservation can shift relatively rapidly. This is not entirely unlike what can be experienced in boomtown conditions anywhere; but the realities of place and community on the Reservation are different from those of other places caught in energy development booms.

In the recent past, for example, the possibility of jobs in nearby energy developments at Colstrip brought Tribal members back to the Reservation. Many jobs were created, but very few went to the Northern Cheyenne. When far fewer jobs than anticipated materialized for returning Northern Cheyenne, the *unemployment rate* on the Reservation actually *increased*, and already stressed social service and economic resources became even more strained.³⁶ This Northern Cheyenne commitment to their homeland, as indicated by the population density of the Reservation contributes to their vulnerability to changing socioeconomic conditions.

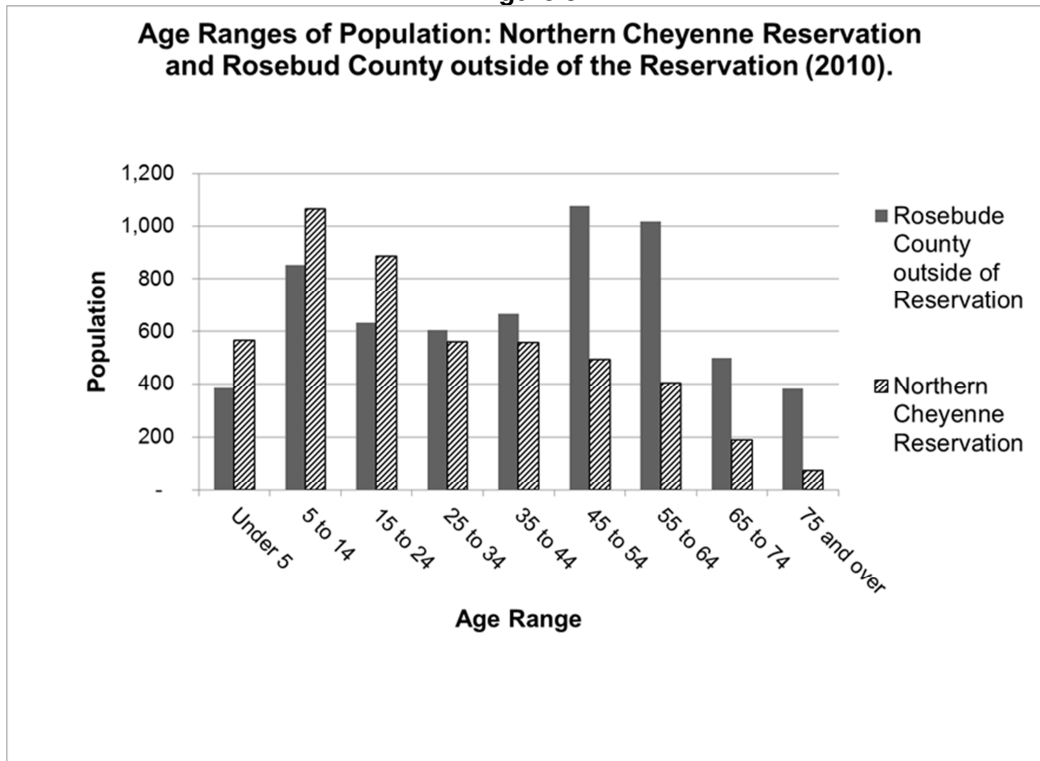
4. Age Structure

The age structure of the Northern Cheyenne Reservation is also quite different from that of the off-Reservation part of Rosebud County. The age distribution of the Northern Cheyenne Tribe is much more heavily weighted toward the young – that is, the Reservation population has relatively more young people and fewer elders. See Figures 5 and 6. To the extent that those of middle age and older provide leadership to younger generations, this could be seen as a problem for the Northern Cheyenne at the present time. As those younger generations mature, having a young and vibrant population as opposed to a population that is significantly aging in place could be seen as a future strength.

³⁵ Personal communication with Wallace Bearchum, the Director of Tribal Services for the Northern Cheyenne Tribe on August 28, 2015.

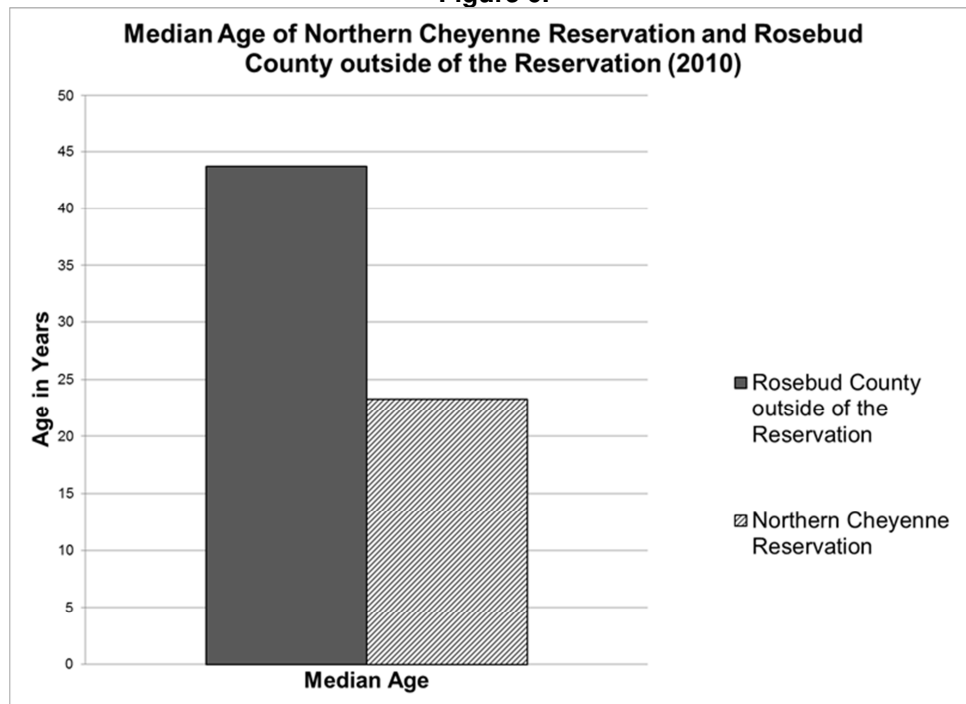
³⁶ “Social and Economic Effects of Regional Coal Development on the Northern Cheyenne Tribe, 1970-1985”, Mara Feeney et al., *Impact Assessment*, 6(2): 71-79, 1988.
<http://www.tandfonline.com/doi/pdf/10.1080/07349165.1988.9725636> .

Figure 5.



Source: 2010 Census. Rosebud County without the Northern Cheyenne Reservation and the Northern Cheyenne Reservation.

Figure 6.



Source: 2010 Census. Rosebud County without the Northern Cheyenne Reservation and the Northern Cheyenne Reservation.

5. Relative Poverty

Tables 1 and 2 below, using economic data from the 2010 census, compare per capita incomes between the Northern Cheyenne Reservation where the population is overwhelmingly American Indian and the part of Rosebud County that is off the Reservation, an area that is overwhelmingly non-American Indian.

Table 1 reflects the huge disparity in incomes in Rosebud County between the Indian and the non-Indian regions. On a per capita basis, in the predominantly white population off-Reservation part of Rosebud County, people enjoy income per person 109 percent higher than their predominantly American Indian neighbors on the Reservation. In the non-Reservation portion of Rosebud County, households also enjoy income 72 percent above the income of Reservation households. The reason that the disparity in household income is not quite as great as the per capita income disparity is that there are larger households on the Indian side, as people join together to pool their meager incomes.

Table 1.

2010 Per Capita Income by Area	
Northern Cheyenne Reservation	\$12,559
Rosebud County outside of the Reservation	\$26,271
2010 Median Household Incomes	
Northern Cheyenne Reservation	\$38,580
Rosebud County outside of the Reservation	\$66,174

Source: Census, 2006-2010 American Community Survey. Values are in 2014 dollars.

Given the figures in Table 1, it is hardly surprising that the poverty rate on the Northern Cheyenne Reservation is almost four times greater than the poverty rate of neighboring non-Reservation portions of Rosebud County. See Table 2.

Table 2.

Poverty Rates on the Northern Cheyenne Reservation and in the Rosebud County Non-Reservation Area	
	% of Population below the Poverty 2010
Northern Cheyenne Reservation	34.8%
Non-Reservation Part of Rosebud Ctny	9.0%

Source: 2006-2010 American Community Survey 5-Year Estimates, S1701, Poverty Status

6. Crime Rates

Poverty, employment, educational attainment, income, age structure, population density, and social geography all tell a similar story of a disadvantaged population relative to Rosebud County outside of the Reservation. It should come as no surprise then that the crime rate on the Northern Cheyenne Reservation is significantly higher than the Montana State average. If we compare the most recent crime statistics that we have³⁷ we find that the crime rate on the Reservation is almost 12 times as high as the Montana state wide average.³⁸

7. Employment and Unemployment

a. Different Measures of the Extent of Unemployment

³⁷ The most recent crime statistics that are available cover the 2005-2009 period.

³⁸ It should be noted that it is not legal to be “intoxicated” on the Reservation. This stands in contrast to the state of Montana which has no such law. The BIA provided Power Consulting with the “bookings” for 2014 for the Northern Cheyenne Reservation and more than 70 percent of those bookings were for “intoxication.” It is likely then that the data that we present for the Northern Cheyenne Reservation is an over exaggeration of the crime rate when compared to the state of Montana that does not have a similar law. However, if we were to discount 70 percent of the crimes on the Reservation, the crime rate would still be a little less than 4 times as high as the State average. Sources: The Montana Board of Crime Control reports on the state of Montana as a whole. Statistics for each year can be obtained at: <http://mtibrsrp.mt.gov/public/Browse/browsetables.aspx> those state wide statistics can be compared to a Montana Crime Control Board publication from 2009 titled “Crime Data for the Reservations of Montana.” The Northern Cheyenne Reservation is broken out in the table on page 1. <http://mbcc.mt.gov/Data/SAC/Tribal/MTAggreg.pdf> The population statistics, for the Northern Cheyenne, were based on the 2005-2009 ACS survey of the Reservation from the Bureau of the Census.

The extent of unemployment in the U.S. is measured by the Bureau of Labor Statistics (BLS) within the U.S. Department of Labor. It provides estimates of the unemployment rate at the national, state, and local levels on a monthly basis. That measure of unemployment is the one that most citizens are familiar with. It is regularly used to compare employment opportunities in one area compared to another.

In the past, the Bureau of Indian Affairs (BIA) also measured the unemployment rate among American Indians on each Reservation. Unfortunately these two federal agencies did not measure unemployment in the same way. The measure used until recently by the BIA produced numeric measures that were much larger than the measure used across the nation by the BLS. Reservation unemployment rates reported by BIA were often above 60 percent, a result almost never reported by the Bureau of Labor Statistics for any other areas in the U.S. These different measures of unemployment can lead to misleading comparisons if the measure applied to enrolled Tribal members living on a particular Reservation is compared to the “official” federal measure applied to counties, states, or the nation. The apparent difference in the extent of unemployment will be exaggerated by such comparisons even if each measure was appropriate in particular uses. The common problem of “comparing apples to oranges” arises if a common measure of the extent of unemployment is not used in comparisons.

The Bureau of Indian Affairs (BIA) American Indian labor market statistics and analysis focuses only on the work status of Tribal members residing on a Reservation. Non-member Reservation residents’ employment status is not considered. BIA also does not focus only on those who are seeking work but have not found it. The BIA unemployment measure includes people of working age who have voluntarily chosen other activities rather than work for pay.

Because we want to compare unemployment rates on the Reservation with unemployment rates off the Reservation in the same geographic area, we have to choose one common measure. We have used the official unemployment rate despite its shortcomings both because it is, by far, the most common measure used and because the BIA’s past and present unemployment measures have even greater shortcomings.

b. Unemployment on the Northern Cheyenne Reservation

While the Northern Cheyenne depend on hunting and fishing for subsistence, they also depend on jobs and business opportunities for livable incomes. In this sense, lower average incomes on the Reservation reflect lack of access to employment and other economic opportunities. The percentage of the workforce that was unemployed was staggering: 27 percent of the labor force on the Reservation is unemployed. We can compare this to Rosebud County outside the Reservation where only 2 percent of the labor force is unemployed.³⁹ The unemployment rate on the Reservation is *almost 14 times* that found off the Reservation in Rosebud County. As mentioned above, the official unemployment rate is based on the number of people who are actively seeking

³⁹ These unemployment rates were calculated from Bureau of the Census data: 2006-2010 American Community Survey 5-Year Estimates, S1701, Work Experience.

work and fail to find it. People who are so discouraged they have stopped seeking work are not included in that “official” unemployment measure.

Since working-age people who have been discouraged by the lack of jobs are not counted in the official unemployment rate, it is important to investigate whether the actual number of working-age residents who would like to work but cannot find jobs is larger than the official unemployment data indicates. Table 3 allows us to do that. It compares the percentage of the population over 16 year of age who are employed on the Reservation and in the non-Reservation part of Rosebud County. It shows that while 28 percent of non-Reservation Rosebud County “working age” population was not working, 40 percent of the Reservation “working age” population was not working.⁴⁰ Sometimes this percentage of the “working age” population is used as a measure of the “true” “unemployment rate” since it includes both those who are seeking work but cannot find it as well as people who have stopped seeking work because the employment opportunities are so limited. This can be misleading given that a paid job is not the only opportunity that may be important to people. Furthering ones education or skills, raising children or caring for other family members, and retirement are also important objectives that may explain why “working age” people do not seek paid employment.

Table 3.

2006-2010 Northern Cheyenne Reservation and Rosebud County Off-Reservation Employment Data				
Work Experience 2006-2009	Northern Cheyenne Reservation		Rosebud County not including Reservation	
	Number	Percentage of 16 and Older	Number	Percentage of 16 and Older
Total Population 16 and Older	2,864	100%	4,681	100%
Worked	1,314	46%	3,374	72%
Did Not Work	1,149	40%	1,307	28%
Seeking work, unemployed	484	16.9%	70	1.5%
Not seeking work and not working	665	23%	1,237	26%

Source: 2006-2010 American Community Survey 5-Year Estimates, S1701, Work Experience.

If we break those who are not working into those who have sought a job but not found one and those who are not seeking work even though they currently are not working, we see that the primary difference between off-Reservation Rosebud County and the Reservation is in those who are “officially” unemployed, i.e. those who are actively seeking work but cannot find it rather than those who are not looking for work, possibly because they have given up looking. The percentage that are not working and not seeking work is actually higher in the non-Reservation part of Rosebud County, 26 percent versus 23 percent on the Reservation. This is likely due to the fact we have

⁴⁰ “Working-age” is in quotation marks because the reference population is all residents age 16 and above. Old age is not used to define or cap what part of the population is working-age nor is full-time participation in schooling.

already discussed above: The non-Reservation part of Rosebud County is much older than the population of the Reservation. That means that one would expect to find more residents who have retired, putting them in the non-working, not-seeking work category. The much younger Northern Cheyenne population would have a higher proportion of people 16 and older who are still in school full time which, one would expect, might well reduce their participation in the workforce. That too, like retirement, should not be treated as “unemployment.”⁴¹

If the official unemployment rate *on* the Reservation were the same as found in Rosebud County *off* the Reservation, there would be 441 additional employed Reservation residents. This would reduce the percentage of those 16 and over who were not working from 40 to 25 percent, a little below what that percentage was in Rosebud County outside the Reservation. This indicates that it is primarily the higher official unemployment on the Reservation that is the source of the higher rate of working age people not working. That is, it does not appear that it is primarily discouraged workers that are the source of the larger percentage of working age people who are not working on the Reservation. The explanation is simpler than that: It is the Northern Cheyenne unemployment rate among those who are actively in the workforce that was almost *14 times* that of residents of the non-Reservation part of Rosebud County.

8. The Relationship between Education, Income and Employment

Educational attainment receives significant economic rewards across the nation. The income received by individuals is significantly affected by their educational accomplishments. Higher levels of education clearly boost the productivity of individuals on the job and with that high level of education come higher rewards for their labor efforts. In 2010, for instance, Americans who did not finish high school earned 30 percent or \$7,963 per year less than those who did earn a high school diploma. Those who received a bachelor's degree earned 44 percent or \$21,000 per year more than those who only finished high school.⁴²

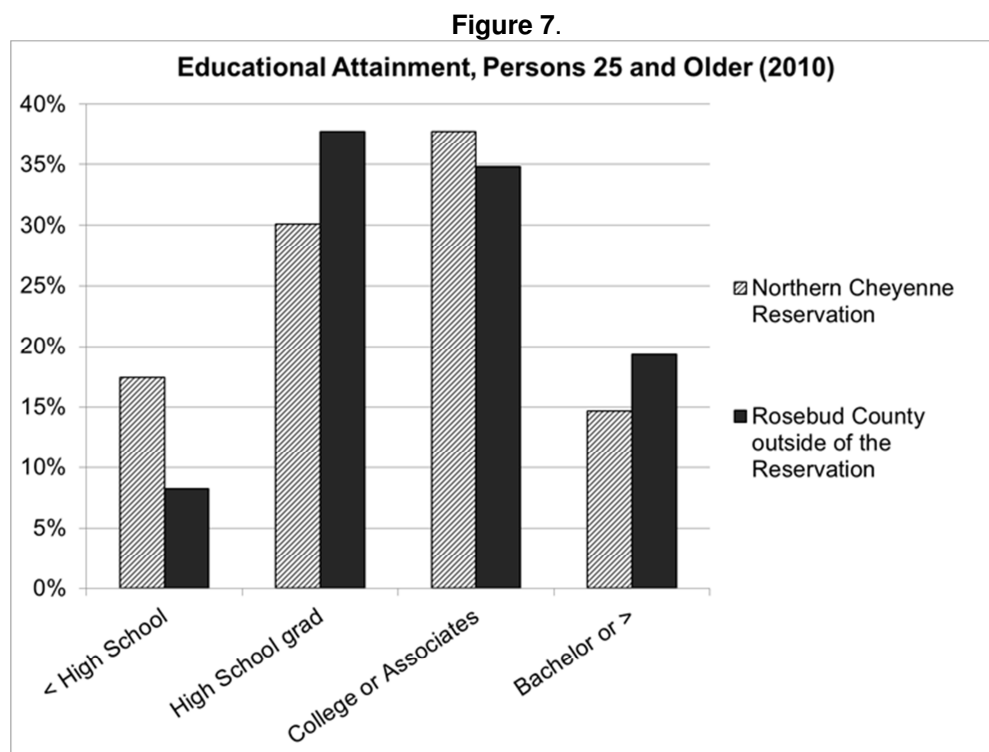
Education is valued on the Northern Cheyenne Reservation. Parents and families make extra efforts, despite their desperately limited resources, to send their children to the best available schools. Given the distances involved in this rural area, such commitment may demand considerable investments in time and transportation costs for after-school events, even where bussing is available for regular school hours. For decades the Northern Cheyenne people had wanted a Reservation high school in Lame Deer. Finally, through intense effort and lobbying a new high school district was authorized and formed and a new school was constructed in Lame Deer in 1997. In the face of difficulties associated with poverty, the Cheyenne community's commitment to the education of their young people remains strong.

⁴¹ The sum of the number of people between the ages of 16 and 22 and over 70 on the Reservation and in the non-Reservation part of Rosebud County is about the same size as the number of people sixteen and over who are not working and not seeking to work. This also suggests that it may be the demographic makeup of the populations that explains the lack of participation in the workforce.

⁴² U.S. Census, 2010 American Community Survey. S1501: Educational Attainment.

Education levels on the Northern Cheyenne Reservation are relatively high. For instance, the 2010 Census indicated that 38 percent of Reservation residents over 25 had some college education. In Rosebud County, outside of the Reservation, about the same percent of residents over 25 had a bachelor's degree or higher. On the other hand, in 2010 there was a higher percentage of Reservation residents who had not obtained a high school diploma: 17 percent versus 8 percent for non-Reservation Rosebud County.

Figure 7 breaks out the Reservation from the non-Reservation area of Rosebud County and shows the educational attainment of the Northern Cheyenne Reservation population (persons 25 years and older) compared to the non-Reservation portions of Rosebud County. The percentage of the population with a high school diploma and with some college is roughly similar on and off the Reservation. Perhaps the most notable differences are the larger proportion of persons on the Reservation without high school or equivalent diplomas.



Source: Census, 2006-2010 American Community Survey.

Table 4 compares the average income by education level for the U.S., the Northern Cheyenne Reservation, and Rosebud County outside the Reservation. Rosebud County outside the Reservation has a relatively high average income level when compared to the U.S. as a whole and the Northern Cheyenne Reservation. It is only when the educational level in Rosebud County outside the Reservation education level reaches a graduate or professional degree that the gap between the Northern Cheyenne Reservation and Rosebud County without the Reservation finally disappears.

The Northern Cheyenne Reservation on the other hand is consistently significantly lower in pay per education level when compared to the U.S. as a whole and, other than at the graduate or professional degree level, is dramatically lower compared to Rosebud County outside the Reservation. Most striking is the pay for individuals who have less than a high school degree on the Northern Cheyenne Reservation -- they make 39 percent of the national average, and about 30 percent of the average in Rosebud County outside the Reservation (who make 128 percent of the national average). The important conclusion that can be drawn from Table 4 is that simply boosting the educational attainment of the Northern Cheyenne residents of the Reservation will not close the income gap between the Northern Cheyenne and the residents of the non-Reservation part of Rosebud County or the residents of the United States. That, of course, is not to say that increasing the high school graduation rate on the Reservation would have no impact. It could potentially more than double an individual's income. But a significant gap relative to the median income on the Reservation would remain relative to both off-Reservation Rosebud County and the U.S. as a whole.

Table 4.
Educational Attainment and Income 2006-2010 Compared to National Average

	Northern Cheyenne Reservation	Rosebud County outside of the Reservation	U.S. Average Income by Education
MEDIAN EARNINGS IN THE PAST 12 MONTHS (IN 2014 INFLATION-ADJUSTED DOLLARS)			
Population 25 years and over with earnings	81%	110%	\$36,151
Ratio: Median Income N. Chey. Res. / Rosebud	73%		
Less than high school graduate	39%	128%	\$19,990
High school graduate (includes equivalency)	79%	108%	\$28,606
Some college or associate's degree	84%	110%	\$34,663
Bachelor's degree	83%	94%	\$51,485
Graduate or professional degree	80%	80%	\$67,982

Source: Census, 2006-2010 American Community Survey (ACS) and 2010 ACS for National Average Income by Education. Percentages by geography are compared to the national average unless otherwise noted.

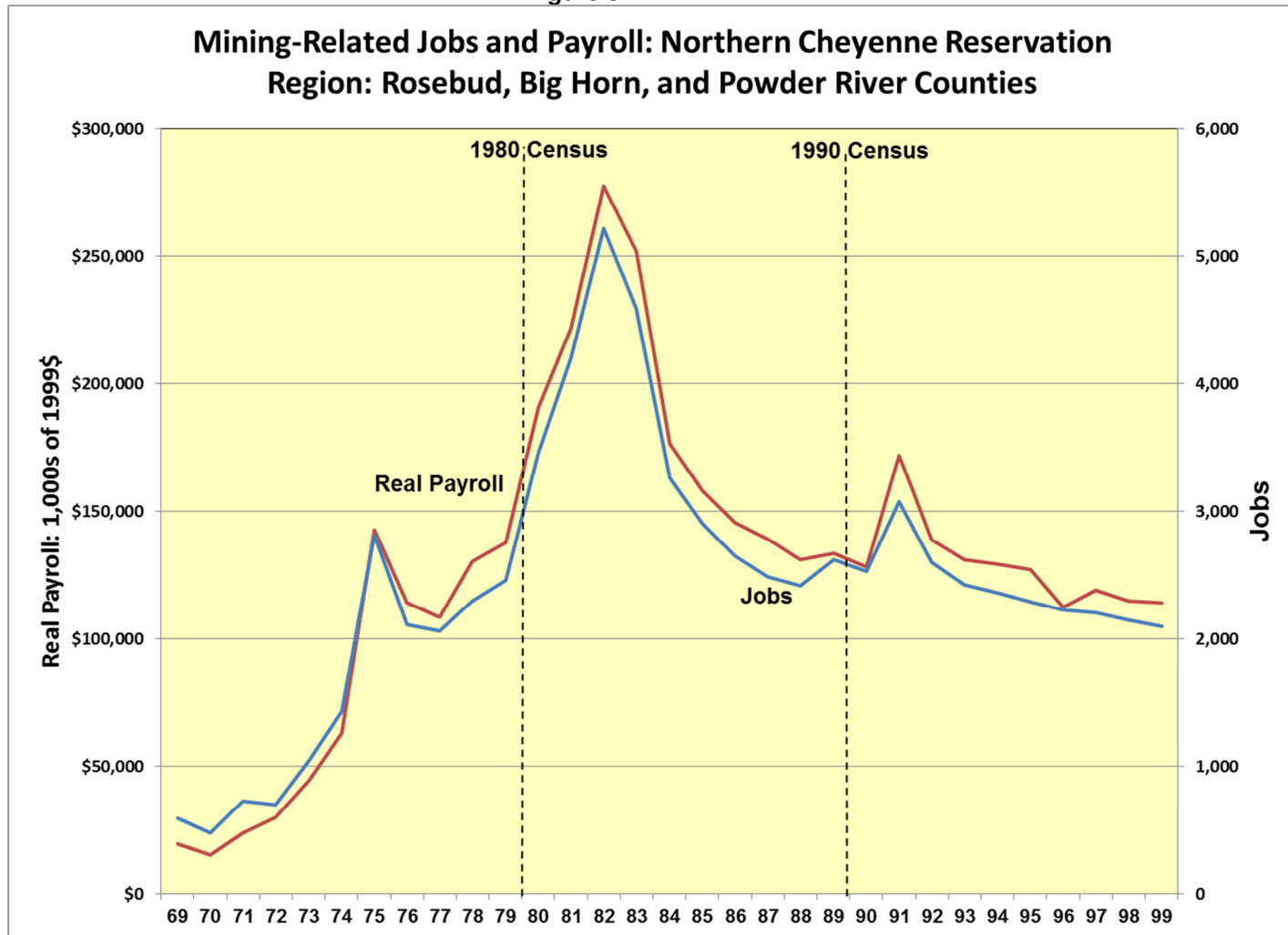
As Table 4 illustrates, except at the highest level, the educational attainments of the Northern Cheyenne are not being rewarded the way similar educational levels are rewarded off the Reservation and around the nation. The very limited employment opportunities available to Reservation residents and the high unemployment rate are the two sources of this outcome.

In sum, educational attainment, income, and employment are closely associated in the United States and Montana. However, this association breaks down dramatically on the Reservation. Wages, of course, are the primary source of income for the Northern Cheyenne just as they are for others in the United States, so the lack of association between educational attainment and income and employment has seriously adverse consequences for the Northern Cheyenne people.

IV. The Previous Energy Boom Failed to Have the Positive Impacts on the Northern Cheyenne That the STB Now Projects from a New Coal Boom

This is not the first time that a major expansion in coal production in the region surrounding the Northern Cheyenne Reservation has been imminent. In 1972-1990, coal development in the Montana portion of the Powder River Basin, especially that associated with the development of the Colstrip electric generating facilities and the coal mines energizing those plants, confronted the Northern Cheyenne as well as non-Indians in the area surrounding the Northern Cheyenne Reservation with significant impacts, both positive and negative. Coal mining and electric generation along with the temporary jobs associated with their construction provide some of the highest paid jobs available in Montana. Because of those high paid jobs, energy development is usually assumed to provide very positive support for local economic development efforts, especially in rural areas where well-paid jobs are relatively scarce. The TRRR seeks to develop coal resources in a region even closer to the Northern Cheyenne Reservation than the 1972-1990 development of coal production and coal-fired electric generation in the Colstrip area. Analysis of the impact of that earlier coal development should provide valuable information on how the benefits of such coal development are actually shared among the various groups, including the Northern Cheyenne.

Figure 8.



1. The Scale of the Energy Development 1972-1990

Between 1972 and the early 1980s, coal, oil, and electric production in the three-county area⁴³ around the Northern Cheyenne Reservation boomed. The real value of coal production expanded 12 fold; the real value of oil production grew about 4 fold, and an export-oriented electrical energy generating complex was built at Colstrip. Mineral extraction jobs expanded about 6 fold and the payroll associated with them grew 10 fold.⁴⁴ Construction to build the coal mines, electricity generating facilities, and related

⁴³ Rosebud, Big Horn, and Powder River Counties. Because the 1972-1990 coal boom involved mines in Big Horn as well as Rosebud Counties as well as proposed mines in Powder River County (where the Otter Creek Mine would be located), we use a three-county study area in this analysis of the impacts of the 1972-1990 coal boom.

⁴⁴ All of the dollar values are expressed in year 2014 constant dollars so that they can be compared to contemporary purchasing power. The CPI was used to adjust for the effects of inflation. The data on coal and oil production come from the Montana Department of Revenue's Biennial Reports. The data on electricity production comes from the US Department of Energy's Energy Information Administration.

homes and businesses caused construction jobs to expand over 7 fold and their payroll almost 10 fold.⁴⁵ In Rosebud County, where the Colstrip generators were located, public utility, including communications, and transportation jobs also increased substantially. Overall, energy-related jobs expanded 7.5 fold and their payroll grew 9 fold. As a result, the share of total jobs located in these energy-related sectors grew from 8 percent in 1972 to 38 percent at its peak in 1982. Real labor earnings in these energy-related sectors grew from 14 percent of total regional real earnings to 64 percent. At the end of that boom period, 1990, the energy-related jobs still represented 22 percent of total employment and 40 percent of total labor earnings. The difference between these two percentages is due to the high pay associated with those jobs. See Figure 8 above and Table 5 below. It should be noted in both Figure 8 and Table 5 that the peak impact of that 1972-1990 energy boom was in the early 1980s. As a result, the rich data sets usually provided by the Census every ten years did not capture much of the boom or smaller expansions both before and after the major boom in employment and payroll that took place in between the 1980 and 1990 Censuses.

Clearly energy development between 1972 and 1990 led to a major expansion in economic activity and created a tremendous amount of economic value. In addition to mineral value extracted and the electricity produced, the four electrical generating plants at Colstrip were constructed and, as of 2015, were still operating. In year 2014 dollars, those generating facilities were assessed as worth \$3.0 billion when they were completed.⁴⁶

The gross dollar value of the energy production was huge. Expressed in constant year 2014 dollars, coal, oil, and electricity production between 1972 and 1990 had a cumulative value of over \$22 billion. The annual production value was about \$1.2 billion. Associated with the coal production was a severance tax that totaled \$2.5 billion during this time period, generating about \$135 million per year for state government. See Table 6.

⁴⁵ Employment and “payroll” (labor earnings) data come from the US Department of Commerce’s Regional Economic Information System (REIS) that provides employment and labor earnings by county. For years when data was not reported to protect against disclosing individual firm data, it was approximated by extrapolating from the data that was reported.

⁴⁶ Montana Department of Revenue Biennial Reports.

Table 5.

Direct Economic Impact of Mineral Extraction in the Northern Cheyenne Reservation Area (Rosebud, Big Horn, and Powder River Counties) 1972-1990			
Economic Impact	1972	Peak Year	1990
Real Value of Coal Production	1972	1984	1990
Coal	\$ 77,000,000	\$946,000,000	\$672,375,000
Value of Oil Production	1972	1981	1990
Oil	\$115,500,000	\$437,250,000	\$ 42,625,000
Real Value of Electricity Generated	1972	1985	1990
Electricity	\$ -	\$405,000,000	\$405,000,000
Mineral Extraction	1972	1981	1990
Jobs	278	1,615	1,133
Real Payroll	\$ 13,750,000	\$143,000,000	\$ 90,750,000
Construction	1972	1982	1990
Jobs	386	2,864	495
Real Payroll	\$ 20,075,000	\$191,812,500	\$ 19,387,500
Public Utility, Transportation, & Communications (Rosebud only)	1972	1988	1990
Jobs	30	931	898
Payroll	\$ 5,225,000	\$ 62,287,500	\$ 64,762,500
Total Direct Economic Impacts	72	82	90
Jobs	695	5,214	2,526
Payroll	\$ 41,112,500	\$381,425,000	\$176,275,000

Note: Values are expressed in constant year 2014 dollars.

Table 6.

Economic Value Created in the Northern Cheyenne Reservation Area 1972-1990				
Type of Mineral	Rosebud County (\$millions)	Big Horn County (\$millions)	Powder River County (\$millions)	Three County Area (\$millions)
Coal: Cumulative Real Value	\$4,274	\$8,317		\$12,592
Coal: Average Annual Real Value	\$226	\$437		\$663
Electricity: Cumulative Real Value	\$5,397			\$5,397
Electricity: Average Annual Real Value	\$337			\$337
Oil: Cumulative Real Value	\$1,100		\$3,167	\$4,267
Oil: Average Annual Real Value	\$58		\$166	\$224
Total Cumulative Value: Coal, Elect, Oil	\$10,770	\$8,317	\$3,167	\$22,256
Average Annual Value: Coal, Elect, Oil	\$620	\$437	\$166	\$1,224
Coal: Cumulative Severance Tax	\$828	\$1,656		\$2,485
Coal: Average Annual Severance Tax	\$44	\$87		\$131

Note: Values are expressed in constant year 2014 dollars
Sources: MT Dept. Revenue Biennial Reports, U.S. Department of Energy, Energy Information Administration

2. Mineral Economic Value Remaining in the Local Area

The primary “local” economic impact that mineral development has is the creation of jobs and the payment of wages. In addition, the state of Montana levies taxes on mineral extraction and local governments also levy property taxes or other mineral taxes.

When studying local economic impacts, it is important to focus on these actual local impacts rather than on the dollar value of the minerals extracted or electricity produced since much of the mineral value does not remain in the local area. In general only a relatively small fraction (20 to 25 percent) of the value of the minerals produced becomes income to local residents.

“Local” is used here loosely because workers in energy industries often commute long distances to their jobs and may not live in the rural counties where the mineral development is taking place. For instance, many of the workers associated with coal development in Big Horn County actually live in the Billings area (Yellowstone County), and we are including those workers as “local.” Many of the construction workers who built the strip mines, the electric generators, and the workers who drilled the oil wells were not permanent residents of the region. For that reason, much of the payroll associated with these activities did not circulate within the local economy either. Since it is difficult to estimate the payroll dollars that were generated by local economic activity but then flowed quickly out of the area, we will label them all “local” impacts.

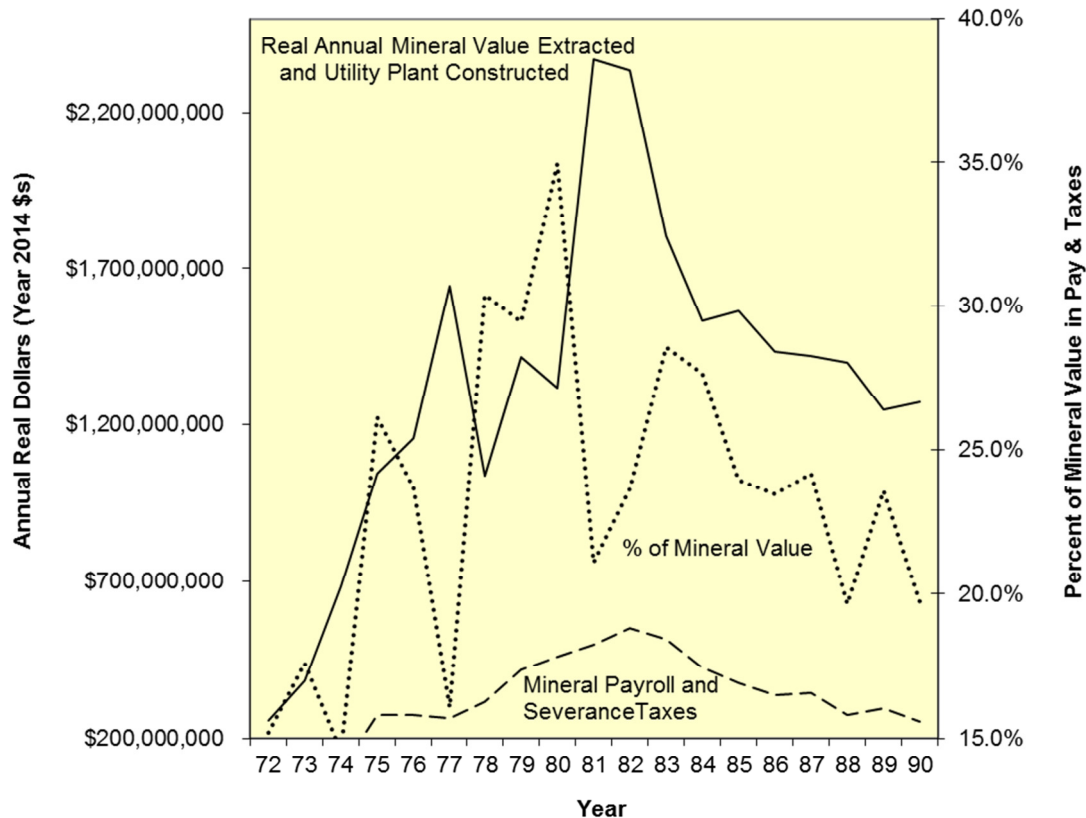
A crude indication of the share of the total economic value created during the 1972-1990 energy development in the region surrounding the Northern Cheyenne Reservation that stayed in the “local” economy can be obtained by comparing the total real value of the mineral-related value created to the real pay received by workers and the coal severance tax received by the state government. Figure 9 compares these two.⁴⁷ The solid line in Figure 9 shows the annual economic value created during the 1972-1990 coal boom. The left-hand axis measures that. The dashed line at the bottom of the figure shows the part of that economic value that went to payrolls and severance taxes. Note how modest it is compared to the total value created. Finally the dotted line expresses the share of the economic value going to payrolls and severance taxes as a percent of the total value created. The right-hand axis measures that percent share.

Keep in mind that most construction payrolls do not get spent within the local rural economy and most of the state coal severance tax also does not flow back to those rural areas either. And the Tribe does not receive any tax revenue for off-Reservation activities.

⁴⁷ Sources: MT Department of Revenue Biennial Reports (value of construction, mineral production value, and mineral taxes), U.S. Department of Commerce Regional Economic Information System (pay); U.S. Department of Energy, Energy Information Administration (electricity production).

Figure 9.

**Real Value of Mineral-Related Production and
Local Income Received: Northern Cheyenne Reservation Region**



Source: Mineral value, coal severance tax and value of utility plant from Montana Department of Revenue, Biennial Reports. Mineral payroll from U.S. Bureau of Economic Analysis, REIS, labor earnings by county and industry. All values adjusted to 2014 dollars using the Consumer Price Index.

Only in the years of heavy construction on the Colstrip generating units in the early 1980s did the share of the wealth being created that was paid out in wages approach and briefly exceed one-third. In most years it was in the 20 to 25 percent range.

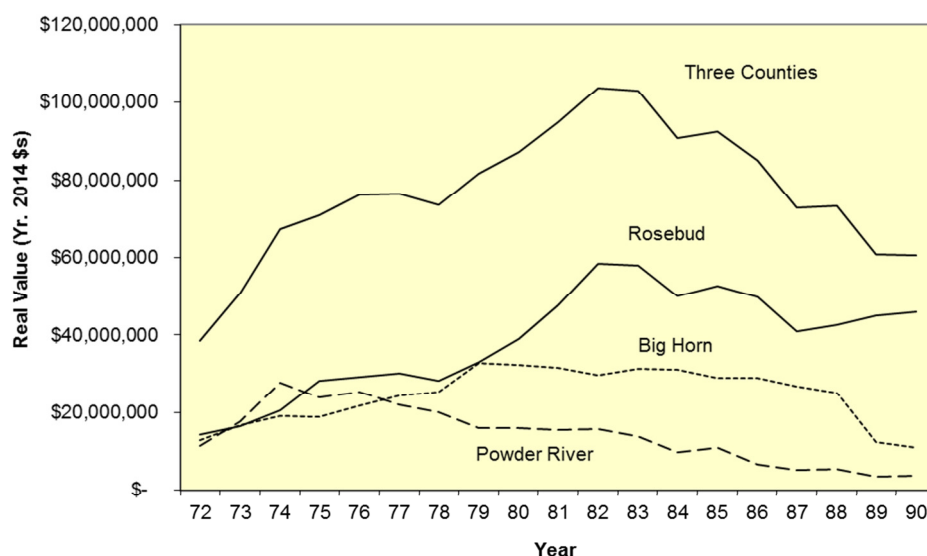
In addition to the coal severance taxes reported in Figure 8, mineral producers also pay property taxes on the equipment they use and, until the late 1980s, on the economic value being generated by the mineral site. Because it is difficult to establish the value of a mineral deposit in place, local governments were allowed to apply their property tax level to the net proceeds of mineral developments. Although this was not really a property tax, it was treated as such.⁴⁸ As mineral development expanded during the 1970s and 1980s in the region surrounding the Northern Cheyenne Reservation, total property tax collections also expanded in real terms. In Rosebud County, where the

⁴⁸ In the late 1980s this “property tax” was replaced with a “local government severance tax” to allow local government to continue to receive tax revenues from producing mineral sites, but the tax is no longer labeled a “property tax.”

Colstrip power plants were built as well as coal mines and oil wells developed, property tax collections in the mid-1980s rose to four times their level in 1972 and then declined to three times that earlier level. In Big Horn County property tax collections rose to 2.5 times the 1972 level before falling back to 1972 levels. In Powder River County where oil development was already under way in 1972, property taxes more than doubled but then fell off to less than half of what they had been in 1972.⁴⁹ See Figure 10.

Figure 10.

**Real Property Taxes Levied for All Purposed in
Three County Northern Cheyenne Reservation Region**



Source: Montana Department of Revenue Biennial Reports. Various years.

Some of the property taxes collected within each county flow to state government to fund school districts across the state. Not all of the property tax dollars are spent within the county where they are collected. If, instead of focusing on property tax revenues, we look at general revenues collected by local governments from their own tax and revenue sources, we may have a better indication of the way in which energy development supported local government activities and expenditures. Table 7 provides this information on a per person basis with the effects of inflation removed. Expressing the local government revenue data on a per person basis allows revenues to be assessed on the basis of the number of people served. Expressed this way, the government revenues per capita indicate how the capacity of local government to support the total population with services has changed over time.

⁴⁹ These property tax collections include taxes collected within the county for all purposes including those levied for the state government, those levied for school districts, etc. They are not just the taxes levied by the county governments themselves. Source: Montana Department of Revenue Annual Reports, deflated using the personal consumption expenditure price deflator.

Table 7.

Real General Revenues per Capita from Own Sources All Local Governments in County Area			
Year	Big Horn	Powder River	Rosebud
1966-67	\$1,076	\$1,456	\$1,679
1976-77	\$3,227	\$5,888	\$5,837
1986-87	\$3,033	\$3,983	\$12,304
1991-92	\$2,153	\$12,908	\$9,454

Note: Values are expressed in constant year 2014 dollars.
Source: Census of Governments. Northern Cheyenne Tribal government not included.

As can be seen, energy development allowed local governments to significantly increase their general revenues per capita. All of the increase was not sustainable, but at the end of the study period real per capita local government revenues were double what they had been before energy development in Big Horn County. In Rosebud County where the Colstrip power plants and coal mines provided a relatively permanent addition to the local property tax base, the real revenues per capita were more than five times what they had been in the late 1960s before energy development. Powder River County showed the greatest increase in per capita local government revenues. This was due to a large increase in non-tax revenues to the local government.

3. The Impact of This Energy Development on the Northern Cheyenne Reservation

Despite the creation of billions of dollars of economic value and thousands of high-paid jobs, the energy boom of the 1970s and 1980s in the region surrounding the Northern Cheyenne Reservation did not support improved prosperity on the Reservation. Between 1970 and 1990, real median family income on the Reservation declined from \$32,300 to \$28,900 in 1980 and declined further, to \$26,800, in 1990, an overall decline of almost one-sixth.⁵⁰ For Rosebud County as a whole, including the part of the Reservation in Rosebud County, median family income increased from \$36,100 to \$61,200, almost doubling, during the same period. In 1970 the Northern Cheyenne Reservation had a median family income that was 90 percent of that of Rosebud County as a whole.⁵¹ By 1990 the Reservation median family income fell to only 45 percent of that in all of Rosebud County. Since the Rosebud County data includes the low income status of the Reservation, this comparison to Rosebud County as a whole understates the difference between the Reservation and non-Reservation parts of Rosebud County.

⁵⁰ 1970, 1980, and 1990 Census of the Population. Constant 2014 dollars.

⁵¹ The estimate for non-Reservation Rosebud County was based on the assumption that the economic characteristics of the Rosebud County part of the Northern Cheyenne Reservation were similar to those of the Reservation as a whole. 70 to 75 percent of the Reservation population, families, etc. are located in the Rosebud County part of the Reservation. In addition, because the 1970 Census did not report separately on the Rosebud and Big Horn County portions of the Reservation, the 1980 division of the Reservation population between the two counties was used.

Although real per capita income on the Northern Cheyenne Reservation improved somewhat over the 20-year period, 1970 to 1990, it declined relative to Rosebud County as a whole, from 52 to 48 percent of the county-wide level. While real per capita income on the Reservation increased by 27 percent, Rosebud County as a whole increased by 40 percent.

During this boom in energy-related employment opportunities, the percentage of working age residents of the Reservation who were not employed increased and the official unemployment rate almost tripled from 5.9 to 16.9 percent.⁵² Relative to Rosebud County as a whole, these employment statistics also deteriorated.

Despite the \$2.3 billion of additional energy industry real payroll between 1972 and 1990 in the surrounding three counties (an average of \$120 million per year), the poverty rate on the Northern Cheyenne Reservation increased from 41 to 48 percent. For Rosebud County residents living off the Reservation, the poverty rate declined from 20 to 10 percent. The percent of Reservation residents living below the poverty level rose from twice that of the Rosebud County residents living off the Reservation to almost five times (4.7x) that of non-Reservation residents.

The generation of billions of dollars of economic value in the form of energy resources did not translate into the economic status of Reservation residents. Home ownership rates on the Northern Cheyenne Reservation fell between 1970 and 1990 from 78 percent to 59 percent. Relative to Rosebud County as a whole, the Reservation went from being 37 percent above the county home ownership rate to being 15 percent below it.

Table 8 summarizes the changes that took place on the Northern Cheyenne Reservation and in Rosebud County as a whole. It documents the startling fact that despite major energy developments in the surrounding region, economic conditions deteriorated on the Reservation in both absolute and relative terms. Whatever happened to the economic value of the energy created, it did not flow to residents of the Northern Cheyenne Reservation.

⁵² The official unemployment rates are substantially lower than those reported in the BIA Labor Force Reports for the same years. This is likely attributable to the fact that the methodology for calculating the official unemployment rate, unlike that used by the BIA in its Labor Force Reports, does not count discouraged job-seekers as part of the work force and may include those who are voluntarily unemployed, e.g. students, retirees, and people caring for family members. Note that these official unemployment rates in the 1970 to 1990 period are well below the official unemployment rate on the Reservation in the 2006-2010 period which was 27 percent while off the Reservation in Rosebud County the unemployment rate was 2 percent. (2006-2010 American Community Survey 5-Year Estimates, S1701, Work Experience.)

Table 8.

Changes in Economic Conditions on the Northern Cheyenne Reservation During the Energy Boom 1970-1990						
Economic Indicator	1970 Census	1980 Census	1990 Census	Northern Cheyenne as % of Rosebud County		
				1970	1980	1990
<u>Employment Status</u>						
% Working Age Not Employed	54.6%	53.7%	56.2%	127%	143%	147%
Official Unemployment Rate	5.9%	8.6%	16.9%	216%	243%	206%
<u>Real Income (\$2014)</u>						
Median Family Income	\$32,300	\$28,883	\$26,834	90%	47%	45%
Per Capita Income	\$7,062	\$7,771	\$9,002	52%	41%	48%
<u>Poverty Rate</u>						
% of All Persons below Poverty	40.7%	41.8%	48.2%	158%	232%	236%
% of All Families below Poverty	39.8%	41.7%	43.8%	220%	318%	302%
<u>Home Ownership Rate</u>	77.7%	63.8%	58.7%	137%	94%	85%
Source: Census of Population						

The first three sections of Table 8 report the economic statistics for the residents of the Northern Cheyenne Reservation for three successive census years. The second three sections put the economic status of the Northern Cheyenne in the context of all of Rosebud County which includes part of that Reservation. That is, it shows how the economic status of Reservation residences changed relative to all of the residents of Rosebud County. For instance at the bottom of Table 8 we see that the percent of Reservation residents and families below the poverty line increased, but that increase was even greater relative to all of the residents of Rosebud County. The Reservation poverty rate went from being 1.6 to 2.2 times the county as a whole to being 2.4 to 3 times the county as a whole.

The first three sections of Table 8 also show that while per capita real income on the Reservation increased from 1970 to 1990, it did not improve relative to average real income across the county as a whole. Reservation residents, on average, receive half the income received by the average county resident.

The lower per capita income on the Northern Cheyenne Reservation relative to the county as a whole during these decades of energy development was not due to higher population growth on the Northern Cheyenne Reservation compared to the rest of Rosebud County.⁵³ During the 1970 – 1990 period the population of the Rosebud County portion of the Reservation grew by 61 percent while that of the rest of Rosebud County grew by 79 percent. During the first decade of this period, the Rosebud County part of the Reservation grew by 30 percent while the rest of Rosebud County grew by 82 percent. During the second decade, the Rosebud County part of the Reservation continued to grow at a slightly lower rate (24 percent for the decade) while the rest of

⁵³ Note that as per capita incomes on the Reservation grew, median family income declined in real terms. This is due to the fact that the number of households was rising faster than the population. Put the other way around, the size of households was declining as birth rates declined and/or the number of single adult households increased. This was a nationwide trend.

the County saw the population decline slightly (2 percent) as the Colstrip construction ended and that workforce dispersed.

Although the Reservation population was growing at a slower pace than the off-Reservation area, the number of Reservation residents who were employed was growing even more slowly, leaving a larger and larger portion of the Reservation population out of the workforce and depressing median incomes. While the number of employed residents of Rosebud County expanded 85 percent between 1970 and 1980, the number of employed residents on the Reservation grew only 28 percent. For the two-decade period, the number of employed residents of Rosebud County expanded 94 percent while Reservation employment expanded 73 percent. Note that the employment data does not tell us *where* the resident of a particular place actually worked. They could commute to a different place to work.

During the decade of the 1980s, the “boom” portion of the energy expansion ended. The huge construction force working on the Colstrip power plants was no longer needed and growth in employment in mining, electric generation, and transportation ended. During that decade, census data indicates that employment in Rosebud County increased by only 217 jobs. Other federal data indicates that wage and salary employment in 1987 was almost the same as it was in 1980. During this period, however, the number of “working age” (16 and older) residents of the Northern Cheyenne Reservation increased by 692. Although the number of employed persons on the Reservation increased by 262, the number of those 16 and older who were not working rose by 434. This suggests that one source of the depressed income and employment on the Reservation is that the Reservation workforce expanded significantly just as employment in some energy sectors fell dramatically and Reservation residents did not find jobs in other sectors. But, as will be seen below, another part of the problem also appears to have been lack of access of Reservation residents to the higher paid energy-related jobs.

Others analyzing the impact of the energy boom in the area surrounding the Northern Cheyenne Reservation during the 1980-1990 period have come to similar conclusions about the relative failure of the Reservation residents to benefit from the energy development. For instance, Professor J. Ward of Brigham Young University concluded a 1998 analysis of the different impacts of that energy boom on white and Northern Cheyenne residents of Rosebud County in the following way:⁵⁴

Thus, the [Northern Cheyenne] Indian population in this rural county [Rosebud] saw their economic conditions worsen over the decade from 1979 to 1989, while the economic changes for whites were considerably more positive.

.....

⁵⁴ “The Importance of Context in Explaining Human Capital Formation and Labor Force Participation of American Indians in Rosebud County, Montana,” 1998, Carol Ward, *Rural Sociology* 63(3): 451-480, p. 457.

Given the income and employment gaps between these two groups [Northern Cheyenne and white residents of Rosebud County], as well as the differences in dependency ratios and average family sizes, it is no surprise that the American Indian population is more vulnerable to poverty than the white population.

4. Changes in the Structure of Employment on the Northern Cheyenne Reservation

The expansion in energy development in the region surrounding the Northern Cheyenne Reservation created many very high paying jobs. Mining jobs paid \$74,000 to \$92,000. Jobs associated with electric generation and transportation paid \$57,000 to \$75,000. Construction jobs at their peak during the construction of the Colstrip generating facilities paid almost \$60,000.⁵⁵ Table 9 below shows real average annual pay in different industries in Rosebud County during the 1970-1990 period expressed in constant 2014 dollars.

Table 9.

Real Pay per Job in Rosebud County, Montana			
Industry	1973	1980	1990
All Jobs	\$ 39,096	\$ 39,507	\$ 40,879
Mining Jobs	\$ 74,439	\$ 91,550	\$ 83,438
Public Utility and Transportation	\$ 57,009	\$ 62,821	\$ 74,596
Construction	\$ 44,187	\$ 59,589	\$ 48,721
Manufacturing	\$ 24,795	\$ 49,327	\$ 24,113
Note: Values are expressed in constant year 2014 dollars.			
Source: BEA and REIS.			

In 1980 on the Northern Cheyenne Reservation, the population 16 years and older (the “working age” population) was 25 percent of the size of the total Rosebud County “working age” population. But the 1980 Census data indicated that Reservation residents held none of the mining jobs, 8.7 percent of the public utility and transportation jobs, and 8.3 percent of the construction jobs. All of these three types of jobs pay above average wages. (See Table 9.) The Census data indicates that while 261 new mining jobs were created between 1970 and 1980 in Rosebud County, *none* of them went to Northern Cheyenne Reservation residents. Of the 420 public utility and transportation jobs created between 1970 and 1980, only 14 or about 3 percent went to Reservation residents. Of the 496 new construction jobs created, only 32 or 6.5 percent went to Reservation residents.⁵⁶

⁵⁵ Annual pay expressed in constant 2014 dollars. U.S. Department of Commerce, Regional Economic Information System. Calculated by dividing labor earnings by number of jobs to estimate annual pay per job.

⁵⁶ This data comes from the Decennial Census long form for 1970, 1980, and 1990. As pointed out above, the date of this data gathering happened to miss the peak employment associated with the 1972-1990 energy boom in the area surrounding the Northern Cheyenne Reservation. It is also important to understand that only a small fraction of all those who are contacted by the Census for its population count

During the 1980s, Northern Cheyenne residents were somewhat more successful at finding jobs in energy-related industries, gaining 12 mining jobs, 70 jobs in public utility and transportation, and 52 jobs in construction, according to 1990 Census data. But even with these gains, in 1990, when the Reservation had the equivalent of a third of the “working age” population of Rosebud County, Reservation residents held only 3 percent of mining jobs and 8.5 percent of the public utility jobs, the two industries with the highest pay. In 1990, Reservation residents *did* hold 21 percent of the Rosebud County transportation jobs and 32 percent of the construction jobs.⁵⁷ In 1990 the relatively high paid construction jobs associated with building the four Colstrip electric generators had already ended with the completion of those facilities. While average real pay in construction in 1983 was \$74,000, in the late 1990s average annual construction pay in Rosebud County was only about \$25,000. (Annual pay per job expressed in constant 2014 dollars.)

While Northern Cheyenne Reservation residents lagged behind, they did somewhat better in the 1980s. Perhaps this is due to an agreement reached between the Northern Cheyenne Tribe in 1980 with “Colstrip Partners,” the electric utilities that owned the four electric generators that were built between 1970 and 1990. That agreement provided training for the Northern Cheyenne Tribe specifically so that they could fill some of the rapidly expanding construction jobs. Those utilities also agreed to provide preferential treatment for qualified Northern Cheyenne Tribal members who applied to work in the construction and operation of electric generators and coal mines. Keep in mind that by the time of the 1990 Census, the energy construction boom in the region had dramatically subsided and thousands of temporary construction jobs had ended.

In explaining the deterioration in Reservation economic opportunities, it is also important to emphasize the overall failure to create employment opportunities for the Reservation’s working age population. As pointed out above, the percentage of the working age population on the Reservation that was not employed rose slightly (from 55 to 56 percent) during 1970-1990 energy boom rather than declining (from 40 to 30

are asked to fill out the long form that asks for much more detailed information such as the industry in which workers are employed. Until the 2010 Census, the Census recognized that it significantly undercounted residents of Indian Reservations. It is also likely that the sample of Northern Cheyenne Reservation residents who filled out the long form also under-represented the actual population and made that information less reliable. Also, the Census employment numbers are below those indicated in the Regional Economic Information System maintained by the U.S. Department of Commerce. As long as the undercount is consistent across industries the general conclusions discussed here will be accurate.

⁵⁷ In 1988 the regional coal mines and the Colstrip electric generating plants reported much higher employment of Native Americans in their operations. The tribal affiliation and reservation of residence was not mentioned. Montana Power Company reported that 19 percent of the workforce at the Colstrip generating stations was Native American. Western Energy Company reported that 10 percent of the workforce at its Rosebud Mine was Native American, and Peabody Coal Company reported that 9 percent of the workers at its Big Sky Area A Mine was Native American. The 1990 Census employment data by industry and race in Rosebud County and the Northern Cheyenne Reservation does not confirm these higher energy company estimates. Table III-16, p. III-42, Draft Environmental Impact Statement Peabody Big Sky Mine-Area B Rosebud County, Montana, July 1988, Montana Department of State Lands and the U.S. Office of Surface Mining Reclamation and Enforcement.

percent) as it did for the whole of the Rosebud County working age population. As the Reservation working age population expanded between 1970 and 1990, 58 percent did not find jobs. For Rosebud County as a whole, only 33 percent of the expanded working age population failed to be employed.⁵⁸

Lack of employment opportunities across the board reduced the labor earnings available to support the Reservation's residents. Fewer people within the Reservation households were working and the pay received by those who were working was much lower than experienced by those living off the Reservation. While only a quarter of the Reservation population held jobs, 40 percent of the overall Rosebud County population was employed. That implies that each worker on the Reservation supported 3 non-workers while each worker in Rosebud County supported 1.5 non-workers. This lack of employment and wage income depressed incomes in absolute as well as relative terms. While about the same percentage of households had wage and salary income in 1989 on both the Reservation and across Rosebud County as a whole (85 percent), the mean wage and salary income for Reservation households was only \$31,600 while it was \$59,200 for Rosebud County as a whole, almost twice as high (87 percent higher).⁵⁹ The energy boom between 1970 and 1990 failed to close the huge gap between the economic status of Reservation residents and that of Rosebud County residents off the Reservation.

V. Explanations for Why the Northern Cheyenne Did Not Benefit from the Previous Coal-Based Energy Boom

As discussed previously⁶⁰, energy development in the region surrounding the Northern Cheyenne Reservation during the 1970s and 1980s created tremendous economic value in the mineral industries, led to the construction of major industrial facilities, and provided over a thousand very high paid jobs in mining, construction, public utilities, and transportation. Despite these dramatically positive economic impacts in the surrounding region, the economic characteristics on the Northern Cheyenne Reservation actually deteriorated during this very boom period with real median incomes falling and

⁵⁸ These differences were partly due to the Northern Cheyenne Reservation having a larger percentage of its population in the "young worker" age category: 16-24. In 1980 about 18.6 percent of the Reservation population was in this age group versus about 16.3 percent of Rosebud County as a whole. Between 1980 and 1990, the percentage of the population in this age category declined in both the Reservation and the county, but much more dramatically in Rosebud County as a whole: 18.6 to 16.1 percent on the Reservation versus 16.3 to 11.8 percent in the county as a whole. While the number of 16-24 year olds increased by 72 on the Reservation, they declined by 387 in the county as a whole. Since this age group is more likely to be in school and not employed, this would contribute to the observed growth in the number of working age not employed. But the number of those 16 and older who were not working grew by 434 on the Reservation between 1980 and 1990; the additional 72 in the 16-24 age category represent only about a sixth of these.

⁵⁹ 1990 Census of Population, Social and Economic Characteristics, Montana, Table 228, p. 419. "Income in 1989 of American Indian...Families...American Indian Areas..." Table 148, Income in 1989 of Households, Families and Persons, p. 238. Adjusted to constant 2014 dollars.

⁶⁰ See Section IV-1 and Figure 8 and Table 5 above.

unemployment and poverty rates rising. Relative to the economic gains in the rest of Rosebud County, the deterioration of economic conditions on the Reservation was even more dramatic. The economic gap grew even larger.

These contrasting economic trajectories, on and off the Northern Cheyenne Reservation, during the energy boom of the 1970s and 1980s, call out for explanation. If the forces that kept the Northern Cheyenne from benefiting from the earlier energy development are not understood, there is little likelihood that new energy development will not benefit them either and could, again, leave them worse off.

There are four primary explanations for the deterioration of economic conditions on the Reservation during the past energy boom.

- i The lack of access by Northern Cheyenne to the higher-paid energy jobs;
- ii The limited local commercial infrastructure on the Reservation;
- iii The lack of access to mineral revenue to support public services and infrastructure on the Reservation; and
- iv The impact of the Northern Cheyenne commitment to place.

1. Lack of Access by Northern Cheyenne to High-Paid Energy-Related Jobs

As discussed above, although the Northern Cheyenne Reservation contained the equivalent of between a quarter and a third of the working-age population in Rosebud County, the Reservation gained only a very small fraction of the better-paid energy-related jobs: mining, public utility, railroad, and construction jobs. Instead of gaining access to 25 to 33 percent of these jobs, it received 3 to 8 percent of those jobs.⁶¹

This by itself meant that the vast majority of the direct impact of the energy boom, the payroll associated with energy-related jobs, bypassed the Northern Cheyenne Reservation. There were very few direct positive impacts on Reservation earnings and what positive impacts there had been diminished as the construction boom passed.

As mentioned above, the Northern Cheyenne negotiated a 1980 agreement with the utilities that were building the Colstrip electric generating plants to increase the likelihood of Tribal members obtaining construction jobs as well as operations jobs at the electric generating plants. In 2012 the Tribe also negotiated an agreement with the operators of the Otter Creek coal mine to provide local Indians “meaningful and substantial opportunities to participate in all categories of Employment-Related Opportunities in the Operations” of the Otter Creek Mine. This would be done “without any preferences or quotas.” The mine operators committed to giving full consideration to qualified local Native American residents for jobs associated with the construction and operation of the Otter Creek Mine. Local Native American-owned businesses will also

⁶¹ As discussed earlier, even the jobs that residents of the Reservation obtained may have been at the lower end of the pay scale. Data on the income associated with the jobs taken by Reservation residents are not available.

be given full consideration as contractors to provide services to the mine. Those mine employers also committed themselves to actively recruiting qualified Native American applicants for mining jobs.⁶² Relatively extensive training, recruiting, and support activities to obtain qualified local Native American job applicants are to be funded and carried out.

The parties to these agreements clearly recognized that barriers in the past have limited the benefit that the Northern Cheyenne have derived from coal development. These agreements are intended to reduce those barriers.

In September 2015, The Northern Cheyenne TERO office estimated that 56 Tribal members were working at the Western Energy Coal mines and about 35 were working on the Colstrip electric power plants now managed by Talent Energy (previously PPL Montana).⁶³

In 2013, employment in mining in Rosebud County totaled 646. Employment in utilities (mostly electric utility, the four Colstrip power plants) was 411.⁶⁴ Northern Cheyenne appear to fill about 8.6 percent of these two types of coal-related jobs in Rosebud County. The total employment in Rosebud County in mining and public utilities generating electricity is 1,820 in 2013. The TERO reported 91 Northern Cheyenne working in the energy industry, which represents 5 percent of this total energy-related employment. This is an improvement from 1970 and 1980 when Census reports indicated that residents of the Northern Cheyenne Reservation held none of the mining jobs. But recall that the Northern Cheyenne Reservation has a total workforce that represents about one-quarter to one-third of the total Rosebud County workforce. The Northern Cheyenne held only 10 to 20 percent of the jobs that one would find if there were a proportional distribution of those high paid coal-related jobs.

2. Limited Local Commercial Infrastructure on the Reservation

The local economic impacts of changes in the economy are usually analyzed using the concept of the “economic base.” Certain types of export-oriented economic activities, like coal mining, put people to work and in the process inject income into the local economy where that income circulates among local businesses putting additional people to work as the money is spent and re-spent. The total impact is larger than the initial payroll’s direct impact to the extent that the local economy is able to capture and hold those dollars in local businesses before they “leak out” to pay for purchases from outside of the local economy. A “multiplier” is used to summarize the amplified impact that the income injected in from the outside has on the local economy.

⁶² Otter Creek Mine Operating Plans, signed by the ARK Land Company and Otter Creek Coal, LLC, and the Northern Cheyenne Tribe on November 5, 2012.

⁶³ Personal communication with Stephanie L. Fisher, TERO Director, Northern Cheyenne Tribe, September 11, 2015.

⁶⁴ U.S. BEA REIS data on employment by industry by county.

This economic base view of the local economy has two parts: the export-oriented activity that injects income into the local economy from the outside and the capacity of the local economy to capture and hold those dollars. The more complete the local economy is in terms of providing goods and services to its residents, the larger is the multiplier impact and the greater is the impact associated with each dollar injected into the local economy.

A small local economy that provides very few goods and services to its residents, leaving them to purchase those goods and services from outside sources, will see whatever dollars are injected into the local economy leak out almost immediately, providing almost no local economic impact beyond the pay that may be earned by local hires into the export-oriented business.

This is one of the problems faced by the Northern Cheyenne Reservation. The 1980 Census did a special expanded survey of residents of the nation's Indian reservations that not only asked in what industry residents worked but also whether that work took place on the reservation. That data for the Northern Cheyenne Reservation indicated that 9.8 percent of job-holders worked in locally-oriented business sectors, trade, service, and finance, on the Reservation. Federal data for the same year indicated that jobs in these same sectors in Rosebud County as a whole represented 20 percent of the workers, over twice as great a percentage.⁶⁵ That by itself would suggest that the off-Reservation part of Rosebud County would receive much more of the indirect and induced benefits associated with the energy industry payrolls than would the Reservation.

As energy development took place in the region surrounding the Northern Cheyenne Reservation, the Reservation did not have a local economy that was able to derive the local economic benefits associated with the new dollars that were being generated. As the economies in Colstrip and other urban centers in the region expanded because of those new energy dollars, they provided a more attractive and competitive set of goods and services than found on the Reservation. But in this largely rural and small town setting, the bulk of the spending on goods and services flowed to the larger and more distant trade centers, especially Billings, Montana's largest urban area. In that sense, the expanded set of businesses off of the Reservation tended to draw even more dollars away from businesses located on the Reservation. Rather than gain from the increased levels of income and expenditure, the Reservation declined in terms of its commercial rank within the regional economy.

In 1996-1997 both businesses and households on the Northern Cheyenne Reservation were surveyed to determine what local businesses existed that could help capture and

⁶⁵ This federal data is from the U.S. Department of Commerce, Regional Economic Information System (REIS). The Census data and RIES data are not completely consistent with one another. If the Reservation Census data is compared to the Census data for Rosebud County as a whole, the locally oriented sectors represented 16 percent of the jobs, still 63 percent above the Reservation figure. If the Reservation is compared to the non-Reservation part of Rosebud County, the off-Reservation area had 17.4 percent of its workers employed in the local sectors compared to the 9.8 percent on the Reservation.

circulate Reservation income within the Reservation and to determine where Reservation residents actually spent their income.⁶⁶ These surveys confirmed there was only a very limited local economy on the Reservation and the bulk of the purchases made by Reservation residents took place off of the Reservation. Although this survey is now dated, a conversation with Tracy Robinson, the Chairman of the Economic Development Committee and member of the Tribal Council, confirmed the current lack of local businesses that could help capture and circulate Reservation income.⁶⁷ In fact there are fewer businesses on the Reservation than there were in the 1996-1997 period.

Not surprising given the limited range of goods and services available on the Reservation, most residents did their purchasing off the Reservation, primarily in the largest trade center in the region and state, Billings. The ongoing growth of Billings' trade and service infrastructure, the new "big box" "warehouse" retail trade stores, the new entertainment opportunities (multiplex theaters, restaurants, etc.), specialized "niche" stores, multi-brand automobile dealerships, etc. provides increasingly stiff competition to smaller towns including those on the Reservation. Tracy Robinson also confirmed that currently the majority of residential and small business purchases were conducted in the Billings area.⁶⁸

The combination of the lack of access to the high-paid energy-related jobs, limited commercial infrastructure on the Northern Cheyenne Reservation, and the rapid expansion of the retail trade and service sectors in the major trade center, Billings, had a cumulative negative impact on the Northern Cheyenne's ability to derive benefits from the surrounding energy development: The direct impact in terms of access to high paid jobs was very small. Then there was little or no indirect or induced impact because there are no substantial trade centers on the Reservation where that increased income could be spent. Finally, the businesses on the Reservation found themselves at an increasing competitive disadvantage compared to the growing trade center within the region.

3. Lack of Access to Energy Revenues to Support Public Services and Infrastructure

Rosebud County, the city of Colstrip, the state of Montana, and the federal government all were able to gain access to a significant amount of energy-related revenues through mineral taxation and the sharing of royalty revenues since substantial energy development began in the early 1970s. These governments could use those mineral revenues to expand the services provided to citizens and businesses, improve schools and other public facilities, and finance various economic development and citizen support programs. For example the city of Colstrip proudly offers a golf course, a fully

⁶⁶ Community and Economic Development Survey and Reservation Business Survey conducted for Native Action, Lame Deer, Montana.

⁶⁷ Personal communication with Tracy Robinson on September 8, 2015.

⁶⁸ Ibid.

equipped recreation facility with an indoor pool, an array of different parks and walking trails, and a school system that is touted as “one of the best in the region” to residents free of charge.⁶⁹

The Northern Cheyenne Tribal government did not have access to a share of those mineral revenues. While other governments were improving their cities and towns and trying to stimulate balanced economic development, the Northern Cheyenne could not do the same. This too put the Reservation at a competitive economic disadvantage. Steps that the Tribal government might have taken to increase the likelihood that some of the benefits associated with regional energy development would flow to and stay on the Reservation could not be adequately funded. In that sense, the Reservation could not act to take advantage of the new economic opportunities that surrounding energy development provided.

4. Impact of the Northern Cheyenne Commitment to Place

To the Northern Cheyenne, the Reservation is not just a convenient location temporarily chosen because of the economic opportunities in the area, but the Tribe’s permanent homeland. Tribal members over many generations have contributed substantial resources to the protection and integrity of this homeland.

This commitment to place can be contrasted with the large, mobile workforce that helped construct the coal mines, the Colstrip power plants, and the oil fields. Those workers came for the well-paid jobs that were available and, when those jobs ended, they traveled on to other places in the pursuit of new economic opportunities. Many of those still holding jobs in the region surrounding the Northern Cheyenne Reservation also commuted in to take the jobs that were proliferating while the energy boom was still underway. As many of the boom-time jobs were lost, the workers move on to other areas looking for new jobs.

This is partly what has allowed Rosebud County to maintain relatively high average incomes and low unemployment rates even though thousands of jobs have been lost since the peak in the early 1980s as various phases of the energy boom subsided. Out-migration is the “safety valve” that prevents wages and incomes from being depressed and unemployment rates from skyrocketing.

For the Northern Cheyenne this is not an attractive solution to low pay and employment opportunities even though limited economic opportunity does ultimately force a certain amount of out-migration from the Reservation. The Northern Cheyenne are committed to making the Reservation a viable homeland for their people, economically as well as culturally, socially, and environmentally.

That complicates the economic challenges the Tribe faces. Given that the quiet out-migration of Tribal members is not an acceptable option to the Tribe, the first three

⁶⁹ http://www.cityofcolstrip.com/?option=com_content&view=article&layout=edit&id=80

problems outlined above, the lack of access to high-paid energy jobs, the very limited range of commercial businesses on the Reservation, and the inability of the Tribal government to raise revenues to compensate for impacts on the Reservation, are all the more damaging and their solution all the more important.

VI. Conclusions

The proposed TRRR and the coal mines it is intended to bring into existence would be located adjacent to the Northern Cheyenne Reservation. For almost 50 years, the Northern Cheyenne have struggled at considerable cost to themselves to minimize the negative impacts of coal development on their members and Reservation. The Northern Cheyenne are also a vulnerable population with high unemployment and poverty rates and low incomes.

Given the presence of this vulnerable American Indian population adjacent to the TRRR and the new coal mines the TRRR will bring into existence, the TRRR DEIS socioeconomic analysis should have focused some of its attention on the Northern Cheyenne and its Reservation. Instead, that socioeconomic analysis almost completely ignored the Northern Cheyenne. This makes the TRRR DEIS socioeconomic analysis seriously incomplete.

In addition, the TRRR DEIS structured its socioeconomic analysis in such a way that the DEIS chapter on socioeconomic impacts found almost no significant long run impacts aside from the loss of agricultural land to railroad right-of-way. The DEIS Socioeconomic chapter and technical appendix was able to come to that conclusion because the socioeconomic impacts of the coal mines that the TRRR is intended to bring into existence were ignored in that DEIS Socioeconomic chapter. The conclusions of the Socioeconomic chapter of the DEIS are an inaccurate portrayal of the socioeconomic impacts of the TRRR and its associated coal mines.

The DEIS, in a separate chapter and technical appendix dealing with “Cumulative Impacts,” did briefly discuss and document some of the socioeconomic impacts of the coal mines associated with the TRRR.

The DEIS makes two assumptions that are not supported by the professional socioeconomic literature. First, the TRRR DEIS assumes that the analysis of the socioeconomic impacts over a relatively large study area (four or nine counties) accurately reflects the impacts experienced by all of the different groups in the study areas including the Northern Cheyenne. Secondly, the TRRR DEIS assumes that the impact on socioeconomic conditions can be accurately indicated by the positive increases in jobs, payroll, and revenues to local governments. These assumptions implicitly contradict the detailed socioeconomic analysis that professional social scientists have indicated is necessary to accurately understand the distribution of socioeconomic costs and benefits resulting from energy booms.

For all of these reasons, the TRRR DEIS is incomplete, too general, and, therefore, an inadequate guide for federal agency decision making about the proposed TRRR.

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Cultural Resources Survey Assessment of Colstrip Alternative Route for the proposed Tongue River Railroad

Prepared by: Chris Finley, Retired National Park Service Archaeologist for Bighorn Canyon National Recreation Area

Results of an inventory to evaluate the quality of the Tongue River Railroad Cultural Resource Survey conducted by ICF International, the third party contractor hired to complete the Section 106 process, in 2013 and 2014 on the Tongue River Railroad Colstrip Alternative for the Surface Transportation Board.

Background:

At the request of the Sierra Club and the Colstrip Alternative Landowners group, I visited the Tongue River Railroad Colstrip Alternative project area in 2014 and observed the ICF Cultural Resource Reconnaissance Survey while it was underway. When the collected documentation was released to the individual land owners I received copies of all site forms and support documentation for review from Carrie La Seur the Attorney representing the land owners association. After reviewing the documents it was apparent that the documentation did not follow guidelines and standards provided in the MTSHPO planning bulletin, and was incomplete, inaccurate, and misleading in providing information for determining potential eligibility of the sites for the NRHP. My concerns include:

1. Montana SHPO standard (CRIS) site forms include 5 sections listed below;
 - (A). Location information.
 - (B). Environmental information.
 - (C). Assessment, recording and management documentation.
 - (D). Prehistoric site description.
 - (E). Historic site description.

Only minimal information was provided on section A, D, or E, and section B and C were totally ignored, and information for section D and E were consolidated into a single paragraph.

2. Montana SHPO standard (CRIS) forms also include a separate form to document isolated finds (IF) which very rarely warrant Smithsonian site numbers. The standard isolated find form was not used, and the same format was used by ICF to document sites and isolates.
3. Only three of the site forms provided to landowners had the correct Township/range information.
4. None of the site forms provided to the landowners had the correct UTM Coordinates.
5. There was no environmental information included (specifically surface visibility).
6. There was no information or assessment of eligibility.
7. There were no site maps or illustrations of features.
8. Identification/description of artifacts and features were incorrect.

I was also invited to attend a landowners meeting and it was clear that ICF had not followed guidelines and standards provided in National Register Bulletin #24 pertaining to the importance of gathering information from local ranchers whose families, in some cases, have

occupied the area since the early 1880's. The general consensus of the landowners was that any information they offered was totally ignored by the ICF crew leaders and that opinion was confirmed by the documentation they received from STB after the field work was finished.

In discussions with some of the Tribal Representatives who participated in the surveys the general consensus was that as a result of heavy vegetation cover ground visibility was so poor they felt like they were wasting their time and just going through the motion of conducting a valid survey. They also felt that some information offered to the ICF crew leaders was ignored and downplayed, and this opinion was clearly confirmed in the information included in the site forms provided to MTSHPO by STB.

I also spent time looking at 3 private stone artifact collections from the area and was not surprised to observe that each collection included Paleoindian Projectile Points including examples of Agate Basin, Hell Gap, and Cody Complex, and included Pryor Stem and Jimmy Allen Terminal Paleoindian Projectile Points as well. The majority of points (approximately 75%) from each collection contained examples of Early, Middle and Late Archaic Northwest Plains Projectile Points, and there were a few examples of Late Plains Prehistoric-Early Plains Historic points as well. This information confirmed my expectations that the project area was typical of prehistoric land use utilization throughout the western Plains and foothills of the Rocky Mountains for over 10,000 years, and that significant cultural sites could be discovered during future intensive survey, site testing and data recovery efforts if significant sites could not be avoided, and the project was approved for construction.

After discussing my opinion of the quality of the "Good Faith Effort" by ICF and STB to meet Section 106 obligations the Sierra Club and the Colstrip Alternative Land Owners Group agreed that a field assessment of the ICF reconnaissance survey was in order. The decision was made to spend eight days in the field with my crew looking at a sample of the sites documented by ICF, and to check the accuracy of their documentation and how complete the results of the survey coverage was.

Methodology;

My crew consisted of myself and three members of the Crow and Northern Cheyenne Tribe who have worked extensively with me in the field for several years. Crew members included Hubert B Two Leggings (former Crow Tribal Cultural Director and THPO) who has worked with me for six years, Johnny Tim Yellowtail (former Crow Tribal Cultural Staff member) who has worked with me for five years, and Serina Red Robe (from the Northern Cheyenne Otter Creek Descendants) who has worked with me for four years.

Field work took place between April 12 and April 19, 2015 to take advantage of ground visibility conditions before seasonal vegetation growth would limit ground visibility. The goal of the field work was to locate and evaluate some of the sites documented on private land by ICF during the 2014 field season, determine how complete the survey

coverage was and to visit sites ICF had missed or ignored within the project area considered important to the landowners.

Before field work commenced, a meeting took place with the Northern Cheyenne THPO James Walks Along and my crew to discuss the information submitted to MTSHPD by ICF and what his suggestions and concerns were about the field work we were about to conduct. He will receive a copy of this report, and will have input on how TCP and NAGPRA issues will be addressed.

Results:

Seven separate areas surveyed by ICF during the 2014 field reconnaissance survey were selected for further investigation during the course of the planned 2015 field assessment. A total of 20 previously documented sites were examined in six of these survey areas, and the seventh area is in an area where the ICF crew leader informed the land owners that there were no cultural resources observed on their property.

Area #1: This area is located on land owned by Hugh and Ann Wells, and we examined TR-F-18 and TR-F-19, documented in 2014 by ICF.

TR-F-18: This site was documented as a low density lithic scatter located 15m north of a large sandstone outcrop. The site was plotted on the 7.5' Quad map near the large sandstone outcrop, but the UTM coordinates entered into the site form place the site place 3/8 of a mile east and south of the above mentioned sandstone outcrop. We went to the UTM location listed on the site form and the location did not match the site description on the form. An intense survey of the location led to the conclusion that there were no cultural materials at this location.



Site overview looking east at UTM location of site given on site form.



GPS unit at UTM location given on site shown above (note zone 13 on the GPS).

TR-F-19: There was no problem with this site except ground visibility around the feature was 0%.

Newly discovered sites:

Six undocumented sites and one isolate were discovered in this area including one lithic scatter (A), one isolate consisting of a complete stone knife (B), two rock art sites (C & E), one rock shelter with lithics present (D), one lithic procurement site (L), and one prehistoric burial site. More details on these sites will be discussed in detail in a separate section of this report.

Area #2: This area is located on land owned by the Rocker Six Cattle Company.

TR-F-4: This site is listed as one-tier rock carin constructed of 20 cobbles. During the survey conducted in 2014 this site was identified as a probable burial site by James Walks Along who left a Tobacco offering on the site. Hubert Two Leggings witnessed this event. Apparently the ICF crew leader chose to ignore this information. During our investigation we collected more detailed information and agree with James Walks Along and Hubert Two Leggings that this site should be treated as a potential burial site. Ground visibility was 0% as a result of heavy vegetation cover.

TR-F-05: This site is listed as a “gravel borrow pit” and “appears to be of historic age and associated with gravel extraction activities, possibly for the construction of nearby roads”. There is a well defined road (see photo) entering the pit area from the northeast that was not documented during the 2014 ICF survey. An interview with the land owner would have revealed that the gravel pit and access road was established by the county road department for construction of the existing county road.



County access road to the gravel borrow pit looking northeast.

TR-F-06: This site was listed and described as a one-tier rock cairn. The rocks actually form a half circle (stone alignment) 3.1m X 2.8m with the opening facing northeast. Rock size ranged from 15cm to 30cm, and ground visibility was less than 20% as a result of heavy vegetation cover. The feature was probably used to set up part of a Tipi as a shade shelter during food or hide processing tasks according to Hubert Two Leggins (see photo).



Outline of the half stone circle documented by ICF as a cairn on TR-F-06.

TR-F-07: No problem with this site, and ground visibility was approximately 50%.

Newly discovered sites:

Six undocumented sites or components of ICF sites and one isolate were discovered in this area including the county access road (M) to the gravel borrow pit (TR-F-05), two rock cairn sites (O & AC), two historic structure sites (AB-1 & AB-2), one probable burial site, and one isolate consisting of a single large primary flake exposed on a gopher mound. The above mentioned historic structure was plotted incorrectly (approximately 400m north of its actual location) on the project map, and no site forms were provided for this site, or the historic ranch buildings located directly east of the road in the same area.

Area # 3: This area is located on land owned by the Rocker Six Cattle Company.

TR-E-I-25: No problem with this site.

TR-E-I-27: This site was listed as an isolate with one biface and one secondary stage reduction flake present. During our investigation of the site we found the “biface” (which turned out to be a fragment of a biface) and the secondary stage reduction flake plus an additional 9 flakes, two cores and one additional biface fragment (see photos). This site is not an isolate but a lithic scatter.



Site overview looking east.



Cores found on site.



Biface fragment found on site.

TR-E-63: This site was listed as a one-tier rock cairn and a rock alignment. The “circular cairn” measured 1.5m in diameter. The rock alignment consisted of 15 local sandstone cobbles in a semi-circular format with a diameter of 1.5m. These features are located within 25m of a large cluster of stone circles left undocumented during the ICF 2014 survey, and are most likely hearths. Eight stone circles each with a well defined internal hearth were documented on this site (H), and several of the internal hearths associated with the stone circles are similar to the two features documented during the 2014 ICF survey, and fall within the same size range.

TR-E-65: This site was listed as a poorly defined and abandoned two track dirt road, and is shown on the 7.5' Quad map as being approximately 1000 feet long. This is not a poorly defined two track road, but is an abandoned section of the county road. The

feature is well defined with a flat road bed with borrow pits on both sides for the entire length, and ties back into the existing county road ½ mile north of where it leaves the existing county road as indicated on the 7.5' Quad map included with the site form. There is also a well defined irrigation ditch (undocumented by ICF in 2014) that courses along the west side of this road on the north ½ of the abandoned county road segment (also undocumented by ICF in 2014).



View of abandoned county road looking northeast where it leaves the existing county road.



View of abandoned county road looking south near where it ties into the existing county road on the north end.

Newly discovered sites:

Five undocumented sites or components of ICF sites were discovered in this area including the northern segment of the abandoned county road ((TR-E-65) one lithic

scatter (F), one isolate consisting of 3 secondary flakes (G), one stone circle site (H), and one abandoned historic irrigation ditch (I).

Area # 4: Located on land owned by the Rocker Six Cattle Company.

TR-E-44: This site is listed as four one-tier stone circles (tipi rings) constructed from large local sandstone and scoria cobbles. All of the members of my crew agree with me that this is not a stone circle site. The rocks were loose on the surface, and there was no evidence of sodding or lichen deposits. Also, the rocks were too small (10cm to 15cm) to weight down a tipi. Average rock size on Stone Circle site H located approximately 2 miles north of this site was 20cm to 30cm, and the rocks were heavily sodded in, and had well developed lichen deposits on the rocks, or TR-E-45 just west of this site that was described as a possible effigy that was actually a cluster of 4 Tipi rings complete with internal hearths, with rock size averaging >30cm in size with the rocks heavily sodded and with well established lichen deposits. The land owner also informed us that approximately 1000 head of cattle are trailed back and forth through this site in the spring and fall resulting in a constant rearrangement of the loose surface rocks. This site was also plotted on the west side of the county road on the 7.5' quad map provided with the site form. The site is actually located on the east side of the road as indicated by the UTM coordinates and site photos included in the site form (see photo).



Rock from the supposed tipi ring on the site.

TR-E-45: This site was described as a stone alignment, “possible effigy” constructed of local sandstone and scoria cobbles and boulders. The “possible effigy” was actually a cluster of 4 Tipi rings complete with internal hearths, with rock size averaging >30cm in size with the rocks heavily sodded with well-established lichen deposits (see photos).



Stone circle #1 on the left, and stone circle #2 on the right.

TR-E-46: This site is listed as a “gravel borrow pit” and “appears to be of historic age and associated with gravel extraction activities, possibly for the construction of nearby roads”. An interview with the land owner would have revealed that the gravel pit and access road was established by the Rosebud County Road Department for construction of the existing county road.

TR-E-47: This site was described as seven small shallow depressions that were used for prehistoric and / or historic warfare and/or hunting. Three of these shallow depressions on the flat area on the south end of the “site” are probably there as a result of the installation of the power line located just south of this area to provide water for a well just north of the Rocker Six Corrals documented as TR_F-BO45. It was common practice to park the auger truck for the night and run the auger into the ground to secure the boom and avoid damage during high wind episodes. The land owner remembers the vehicle parking there during installation of the power line (see photo of Hubert Two Leggins on his knees in one of these depressions). The other four depressions are in different stages of sod restoration as is clearly illustrated in site photos of feature 1 and feature 2 (where the edges of the disturbance have not even slumped in yet in feature2). These depressions are not depressions that were used for warfare or hunting blinds, but are simply the result of depressions (i.e., bull wallows) caused by bulls rooting and throwing/pawing dirt over their backs with their front legs during mating/fighting or to protect themselves from biting insects (face flies, horse flies, etc). There was a fresh example of this disturbance documented and photographed on TR-E-I-15 recorded as an isolated find by ICF in 2014 (see photo). My crew agreed with me that these features are

not associated with prehistoric and/or historic warfare and/or hunting, and should not be included in this project as cultural resources.



Burdick Two Leggins on his knees in one of the auger holes.



Fresh “Bull Wallow” from last fall measuring 1.2m X 1.4m in diameter, and 20cm deep.

TR-E-56: This site was described as “a petroglyph of undetermined age”. This petroglyph is the letter “N” etched into the rock face. Segments of the etching show no evidence of weathering, and 1/3 of the etching looks like it could have been done within the last few years. There is no date associated with this etching, and in my opinion it is not over 50 years old, and therefore should not be documented as a historic property.

Newly discovered sites:

There was one undocumented lithic scatter discovered in this area (AD) during our survey.

AREA #5: This area is on land owned by the Rocked Six Cattle Company.

TR-E-I-15: This site was documented by ICF as an “Isolate” with three flakes and one fragment of shatter. Our survey revealed a large lithic scatter at this location with approximately 100 porcellanite flakes 2cm to 5cm in size (mostly secondary and tertiary), three tertiary non-volcanic glass flakes and the midsection or a gray porcellanite projectile point 23mm long, 17mm wide, and 4mm thick (probably Late Prehistoric). There was also evidence of final stage reduction micro-flakes included in the majority of gopher mounds scattered across the site indicating subsurface deposition of cultural material. Ground visibility was estimated at 10% to 40% over the majority of the site with the exception of a slump area on the east side of the side of the site where the projectile point fragment and several flakes were exposed. The site was 40m long on a north/south axis, and 10m wide on an east/west axis. There was also a bull wallow on this site that was most likely made last fall, and was photographed to provide a fresh example of the bull wallows described as “pits described by ICF as possibly used for prehistoric and/or historic warfare and/or hunting” by ICF on TR-E-47 (photo will be included in both sections of this report). The bull wallow was 1.2m X 1.4m in diameter, and 20cm deep.



Site overview looking southeast.



**Gray Porcellanite projectile point midsection.
flake.**



**Non-volcanic glass tertiary
flake.**



**Fresh “Bull Wallow” from last fall measuring 1.2m X 1.4m in diameter and 20cm
deep.**

TR-E-26: This site was documented as a “low density” lithic scatter with 10 flakes present. During our survey we documented 18 flakes, 1 large gray porcellanite core, and 1 gray porcellanite scraper 58mm long, 31mm wide, and 7mm thick.



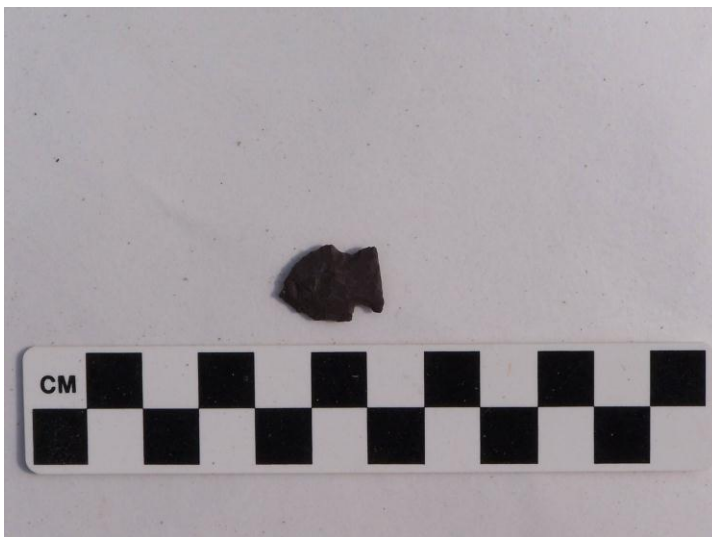
Scraper found on site.

TR-E-27: This site was documented as a “low density lithic scatter, and all we found different from their documentation was the presence of a gray porcellanite core.

TR-E-28: This site was documented as a low density lithic scatter. There was no problem with this assessment except we found a stage 4 gray Porcellanite biface fragment 45mm long, 17mm wide, and 6mm thick, and a complete Late Prehistoric side notch projectile point 18mm long, 12mm wide, and 3mm thick on this site (see photos).



Gray Porcellanite Biface fragment.



Dark purple Porcellanite side notch projectile point (Late Prehistoric).

TR-E-29: This site was not included on the project map.

Newly discovered sites:

There were 2 undocumented isolated finds and one undocumented lithic scatter found in this area during our survey. One isolate consisted of a gray Porcellanite retouched flake (AH), and the other isolate was a red Porcellanite scraper (AE). The lithic scatter (AG) consisted of 11 red and gray Porcellanite flakes, 1 red Porcellanite core, and the distal end of a gray Porcellanite projectile point fragment

21mm long, 15mm wide, and 3mm thick (probably Late Prehistoric). All but two of the artifacts documented were found in a blowout area on the north side of a large sandstone boulder indicating the possibility of buried cultural material on the site. Ground visibility around the blowout area was less than 10%.

Area #6: This area is on land owned by the Rocker Six Cattle Company.

TR-E-14: This site was documented as a “low density lithic scatter” consisting of 100-200 flakes. That many flakes on this site should not be considered low density. The only place ground visibility on this site is 100% is in the two track road passing through the site. Some areas of the site have approximately 20% ground visibility, but ground visibility on the majority of the site and the surrounding area is 0% due to heavy ground cover vegetation (see photos attached to site form for an example).

Newly discovered sites:

There was one probable burial site and one stone circle site (AF) discovered in this area.

Area #7: This area is on lands owned by Hank Coffin and Kirk Green. Hank Coffin (a Crow Tribal Member) was informed that no cultural resources were found on his land even when he offered to show the ICF crew leader sites he knew were there. Kirk Green tried to show the ICF crew leader a “Box Burial” and was told that “they (ICF) did not know what a Box Burial was and would not deal with it”.

Newly discovered sites:

On Hank Coffin’s property we documented 9 sites including two burial sites documented as 1 probable cairn burial that could be either prehistoric or historic in origin, and 1 historic burial (a family member of Hank Coffin) with documentation. We also recorded 1 TCP with documentation, 3 lithic scatters (S,V, & X) 1 lithic procurement site (W), 1 cairn, and 1 historic site that was reported to be an historic military artillery emplacement(U).

On Kirk Green’s land we documented 2 sites including 1 crevice burial and 1 Box burial which contained a hand made coffin made sometime between 1888 and 1900.

There are ten site forms that warrant comment that contain errors in site identification/evaluation, or artifact identification, and comments related to these issues are listed below.

TR-E-I-23: This isolate was identified as a “Historic wood frame hitch”. This isolate is actually an axel off of a horse drawn wagon (most likely the rear axel).

TR-E-15: This site is listed as one oval rock cairn 1.5m X 2m in size. The size and shape of this cairn is similar to the other burial cairns discovered in this area, and the

function of this cairn should be examined closely by Tribal Representatives for their input.

TR-F-21: No (CRIS) site form was included for this site. Only the photo which was blurred, and the 7.5' Quad site location map where provided to the landowner.

TR-E-23: This site is listed as “three one-tier stone circles” and go on to say that “Abundant cobbles of the same material present in the area, and it is uncertain as whether the resource is cultural or not”. If ICF had doubts about this site being real they should not have recorded it as a site. Look at the situation on TR-E-44 as an example of a stone circle site ICF claimed was a site.

TR-E-43: This site is listed as a “one-tier rock cairn approximately 20cm in diameter”. The photo shows a feature that resembles a rock lined hearth that is commonly found as a hearth associated with stone circle sites in the area.

TR-E-52: This site was documented as a “one-tier rock alignment of 4 local cobbles and one small petroglyph”. The photos show all of the rocks loose on the surface with no indication that the stones were ever imbedded in the sod as should be expected if the rocks were old enough to be associated with a prehistoric site. The photo of the petroglyph is of poor quality, and better photos and a detailed drawing should have been included with the site form.

TR-E-53: This site was documented as “two rock cairns measuring 2.5m X 2.5m and 1.5m X 2m in diameter. In the documents provided to the landowners, cairns are described as piles of rocks of various sizes, typically ranging from several stones to large stacks of rocks. The photos with the site form show stone circles as described in the site forms, and stacked (to model the natural slope). These features are typical of rock hunting blinds found in the Tongue River area, on the hill tops east of TR-F-BO45 (Rocker Six Corral), and throughout the western edge of the plains of Colorado, Montana and Wyoming.

TR-E-54: This site was documented as “three rock cairns measuring 2m X 3m, 2m X 2m, and 2m X 2m in diameter. As described above in regards to the actual description the features, they are not cairns, but stone alignment features that form possible hunting blinds. These features are typical of rock hunting blinds found in the Tongue River area, on the hill tops east of TR-F-BO45 (Rocker Six Corral), and throughout the western edge of the plains of Colorado, Montana and Wyoming.

TR-E-58: This site was documented as “two rock cairns measuring 2.5m X 3m, and 2m X 1.5m in diameter. Once again, these features are described by ICF as linear features, but are called cairns (stacks of rocks).

TR-E-60: This site was documented as one tipi ring constructed of 8 sandstone cobbles and measures approximately 4m in diameter, and one semi-circular rock alignment 1m in diameter. I would question the reality of this tipi ring having only 8 rocks to determine a

stone circle 4m in diameter. Also, the rocks visible in the photo appear to be too small to be part of a tipi ring as previously mentioned in relation to site TR-E-44 documented by ICF.

Summary: During the survey conducted during the course of this project, we examined 20 sites documented by ICF in 2014 on private land. While examining these sites and one area where ICF said they found nothing, 36 undocumented sites were discovered including 5 cairns, 7 lithic scatters, 2 lithic procurement sites, 1 rock shelter, 2 historic rock art sites, 2 stone circle sites, 6 probable prehistoric burials, 2 historic burials, 1 TCP, 6 historic sites, and 4 isolates. Ground visibility in the project area was mostly poor (0% to 20%) as a result of heavy vegetation cover, and I'm sure that we would have discovered more sites and more cultural material on the sites we did document if ground visibility had been better.

Overall, the quality of the survey documentation and maps was problematic with inaccurate and incomplete documentation provided on most the site forms, several of the 7.5' Quad maps provided with site forms, and even the project maps had sites plotted in the wrong place or omitted from the maps. We found more lithic material on the majority of the sites ICF documented as lithic scatters, and in one case a site listed as a lithic isolate with 4 artifacts turned out to be a large concentration of lithic material with an obvious buried component. There were also several sites that were miss-identified, and it was questionable if some of the sites were even cultural, or old enough to be considered historic properties.

Field notes and photos (with the exception of the TCP and burial sites) will be provided as a separate document. Information on the TCP and burial sites will be provided **as needed** after tribal representatives have had the opportunity to comment on the data collected during the documentation process.

For further information contact me at chris_finley@nps.gov.

Chris C. Finley



-Wohehiv-
The Morning Star

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Cultural Commission Field Visit

8/6/15

A field visit was taken to the Colstrip Alternative site on August 6, 2015. This area is the preferred route for the Tongue River Railroad. The Colstrip land owners are strongly opposed to this undertaking due to the value of this land in a traditional sense to the many tribes that once roamed the area. Most notably the Northern Cheyenne, as this land borders our reservation and our ancestors frequented the area.

In April of 2015, the land owners hired an archaeologist named Chris Finley to do a follow up of a class III survey that was previously done in the area and to do an inventory of the proposed route. While doing his work, Chris Finley discovered some discrepancies in the ICF-Archaeology reports. The Tribal delegation and my office concurred with Mr. Finley's report and found it to be accurate. I was able to point out significant sites that were not documented or given to the Surface Transportation (STB). I was on these field surveys and noted these sites in addition to placing tobacco offerings at each one. Most notably, there are fourteen burial sites within the proposed route in addition to stone circles, effigy sites, and cairns. I advised to the delegation that the whole project by the Tongue River Railroad would have to be re-evaluated and addressed.

The delegation had concerns with unreported documented finds. The field visit took a majority of the day. I wish to give Chief Dull Knife College a big thanks for providing transportation for the field visit.

The attendees for the field visit were as follows:

Cultural Commission: Roger Killsnight, Sr., Gerald Rowland

Council, Lame Deer District: Conrad Fisher

THPO Office: James Walksalong, Alfonzo Spang

Crazy Dog Society: Otto Braided Hair, Martin Braided Hair

Colstrip land owners Archaeologist: Chris Finley

Chief Dull Knife College, Driver: Leslie Spang

LITTLE WOLF AND MORNING STAR - Out of defeat and exile they led us back to Montana and won our Cheyenne homeland that we will keep forever.

Comments on the Air Quality (Chapter 4) and Coal Dust (Chapter 6) Sections of the Draft EIS for the Proposed Tongue River Railroad Company, Inc. Rail Construction and Operation in Custer, Powder River and Rosebud Counties, Docket No. FD 30186, Surface Transportation Board (STB), Office of Environmental Analysis (OEA)

By

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Introduction

The Draft EIS attempts to analyze the potential environmental impacts of the Tongue River Railroad Company's (TRRC) October 2012 revised application to the STB requesting authority to construct and operate a rail line in southeast Montana. In TRRC's December 2012 supplemental application, TRRC identified its preferred route for the proposed Tongue River Railroad as the 42-mile Colstrip Alternative, which would travel between Colstrip, Montana, and the Ashland/Otter Creek areas of Montana. The Draft EIS purportedly analyzes the environmental impacts of the proposed rail line and alternatives, including the No-Action Alternative.

These comments specifically focus only on the Air Quality and Coal Dust impacts of the proposed action and on how these impacts affect the interests of the Northern Cheyenne Tribe (hereafter "Tribe"). As the Draft EIS notes, "[T]he Northern Cheyenne Indian Reservation borders the west side of the Tongue River in the project area near Ashland."² In addition, the mines that would be the source of coal for the proposed action would also be located very close to the Tribe's western boundaries.³

¹ Resume provided in Attachment A.

² See file _Introductory_Material.pdf, p. 28.

³ See file _Introductory_Material.pdf, p. 36 (S-10, Figure 2).

As detailed below, there are numerous flaws and unsupported assumptions in the STB's analysis of the potential adverse air quality impacts in the project area. As a result, it appears that the STB has seriously understated the potential impacts to air quality on the Northern Cheyenne Reservation, which is a Class 1 airshed.

General Comments

[A] The Draft EIS Improperly Characterizes the Impacts from Air Quality and Coal Dust Due to the Project

In the Abstract, describing the proposed action, the STB states that:

“TRRC proposes to construct and operate a 42-mile rail line (the Colstrip Alternative) between Colstrip, Montana and the Ashland and Otter Creek areas of Montana. The Board’s Office of Environmental Analysis (OEA) and the cooperating agencies have prepared this Draft Environmental Impact Statement (EIS), which analyzes the environmental impacts that could occur if TRRC were to construct and operate the proposed rail line. This Draft EIS analyzes the environmental impacts of ten build alternatives and the No-Action Alternative. Any of the build alternatives could have minor to highly adverse impacts on the following resources: transportation, greenhouse gases and climate change, noise, biological resources, water resources, visual resources, cultural and historical resources, land resources, geology and soils, socioeconomics, and environmental justice. All other resources would experience negligible impacts. OEA has included draft recommended mitigation measures in this Draft EIS. These mitigation measures will be considered by the Board as potential conditions if the Board decides to grant TRRC authority to construct and operate the rail line.”⁴

We note that the Abstract quoted above, by not including “Air Quality” or “Coal Dust” among the resources that could have “minor to highly adverse” impacts, indicates that these would have “negligible” impacts. As detailed below, this characterization of both the Air Quality and the Coal Dust impacts due to the project as “negligible” is based on numerous unsupported and optimistic assumptions in the analysis by the STB/OEA.⁵ Specifically, the STB has not properly

⁴ *Ibid.*

⁵ I recognize that, all of its flaws notwithstanding, the Draft EIS does admit that air quality impacts from its cumulative assessment (i.e., including the project and the identified 18 or so other projects whose impacts would likely coincide in time/space) are not negligible:

“OEA determined that the cumulative impacts of the proposed rail line and the other projects that OEA identified could affect grade-crossing safety, grade-crossing delay, air quality, greenhouse gases and climate change, biological resources, water resources, visual resources, cultural resources, geology and soils, paleontological resources, land use and recreation, energy resources, and socioeconomics.” (emphasis added) See file _Introductory_Material.pdf, p. 24-25 (Q&A-14/15).

assessed air quality impacts to lands and resources (including agriculture, water quality, recreation, etc.) belonging to and affecting the Tribe.⁶

[B] The Entire Air Quality Analysis in the Draft EIS is Inappropriately Censored by Reliance on the Board's "Thresholds"

In the Draft EIS, the STB discusses the impacts from trains that will be transporting coal as a result of this proposed action and states that:

“OEA used a computer model to predict where the trains from the proposed rail line would travel and to identify rail lines that would experience an increase in rail traffic. The model identified segments of rail where the volume of traffic could increase beyond the Board’s thresholds for environmental analysis (an increase of eight trains per day or more for areas in compliance with national air quality standards and an increase of three trains per day or more for areas not in compliance with national air quality standards). OEA analyzed the potential environmental impacts that could occur on these rail segments due to increased rail traffic.”⁷

I note that the Draft EIS does not include any discussion or support (that I could find) which justifies the Board’s threshold (i.e., an increase of eight trains per day or more for areas in compliance with national ambient air quality standards (NAAQS) and an increase of three trains per day or more for areas not in compliance with NAAQS). It is not clear how these thresholds were established. Specifically, it is not clear which of the several NAAQS were controlling in establishing these thresholds – i.e., the PM_{2.5} NAAQS, the PM₁₀ NAAQS, the CO NAAQS, the NO_x NAAQS, or some other NAAQS. Clearly, assumptions on the emissions of pollutants (from the locomotives) as well as from coal dust, brake wear dust and re-entrained track-side dust would be fundamental to and foundational to establishing these thresholds.

⁶ In fact, the analysis misleads in its likely impacts on the Tribe. For example, in Chapter 4, page 4-8, the Draft EIS states that “[N]one of the build alternatives would pass through Lane Deer or the Northern Cheyenne Reservation.” While that may be true as a factual matter, in context, it appears to imply that therefore there should not be air quality impacts on the Tribe. This is highly misleading. Several of the route alignments are located immediately adjacent to the Tribe’s boundaries; as such, there are likely to be significant adverse air quality impacts on the Reservation, both during construction and operation of the project.

⁷ See file _Introductory_Material.pdf, p. 14 (Q&A-4)

The entire analysis in the Draft EIS is flawed because of reliance on these unsupported “thresholds.” As the Draft EIS states:

“OEA assessed the potential environmental impacts that could occur because of increased rail traffic on rail lines that would experience an increase beyond the Board’s thresholds for environmental analysis. This Draft EIS does not consider impacts on rail lines that would not experience a net increase in rail traffic because of construction and operation of the proposed rail line or that would experience an increase less than the Board’s thresholds for environmental analysis.”⁸ (emphasis added).

Thus, since the Draft EIS clearly relies on these “thresholds,” and only considers those rail alternative routes/volumes that exceeded these “thresholds,” the manner in which these “thresholds” were established, along with all supporting details, including all calculations and assumptions should be provided for public review. As it stands, by not providing this basic detail, the Draft EIS lacks adequate transparency.

[C] The Analysis is Not Transparent Due To Its Reliance on the Integrated Planning Model

Further, on this point, the Draft EIS relies on the Integrated Planning Model (IPM)⁹ to determine the various rail route alternatives and volumes¹⁰ (before censoring them as discussed above).

⁸ See file _Introductory_Material.pdf, p. 22 (Q&A-12)

⁹ See, for example, file _Introductory_Material.pdf, p. 21 (Q&A-11), as follows:

“[B]ecause there were so many variables that needed to be considered to determine where the trains would move, OEA used a computer model called the Integrated Planning Model (IPM). The model determines the least overall cost for meeting U.S. electric demand. In determining the least cost solution, IPM identifies where each coal plant obtains the coal that it consumes and how much it will consume. The model determines the amount of coal and thus the number of trains needed to transport the coal. Inputs to the model included coal production and transportation costs, national and international coal distribution patterns, and economic and regulatory uncertainties such as low natural gas prices and carbon dioxide emission regulations that could affect coal markets in the future.” (emphasis added)

¹⁰ For example, the Draft EIS notes that:

“[T]he estimated coal dust emission rates were based on the maximum estimated train traffic for any scenario to provide a conservative estimate (high production scenario, southern alternatives, 26.7 trains per day...” (internal citations omitted). See Appendix G, p. G-11.

Yet, there is no discussion in the Draft EIS regarding this model and whether the myriad assumptions made in its implementation are appropriate or reliable. For example, there is little discussion on any calibration or back-testing that may indicate or shed light on the reliability of the IPM results.

Therefore, all of the general and specific issues discussed below relating to Air Quality and Coal Dust impacts to the Tribe are underpinned by these two basic and unsupported assumptions – namely on the use of the IPM model with no discussion as to its reliability in the current context; and the further censoring of the IPM output routes/volumes using the unsupported Board’s “thresholds.” The validity of Draft EIS is significantly compromised due to the lack of discussion and transparency on these two issues. The STB should consider reissuing the Draft EIS, correcting these major deficiencies.

The above notwithstanding, we provide the following additional general comments.

[D] The Overall Assessment of Air Quality Impacts is Simplistic

Summarizing the results of its Air Quality analysis (excluding climate change impacts), the Draft EIS states that:

“OEA modeled the potential effects of the proposed rail line on air quality in the project area. OEA found that construction and operation of the proposed rail line would not cause the concentrations of nitrogen dioxide, carbon monoxide, lead, particulate matter, or sulfur dioxide in the air to exceed the national standards for air quality. The addition of the project-related trains to existing rail traffic could adversely affect air quality along some existing rail lines outside of the project area, but would not cause concentrations of pollutants in the air to exceed national standards.”¹¹

I note that the air quality impacts on the resources of the Tribe were not specifically addressed in the DEIS – which seems to focus entirely on NAAQS compliance in the “project area” as the only end point of the air quality analysis.

This estimate of 26.7 trains per day, which is noted to be “conservative” and is widely used as such as a basic input in estimating “maximum” impacts is itself simply an output of the IPM, including all of its assumptions and uncertainties.

¹¹ See file _Introductory_Material.pdf, p. 15-16 (Q&A-5-6)

For reasons that are discussed below, this is a major (and likely fatal) shortcoming of the entire analytical framework of the DEIS – affecting all of the impacts analyses and not just that for Air Quality. By assessing the Air Quality impacts “in the project area” but not specifically on the resources of the Tribe, in effect, the analysis assumes that impacts throughout the “project area” are of equal importance.

This (implicit) assumption is false. Impacts are not the same everywhere in the “project area.” That is, the same level of predicted air quality (i.e., concentrations of specific pollutants derived from modeling) even assuming the stated modeling was done correctly from a technical standpoint (which we specifically do not believe or concede) can have different impacts at different locations. We note that the Tribe’s lands are designated as a Class I area, deserving of special protection for numerous air quality related values, including visibility, haze, and deposition.

As an example, let’s say that the predicted (i.e., modeled) maximum concentration of PM10 adjacent to a certain build alternative is X ug/m³. Let us further assume that X is smaller than the NAAQS for PM10 in this instance. One possible conclusion from this analysis is that the impact is therefore “negligible” (from a NAAQS compliance standpoint). Yet, the predicted concentration of PM10 (and its constituents, say toxic metals) could be deposited into the Tongue River, which is adjacent to certain of the build alternatives. And, as a result, this deposition could adversely affect the ability to fish, swim, or recreate in the river. From this latter standpoint, the predicted PM10 concentration is no longer a “negligible” impact. Thus, context matters. NAAQS is not the only attribute that is appropriate for the air quality assessment. And, specific locations within the “project area” matter. The air quality analysis presented in the Draft EIS does not distinguish or consider such distinctions. As a result, it draws simplistic and incorrect conclusions.

[E] The Coal Dust Impacts Analysis is Not Reliable Since the Input Source Term Quantifying Coal Dust Emissions Is Not Reliable

With regards to coal dust and its effect on human health, the Draft EIS states that:

“OEA analyzed the risks of airborne coal dust and determined that exposure would be within applicable standards and guidelines. The aggregate concentration of all types of particulate matter, including airborne coal dust, would be below air quality standards for particulate matter. OEA also analyzed how coal dust could affect human health if it were to be ingested by humans or to make its way into soil or water. OEA found that the concentrations of all of the chemical components of coal dust would be below the screening levels for human exposure in soil, dust, water, and fish. OEA concluded that coal dust from rail cars on the proposed rail line would not affect human health.”¹²

I disagree with this analysis and conclusion. The entire coal dust analysis is dependent on a correct assessment of the source(s) of the coal dust due to the project – i.e., the coal dust that is not only directly emitted from the rail cars themselves (and which can become airborne and then disperse and deposit not just adjacent to but throughout the project area) but also that which is re-entrained as a result of the passage of trains affecting trackside dust which will accumulate over time. I have significant concerns with how each of these “source” terms has been handled in the analysis. For example, as discussed below, re-entrainment of coal dust is not analyzed at all.¹³ Based on my concerns, I do not believe that the analysis is appropriate. Thus, I do not believe that the conclusions of the analysis can or should be relied upon.

The Draft EIS also states as follows, with regards to coal dust and its impacts on surface waters:

“OEA analyzed the potential effect of coal dust from rail cars on the proposed rail line that could make its way into surface waters. OEA found that coal dust constituents in surface water would be below screening levels for ecological exposure, except for barium. The conservative analysis assumptions overestimate the amount of barium that would actually be found in surface waters such that actual barium concentrations would be lower and below screening levels.”¹⁴

¹² See file _Introductory_Material.pdf, p. 16 (Q&A-6)

¹³ See Chapter 4, p. 4-14.

¹⁴ See file _Introductory_Material.pdf, p. 17 (Q&A-7)

Again, as with the impacts on human health from coal dust, as discussed above – the key driver of the surface water impact analysis is the proper assessment of the “sources” of coal dust. In this regard, I show that the analysis falls short – thereby making any conclusions unreliable.

[F] The Draft EIS Improperly Attempts to Dismiss Predicted Significant Impacts

As a general flaw, at times when the predicted impacts are above corresponding thresholds and thus inconvenient, the Draft EIS minimizes such results of significance by claiming, without support or discussion, that the underlying analysis “overestimates” these impacts and that actual impacts would be lower. I provide two such examples.

First, in discussion the level of barium (present in coal dust) impacts to surface waters, the Draft EIS states:

“OEA also found that estimated concentrations of coal dust in soil, sediment, and surface water would be below screening levels for ecological exposure, with the exception of barium in surface water. OEA’s analysis, however, overestimated the amount of barium that would actually be found in surface waters so that actual barium concentrations resulting from the proposed rail line would be lower and below screening levels.”¹⁵

Second, in relation to the impacts of NO₂, which even the STB’s analysis in the Draft EIS shows will result in an exceedance of the NAAQS, the Draft EIS states:

“The modeling results indicate that the 1-hour NO₂ standard also would be exceeded for the medium production scenario in 2023 (for the northern and southern alternatives) and the high production scenario in 2037 (for the southern alternatives only). The AERMOD model has been documented in a number of studies to over-predict the highest 1-hour NO₂ concentration from 1.7 to 2 times the observed concentration (RTP Environmental Associates 2013, American Petroleum Institute 2012, Golder 2011). Therefore, anticipated maximum 1-hour NO₂ concentrations would be expected to be less than the modeled levels. The maximum modeled 1-hour NO₂ concentrations would not exceed the NAAQS in any analysis year with a downward adjustment for this model bias.”¹⁶ (internal citations omitted)

¹⁵ See file _Introductory_Material.pdf, p. 39 (S-13).

¹⁶ See Chapter 4, p. 4-17 through 4-18.

These are misleading characterizations and should be struck from the Draft EIS. If the STB/OEA believes that its analysis overestimates a predicted impact, it should provide specifics of how and why this overestimate occurred rather than vague and unquantified references to overestimation and bias.

The STB should then correct or not include such overestimate. Or, the STB should provide its analysis of what it believes the “actual” (as opposed to the overpredicted) impact will be. But, in reality, no one – not even the STB – can provide an analysis of the “actual” future impact. That is why analyses rely on predictions. And, predictions can include, with good reason, conservative assumptions. That is not because the goal is to inflate a future impact – it is simply a prudent practice in order to accommodate the many unknowns inherent in a predictive analysis that can result in underestimating impacts.

For example, as the STB notes and as I discuss above, much is unknown and unknowable about how the various rail alternatives were developed in the first place. Models used at every stage of the analysis rely on myriad assumptions – not all of which are “conservative” leading to only high levels of impacts.

In the first example above the analysis in the Draft EIS does not include the quantitative impacts of train derailments and the resultant spillage or vast quantities of coal directly into the Tongue River or into its feeder streams or near its banks and thence to the waters of the river. Should that occur, it is certain that not only barium but most other dust/metal impacts to water (and sediments) would be large, persistent and therefore significant – directly affecting the Tribe in a most adverse manner. Nor can the STB assure that such derailments will never occur in the future. No one can. For example, well publicized derailments in the Powder River Basin have occurred in the recent past and there cannot be guaranteed assurances by anyone, much less the STB, that they will not occur in the past.

In the second example above, the Draft EIS notes overestimation by AERMOD but does not discuss underestimation of the emission rates used. For example, actual emissions rates from locomotive and other equipment are affected by deterioration of the underlying equipment. It is not unheard of that equipment sometimes do not meet respective standards. This is especially

true of mobile equipment. Therefore, by using emission rates corresponding to the standard, the analysis assumes 100% compliance with standards, which is not a conservative assumption.¹⁷ Use of higher non-compliant emission rates, such as may occur in practice, will result in higher, not lower impacts.

And, in addition, the analysis for NO₂ compares the estimated concentrations to the NAAQS today. NAAQS are subject to change (and have generally been subject to downward revisions). If in the future, the NAAQS becomes lower then the predicted impacts would be even greater on a relative basis.

For all of these reasons, the STB should, at the very least, not mischaracterize the results of its own analysis. The public is entitled to a straightforward, transparent, assessment and interpretation of impacts – not a qualitative, backdoor, misleading, revisionist interpretation of the analysis – when the results are inconvenient.

[G] Conclusion

As detailed above, there are significant basic flaws with the overall analytical framework for the air quality analysis in the Draft EIS. Unless corrected or properly supported, any additional “analyses” which rest on these basic framework assumptions cannot lead to reliable conclusions. Nonetheless, I point out some of the additional issues and technical shortcomings in the Air Quality and Coal Dust analyses as presented in the Draft EIS.

¹⁷ The analysis does not contain any information regarding the level of compliance of the many current locomotive in the BNSF fleet with applicable standards. It is therefore an implicit and unsupported non-conservative assumption that all of the locomotives in the fleet are and will comply with their respective standards at all times.

Specific Comments on Air Quality

In addition to the General Comments above, I provide the following specific comments on the Air Quality analysis presented in the Draft EIS in this section.

[A] Construction Impacts Are Not Temporary And Are Not Demonstrated To Be Negligible

The Draft EIS's own estimates of construction fugitive dust (i.e., PM10, as an example), as shown in Tables 4-11 or 4-12 show that emissions of PM10 will be thousands of tons per year, depending on the alternative considered. For the Decker alternative, using 12 month construction schedule, for example, emissions are 2,583 tons per year.

Yet, the Draft EIS concludes that:

“In summary, air pollutant emissions during construction would be temporary and at any given time would occur only where construction is occurring or along roads traveled by construction vehicles. Pollutant concentrations during construction are expected to remain within applicable air quality standards.... OEA concludes that construction and operation impacts would be negligible.”¹⁸

I believe that characterizing construction emissions as “temporary” is misleading when, in fact, depending on the build alternative/production scenario, construction could last for 3 to 6 years, the former on a year round basis.¹⁹ While this may be “temporary” only in the sense that it will not last for decades, anything that lasts for multiple years is hardly “temporary.” I suggest the Draft EIS remove references to “temporary” in this context due to its erroneous implication.

I also disagree with the STB's statement that “concentrations during construction are expected to remain within applicable air quality standards.” Here again, the truth of that statement depends on when and where the NAAQS or MAAQS assessments are conducted. It is clear that ambient air will be affected adversely by construction activities. Even though the most significant impacts will occur within and adjacent to the railroad right-of-way and along roads supporting

¹⁸ See Chapter 4, p. 4-1. See also Section 4.5.1.1, p. 4-13.

¹⁹ See Appendix E, Table E.1-104.

construction, many of the NAAQS and MAAQS have very short averaging times,²⁰ such as the hourly MAAQS for NO₂, ozone, sulfur dioxide, and hydrogen sulfide; hourly NAAQS for ozone; 3-hour average NAAQS for sulfur dioxide; 8-hour average NAAQS for carbon monoxide and ozone; 8-hour average MAAQS for carbon monoxide; 24-hour average NAAQS for sulfur dioxide, PM₁₀, and PM_{2.5}; and 24-hour average MAAQS for sulfur dioxide and PM₁₀.

The emission calculations presented in the Draft EIS simply do not provide enough details for each of the pollutant emissions on very short-term basis so that the short term NAAQS and MAAQS can be properly assessed. Construction emissions are discussed in Section E.1.5 in Appendix E of the Draft EIS.²¹ However, none of the emissions summary Tables E.1-109 through E.1-128 show the maximum hourly construction emissions for any of the alternatives. While Tables E.1-120, E.1-121, and E.1-123 show the estimated daily emissions, that is not sufficient to analyze impacts on a still-smaller time scale.

Thus, based on a lack of emission estimates, coupled with similar lack of modeling for short term impacts, there is no basis to conclude that all construction impacts will be “negligible” even when the assessment is purely limited to that of NAAQS and MAAQS compliance.

In addition, I disagree with the STB’s suggestion that the only meaningful impact of construction impacts is comparison with NAAQS and MAAQS. I am particularly concerned with the impacts on the Tribe’s lands and the Tongue River (which is a critical resource for the Tribe) due to deposition of emissions from the construction phase on many of the potential alternatives such as portions of the Decker, Tongue River, and even Colstrip alignments. I did not see any specific assessment of such impacts on the Tribe in the Air Quality section.²²

Finally I note that construction impacts will be occurring along with many other projects as discussed in the cumulative analysis. These will be additive and further exacerbate impacts on

²⁰ See Chapter 4, Table 4-2, p. 4-7.

²¹ I note that many of the Tables in this section reference “Table E.1-177” which does not exist. See, for example, FN1 to Tables E.1-89, E.1-90, E.1-91, E.1-92, E.1-93, and E.1-94.

²² In fact, a search of the words “Tribe” or “Cheyenne” for the entire Air Quality section Appendix E, where the details of the analysis are presented, did not result in a single instance of these words. Thus, the Air Quality analysis is deficient since it did not conduct any specific and particular analysis of impacts on the Tribe’s resources.

the Tribe's resources. These cumulative impacts during construction have not been properly quantified or assessed.

[B] Construction Impacts Rely on Information Provided By TRRC That Are Unverifiable

Construction air quality impacts for all alternatives other than Colstrip rely on ratios such as those listed in Appendix E, Table E.1-105 (which, in turn appear to be based on earthwork volumes listed in Table E.1-106), which were provided by TRRC. However, no details as to how these earthwork volumes were estimated or calculated and the underlying assumptions that were made in arriving at these ratios are not provided anywhere in the Draft EIS.

Even assuming that the details provided by TRRC relating to the Colstrip alternative are correct²³ – and this too is unverifiable as presented in the Draft EIS – the assessment of construction impacts for all of the other alternatives rests on the ratios of these unverifiable earthwork volumes from TRRC.

Thus, using these unverifiable earthwork volumes constitutes an act of faith. The Draft EIS should provide the underlying cut/fill drawings along each alignment and similar documentation which presumably provide the basis of the earthwork estimates received from TRRC.

[C] The Air Quality Analysis Improperly Limits the Study Area

Addressing the study area, the Draft EIS states that:

“Potential impacts on *criteria pollutant* concentrations relative to the National Ambient Air Quality Standards (NAAQS) and Montana Ambient Air Quality Standards (Montana AAQS) would be negligible beyond the immediate vicinity (less than 1 kilometer) of the rail line right-of-way, so detailed air quality modeling for the NAAQS assessment is limited to this smaller portion of the study area.”²⁴

²³ See, for example, details provided in Appendix E, Tables E.1-89, E.1-103, E.1-92, E.1-108, etc. showing the list of equipment that will be required, equipment sizes, equipment fuel consumption rates, and the expected annual hours of operation of the each type of equipment.

²⁴ See Chapter 4, p 4-2.

I know of no empirical reasons or any laws of nature that would justify constraining the study area for the entire air quality analysis to just the immediate vicinity – i.e., less than 1 km of the rail line right of way. I note again that the impact of air quality is not just felt in its effect on the NAAQS and MAAQS; additional impacts will occur due to deposition and transport of pollutants away from this immediate area during construction and during actual operation. For example, emissions of PM_{2.5} will likely travel far from just the vicinity of the rail line. So will emissions from gaseous pollutants such as NO_x. Of course, any deposition onto adjacent roads and/or the Tongue River can be further dispersed and transported away from the immediate vicinity via secondary processes. Thus, there is no justification to handicap the entire analysis by severely constraining the study area as noted above. This conceptually unsupported assumption is a fatal flaw.

[D] Fugitive Dust Control Levels Are Unsupported

Appendix E, Table E.1-107 shows uncontrolled and controlled emission factors for fugitive dust for PM₁₀ and PM_{2.5}. In each case, the control efficiency based on ‘watering’ is assumed to be 50%. However, no basis is provided for this assumption.

Dust control via watering is subject to many variables, not limited to: the quantity of water used; the manner in which the water is applied to the activity causing the dust, including proximity of the watering equipment; the type of atomization used; the size distribution of the water droplets; and the training of the operators.

Thus, a control efficiency of 50% is not automatically guaranteed without much more detail. The Draft EIS does not provide any support for assuming the 50% control efficiency used in its emission estimates. Thus, the estimated emissions, just from this standpoint alone, are unsupported and too high.

[E] The Use of Wind Speeds From The Birney Station May Not Be Conservative

The Draft EIS states that:

“[T]he average wind speed at Birney (2.3 meters per second, about 5.1 mph) is lower than at Miles City (4.4 meters per second, about 9.9 mph). Use of the lower

wind speed at Birney results in a more conservative analysis (higher pollutant concentrations) than the higher wind speed at Miles City. Accordingly, OEA used the data from the Birney station for the air quality analysis.”²⁵

While the use of the lower wind speed may result in a more conservative analysis from a dispersion modeling standpoint, these lower wind speeds, if used for the emissions calculations from various sources of fugitive dust will not result in conservative emissions estimates. Since emissions estimates are critical inputs to the dispersion modeling analysis, in addition to the meteorological data such as wind speeds, the overall impact of using lower wind speeds – both for emission estimates and for dispersion modeling – cannot be discerned. The Draft EIS should fully clarify this issue.

[F] The Analysis Does Not Use Appropriate Coal Particle Size Distributions

The particle size distribution of the coal that will be emitted as dust, and also from spillage and reentrainment of previously deposited dust is an obviously critical parameter in the air quality impacts analysis. Since large particles are expected to deposit closer to the source or activity while smaller particles will travel much farther, it is important to establish the proper size distributions for the coal particles.

Additionally, PRB coal is known to be highly friable,²⁶ subject to breakage under many factors. Thus, the particle size distribution of PRB coal in the rail cars, which is subject to vibration, settling, abrasion, etc., is an important aspect of the inputs to the analysis.

However, the entire Draft EIS analysis relies on unsupported particle size distribution data not from the PRB but from Australia – with no discussion whatsoever as to why the characteristics of Australian coals are relevant to the current analysis. In Table E.1-42, the PM₁₀ and PM_{2.5} fractions of coal are assumed to be 45% and 8.6% of TSP, respectively, referencing work from Australia. Although there is additional discussion of this in Appendix E, Section E.2.3.2, that discussion provides even less assurance for this assumption. In fact, the additional discussion in

²⁵ See Chapter 4, p. 4-6.

²⁶ See, for example, <http://krtcommodities.com/files/PRB%20COAL%20DEGRADATION.pdf>.

Section E.2.3.2 provides no comfort that the assumed size fractions have any resemblance to that from PRB coals:

“Ideally, the characterization of the particle size distribution for the proposed rail line could be improved by matching the coal characteristics of the coal that TRRC would haul with one of the 11 coals assessed in the Katestone Scientific (2000) study (Table E.2-1). However, the coal characterization information on these 11 coal types is not available.”²⁷ (emphasis added)

As to the larger sized particles, whose dispersion was not modeled, the Draft EIS states:

“The majority of the coal dust particles are large (greater than 250 microns) and deposit quickly after being lifted from the moving train, and therefore, would be deposited within 5 meters (16 feet) of the rail line and would not contribute to nuisance impacts beyond the right-of-way. OEA estimated that these large coal dust particles would account for about 62 percent of the total mass of coal dust emitted from rail line operation.”²⁸

The analysis provides no citations or support for any of the assumptions excerpted above – such as the fact that “majority of the coal dust particles are large (greater than 250 microns),” that these particles would be “deposited within 16 feet of the rail line,”²⁹ or that these particles “account for about 62 percent of the total mass of coal dust.” Without supporting documentation for these assumptions, there is no basis to assess the accuracy of the coal dust dispersion analysis in the Draft EIS.

In summary, the particle size distributions assumed in the analysis – both for the larger fractions and for the smaller fractions – are simply unsupported.

²⁷ See Appendix E, p. E-133.

²⁸ See Chapter 4, p. 4-18.

²⁹ If, as the Draft EIS contends that no particles greater than 250 microns have been ever found more than 16 feet of a rail line in the PRB, it should provide documentary proof of this patently absurd assumption.

Specific Comments on Coal Dust

[A] Coal Dust Emissions Are Significantly Underestimated

OEA has concluded that coal dust from trains on the proposed rail line would not harm human health or the environment.³⁰ This is not supported by the analysis presented. As presented, the total TSP, PM10, and PM2.5 emissions due to coal dust, even for the high production scenario range from several hundred tons per year (depending on route alternative) for TSP to several tens of tons per year for PM2.5.³¹ For the Decker alternative in this high production scenario, which I will use as an example, this table shows TSP emissions of 168.3 tons/year due to wind driven emissions from the tops of the loaded rail cars.

I note that these emission estimates appear to be quite low. For example, in a presentation to members of the STB Board in 2009, BNSF indicated that coal dust emissions from the tops of rail cars are 600 pounds per car over a 400 mile route.³² Thus, for the Decker alternative (distance 51.1 miles³³), the per car emissions from the top should be around 76 pounds. Using the Draft EIS assumption of 125 cars per train,³⁴ the coal dust emissions from the top would be 4.79 tons per train. Per the Draft EIS, in the high production scenario this southern alternative would have 26.7 trains per day.³⁵ Thus, the daily emissions of coal dust from the loaded car tops should be 26.7 times 4.79 or 127.9 tons per day. Annually, therefore, emissions for Decker/High Production should be 46,687 tons per year. Compare this to the 168.3 tons/year used in the analysis.³⁶ The value used in the analysis is 277 times smaller.

³⁰ See Chapter 6, p. 6-1.

³¹ See Chapter 4, Table 4-19.

³² <http://www.scribd.com/doc/129350651/Surface-TransMinutes-9-10-09-1>

³³ See _Introductory_Material.pdf, Table 1, p. S-6.

³⁴ See Appendix E, Table E.1-1.

³⁵ See Appendix E, Table E.1-5.

³⁶ Even if I make the assumption that BNSF's statement to the STB Board in 2009 referred to uncontrolled emissions (i.e., before the use of any load shaping and application of topper agents) and using the BNSF-claimed 85% reduction as a result of these mitigations, I arrive at an annual emissions estimate for the Decker/High Production alternative of $46,687 \times (1 - 0.85)$ or 7003 tons/year – which is over 41 times the value used in the analysis.

This analysis indicates that that the calculated estimates for the coal dust projected to be emitted in the Draft EIS are grossly inaccurate. If the estimated emissions are hundreds of times smaller than what BNSF itself has reported, then the rest of the impact analysis is, plainly, wrong.

Moreover, I note that the Draft EIS estimates for coal dust are riddled with several critical assumptions – none of which are supported or even properly discussed in the Draft EIS. For example:

- On page E-43, the emission factor equation for coal dust used in the analysis is shown. It includes, as an important input variable, the train speed in km/hr. While the Draft EIS “anticipates that average operating speeds would range from 29.7 to 39.5 miles per hour, depending on the build alternative and whether the train is loaded or empty...,”³⁷ the specific assumed speed(s) used in the calculations for each build alternative/line are not stated further in this section or anywhere else the Draft EIS to the best of our knowledge.

- Again, with regards to the the emission factor equation for coal dust noted above, it is attributed to Connell Hatch 2008, Witt et al. 1999, and Ferreira et al. 2003. As far as I could determine, none of these studies involved PRB coal. In fact, as the Draft EIS explicitly states, “[M]uch of the basis for the coal dust emissions is based on research conducted in Australia by government agencies, academics, and the Australian Rail Track Corporation over the past 10 years.”³⁸ It is therefore unclear why this equation, based on Australian coals, without any further adjustments, is relevant or representative of coal dust emissions from trains and rail cars carrying PRB coal. This is a critical assumption, used without any discussion at all in the analysis.

I understand that BNSF has claimed to be studying coal dust emissions (albeit for ballast related issues and not environmental impacts, per se) for the last decade.³⁹ Therefore, it is not clear why

³⁷ Draft EIS, Chapter 2, Section 2.3.

³⁸ See Appendix E, p. E-130. See also, discussion in Section E.2.3.1, beginning on p. E-132.

³⁹ On its website, BNSF states that

“[S]ince 2005, BNSF has been at the forefront of extensive research regarding the impacts of coal dust escaping from loaded coal cars on rail lines in the Powder River Basin (PRB), which is located in Wyoming and Montana. From these studies, BNSF has determined that coal dust poses a serious threat to the stability of the track structure and the operational integrity of our lines in,

actual data on PRB coals (including properties, dust emissions, etc.) from these BNSF studies themselves were not used in the analysis to estimate the source term in the coal dust analysis. The analysis does not critique the prior BNSF work in order to justify its rejection and use of the Australian-coal based data.

While ignoring any PRB-related data developed by BNSF as a starting point, the analysis freely uses the BNSF-based control efficiency of 85% (a combination of 50% due to coal shaping in the rail car and an additional 70% due to the use of BNSF-approved topper agents) to reduce its estimate of predicted emissions. See Table E.1-42. However, the public record does not contain any details or underlying data as basis for any of these control efficiency assumptions. Other than a brief public summary by BNSF simply reporting the results but none of the underlying data, these critical control efficiency assumptions are not documented anywhere in the Draft EIS.

[B] Coal Dust Emissions Calculations Do Not Include Reentrainment Emissions

In addition to the significant underestimation noted above, the emissions calculations (and later modeling) for coal dust do not seem to account for re-entrainment of coal dust previously deposited trackside or in adjacent right-of-ways.⁴⁰ Smaller sized particles including PM₁₀ and fine particulate matter including PM_{2.5} are readily resuspended when a train passes; thus these emissions should have been included in the emissions calculations. As a result of their omission, the estimated emissions (which are also then used in the modeling analysis) are underestimated. This should be corrected.

[C] Impacts Analyses Contain No Uncertainty Analyses

In Appendix G, neither the human impacts analysis nor the ecological impacts analysis contains a discussion of the uncertainties inherent in these analyses. It is customary to include a discussion of such uncertainties in any health or ecological risk assessment. Given the numerous

and close to, the mines in the PRB. The STB, our regulating agency, has confirmed that coal dust is a harmful contaminant of rail ballast. Tests have shown that dusting events from untreated cars occur with the most frequency close to the mine loading points in the PRB and materially decrease as the railcars move further from the PRB.”

See <http://www.bnsf.com/customers/what-can-i-ship/coal/coal-dust.html>.

⁴⁰ See Appendix E, Section E.2.1, p. E-131.

assumptions and unknowns associated with human and ecological risk assessments in general, results of such assessments are accompanied by a discussion of uncertainties in order to provide appropriate context to the reader. Without the discussion on uncertainties, readers can often misinterpret the results (i.e., the predicted risks) of such assessments. The Draft EIS should therefore include such uncertainty analyses.

[D] Estimation of Trace Element Concentrations in Coal Dust Are Improper

In Appendix G, Section G.2.1, the Draft EIS states that:

“OEA included in the exposure assessment each of the trace elements that had measured values in the composite data. To obtain a single concentration value for each trace element, OEA averaged the concentrations of each chemical in each workbook. Then, if the element was reported in both workbooks, OEA averaged the two averages into an overall average concentration (Table G-1).”

The Draft EIS should disclose why the STB used averaging (or even double averaging, as discussed above) instead of the more customary use of maximum values, particularly given the “screening” nature of the overall assessment and the fact that the underlying coal properties database is not discussed other than the results were from 2004.⁴¹ The Appendix does not discuss where the samples originated from (i.e., from just the Otter Creek Mine area, the other mines that could also be developed as a result of this project, or elsewhere); how the samples were obtained; or how representative the samples were in relation to the coal seams at the likely mines.

In view of these many questions, it is improper to simply use averages as the starting point of the analysis. Given the fundamental flaw in this basic input, none of the subsequent “results” of the analysis, both for human as well as ecological impacts, are reliable.

[E] Composition of Most of the Topper Agents is Unknown

It is clear from the discussion of the topper agents in Appendix G that much is unknown as far as the composition of almost all of the “approved” agents. For example, the Draft EIS states:

⁴¹ See Appendix G, p. G-2.

“The MSDS include wide ranges for the concentrations of some the constituents (e.g., 5 to 50 percent). In other cases, the MSDS identify some constituents as “proprietary” and provide no further information.”⁴²

“Given that the actual chain length is not specified, the environmental fate of this topper agent is uncertain.”⁴³

“The purpose of Soil-Sement® is to bind to soils, making it likely that the copolymer of acrylic and polyvinyl acetate will preferentially bind to soils, although given the limited information available on the composition of the product and mobility characteristics of the constituents, this is uncertain.”⁴⁴

“The MSDS for AKJ CTS-100 does not provide information on ecotoxicity or chronic impacts.....The MSDS does not describe the environmental mobility of the product in air, water, and soil/sediment, but the MSDS notes that accidentally released product should not be flushed into sewers.”⁴⁵

“The MSDS does not describe the environmental mobility of AKJ CTS-100C in air, water, and soil/sediment, nor does it provide information on ecotoxicity.”⁴⁶

“No additional information is provided in the MSDS on the chemical components in Min Topper S+0150.”⁴⁷

Given this level of lack of knowledge of these topper agents, it is not clear why the present “analysis” is, in fact, useful at all. Unless the STB can obtain meaningful data on the constituents in these agents, it has no basis to present its findings as some sort of impact analysis. Coupled with the lack of any uncertainty analyses as noted earlier, the entire analysis is misleading and unreliable.

[F] Additional Assumptions Relating to Topper Agent Emissions are Unsupported

⁴² See Appendix G, p. G-4.

⁴³ See Appendix G, p. G-6. Pertaining to Nalco Dustbind Plus.

⁴⁴ See Appendix G, p. G-7. Pertaining to Midwest Soil-Sement.

⁴⁵ See Appendix G, p. G-7. Pertaining to AKJ CTS-100. In addition, this topper agent contains an unknown proprietary addition (See Table G-2).

⁴⁶ See Appendix G, p. G-8. Pertaining to AKJ CTS-100C. In addition, this topper agent contains an unknown proprietary addition (See Table G-2).

⁴⁷ See Appendix G, p. G-9. Pertaining to Mintech Min Topper S+0150. In fact, nothing useful is known about this topper agent (See Table G-2).

Continuing further, the Draft EIS states that:

“Assuming a railcar is 480 square feet in surface area or 4,603 cubic feet in volume (BNSF Railway Company 2013) and assuming that the topper agent penetrates the top 4 inches of the coal in the railcar, the topper agent would penetrate 160 cubic feet of coal, corresponding to approximately 3.5 percent of the coal in the railcar.”⁴⁸

This statement raises numerous questions that are not addressed in the Draft EIS, including the following:

What is the basis of the surface area of each railcar as noted above?

Are all railcars assumed to have the same surface area?

What is the basis of the volume of each railcar as noted above?

Are all railcars assumed to have the same volume?

What is the basis for assuming that any of the topper agents “penetrates the top 4 inches of the coal” as assumed above?

What is the basis for assuming that any of the topper agents fully covers the entire exposed surface area of each railcar in an unit train?

Without addressing these questions with further detailed discussion of how these agents are actually applied in practice, the various assumptions above are unsupported.

[G] Coal Deposition Modeling is Fatally Compromised

With regards to coal dust deposition modeling, the Draft EIS states that:

“OEA modeled wet, dry, and total coal dust deposition rates based on estimated rail car coal dust emissions, adjusted for the use of load profiling and topper agents for coal dust emission reduction. OEA estimated deposition rates at 10-meter intervals from the center of the rail line to a distance of 300 meters on each

⁴⁸ See Appendix G, p. G-9.

side of the rail line, or 60 locations (receptors). OEA evaluated particle size categories of less than 60 microns in diameter, 60 to 250 microns in diameter, and the sum of the two (i.e., all particles up to 250 microns in diameter).”⁴⁹

It is not at all clear why the Draft EIS included as its smallest size fraction, particle size of “less than 60 microns in diameter.” It is obvious that the particle sizes of concern include much smaller sizes such as PM10 and PM2.5 (for which there are NAAQS) and which are capable for being inhaled, resulting in adverse health outcomes. It is also clear that these much smaller size particles could travel much farther than the assumed 300 meters distance on each side of the rail line. Unless the STB can demonstrate that none of the (very friable PRB coal dust) particles are or can be less than 10 microns or 2.5 microns, simply assuming that even the smallest particles will not travel beyond 300 meters is an unsupported assumption. Thus, I believe that the results of these deposition modeling are unreliable and should be set aside.

⁴⁹ See Appendix G, p. G-11.

Conclusions

As discussed in detail in these comments, the Draft EIS contains significant deficiencies in both the air quality and the coal dust emissions analyses.

A major and unexplained flaw that affects both sections is the apparent significant underestimation of coal dust emissions from railcars. The coal dust emissions estimates provided in the Draft EIS – relying on Australian work with no discussion as to relevance to the PRB coals that will be transported – do not approach the levels of emissions publicly stated by BNSF, the operator of the proposed project in statements to the STB. Also, the coal dust emissions estimates omit assessment of re-entrainment emissions of dust previously deposited. Since the coal dust emissions estimates are foundational inputs that feed into the air quality analyses, the results of all the air quality analyses that rely on these vastly underestimated coal dust emissions are also therefore underestimated and cannot be relied upon.

As discussed above, the air quality analysis is significantly compromised in other aspects as well, including the following: it suffers from a lack of transparency with no support for numerous assumptions including the use of the IPM Model; it improperly relies on improper and unsupported Board thresholds to censor the analysis at the outset; it does not distinguish between the Tribe's Class I area and its need for special protections versus other impacted areas; and it improperly relies on the NAAQS and MAAQS as the only appropriate comparison standards.

Based on this review, I conclude that the coal dust and air quality emissions assessments in the Tongue River Railroad Draft EIS are deeply flawed and fail to provide a reliable evaluation of the potential environmental and human health impacts from emissions of coal dust and other air pollutants.

ATTACHMENT A - RESUME

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CONSULTANT, ENVIRONMENTAL AND ENERGY ISSUES

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EXPERIENCE SUMMARY

Dr. Sahu has over twenty three years of experience in the fields of environmental, mechanical, and chemical engineering including: program and project management services; design and specification of pollution control equipment for a wide range of emissions sources; soils and groundwater remediation including landfills as remedy; combustion engineering evaluations; energy studies; multimedia environmental regulatory compliance (involving statutes and regulations such as the Federal CAA and its Amendments, Clean Water Act, TSCA, RCRA, CERCLA, SARA, OSHA, NEPA as well as various related state statutes); transportation air quality impact analysis; multimedia compliance audits; multimedia permitting (including air quality NSR/PSD permitting, Title V permitting, NPDES permitting for industrial and storm water discharges, RCRA permitting, etc.), multimedia/multi-pathway human health risk assessments for toxics; air dispersion modeling; and regulatory strategy development and support including negotiation of consent agreements and orders.

He has over twenty one years of project management experience and has successfully managed and executed numerous projects in this time period. This includes basic and applied research projects, design projects, regulatory compliance projects, permitting projects, energy studies, risk assessment projects, and projects involving the communication of environmental data and information to the public.

He has provided consulting services to numerous private sector, public sector and public interest group clients. His major clients over the past twenty three years include various steel mills, petroleum refineries, cement companies, aerospace companies, power generation facilities, lawn and garden equipment manufacturers, spa manufacturers, chemical distribution facilities, and various entities in the public sector including EPA, the US Dept. of Justice, California DTSC, various municipalities, etc.). Dr. Sahu has performed projects in over 44 states, numerous local jurisdictions and internationally.

In addition to consulting, Dr. Sahu has taught numerous courses in several Southern California universities including UCLA (air pollution), UC Riverside (air pollution, process hazard analysis), and Loyola Marymount University (air pollution, risk assessment, hazardous waste management) for the past seventeen years. In this time period he has also taught at Caltech, his alma mater (various engineering courses), at the University of Southern California (air pollution controls) and at California State University, Fullerton (transportation and air quality).

Dr. Sahu has and continues to provide expert witness services in a number of environmental areas discussed above in both state and Federal courts as well as before administrative bodies (please see Annex A).

EXPERIENCE RECORD

2000-present **Independent Consultant.** Providing a variety of private sector (industrial companies, land development companies, law firms, etc.) public sector (such as the US Department of Justice) and

public interest group clients with project management, air quality consulting, waste remediation and management consulting, as well as regulatory and engineering support consulting services.

- 1995-2000 Parsons ES, **Associate, Senior Project Manager and Department Manager for Air Quality/Geosciences/Hazardous Waste Groups**, Pasadena. Responsible for the management of a group of approximately 24 air quality and environmental professionals, 15 geoscience, and 10 hazardous waste professionals providing full-service consulting, project management, regulatory compliance and A/E design assistance in all areas.
- Parsons ES, **Manager for Air Source Testing Services**. Responsible for the management of 8 individuals in the area of air source testing and air regulatory permitting projects located in Bakersfield, California.
- 1992-1995 Engineering-Science, Inc. **Principal Engineer and Senior Project Manager** in the air quality department. Responsibilities included multimedia regulatory compliance and permitting (including hazardous and nuclear materials), air pollution engineering (emissions from stationary and mobile sources, control of criteria and air toxics, dispersion modeling, risk assessment, visibility analysis, odor analysis), supervisory functions and project management.
- 1990-1992 Engineering-Science, Inc. **Principal Engineer and Project Manager** in the air quality department. Responsibilities included permitting, tracking regulatory issues, technical analysis, and supervisory functions on numerous air, water, and hazardous waste projects. Responsibilities also include client and agency interfacing, project cost and schedule control, and reporting to internal and external upper management regarding project status.
- 1989-1990 Kinetics Technology International, Corp. **Development Engineer**. Involved in thermal engineering R&D and project work related to low-NO_x ceramic radiant burners, fired heater NO_x reduction, SCR design, and fired heater retrofitting.
- 1988-1989 Heat Transfer Research, Inc. **Research Engineer**. Involved in the design of fired heaters, heat exchangers, air coolers, and other non-fired equipment. Also did research in the area of heat exchanger tube vibrations.

EDUCATION

- 1984-1988 Ph.D., Mechanical Engineering, California Institute of Technology (Caltech), Pasadena, CA.
- 1984 M. S., Mechanical Engineering, Caltech, Pasadena, CA.
- 1978-1983 B. Tech (Honors), Mechanical Engineering, Indian Institute of Technology (IIT) Kharagpur, India

TEACHING EXPERIENCE

Caltech

"Thermodynamics," Teaching Assistant, California Institute of Technology, 1983, 1987.

"Air Pollution Control," Teaching Assistant, California Institute of Technology, 1985.

"Caltech Secondary and High School Saturday Program," - taught various mathematics (algebra through calculus) and science (physics and chemistry) courses to high school students, 1983-1989.

"Heat Transfer," - taught this course in the Fall and Winter terms of 1994-1995 in the Division of Engineering and Applied Science.

"Thermodynamics and Heat Transfer," Fall and Winter Terms of 1996-1997.

U.C. Riverside, Extension

"Toxic and Hazardous Air Contaminants," University of California Extension Program, Riverside, California. Various years since 1992.

"Prevention and Management of Accidental Air Emissions," University of California Extension Program, Riverside, California. Various years since 1992.

"Air Pollution Control Systems and Strategies," University of California Extension Program, Riverside, California, Summer 1992-93, Summer 1993-1994.

"Air Pollution Calculations," University of California Extension Program, Riverside, California, Fall 1993-94, Winter 1993-94, Fall 1994-95.

"Process Safety Management," University of California Extension Program, Riverside, California. Various years since 1992-2010.

"Process Safety Management," University of California Extension Program, Riverside, California, at SCAQMD, Spring 1993-94.

"Advanced Hazard Analysis - A Special Course for LEPCs," University of California Extension Program, Riverside, California, taught at San Diego, California, Spring 1993-1994.

"Advanced Hazardous Waste Management" University of California Extension Program, Riverside, California. 2005.

Loyola Marymount University

"Fundamentals of Air Pollution - Regulations, Controls and Engineering," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1993.

"Air Pollution Control," Loyola Marymount University, Dept. of Civil Engineering, Fall 1994.

"Environmental Risk Assessment," Loyola Marymount University, Dept. of Civil Engineering. Various years since 1998.

"Hazardous Waste Remediation" Loyola Marymount University, Dept. of Civil Engineering. Various years since 2006.

University of Southern California

"Air Pollution Controls," University of Southern California, Dept. of Civil Engineering, Fall 1993, Fall 1994.

"Air Pollution Fundamentals," University of Southern California, Dept. of Civil Engineering, Winter 1994.

University of California, Los Angeles

"Air Pollution Fundamentals," University of California, Los Angeles, Dept. of Civil and Environmental Engineering, Spring 1994, Spring 1999, Spring 2000, Spring 2003, Spring 2006, Spring 2007, Spring 2008, Spring 2009.

International Programs

"Environmental Planning and Management," 5 week program for visiting Chinese delegation, 1994.

"Environmental Planning and Management," 1 day program for visiting Russian delegation, 1995.

"Air Pollution Planning and Management," IEP, UCR, Spring 1996.

"Environmental Issues and Air Pollution," IEP, UCR, October 1996.

PROFESSIONAL AFFILIATIONS AND HONORS

President of India Gold Medal, IIT Kharagpur, India, 1983.

Member of the Alternatives Assessment Committee of the Grand Canyon Visibility Transport Commission, established by the Clean Air Act Amendments of 1990, 1992-present.

American Society of Mechanical Engineers: Los Angeles Section Executive Committee, Heat Transfer Division, and Fuels and Combustion Technology Division, 1987-present.

Air and Waste Management Association, West Coast Section, 1989-present.

PROFESSIONAL CERTIFICATIONS

EIT, California (# XE088305), 1993.

REA I, California (#07438), 2000.

Certified Permitting Professional, South Coast AQMD (#C8320), since 1993.

QEP, Institute of Professional Environmental Practice, since 2000.

CEM, State of Nevada (#EM-1699). Expiration 10/07/2011.

PUBLICATIONS (PARTIAL LIST)

"Physical Properties and Oxidation Rates of Chars from Bituminous Coals," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **67**, 275-283 (1988).

"Char Combustion: Measurement and Analysis of Particle Temperature Histories," with R.C. Flagan, G.R. Gavalas and P.S. Northrop, *Comb. Sci. Tech.* **60**, 215-230 (1988).

"On the Combustion of Bituminous Coal Chars," PhD Thesis, California Institute of Technology (1988).

"Optical Pyrometry: A Powerful Tool for Coal Combustion Diagnostics," *J. Coal Quality*, **8**, 17-22 (1989).

"Post-Ignition Transients in the Combustion of Single Char Particles," with Y.A. Levendis, R.C. Flagan and G.R. Gavalas, *Fuel*, **68**, 849-855 (1989).

"A Model for Single Particle Combustion of Bituminous Coal Char." Proc. ASME National Heat Transfer Conference, Philadelphia, **HTD-Vol. 106**, 505-513 (1989).

"Discrete Simulation of Cenospheric Coal-Char Combustion," with R.C. Flagan and G.R. Gavalas, *Combust. Flame*, **77**, 337-346 (1989).

"Particle Measurements in Coal Combustion," with R.C. Flagan, in "**Combustion Measurements**" (ed. N. Chigier), Hemisphere Publishing Corp. (1991).

"Cross Linking in Pore Structures and Its Effect on Reactivity," with G.R. Gavalas in preparation.

"Natural Frequencies and Mode Shapes of Straight Tubes," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Optimal Tube Layouts for Kamui SL-Series Exchangers," with K. Ishihara, Proprietary Report for Kamui Company Limited, Tokyo, Japan (1990).

"HTRI Process Heater Conceptual Design," Proprietary Report for Heat Transfer Research Institute, Alhambra, CA (1990).

"Asymptotic Theory of Transonic Wind Tunnel Wall Interference," with N.D. Malmuth and others, Arnold Engineering Development Center, Air Force Systems Command, USAF (1990).

"Gas Radiation in a Fired Heater Convection Section," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1990).

"Heat Transfer and Pressure Drop in NTIW Heat Exchangers," Proprietary Report for Heat Transfer Research Institute, College Station, TX (1991).

"NO_x Control and Thermal Design," Thermal Engineering Tech Briefs, (1994).

"From Purchase of Landmark Environmental Insurance to Remediation: Case Study in Henderson, Nevada," with Robin E. Bain and Jill Quillin, presented at the AQMA Annual Meeting, Florida, 2001.

"The Jones Act Contribution to Global Warming, Acid Rain and Toxic Air Contaminants," with Charles W. Botsford, presented at the AQMA Annual Meeting, Florida, 2001.

PRESENTATIONS (PARTIAL LIST)

"Pore Structure and Combustion Kinetics - Interpretation of Single Particle Temperature-Time Histories," with P.S. Northrop, R.C. Flagan and G.R. Gavalas, presented at the AIChE Annual Meeting, New York (1987).

"Measurement of Temperature-Time Histories of Burning Single Coal Char Particles," with R.C. Flagan, presented at the American Flame Research Committee Fall International Symposium, Pittsburgh, (1988).

"Physical Characterization of a Cenospheric Coal Char Burned at High Temperatures," with R.C. Flagan and G.R. Gavalas, presented at the Fall Meeting of the Western States Section of the Combustion Institute, Laguna Beach, California (1988).

"Control of Nitrogen Oxide Emissions in Gas Fired Heaters - The Retrofit Experience," with G. P. Croce and R. Patel, presented at the International Conference on Environmental Control of Combustion Processes (Jointly sponsored by the American Flame Research Committee and the Japan Flame Research Committee), Honolulu, Hawaii (1991).

"Air Toxics - Past, Present and the Future," presented at the Joint AIChE/AAEE Breakfast Meeting at the AIChE 1991 Annual Meeting, Los Angeles, California, November 17-22 (1991).

"Air Toxics Emissions and Risk Impacts from Automobiles Using Reformulated Gasolines," presented at the Third Annual Current Issues in Air Toxics Conference, Sacramento, California, November 9-10 (1992).

"Air Toxics from Mobile Sources," presented at the Environmental Health Sciences (ESE) Seminar Series, UCLA, Los Angeles, California, November 12, (1992).

"Kilns, Ovens, and Dryers - Present and Future," presented at the Gas Company Air Quality Permit Assistance Seminar, Industry Hills Sheraton, California, November 20, (1992).

"The Design and Implementation of Vehicle Scrapping Programs," presented at the 86th Annual Meeting of the Air and Waste Management Association, Denver, Colorado, June 12, 1993.

"Air Quality Planning and Control in Beijing, China," presented at the 87th Annual Meeting of the Air and Waste Management Association, Cincinnati, Ohio, June 19-24, 1994.

Annex A

Expert Litigation Support

1. Occasions where Dr. Sahu has provided Written or Oral testimony before Congress:

- (a) In July 2012, provided expert written and oral testimony to the House Subcommittee on Energy and the Environment, Committee on Science, Space, and Technology at a Hearing entitled “Hitting the Ethanol Blend Wall – Examining the Science on E15.”

2. Matters for which Dr. Sahu has have provided affidavits and expert reports include:

- (b) Affidavit for Rocky Mountain Steel Mills, Inc. located in Pueblo Colorado – dealing with the technical uncertainties associated with night-time opacity measurements in general and at this steel mini-mill.
- (c) Expert reports and depositions (2/28/2002 and 3/1/2002; 12/2/2003 and 12/3/2003; 5/24/2004) on behalf of the United States in connection with the Ohio Edison NSR Cases. *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
- (d) Expert reports and depositions (5/23/2002 and 5/24/2002) on behalf of the United States in connection with the Illinois Power NSR Case. *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
- (e) Expert reports and depositions (11/25/2002 and 11/26/2002) on behalf of the United States in connection with the Duke Power NSR Case. *United States, et al. v. Duke Energy Corp.*, 1:00-CV-1262 (Middle District of North Carolina).
- (f) Expert reports and depositions (10/6/2004 and 10/7/2004; 7/10/2006) on behalf of the United States in connection with the American Electric Power NSR Cases. *United States, et al. v. American Electric Power Service Corp., et al.*, C2-99-1182, C2-99-1250 (Southern District of Ohio).
- (g) Affidavit (March 2005) on behalf of the Minnesota Center for Environmental Advocacy and others in the matter of the Application of Heron Lake BioEnergy LLC to construct and operate an ethanol production facility – submitted to the Minnesota Pollution Control Agency.
- (h) Expert Report and Deposition (10/31/2005 and 11/1/2005) on behalf of the United States in connection with the East Kentucky Power Cooperative NSR Case. *United States v. East Kentucky Power Cooperative, Inc.*, 5:04-cv-00034-KSF (Eastern District of Kentucky).
- (i) Affidavits and deposition on behalf of Basic Management Inc. (BMI) Companies in connection with the BMI vs. USA remediation cost recovery Case.
- (j) Expert Report on behalf of Penn Future and others in the Cambria Coke plant permit challenge in Pennsylvania.
- (k) Expert Report on behalf of the Appalachian Center for the Economy and the Environment and others in the Western Greenbrier permit challenge in West Virginia.
- (l) Expert Report, deposition (via telephone on January 26, 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women’s Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) in the Thompson River Cogeneration LLC Permit No. 3175-04 challenge.

- (m) Expert Report and deposition (2/2/07) on behalf of the Texas Clean Air Cities Coalition at the Texas State Office of Administrative Hearings (SOAH) in the matter of the permit challenges to TXU Project Apollo's eight new proposed PRB-fired PC boilers located at seven TX sites.
- (n) Expert Testimony (July 2007) on behalf of the Izaak Walton League of America and others in connection with the acquisition of power by Xcel Energy from the proposed Gascoyne Power Plant – at the State of Minnesota, Office of Administrative Hearings for the Minnesota PUC (MPUC No. E002/CN-06-1518; OAH No. 12-2500-17857-2).
- (o) Affidavit (July 2007) Comments on the Big Cajun I Draft Permit on behalf of the Sierra Club – submitted to the Louisiana DEQ.
- (p) Expert Report and Deposition (12/13/2007) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
- (q) Expert Reports and Pre-filed Testimony before the Utah Air Quality Board on behalf of Sierra Club in the Sevier Power Plant permit challenge.
- (r) Expert Report and Deposition (October 2007) on behalf of MTD Products Inc., in connection with General Power Products, LLC v MTD Products Inc., 1:06 CVA 0143 (Southern District of Ohio, Western Division)
- (s) Experts Report and Deposition (June 2008) on behalf of Sierra Club and others in the matter of permit challenges (Title V: 28.0801-29 and PSD: 28.0803-PSD) for the Big Stone II unit, proposed to be located near Milbank, South Dakota.
- (t) Expert Reports, Affidavit, and Deposition (August 15, 2008) on behalf of Earthjustice in the matter of air permit challenge (CT-4631) for the Basin Electric Dry Fork station, under construction near Gillette, Wyoming before the Environmental Quality Council of the State of Wyoming.
- (u) Affidavits (May 2010/June 2010 in the Office of Administrative Hearings))/Declaration and Expert Report (November 2009 in the Office of Administrative Hearings) on behalf of NRDC and the Southern Environmental Law Center in the matter of the air permit challenge for Duke Cliffside Unit 6. Office of Administrative Hearing Matters 08 EHR 0771, 0835 and 0836 and 09 HER 3102, 3174, and 3176 (consolidated).
- (v) Declaration (August 2008), Expert Report (January 2009), and Declaration (May 2009) on behalf of Southern Alliance for Clean Energy et al., v Duke Energy Carolinas, LLC. in the matter of the air permit challenge for Duke Cliffside Unit 6. *Southern Alliance for Clean Energy et al., v. Duke Energy Carolinas, LLC*, Case No. 1:08-cv-00318-LHT-DLH (Western District of North Carolina, Asheville Division).
- (w) Declaration (August 2008) on behalf of the Sierra Club in the matter of Dominion Wise County plant MACT.
- (x) Expert Report (June 2008) on behalf of Sierra Club for the Green Energy Resource Recovery Project, MACT Analysis.
- (y) Expert Report (February 2009) on behalf of Sierra Club and the Environmental Integrity Project in the matter of the air permit challenge for NRG Limestone's proposed Unit 3 in Texas.
- (z) Expert Report (June 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*

- (aa) Expert Report (August 2009) on behalf of Sierra Club and the Southern Environmental Law Center in the matter of the air permit challenge for Santee Cooper's proposed Pee Dee plant in South Carolina).
- (bb) Statements (May 2008 and September 2009) on behalf of the Minnesota Center for Environmental Advocacy to the Minnesota Pollution Control Agency in the matter of the Minnesota Haze State Implementation Plans.
- (cc) Expert Report (August 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (dd) Expert Report and Rebuttal Report (September 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.
- (ee) Expert Report (December 2009) and Rebuttal reports (May 2010 and June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).
- (ff) Pre-filed Testimony (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (gg) Pre-filed Testimony (July 2010) and Written Rebuttal Testimony (August 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
- (hh) Expert Report (August 2010) and Rebuttal Expert Report (October 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Liability Phase.
- (ii) Declaration (August 2010), Reply Declaration (November 2010), Expert Report (April 2011), Supplemental and Rebuttal Expert Report (July 2011) on behalf of the United States in the matter of DTE Energy Company and Detroit Edison Company (Monroe Unit 2). *United States of America v. DTE Energy Company and Detroit Edison Company*, Civil Action No. 2:10-cv-13101-BAF-RSW (US District Court for the Eastern District of Michigan).
- (jj) Expert Report and Deposition (August 2010) as well as Affidavit (September 2010) on behalf of Kentucky Waterways Alliance, Sierra Club, and Valley Watch in the matter of challenges to the NPDES permit issued for the Trimble County power plant by the Kentucky Energy and Environment Cabinet to Louisville Gas and Electric, File No. DOW-41106-047.
- (kk) Expert Report (August 2010), Rebuttal Expert Report (September 2010), Supplemental Expert Report (September 2011), and Declaration (November 2011) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).
- (ll) Written Direct Expert Testimony (August 2010) and Affidavit (February 2012) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
- (mm) Deposition (August 2010) on behalf of Environmental Defense, in the matter of the remanded permit challenge to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).

- (nn) Expert Report, Supplemental/Rebuttal Expert Report, and Declarations (October 2010, November 2010, September 2012) on behalf of New Mexico Environment Department (Plaintiff-Intervenor), Grand Canyon Trust and Sierra Club (Plaintiffs) in the matter of Plaintiffs v. Public Service Company of New Mexico (PNM), Civil No. 1:02-CV-0552 BB/ATC (ACE). (US District Court for the District of New Mexico).
- (oo) Expert Report (October 2010) and Rebuttal Expert Report (November 2010) (BART Determinations for PSCo Hayden and CSU Martin Drake units) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
- (pp) Expert Report (November 2010) (BART Determinations for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) to the Colorado Air Quality Commission on behalf of Coalition of Environmental Organizations.
- (qq) Declaration (November 2010) on behalf of the Sierra Club in connection with the Martin Lake Station Units 1, 2, and 3. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Case No. 5:10-cv-00156-DF-CMC (US District Court for the Eastern District of Texas, Texarkana Division).
- (rr) Pre-Filed Testimony (January 2011) and Declaration (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).
- (ss) Declaration (February 2011) in the matter of the Draft Title V Permit for RRI Energy MidAtlantic Power Holdings LLC Shawville Generating Station (Pennsylvania), ID No. 17-00001 on behalf of the Sierra Club.
- (tt) Expert Report (March 2011), Rebuttal Expert Report (June 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (US District Court for the District of Colorado).
- (uu) Declaration (April 2011) and Expert Report (July 16, 2012) in the matter of the Lower Colorado River Authority (LCRA)'s Fayette (Sam Seymour) Power Plant on behalf of the Texas Campaign for the Environment. *Texas Campaign for the Environment v. Lower Colorado River Authority*, Civil Action No. 4:11-cv-00791 (US District Court for the Southern District of Texas, Houston Division).
- (vv) Declaration (June 2011) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.
- (ww) Expert Report (June 2011) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
- (xx) Declaration (August 2011) in the matter of the Sandy Creek Energy Associates L.P. Sandy Creek Power Plant on behalf of Sierra Club and Public Citizen. *Sierra Club, Inc. and Public Citizen, Inc. v. Sandy Creek Energy Associates, L.P.*, Civil Action No. A-08-CA-648-LY (US District Court for the Western District of Texas, Austin Division).
- (yy) Expert Report (October 2011) on behalf of the Defendants in the matter of *John Quiles and Jeanette Quiles et al. v. Bradford-White Corporation, MTD Products, Inc., Kohler Co., et al.*, Case No. 3:10-cv-747 (TJM/DEP) (US District Court for the Northern District of New York).

- (zz) Declaration (February 2012) and Second Declaration (February 2012) in the matter of *Washington Environmental Council and Sierra Club Washington State Chapter v. Washington State Department of Ecology and Western States Petroleum Association*, Case No. 11-417-MJP (US District Court for the Western District of Washington).
- (aaa) Expert Report (March 2012) and Supplemental Expert Report (November 2013) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (US District Court for the Southern District of Texas, Houston Division).
- (bbb) Declaration (March 2012) in the matter of *Center for Biological Diversity, et al. v. United States Environmental Protection Agency*, Case No. 11-1101 (consolidated with 11-1285, 11-1328 and 11-1336) (US Court of Appeals for the District of Columbia Circuit).
- (ccc) Declaration (March 2012) in the matter of *Sierra Club v. The Kansas Department of Health and Environment*, Case No. 11-105,493-AS (Holcomb power plant) (Supreme Court of the State of Kansas).
- (ddd) Declaration (March 2012) in the matter of the Las Brisas Energy Center *Environmental Defense Fund et al., v. Texas Commission on Environmental Quality*, Cause No. D-1-GN-11-001364 (District Court of Travis County, Texas, 261st Judicial District).
- (eee) Expert Report (April 2012), Supplemental and Rebuttal Expert Report (July 2012), and Supplemental Rebuttal Expert Report (August 2012) on behalf of the states of New Jersey and Connecticut in the matter of the Portland Power plant *State of New Jersey and State of Connecticut (Intervenor-Plaintiff) v. RRI Energy Mid-Atlantic Power Holdings et al.*, Civil Action No. 07-CV-5298 (JKG) (US District Court for the Eastern District of Pennsylvania).
- (fff) Declaration (April 2012) in the matter of the EPA's EGU MATS Rule, on behalf of the Environmental Integrity Project
- (ggg) Expert Report (August 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana) – Harm Phase.
- (hhh) Declaration (September 2012) in the Matter of the Application of *Energy Answers Incinerator, Inc.* for a Certificate of Public Convenience and Necessity to Construct a 120 MW Generating Facility in Baltimore City, Maryland, before the Public Service Commission of Maryland, Case No. 9199.
- (iii) Expert Report (October 2012) on behalf of the Appellants (Robert Concilus and Leah Humes) in the matter of Robert Concilus and Leah Humes v. Commonwealth of Pennsylvania Department of Environmental Protection and Crawford Renewable Energy, before the Commonwealth of Pennsylvania Environmental Hearing Board, Docket No. 2011-167-R.
- (jjj) Expert Report (October 2012), Supplemental Expert Report (January 2013), and Affidavit (June 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
- (kkk) Pre-filed Testimony (October 2012) on behalf of No-Sag in the matter of the North Springfield Sustainable Energy Project before the State of Vermont, Public Service Board.
- (lll) Pre-filed Testimony (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
- (mmm) Expert Report (February 2013) on behalf of Petitioners in the matter of Credence Crematory, Cause No. 12-A-J-4538 before the Indiana Office of Environmental Adjudication.

- (nnn) Expert Report (April 2013), Rebuttal report (July 2013), and Declarations (October 2013, November 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
- (ooo) Expert Report (May 2013) and Rebuttal Expert Report (July 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
- (ppp) Declaration (August 2013) on behalf of A. J. Acosta Company, Inc., in the matter of A. J. Acosta Company, Inc., v. County of San Bernardino, Case No. CIVSS803651.
- (qqq) Comments (October 2013) on behalf of the Washington Environmental Council and the Sierra Club in the matter of the Washington State Oil Refinery RACT (for Greenhouse Gases), submitted to the Washington State Department of Ecology, the Northwest Clean Air Agency, and the Puget Sound Clean Air Agency.
- (rrr) Statement (November 2013) on behalf of various Environmental Organizations in the matter of the Boswell Energy Center (BEC) Unit 4 Environmental Retrofit Project, to the Minnesota Public Utilities Commission, Docket No. E-015/M-12-920.
- (sss) Expert Report (December 2013) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
- (ttt) Expert Testimony (December 2013) on behalf of the Sierra Club in the matter of Public Service Company of New Hampshire Merrimack Station Scrubber Project and Cost Recovery, Docket No. DE 11-250, to the State of New Hampshire Public Utilities Commission.
- (uuu) Expert Report (January 2014) on behalf of Baja, Inc., in *Baja, Inc., v. Automotive Testing and Development Services, Inc. et. al*, Civil Action No. 8:13-CV-02057-GRA (District of South Carolina, Anderson/Greenwood Division).
- (vvv) Declaration (March 2014) on behalf of the Center for International Environmental Law, Chesapeake Climate Action Network, Friends of the Earth, Pacific Environment, and the Sierra Club (Plaintiffs) in the matter of Plaintiffs v. the Export-Import Bank (Ex-Im Bank) of the United States, Civil Action No. 13-1820 RC (United States District Court for the District of Columbia).
- (www) Direct Prefiled Testimony (June 2014) on behalf of the Michigan Environmental Council and the Sierra Club in the matter of the Application of DTE Electric Company for Authority to Implement a Power Supply Cost Recovery (PSCR) Plan in its Rate Schedules for 2014 Metered Jurisdictional Sales of Electricity, Case No. U-17319 (Michigan Public Service Commission).
- (xxx) Expert Report (June 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).
- (yyy) Declaration (July 2014) on behalf of Public Health Intervenors in the matter of EME Homer City Generation v. US EPA (Case No. 11-1302 and consolidated cases) relating to the lifting of the stay entered by the Court on December 30, 2011 (US Court of Appeals for the District of Columbia).

3. Occasions where Dr. Sahu has provided oral testimony in depositions, at trial or in similar proceedings include the following:

- (zzz) Deposition on behalf of Rocky Mountain Steel Mills, Inc. located in Pueblo, Colorado – dealing with the manufacture of steel in mini-mills including methods of air pollution control and BACT in steel mini-mills and opacity issues at this steel mini-mill.
- (aaaa) Trial Testimony (February 2002) on behalf of Rocky Mountain Steel Mills, Inc. in Denver District Court.
- (bbbb) Trial Testimony (February 2003) on behalf of the United States in the Ohio Edison NSR Cases, *United States, et al. v. Ohio Edison Co., et al.*, C2-99-1181 (Southern District of Ohio).
- (cccc) Trial Testimony (June 2003) on behalf of the United States in the Illinois Power NSR Case, *United States v. Illinois Power Co., et al.*, 99-833-MJR (Southern District of Illinois).
- (dddd) Deposition (10/20/2005) on behalf of the United States in connection with the Cinergy NSR Case. *United States, et al. v. Cinergy Corp., et al.*, IP 99-1693-C-M/S (Southern District of Indiana).
- (eeee) Oral Testimony (August 2006) on behalf of the Appalachian Center for the Economy and the Environment re. the Western Greenbrier plant, WV before the West Virginia DEP.
- (ffff) Oral Testimony (May 2007) on behalf of various Montana petitioners (Citizens Awareness Network (CAN), Women’s Voices for the Earth (WVE) and the Clark Fork Coalition (CFC)) re. the Thompson River Cogeneration plant before the Montana Board of Environmental Review.
- (gggg) Oral Testimony (October 2007) on behalf of the Sierra Club re. the Sevier Power Plant before the Utah Air Quality Board.
- (hhhh) Oral Testimony (August 2008) on behalf of the Sierra Club and Clean Water re. Big Stone Unit II before the South Dakota Board of Minerals and the Environment.
- (iiii) Oral Testimony (February 2009) on behalf of the Sierra Club and the Southern Environmental Law Center re. Santee Cooper Pee Dee units before the South Carolina Board of Health and Environmental Control.
- (jjjj) Oral Testimony (February 2009) on behalf of the Sierra Club and the Environmental Integrity Project re. NRG Limestone Unit 3 before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (kkkk) Deposition (July 2009) on behalf of MTD Products, Inc., in the matter of *Alice Holmes and Vernon Holmes v. Home Depot USA, Inc., et al.*
- (llll) Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Coletto Creek coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (mmmm) Deposition (October 2009) on behalf of Environmental Defense, in the matter of permit challenges to the proposed Las Brisas coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (nnnn) Deposition (October 2009) on behalf of the Sierra Club, in the matter of challenges to the proposed Medicine Bow Fuel and Power IGL plant in Cheyenne, Wyoming.
- (oooo) Deposition (October 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed Tenaska coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH). (April 2010).
- (pppp) Oral Testimony (November 2009) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.

- (qqqq) Deposition (December 2009) on behalf of Environmental Defense and others, in the matter of challenges to the proposed White Stallion Energy Center coal fired power plant project at the Texas State Office of Administrative Hearings (SOAH).
- (rrrr) Oral Testimony (February 2010) on behalf of the Environmental Defense Fund re. the White Stallion Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (ssss) Deposition (June 2010) on behalf of the United States in connection with the Alabama Power Company NSR Case. *United States v. Alabama Power Company*, CV-01-HS-152-S (Northern District of Alabama, Southern Division).
- (tttt) Trial Testimony (September 2010) on behalf of Commonwealth of Pennsylvania – Dept. of Environmental Protection, State of Connecticut, State of New York, State of Maryland, and State of New Jersey (Plaintiffs) in connection with the Allegheny Energy NSR Case in US District Court in the Western District of Pennsylvania. *Plaintiffs v. Allegheny Energy Inc., et al.*, 2:05cv0885 (Western District of Pennsylvania).
- (uuuu) Oral Direct and Rebuttal Testimony (September 2010) on behalf of Fall-Line Alliance for a Clean Environment and others in the matter of the PSD Air Permit for Plant Washington issued by Georgia DNR at the Office of State Administrative Hearing, State of Georgia (OSAH-BNR-AQ-1031707-98-WALKER).
- (vvvv) Oral Testimony (September 2010) on behalf of the State of New Mexico Environment Department in the matter of Proposed Regulation 20.2.350 NMAC – *Greenhouse Gas Cap and Trade Provisions*, No. EIB 10-04 (R), to the State of New Mexico, Environmental Improvement Board.
- (wwww) Oral Testimony (October 2010) on behalf of the Environmental Defense Fund re. the Las Brisas Energy Center before the Texas State Office of Administrative Hearings (SOAH) Administrative Law Judges.
- (xxxx) Oral Testimony (November 2010) regarding BART for PSCo Hayden, CSU Martin Drake units before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
- (yyyy) Oral Testimony (December 2010) regarding BART for TriState Craig Units, CSU Nixon Unit, and PRPA Rawhide Unit) before the Colorado Air Quality Commission on behalf of the Coalition of Environmental Organizations.
- (zzzz) Deposition (December 2010) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
- (aaaaa) Deposition (February 2011 and January 2012) on behalf of Wild Earth Guardians in the matter of opacity exceedances and monitor downtime at the Public Service Company of Colorado (Xcel)'s Cherokee power plant. No. 09-cv-1862 (D. Colo.).
- (bbbbb) Oral Testimony (February 2011) to the Georgia Office of State Administrative Hearings (OSAH) in the matter of Minor Source HAPs status for the proposed Longleaf Energy Associates power plant (OSAH-BNR-AQ-1115157-60-HOWELLS) on behalf of the Friends of the Chattahoochee and the Sierra Club).
- (ccccc) Deposition (August 2011) on behalf of the United States in *United States of America v. Cemex, Inc.*, Civil Action No. 09-cv-00019-MSK-MEH (US District Court for the District of Colorado).
- (ddddd) Deposition (July 2011) and Oral Testimony at Hearing (February 2012) on behalf of the Plaintiffs MYTAPN in the matter of Microsoft-Yes, Toxic Air Pollution-No (MYTAPN) v. State of

Washington, Department of Ecology and Microsoft Corporation Columbia Data Center to the Pollution Control Hearings Board, State of Washington, Matter No. PCHB No. 10-162.

- (eeeeee) Oral Testimony at Hearing (March 2012) on behalf of the United States in connection with the Louisiana Generating NSR Case. *United States v. Louisiana Generating, LLC*, 09-CV100-RET-CN (Middle District of Louisiana).
- (fffff) Oral Testimony at Hearing (April 2012) on behalf of the New Hampshire Sierra Club at the State of New Hampshire Public Utilities Commission, Docket No. 10-261 – the 2010 Least Cost Integrated Resource Plan (LCIRP) submitted by the Public Service Company of New Hampshire (re. Merrimack Station Units 1 and 2).
- (ggggg) Oral Testimony at Hearing (November 2012) on behalf of Clean Wisconsin in the matter of Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System (ReACT) for Unit 3 of the Weston Generating Station, before the Public Service Commission of Wisconsin, Docket No. 6690-CE-197.
- (hhhhh) Deposition (March 2013) in the matter of various Environmental Petitioners v. North Carolina DENR/DAQ and Carolinas Cement Company, before the Office of Administrative Hearings, State of North Carolina.
- (iiiiii) Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
- (jjjjj) Deposition (August 2013) on behalf of the Sierra Club in connection with the Luminant Martin Lake Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 5:10-cv-0156-MHS-CMC (Eastern District of Texas, Texarkana Division).
- (kkkkk) Deposition (February 2014) on behalf of the United States in *United States of America v. Ameren Missouri*, Civil Action No. 4:11-cv-00077-RWS (Eastern District of Missouri, Eastern Division).
- (lllll) Trial Testimony (February 2014) in the matter of *Environment Texas Citizen Lobby, Inc and Sierra Club v. ExxonMobil Corporation et al.*, Civil Action No. 4:10-cv-4969 (US District Court for the Southern District of Texas, Houston Division).
- (mmmmm) Trial Testimony (February 2014) on behalf of the Sierra Club in connection with the Luminant Big Brown Case. *Sierra Club v. Energy Future Holdings Corporation and Luminant Generation Company LLC*, Civil Action No. 6:12-cv-00108-WSS (Western District of Texas, Waco Division).
- (nnnnn) Deposition (June 2014) and Trial (August 2014) on behalf of ECM Biofilms in the matter of the US Federal Trade Commission (FTC) v. ECM Biofilms (FTC Docket #9358).

**NORTHERN CHEYENNE TRIBE
OF THE
NORTHERN CHEYENNE INDIAN RESERVATION**



SURFACE WATER QUALITY STANDARDS

Prepared by
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NORTHERN CHEYENNE TRIBE

SURFACE WATER QUALITY STANDARDS

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NORTHERN CHEYENNE TRIBE SURFACE WATER QUALITY STANDARDS

Chapter 1

PART I. GENERAL PROVISIONS

1.1.1 Purpose

A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by protecting water quality through antidegradation provisions. The Northern Cheyenne Tribe is adopting these standards to protect public health and welfare, enhance the quality of water and serve the purposes of the Federal Clean Water Act.

These standards will specifically serve the dual function of:

- (1). Assessment. A primary purpose of these water quality standards is to guide, and inform efforts to monitor and assess surface water quality within the Reservation. These water quality standards play a central role in the Tribe's water quality protection program, and have broad application and use in evaluating potential impacts on water quality from a broad range of causes and sources.
- (2). Regulatory Controls. Any regulatory pollution controls established by the Tribe or the Federal Government must be developed to ensure a level of water quality that will satisfy these water quality standards. Regulatory pollution controls established for pollution sources shall be consistent with applicable portions of the Federal Clean Water Act.

1.1.2 Authority

These rules are adopted by the Tribal Council upon recommendation of the Northern Cheyenne Environmental Protection Department, under authority of the Constitution of the Northern Cheyenne Tribe and Tribal Administrative Procedures Ordinance.

1.1.3 Severability

If any word, phrase, clause, sentence, paragraph, section, or other part of these rules is held invalid by any court of competent jurisdiction, such judgment shall affect only that portion held invalid.

1.1.4 Other Law

These rules in no manner supersede or negate the necessity of any person to obtain permits or conduct such environmental studies as may be required by Federal or Tribal authorities for any conduct or activity affecting or potentially affecting Reservation waters.

1.1.5 **Review and Revision of Standards**

Standards will be reviewed and revised in accordance with applicable sections of the Federal Clean Water Act and Tribal Administrative Procedures Ordinance.

PART II. PROCEDURES

1.2.1 **Water Quality Standards and Antidegradation Policy**

The rule-making procedures found in the Tribal Administrative Procedures Ordinance, Part IV, Sections 7-12, will be followed with respect to the classification and adoption of water quality standards for, and antidegradation policy decisions regarding, Reservation waters, defined as all surface water bodies of the Northern Cheyenne Reservation.

PART III. SURFACE WATER QUALITY STANDARDS

1.3.1 **Policy**

The following standards are adopted to preserve, protect and maintain the chemical, physical, and biological integrity of the surface waters and wetlands of the Northern Cheyenne Reservation and shall be effective thirty days after adoption for Tribal law, pursuant to the Tribal Administrative Procedures Ordinance.

1.3.2 **Application and Composition of Surface Water Quality Standards**

The standards in this Part are adopted to establish maximum allowable levels or concentrations of pollutants and provide a basis for protecting water quality that is better than standards required for surface water quality and to establish a basis for limiting the introduction of pollutants which could affect existing or designated uses of Reservation surface waters.

Current copies of this material may be obtained from the **Northern Cheyenne Tribe, Environmental Protection Department, P.O. Box 128, Lame Deer, Montana 59043, phone (406) 477-6506.**

1.3.3 **Definitions**

In this Part, the following terms have the meanings indicated below:

- (1). "Artificial wetland" means a landscape feature where hydrophytic vegetation may be present as a result of human modifications to the landscape of hydrology and for which there is no prior wetland or stream history.
- (2). "Assimilative capacity" means the increment of water quality (in terms of concentration), during the appropriate critical condition(s), that is better than the applicable numeric criterion.
- (3). "Best Management Practices" ("BMP's") means schedules of activities, operational practices, maintenance procedures, and other management practices adopted by rule or incorporated by an agency as a condition of a permit or contract to prevent or reduce the pollution of Reservation waters. Best Management Practices may also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
- (4). "Contaminated sediments" means sediments containing any of the specifically regulated toxic pollutants included in the Tribal Criteria Chart and any other materials in concentrations or combinations which are toxic to human, animal, plant or aquatic life.
- (5). "Conventional water treatment" means, in order of application, the processes of coagulation, sedimentation, filtration and disinfecting. It may also include taste and odor control and lime softening.
- (6). "Deleterious substances" means any physical, chemical or biological materials in concentrations or amounts that do or could impair existing or designated uses of Reservation surface waters.
- (7). "Department" means the Tribal Environmental Protection Department which will administer the water quality standards for the Northern Cheyenne Tribe.
- (8). "Designated use" means those beneficial uses of Reservation waters which are specified under sections 1.3.4 whether or not they are being attained. In addition, it is the intent of these regulations that all "existing uses", as defined under 1.3.3 (10) be designated as they become known.
- (9). "Discharge" means any addition of pollutants or combination of pollutants to Reservation waters from any point source.
- (10). "EPA" means the United States Environmental Protection Agency.
- (11). "Ephemeral stream" means a stream or part of a stream which flows only in direct response to precipitation in the immediate watershed or in

response to the melting of a cover of snow and ice and whose channel bottom is always above the local water table.

- (12). "Existing use" means a use actually attained in the water body on or after November 28, 1975, whether or not it is a designated use and included in water quality standards.
- (13). "Geometric mean" means the value obtained by taking the nth root of the product of the measured values where zero values for measured values are taken to be the detection limit.
- (14). "Intermittent stream" means a stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground water discharge.
- (15). "Mitigation project" means the restoration, enhancement or creation of wetlands to compensate for adverse impacts to other wetlands.
"Mitigation project" includes using credits from a wetland mitigation bank.
- (16). "Naturally occurring" means the range, mean, mode and other appropriate descriptors of seasonal water quality in Reservation waters occurs at levels over which humans have no control.
- (17). "Outstanding Tribal Resource Waters" (OTRW) means waters that because of their quality, location and significance constitute an outstanding Tribal resource, recognized as possessing special ecological, cultural, aesthetic, educational, recreational or scientific qualities.
- (18). "Perennial Stream" means a stream or reach of a stream that flows continuously. They are generally fed in part by springs. Surface water elevations are commonly lower than water table elevations in adjacent soils.
- (19). "Person" means an individual, association, partnership, corporation, commercial or professional establishment, firm, agency, or any agent or employee thereof.
- (20). "Pesticide" means any insecticide, herbicide, rodenticide, fungicide or any substance or mixture of substances intended for preventing, destroying, repelling, altering life processes, or controlling insects, rodents, nematodes, fungi, weeds and other undesirable forms of plant and animal life.
- (21). "Pollutant" means dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded

equipment, rock, sand, cellar dirt, or any industrial, municipal, and agricultural wastes discharged into water.

- (22). “Practicable alternatives” means available and capable of being implemented after taking into consideration cost, available technology and logistics in light of overall project purposes.
- (23). “Regulated Activity “ means any activity that requires a permit or a water quality certification pursuant to federal law (e.g. CWA §402 NPDES permits, CWA §404 dredge and fill permits, FERC licenses, any activity requiring a CWA §401 certification), and any other activities (which may include nonpoint sources of pollution) where tribal regulations specify that an antidegradation review is required.
- (24). “Sediment” means solid material settled from suspension in a liquid; mineral or organic solid material that is being transported or has been moved from its site of origin by air, water or ice and has come to rest on the earth’s surface, either above or below sea level; or inorganic or organic particles originating from weathering, chemical precipitation or biological activity.
- (25). “Settleable solids” means inorganic or organic particles that are being transported or have been transported by water from the site or sites of origin and are settled or are capable of being settled from suspension.
- (26). “State” means the State of Montana.
- (27). “Surface waters” means any waters on the surface of the Reservation, including but not limited to streams and rivers, (perennial, intermittent, and ephemeral), lakes, ponds, wetlands, reservoirs, and irrigation and drainage systems discharging to a stream, lake, pond, wetland, reservoir or other surface water. Treatment works used solely for treating, transporting or impounding pollutants are not considered surface water.
- (28). “Toxic substances” means those in EPA’s most recently published list of toxic pollutants in the National Recommended Water Quality Criteria – Correction, EPA 822-Z-99-001, April 1999 and updates to that document published prior to the date of this rule and any material in concentrations and combinations which are toxic or harmful to human, animal, plant or aquatic life.
- (29). “Tribe” means the Northern Cheyenne Indian Tribe.
- (30). “True color” means the color of water from which turbidity has been removed.

- (31). “Turbidity” means a condition in water or wastewater caused by the presence of suspended matter resulting in the scattering and absorption of light rays.
- (32). “Use Attainability Analysis” means a structured scientific assessment of the factors affecting the attainment of a use. The assessment may include evaluation of physical, chemical, biological and economic factors as described in the federal water quality standards regulation at 40 CFR Part 131.10(g). A use attainability analysis may be used to determine whether or not a use is attainable were it not for natural or anthropogenic conditions that are not reparable within a 20-year planning period.
- (33). “Water dependency” or “wetland dependency” means the activity is of a nature that requires location in or adjacent to surface waters or wetlands to fulfill its basic purpose.
- (34). “Water Quality Standards” means those provisions of Tribal or Federal law which consist of a designated use or uses for the waters of the United States, water quality criteria for such water based upon such uses, and an antidegradation policy. Water quality standards are to protect public health and welfare, enhance the quality of the water and serve the purposes of the Federal Clean Water Act.
- (35). “Waters of the tribe” includes those portions of all reservation watersheds within and including the boundary of the reservation, and all ponds, reservoirs, streams, springs, wells, marshes, watercourses, drainage systems and other surface of ground water, natural or artificial, tribal or allotted, within the reservation or its jurisdiction.
- (36). “Wetland mitigation bank” means a system of accounting for wetland loss and compensation that includes one or more sites where wetlands are restored, enhanced or created to provide transferable credits to be subsequently applied to compensate for adverse impacts to other wetlands.
- (37). “Wetlands” means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils conditions, including lotic, riparian, and lentic, pothole, wetlands. Wetlands are recognized as “Waters of the tribe.”

1.3.4

Tribal Beneficial Use Classifications

The federal water quality standards regulation at 40 CFR Part 131.10 requires that the Tribe specify appropriate water uses to be achieved and protected. The Classification of Tribal waters must consider the use and value of the waters for public water supplies, protection and propagation of fish, shellfish and wildlife,

recreation in and on the waters, agriculture, industry and other purposes. The Tribe will use the following beneficial use classifications in meeting that requirement and designating appropriate uses for Tribal waters.

- (1). Class 1 Cold Water Salmonid Propagation – Provides for protection, propagation and growth of Salmonid fishes, as well as protection, growth and propagation of associated aquatic life normally found where summer water temperatures do not often exceed 20 degrees C.
- (2). Class 2 Cold Water Salmonid Growth – Provides for protection and growth of salmonid fishes as well as protection, propagation, and growth of associated aquatic life normally found in water where the summer water temperature does not often exceed 20 degrees C. However, due to physical habitat limitations or uncorrectable water quality conditions, these waters do not support propagation of salmonid fishes.
- (3). Class 1 Cool Water Propagation – Provides for protection, propagation, and growth of cool water fishes, as well as protection, growth, and propagation of associated aquatic life normally found in waters where the summer temperatures do not often exceed 25 degrees C.
- (4). Class 2 Cool Water Marginal Propagation - Provides for protection, marginal propagation, and growth of cool water fishes, as well as protection, propagation, and growth of associated aquatic life normally found in waters where the summer temperatures do not often exceed 30 degrees C. However due to physical habitat limitations or uncorrectable water quality conditions, these waters provide or have the potential to provide for only marginal propagation of cool water fishes.
- (5). Class 1 Warm Water Propagation – Provides for protection, propagation and growth of warm water fishes as well as propagation and growth of associated aquatic life normally found where surface water temperatures do not often exceed 35 degrees C.
- (6). Class 2 Warm Water Marginal Propagation – Provides for the protection, marginal propagation and growth of warm water fishes as well as protection, propagation and growth of associated aquatic life where summer temperature do not often exceed 35 degrees C. However, due to physical habitat or uncorrectable water quality conditions, these waters provide for only marginal propagation of warm water fishes.
- (7). Class 1 Aquatic Life other than Fish – Provides for the protection, propagation and growth of a wide variety of aquatic invertebrate biota, including sensitive species. These are small perennial headwater streams, intermittent streams or springs which due to natural habitat conditions, water flows or levels, or uncorrectable water quality conditions do not support nor have the potential to support fish.

- (8). Class 2 Aquatic Life other than Fish - These are waters not capable of sustaining a wide variety of invertebrate aquatic biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that substantially limit the diversity of species.
- (9). Full Contact Recreation - These surface waters are suitable or intended to become suitable for recreational activities in or on the water when the ingestion of small quantities of water is likely to occur. Such waters include but are not limited to those used for bathing, swimming, and ceremonial uses.
- (10). Incidental Contact Recreation - These surface waters are suitable or intended to become suitable for recreational activities on or about the water which are not included in the full contact category, including but not limited to fishing, wading and other streamside recreation.
- (11). Public Water Supply - These surface waters are suitable or intended to become suitable for drinking, culinary and food processing purposes, after conventional treatment for naturally present impurities.
- (12). Wildlife - These surface waters are suitable for all furbearers and waterfowl.
- (13). Agriculture - These surface waters are suitable or intended to become suitable for crops usually grown on the reservation and are not hazardous as drinking water for livestock.
- (14). Industrial - These are waters suitable for industrial processes and cooling water.
- (15). Cultural – These waters are suitable for cultural, ceremonial, and religious uses to support and maintain the way of life and traditional activities practiced on the Northern Cheyenne Reservation. These activities include, but are not limited to cultural, spiritual, and medicinal practices which include the preservation and utilization of riparian habitat, as well as associated wetland species, significant to the cultural values of the Northern Cheyenne Tribe. These practices may include full contact and incidental contact with surface waters.
- (16). Wetlands – These surface waters are suitable for maintaining and restoring natural wetland characteristics and functions, within the natural range of variation of the wetland.

All reservation surface waters may be assigned one or more of the designated uses shown in Table 1 of Appendix B.

1.3.5

Narrative Water Quality Criteria

- A. Reservation surface waters must be free from substances which are or may become injurious to public health, safety, welfare, or any of the designated or existing beneficial uses. Such substances may or will:
- (1). Settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
 - (2). Create floating debris, scum, a visible oil film (or oil be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
 - (3). Produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
 - (4). Create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life except for pesticide application as described in this section below and,
 - (5). Create conditions which produce undesirable aquatic life.
- B. No pollutants may be discharged which, either alone or in combination with other pollutants, will cause exceedances of surface water quality standards or criteria.
- C. In all public water supply watersheds, detailed plans and specifications for the construction and operation of roads will be submitted to the Department for its written approval no less than 60 days prior to the day on which it is desired to commence road construction. Such approval must be obtained in writing prior to commencement of such construction.
- D. Leaching pads, tailing ponds, or water, waste, or product holding facilities utilized in the processing of natural resources must be located, constructed, operated and maintained in such a manner and be constructed of materials which prevent the discharge, seepage, drainage, infiltration, or flow which cause, threaten or allow pollution of surface waters. The Department may require that a monitoring system be installed and operated if the Department determines that pollutants may reach surface waters or present a substantial risk to public health.
- E. Complete plans and specifications for proposed leaching pads, tailing ponds, or water, waste, or product holding facilities must be submitted to the Department no less than 60 days prior to the proposed commencement of construction. Prior to commencement of construction, written Departmental approval must be obtained.
- F. Application of pesticides in or adjacent to Reservation surface waters must be in strict compliance with the labeled directions for use of the pesticide and other relevant requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and other Federal or Tribal laws which apply.

Pesticide application must not impact the structure or function of indigenous or intentionally introduced aquatic and wildlife communities. Application of pesticides and/ or herbicides within 100 feet of all surface waters must have detailed plans for proposed activity and written approval from the Department prior to application.

1.3.6 **Sampling Methods**

Methods of sample collection, preservation and analysis used to determine compliance with the applicable water quality standards will comply with the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association, the Northern Cheyenne Quality Assurance Project Plans approved for the Reservation in accordance with the EPA guidelines, or be in accordance with tests or procedures that have been found to be equivalent or more applicable by the EPA as set forth in 40 C.F.R. 141.23 and 40 C.F.R. 136, including any other applicable EPA guidance.

1.3.7 **Biological Standards**

It is the goal of the Tribal Council that all surface waters of the Reservation shall be free from substances in concentrations or combinations which will adversely impact the structure or function of indigenous or intentionally introduced aquatic and wildlife communities.

1.3.8 **Water Quality Standards for Wetlands**

Subchapter I –Standards

A. Purpose.

(1). The purpose of this chapter is to establish water quality standards for wetlands of the Northern Cheyenne Reservation. This is to be included with the Northern Cheyenne Surface Water Quality Standards.

(2). Water quality standards are intended to protect tribal rights and interest, tribal health and welfare and the present and prospective uses of all waters of the tribe for tribal and member water supplies, propagation of fish and other aquatic life and wild and domestic animals, preservation of natural flora and fauna, domestic and recreational uses, and agricultural, commercial and cultural uses. In all cases associated with wetland areas, where the potential beneficial uses classified in Section 1.3.4, are in conflict with potential uses identified in the proposed Water Quality Standards for Wetlands, these water quality standards for wetlands shall be administered to protect the tribal interest for water quality.

(3). This subchapter sets forth the conditions necessary to protect water quality related functions and values of wetlands including sediment and pollutant attenuation, storm and flood water retention, hydrologic cycle maintenance,

shoreline and streambank protection against erosion, biological diversity and production, as well as, tribal cultural and recreational uses.

(4). Water quality standards serve as a basis for developing and implementing strategies to achieve legislative policies and goals. These standards also serve as a basis for potential decisions in regulatory, permitting, planning or funding activities which may impact water quality including wetlands.

(5). Narrative Water Quality Standards and anti-degradation policies as outlined in the Northern Cheyenne Surface Water Quality Standards apply to wetlands of the Northern Cheyenne Reservation.

B. Wetland water quality standards.

(1). To protect, preserve, restore and enhance the quality of waters in wetland and other waters of the tribe influenced by wetlands, the following water quality related functional values or uses of wetlands, within the range of natural variation of the affected wetland, shall be protected:

- (a). Storm and flood water storage and retention and the moderation of water level fluctuation extremes;
- (b). Hydrologic functions including the maintenance of dry season stream flow, the discharge of groundwater to a wetland, the recharge of groundwater from a wetland to another area and the flow of groundwater through a wetland;
- (c). Filtration or storage of sediments, nutrients or toxic substances that would otherwise adversely impact the quality of other waters of the tribe;
- (d). Shoreline protection against erosion through the dissipation of wave energy and water velocity and anchoring of sediments;
- (e). Habitat for aquatic organisms in the food web including, but not limited to fish, crustaceans, mollusks, insects, annelids, planktonic organisms and the plants and animals upon which these aquatic organisms feed and depend upon for their development in all life stages;
- (f). Habitat for resident and transient wildlife species, including mammals, birds, reptiles and amphibians for breeding, resting, nesting, escape cover, travel corridors and food; and
- (g). Recreational, culturally significant wetland plant species, educational, scientific and natural scenic beauty values and uses.

(2). The following criteria shall be used to assure the maintenance or enhancement of the functional values and uses identified in sub. (1):

- (a). Liquids, fill or other solids or gas may not be present in amounts which may cause significant adverse impacts to wetlands;
- (b). Floating or submerged debris, oil or other material(s) may not be present in amounts which may interfere with tribal rights or interest or which may cause significant adverse impacts to wetlands;

- (c). Materials producing color, odor, taste or unsightliness may not be present in amounts which may cause significant adverse impacts to wetlands;
 - (d). Concentrations or combinations of substances which are toxic or harmful to human, animal or plant life may not be present in amounts which individually or cumulatively may cause significant adverse impacts to wetlands;
 - (e). Hydrological conditions necessary to support the biological and physical characteristics naturally present in wetlands shall be protected to prevent significant adverse impacts on:
 - (i). Water currents, erosion, or sedimentation patterns;
 - (ii). Water temperature variations;
 - (iii). The chemical, nutrient and dissolved oxygen regime of the wetland;
 - (iv). The movement of aquatic flora and/or fauna;
 - (v). The pH of the wetland; and
 - (vi). Water levels or elevations.
 - (f). Existing habitats and the populations of wetland animals and vegetation shall be maintained by:
 - (i). Protecting food supplies for fish and wildlife;
 - (ii). Protecting reproductive and nursery areas, and
 - (iii). Preventing conditions conducive to the establishment or proliferation of nuisance organisms.
- (3). The following numeric criteria shall apply to wetlands that contain any of the following culturally significant wetland plant species:
- (a). Sodium Adsorption Ratio (SAR) shall not exceed 2.0
 - (b). pH range shall remain within 6.9 and 8.9.
 - (i). June/Service Berry, *Amelanchier alnifolia*
 - (ii). Red Osier Dogwood, *Cornus stolonifera*
 - (iii). Common spikerush, *Eleocharis palustris*
 - (iv). Horsetail, Field, *Equisetum arvense*
 - (v). Wild licorice, *Glycyrrhiza lepidota*
 - (vi). Goose Berry, red shoot, *Ribes setosum*
 - (vii). Mint/Field, *Mentha arvensis*
 - (viii). Horsemint, *Monarda fistulosa*
 - (ix). Water plant, *Nasturtium officinale*
 - (x). Sweet Medicine, ***Oxtropis (lambertii)***
 - (xi). Chokecherry, *Prunus virginiana*
 - (xii). Cottonwood, *Populus deltoides*
 - (xiii). Box elder, *Acer negundo*
 - (xiv). Green ash, *Fraxinus pennsylvanica*
 - (xv). Sandbar willow, *Salix exigua*
 - (xvi). Snow berry, *Symphoricarpos occidentalis*
 - (xvii). Cattail, *Typha latifolia*
 - (xviii). Wild Plum, *Prunus americana*
 - (xiv). Sweet Grass, *Hierochloe odorata*

- (xx). Quaking aspen, *Populus tremuloides*
- (xxi). Saw beak sedge, *Carex stipata*
- (xxii). Leafy aster, *Aster foliacius*
- (xxiii). Stinging nettle, *Urtica dioica*
- (xxiv). Bulrush, *Scirpus nevadensis*
- (xxv). Arrow leaf, *Sagittaria latifolia*
- (xxvi). Golden currant, *Ribes aureum*
- (xxvii). Skunkbush sumac, *Rhus Tribobata*
- (xxviii). Milkweed, showy, *Asclepias speciosa*
- (xxiv). Western yarrow, *Achilliea millefolium*
- (xxx). Raspberry, red, *Rubes idaes*
- (xxxi). Rose bush, *Rosa arkansana*

C. Wetlands in areas of special natural resource interest. Wetlands in areas of special natural resource interest include those wetlands both within the boundary of designated areas of special natural resource interest, such as outstanding tribal resource waters, and those wetlands which are in proximity to or have a direct hydrologic connection to such designated areas. For the purposes of this chapter, the following are designated as areas of special natural resource interest:

- (1). Cold water communities as defined in the Tribal surface water quality standards, including all salmonid streams and their tributaries;
- (2). Tribal designated wild and scenic rivers and waterways;
- (3). Unique and significant wetlands identified by the Tribe as possessing culturally significant wetlands plant species and areas designated by the United States Environmental Protection Agency under §404, 33USC 1344 (c);
- (4). Calcareous fens (Low, flat, swampy land; bog areas, composed of, containing or characteristic of calcium carbonate, calcium, or limestone; chalky).
- (5). Habitat used by Tribal or federally designated threatened or endangered species;
- (6). Tribal parks, forests, trails and recreation areas;
- (7). Tribal fish and wildlife refuges and fish and wildlife management areas;
- (8). Tribal designated wilderness areas;
- (9). Culturally significant wetland areas;
- (10). Any other surface waters identified as outstanding tribal resources waters (OTRW) in the Tribal surface water quality standards.

(11). Springs (Groundwater issues or discharge at the earth's surface, the formation is resultant of various subsurface conditions).

(12). Seeps (A spot where water trickles out of the ground to form a pool).

Subchapter II –Implementation

A. Purpose.

(1). The purpose of this subchapter is to establish implementation procedures for application of wetland water quality standards contained in Subchapter I.

(2). These procedures are promulgated under the Tribal surface water quality standards.

B. Applicability. The provisions of this chapter shall, subject to the provisions below, apply to all department regulatory, planning, resource management, liaison and financial aid determinations that affect wetlands.

(1). Activities subject to the requirements of the this chapter include, but are not limited to:

- (a). permit reviews, approvals and other actions of the Tribe
- (b). water quality certification
- (c). Department development and management projects.

(2). This chapter shall apply to new or increased point source discharges to wetlands.

(3). Wetland alterations which are directly caused by operations on a metallic mineral prospecting site or mining site shall be regulated pursuant to specific wetland standards under Tribal surface water quality standards.

(4). EXEMPTIONS. A person who proposes a project that may affect an artificial wetland shall notify the department at least 15 working days prior to initiating the project. For purposes of this chapter, the following artificial wetlands are exempt from the provisions of this chapter unless the department notifies the applicant 15 working days from when the department receives the notice of the proposed project from the applicant that the artificial wetland has significant functional values or uses.

- (a). Sedimentation and stormwater detention basins and associated conveyance features operated and maintained only for sediment detention;
- (b). Active sewage lagoons, cooling ponds, waste disposal pits;
- (c). Artificial wetlands within active nonmetallic mining operations.

C. Department determinations.

(1). The department shall review all proposed activities subject to this chapter and shall determine whether the project proponent has shown if activities are in conformance with the provisions of this chapter. The department shall, upon request, meet with a project proponent and other interested persons to make a preliminary assessment of the scope for analysis of alternatives and the potential for compliance with this chapter.

(a). The department shall review the application for completeness within 30 days of receipt of the application. The department shall notify the applicant of any additional information reasonably necessary to review the application. Response time will be within 180 days of receipt of a complete application.

(b). The applicant shall submit, at any time during the review process, additional information which the department finds to be reasonably necessary for review of the application.

(c). The department may rely upon wetland boundary determinations made by other agencies and consultants. If there is a dispute concerning a wetland boundary delineation, the review of the delineation shall be consistent with the procedures identified in the "Corps of Engineers Wetlands Delineation Manual, 1987."

(2). Wetland functional values and the impact of a proposed activity upon those functional values shall be determined using wetland ecological evaluation methods accepted by the department, i.e. riparian health evaluation, and/or 106 Rapid Bioassessments appropriate to the affected wetland (see Appendix F). The department shall consider available land use studies in its determinations.

(3). To protect all present and prospective future uses of wetlands, the following factors shall be considered by the department in making determinations under this section:

(a). Wetland dependency of the proposal;

(b). Practicable alternatives to the proposal which will avoid and minimize adverse impacts to wetlands and will not result in other significant adverse environmental consequences;

(c). Impacts which may result from the activity on the maintenance, protection, restoration or enhancement of standards under the "Wetland water quality standards' section;

(d). Cumulative impacts attributable to the proposed activity which may occur, based upon past or reasonably anticipated impacts on wetland functional values of similar activities in the affected area;

(e). Potential secondary impacts on wetland functional values from the proposed activity;

(f). Any potential adverse impacts to wetlands in areas of special natural resource interest; and

(g). Any potential adverse impact to wetlands in environmentally or culturally sensitive areas and environmental corridors identified in