GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

# Specific Site Assessment for Coal Combustion Waste Impoundments at Basin Electric Antelope Valley Station

**Beulah, North Dakota**

Submitted to:
**U.S. Environmental Protection Agency**
Office of Resource Conservation and Recovery
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Washington, DC 20460


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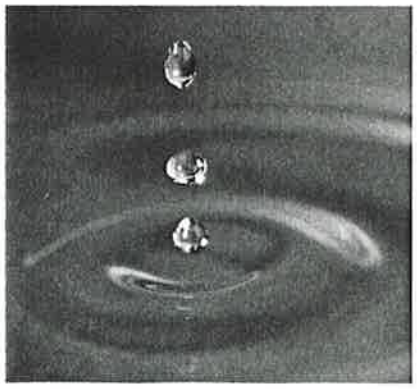


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## Acronym List

| | |
|---|---|
| AVS | Antelope Valley Station |
| CCW | coal combustion waste |
| EPA | U.S. Environmental Protection Agency |
| FEMA | Federal Emergency Management Agency |
| FERC | Federal Energy Regulatory Committee |
| GEI | GEI Consultants, Inc. |
| HDPE | high density polyethylene |
| IDF | inflow design flood |
| MW | megawatts |
| NDDH | North Dakota Department of Health |
| PMF | probable maximum flood |
| PMP | probable maximum precipitation |
| USACE | U.S. Army Corps of Engineers |
| USBR | U.S. Bureau of Reclamation |
| USGS | U.S. Geological Survey |

# 1.0 Introduction

## 1.1 Purpose

This report presents the results of a specific site assessment of the dam safety of coal combustion waste (CCW) impoundments at the Antelope Valley Station (AVS) north of Beulah in Mercer County, North Dakota. The Antelope Valley Station is operated and owned by Basin Electric Power Cooperative. The impoundments are the Spray Drier Ash Water Make-Up Pond (SDA Pond) and the SDA Decantation Pond. The specific site assessment was performed on October 19, 2010.

The specific site assessment was performed with reference to Federal Emergency Management Agency (FEMA) guidelines for dam safety, which includes other federal agency guidelines and regulations (such as U.S. Army Corps of Engineers [USACE] and U.S. Bureau of Reclamation [USBR]) for specific issues, and includes defaults to state requirements where not specifically addressed by federal guidance or if the state requirements were more stringent.

## 1.2 Scope of Work

The scope of work between GEI Consultants, Inc. (GEI) and the U.S. Environmental Protection Agency (EPA) for the specific site assessment is summarized in the following tasks:

1. Acquire and review existing reports and drawings relating to the safety of the project provided by the EPA and Basin Electric.
2. Conduct detailed physical inspections of the project facilities. Document observed conditions on Field Assessment Check Lists provided by EPA for each management unit being assessed.
3. Review and evaluate stability analyses of the project's coal combustion waste impoundment structures.
4. Review the appropriateness of the inflow design flood (IDF), and adequacy of ability to store or safely pass the inflow design flood, provision for any spillways, including considering the hazard potential in light of conditions observed during the inspections or to the downstream channel.
5. Review existing dam safety performance monitoring programs and recommend additional monitoring, if required.
6. Review existing geologic assessments for the projects.
7. Submit draft and final reports.

## 1.3 Authorization

GEI performed the coal combustion waste impoundment assessment as a contractor to the EPA. This work was authorized by EPA under Contract No. EP09W001698, Order No. EP-C10S-00018 between EPA and GEI, dated September 23, 2010.

## 1.4 Project Personnel

The scope of work for this task order was completed by the following personnel from GEI:

| | |
|---|---|
| Ken L. Hardesty, P.E. | Project Engineer/Task Leader |
| Stephen G. Brown, P.E. | Project Manager |
| Gillian M. Hinchliff | Project Geotechnical Engineer |
| Nick Miller, P.E. | Project Water Resources Engineer |
| Jim E. Wright | Project Geologist |

The Program Manager for the EPA was Stephen Hoffman.

## 1.5 Limitation of Liability

This report summarizes the assessment of dam safety of coal combustion waste impoundments SDA Pond and the SDA Decantation Pond at Antelope Valley Station, Beulah, North Dakota. The purpose of each assessment is to evaluate the structural integrity of the impoundments and provide summaries and recommendations based on the available information and on engineering judgment. GEI used a professional standard of practice to review, analyze, and apply pertinent data. No warrantees, express or implied, are provided by GEI. Reuse of this report for any other purpose, in part or in whole, is at the sole risk of the user.

## 1.6 Project Datum

The project coordinate system is identified as North Dakota State Plane South Zone, 1927, and the elevations are based on 1929 Mean Sea Level datum as noted on the drawing titled "Plant Site", dated October 2010, prepared by Basin Electric Power Cooperative.

## 1.7 Prior Inspections

Annual inspections for the CCW impoundments are performed by a North Dakota Department of Health (NDDH) inspector. The NDDH representative present during the site assessment indicated that the annual inspections were intended to assess the environmental conditions of the CCW impoundments and not to assess conditions from a dam safety perspective.

# 2.0 Description of Project Facilities

## 2.1 General

Antelope Valley Station is a coal-fired power plant consisting of two units that generate about 900 megawatts (MW) combined. The power plant is located approximately 8 miles north of Beulah town center in Mercer County, North Dakota (see Figure 1). Both generating units are owned and operated by Basin Electric. Unit 1 went online in 1984 and Unit 2 went online in 1986.

Antelope Valley Station is a dry ash facility. Raw water used in the power plant is pumped from Lake Sakakawea through a 42-inch-diameter pipe and stored in the raw water ponds located on the south side of the site. Water used in the power plant is discharged to the SDA Pond and is reused as make-up water in the ash water system, the $SO_2$ removal system, and coal handling dust suppression systems. Antelope Valley Station does not discharge water to any waterway and is not located on a waterway.

The CCW impoundments are located northeast and north of the power plant. The CCW impoundments include the SDA Pond and the SDA Decantation Pond and are permitted to store fly ash/flue gas emission and bottom ash. The CCW byproducts generated at AVS are hauled to a nearby landfill operated under the same permit issued by the North Dakota Department of Health for the SDA Pond and SDA Decantation Pond. Some of the design records and construction drawings of the impoundments were available for review during the preparation of this report.

## 2.2 Impoundment Dams and Reservoirs

The embankment dams of the two CCW impoundments have not been previously assigned a hazard potential by a state or federal agency. Based on the geometry of the impoundments and the facilities downstream, recommended hazard potential classifications for the impoundments have been developed in Section 4.0 of this report. The basic dimensions and geometry of the CCW impoundments are summarized in Table 2-1.

The SDA Pond was commissioned during construction of the plant. Commissioning activities began in late 1982, with the plant being fully commissioned on April 14, 1983. The SDA Pond provides make-up water for the ash water system, the $SO_2$ removal system and the coal handling dust suppression systems. The major waste sources to the pond are the plants low quality sumps, neutralizing sumps and cooling water blow-down. The coal handling area sumps, $SO_2$ absorber and lime receiving building sumps discharge to the pond intermittently. The pond was originally constructed with a Hypalon liner, and in 1995, the Hypalon liner was replaced with a double layer high density polyethylene (HDPE) leachate collection system. The HDPE leachate collection system collects seepage, which is then pumped back

to the pond. Basin Electric personnel indicated that about 200 gallons per day (gpd) is collected and pumped back into the pond.

The SDA Pond covers 3.1 acres and has a nominal capacity of 28 acre-feet at a maximum design depth of 11 feet. The perimeter embankment is approximately 1,500 linear feet ranging in height from 11 to 12 feet. The SDA Pond has a minimum crest width of 10 feet and typically 3H:1V slopes, except for the east embankment downstream slope which is approximately 2H:1V. A surface water drainage ditch is located at the downstream toe.

The SDA Decantation Pond was first constructed and utilized in 1986, and the pond was first permitted in 1988. The SDA Decantation Pond accepts dredged material and water from the SDA Pond when the SDA Pond is taken off-line and dredged every five to ten years, depending on the accumulated waste volume. The SDA Decantation Pond is re-lined with two feet of compacted clay prior to each time it is used, and according to the design criteria, affords a minimum three feet of freeboard when in use. Construction documentation of compaction tests and permeability tests are available for the compacted clay liner. Permeability tests indicate the specified permeability is $1 \times 10^{-7}$ centimeters per second (cm/sec).

The SDA Decantation Pond covers 3.4 acres with a storage capacity of approximately 18.6 acre-feet. It is impounded by approximately 1,550 linear feet of perimeter embankment dikes approximately 7 to 11 feet high with crest widths of approximately 12 feet. The downstream slopes of the dikes appear to be 5H:1V, except for the west embankment which appears to be about 2H:1V because of the presence of the railroad tracks at the downstream toe. The embankment slopes are either exposed earth or covered with sparse vegetation.

**Table 2-1: Summary Information for Impoundment Dam Parameters**

| Parameter | Value | |
|---|---|---|
| Dam | SDA Pond | SDA Decantation Pond |
| Estimated Maximum Height (ft) | 12[3] | 11[4] |
| Estimated Perimeter Length (ft) | 1,500[5] | 1,550[5] |
| Minimum Crest Width (ft) | 10[3] | 12 |
| Crest Elevation[2] (ft) | 1937 | 1946 |
| Design Side Slopes Upstream/Downstream (H:V) | 3:1/2:1[6] | 5:1/2:1[4] |
| Estimated Freeboard (ft) at time of site visit | 2.7 | 7 |
| Storage Capacity[1] (ac-ft) | 28 | 18.6 |
| Surface Area[1] (acres) | 3.1 | 3.4 |

[1] Surface area and capacity based on CERCLA 104(e) Request for Information prepared by AVS at the request of the EPA, dated August 27, 2009.

[2] Based on drawings "SDA Pond Elevation/Capacity/Area Curves", Sheet Y1-29, and "SDA Decantation Pond", Sheet Y1-17, prepared by Basin Electric Cooperative, dated May 1993.

[3] Based on drawing titled "Rough Grading Sections Sheet 1", Sheet Y1-10, by Stearns-Roger Inc., prepared for Basin Electric Power Cooperative, and revised 9/11/1986.

[4] Based on drawing titled "SDA Decantation Pond", Sheet Y1-17, prepared by Basin Electric Power Cooperative, dated May 1993. The west embankment downstream slope is approximately 2:1 due to the railroad tracks at the downstream toe. The north, east and south embankments and west embankment upstream slope are approximately 5:1.

[5] Estimated from Aerial Photographs.
[6] Based on drawing titled "Layout and Rough Grading Plan Sheet 2", prepared by Stearns-Roger Inc., prepared for Basin Electric Cooperative, revised 1995. The SDA Pond upstream slopes are 3:1, and the east embankment downstream slope is approximately 2:1 due to the drainage ditch located at the downstream toe.

Exerts from the original geotechnical report for the SDA Pond prepared by Woodward-Clyde Consultants and dated October 7, 1977 was available for our review. Based on boring logs, the on-site soils consist of sandy clay, silty clay and fine sand to gravel. Basin Electric indicated to GEI during the site visit that the CCW impoundment embankments were constructed of on-site, natural soils.

## 2.3 Spillways

None of the impoundments have spillways.

## 2.4 Intakes and Outlet Works

Inlets to the SDA pond include two overhead pipes, a 6-inch pipe and 16-inch pipe that appear to be steel, that can discharge directly into the SDA Pond or into the two sedimentation basins located on the south side of the SDA Pond. The sedimentation basins facilitate settling of mostly lime, and the water overflows into the SDA Pond through a system of steel troughs. Once one of the sedimentation basins is full, discharge is directed into the other basin and the full basin is cleaned out. A 14-inch pipe, that appears to be plastic, also discharges into the SDA Pond in the southwest corner. A pump house is located in the northwest corner of the pond, and pumps water from the SDA Pond back to the plant for reuse in the ash water system, the $SO_2$ removal system and coal handling dust suppression systems. The pump house has three underground outlet pipes that include an 8-inch pipe (identified as MW-1008-DPF on construction drawings), 18-inch pipe (identified as MW-1013-DPB), and a 10-inch pipe (identified as MW-1002-DPB). The 8-inch pipe and 18-inch pipe appear to return to the plant, and the 10-inch pipe appears to discharge to the drainage ditch located on the east side of the SDA Pond. The SDA Pond has a 6-inch HDPE leachate collection pipe that penetrates the dike in the northwest corner of the pond. The leachate collection pipe is located beneath the first layer of the double layer HDPE liner. Any collected in the leachate collection system is pumped back into the SDA Pond.

Approximately every 5 to 10 years, CCW material is dredged from the SDA Pond and discharged into the SDA Decantation Pond by temporary pipes placed over the SDA Decantation Pond embankment. The CCW material in the SDA Decantation Pond is dewatered by pumping the water back to the SDA Pond. Three 4-inch perforated pipes run along the bottom of the SDA Decantation Pond and discharge into a leachate manhole. The perforated pipes are covered with bottom ash and are used for dewatering. A temporary sump is placed in the leachate manhole to pump water back to the SDA Pond. Once dewatered, the ash in the SDA Decantation Pond is then hauled to the permitted AVS Landfill. There are no pipes penetrating the dikes of the SDA Decantation Pond.

## 2.5 Vicinity Map

Antelope Valley Station is located approximately 8 miles north of Beulah town center, North Dakota, as shown on Figure 1. The two CCW impoundments are located north and northeast of the station, as shown on Figure 2.

## 2.6 Plan and Sectional Drawings

Survey drawings for the two CCW impoundments were provided by Basin Electric and were prepared as part of the design package. Construction record drawings from the original construction and the SDA Decantation Pond liner replacement project were available for review.

## 2.7 Standard Operational Procedures

AVS is a coal-fired power plant producing a total combined capacity of 900 MW. Coal is delivered directly from the mine to the plant, where it is then combusted to power the steam turbines. AVS is a dry coal ash disposal facility, and the amount of sluiced CCW is considerably less than wet coal ash facilities.

Waste includes fly ash/flue gas emissions, bottom ash and lime. The waste is sluiced to the SDA Pond. Water in the SDA Pond is pumped back to the plant for use as make-up water for the ash water system, the $SO_2$ removal system and the coal handling suppression systems.

Every 5 to 10 years, depending on the rate of accumulating CCW, the SDA Pond is dredged and the SDA Decantation pond is used. The SDA Decantation Pond has a compacted clay liner that is reconstructed prior to being put into service. The SDA Decantation Pond receives the dredged material from the SDA Pond through temporary pipes. The ash is allowed to settle in the SDA Decantation Pond, and the water is pumped back to the SDA Pond through temporary pipes. After dewatering of the ash in the SDA Decantation Pond, the ash is excavated from the pond and hauled to the permitted AVS Landfill. The ash removal process includes the removal of the temporary 4-inch perforated leachate pipes located along the bottom of the pond, bottom ash used to protect the pipes, and the upper portions of the clay liner, all of which are also hauled to the permitted AVS Landfill.

According to Basin Electric, an operation and maintenance manual currently does not exist for the CCW facilities. Plant operators perform daily operating inspections of the plant facilities.

# 3.0 Summary of Construction History and Operation

Unit 1 at the Antelope Valley Station became operational in 1984 and Unit 2 was operational in 1986. The SDA Pond was commissioned on April 14, 1983. In 1995, it was modified with a double layer HDPE liner and leachate collection system. Basin Electric personnel indicated that about 200 gpd of leachate is collected and pumped back into the pond.

The SDA Decantation Pond was constructed and utilized in 1986, and the pond was first permitted in 1988. It is used periodically when the SDA Pond is taken out of service for cleaning, at approximately 5 to 10 year cycles. Before the SDA Decantation Pond is used, it is re-lined with a nominal 2-foot thick clay liner, and new 4-inch perforated leachate pipes are installed along the bottom of the pond. Compaction records and permeability testing for the reconstruction of the clay liner in July and August 2010 were available for review. The clay was compacted to a minimum of 95 percent of the maximum dry density of the standard proctor. Permeability tests indicate the clay had a permeability less than the specified $1 \times 10^{-7}$ cm/sec.

Some drawings of the original design and construction of the CCW facilities were available for review. Twenty boring logs were available, and three of the borings were performed within the extents of the SDA Pond in 1976 and 1977. It appears no borings were drilled for the SDA Decantation Pond. Two of the borings for the SDA Pond extended approximately 15 to 20 feet below the ground surface and one boring extended approximately 100 feet below the ground surface. One of the borings extends to nearly 220 feet, but bedrock was not encountered in any of the borings. Subsurface soils consist mostly of medium stiff to stiff sandy clays underlain by interbedded lenses of clays, sands and silts. Construction drawings indicate that the Antelope Valley property was built up with fill to the current grades at the locations of the SDA Pond and SDA Decantation Pond. The SDA Pond appears to be excavated into the fill down to the natural soils, while the SDA Decantation Pond appears to be founded on the fill material. The drawings do not indicate the source of the fill; however, Basin Electric personnel indicated that the embankments were constructed of on-site, natural soils.

No evidence of prior releases, failures or patchwork construction was observed during the site visit or disclosed by plant personnel.

# 4.0 Hazard Potential Classification

## 4.1 Overview

According to the Federal Guidelines for Dam Safety, the hazard potential classification for the CCW impoundments is based on the possible adverse incremental consequences that result from release of stored contents due to failure of the dam or misoperation of the dam or appurtenances. Impoundments are classified as Low, Significant, or High hazard, depending on the potential for loss of human life and/or economic and environmental damages.

## 4.2 SDA Pond

The SDA Pond perimeter dikes, containing a surface area of about 3.1 acres, storage capacity of 28 acre-feet and a height of about 12 feet would be considered a "Small" sized dam in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 2-106 criteria.

Antelope Valley Station is not located on a waterway. A failure of the SDA Pond would release coal combustion ash into areas around the pond. The discharge could reach the toe of the Antelope Valley Station railroad track sub-grade east of the pond and potentially enter the storm-water ditch located to the north. The ditch would direct the discharge into the north construction run-off pond located on Antelope Valley property. Loss of life is not anticipated and environmental and economic damage is expected to be low.

Based on the low potential environmental impacts to the plant site and surrounding area and consistent with the Federal Guidelines for Dam Safety and the North Dakota State Water Commission, Department of Dam Safety, North Dakota Dam Design Handbook, we recommend the SDA Pond dike be classified as a "Low" hazard structure.

## 4.3 SDA Decantation Pond

The SDA Decantation Pond perimeter dikes, containing a surface area of about 3.4 acres, storage capacity of 18.6 acre-feet and a height of about 11 feet would be considered a "Small" sized dam in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria.

Antelope Valley Station is not located on a waterway. A failure of the SDA Decantation Pond would release coal combustion ash into areas around the pond. The discharge could reach the toe of the Antelope Valley Station railroad track sub-grade east and west of the pond and potentially enter the storm-water ditch located to the north. The ditch would direct the discharge into the north construction run-off pond located on Antelope Valley property. It is possible that a failure of this kind could flood the Antelope Valley Station equipment storage

area located south of the pond. Based on the flat topography and small pond capacity, the flood waters would be shallow. Loss of life is not anticipated and environmental and economic damage is expected to be low.

Based on the low potential environmental impacts to the plant site and surrounding area and consistent with the Federal Guidelines for Dam Safety and the North Dakota State Water Commission, Department of Dam Safety, North Dakota Dam Design Handbook, we recommend the SDA Decantation Pond dike be classified as a "Low" hazard structure.

# 5.0 Hydrology and Hydraulics

## 5.1 Floods of Record

Floods of record have not been evaluated and documented for the CCW impoundments at the Antelope Valley Power Station.

## 5.2 Inflow Design Floods

Currently there is no hazard classification for the CCW impoundments at the Antelope Valley Power Station. Based on the recommended "Low" hazard classification, the North Dakota Dam Design Handbook specifies "Low" hazard dams between 10 to 24 feet high be capable of passing the 50-year storm event without overtopping the dam. The USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 recommends a small "Low" hazard dam be capable of passing the 50- to 100-year storm event without overtopping the dam. Considering the relatively low economic and environmental damages that could potentially occur upon failure, and the recommended range of inflow design storms, it is reasonable to select the 50-year storm event as the inflow design storm for the Antelope Valley Power Station. Accordingly, the 50-year storm 24-hour precipitation at the Antelope Valley Power Station is about 4.15 inches based on Technical Paper No. 40, Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 hours and Return Periods from 1 to 100 Years Report Number 51 6-hour PMP data.

### *5.2.1 Antelope Valley Power Station SDA Pond*

The Antelope Valley Power Station SDA Pond contributing drainage area includes the impoundment area and portions of the site area north of the plant buildings. The total contributing drainage area was estimated to be 21.8 acres, however, due to the limited site drainage documentation this value should be confirmed in additional hydrologic studies.

Currently, the SDA Pond water level is maintained at elevation (El.) 1934.3, providing about 2.7 feet of freeboard and approximately 7.9 acre-feet of available storage capacity. Based on the 50-year 24-hour precipitation of 4.15 inches, the SDA Pond would receive approximately 7.5 acre-feet of storm water runoff assuming no losses. Considering the storm volume is relatively close to the estimated available storage capacity of the pond and the drainage area is not well defined, the water surface elevation would likely approach or exceed the dam crest. Based on this result, the Antelope Valley Power Station SDA Pond may not meet the regulatory requirements for storing and passing of the 50-year 24-hour precipitation inflow design flood without overtopping the dam. Detailed site drainage and hydrologic studies should be performed to confirm these results for the SDA Pond.

## 5.3 Antelope Valley Power Station SDA Decantation Pond

The Antelope Valley Power Station SDA Decantation Pond contributing drainage area is limited to the impoundment area (approximately 3.4 acres) because of the perimeter dikes. Under the configuration, CCW and water in the SDA Pond is dredged and pumped into the SDA Decantation Pond through mobile equipment. Once the target capacity is reestablished in the SDA Pond, decant water in the SDA Decantation Pond is then pumped back to the SDA Pond. Currently, the Antelope Valley Power Station SDA Decantation Pond and water level is maintained at approximately El. 1939.0, providing about 7.0 feet of freeboard and an estimated storage capacity of approximately 18.6 acre-feet. Based on the 50-year 24-hour storm precipitation, the Antelope Valley Power Station SDA Decantation Pond would receive approximately 1.2 acre-feet of storm water assuming no losses. Considering the storm volume is relatively small compared to the estimated available storage capacity of the pond, the water surface elevation would likely be raised less than 1 foot. Based on this result, the Antelope Valley Power Station SDA Decantation Pond is expected to meet the regulatory requirements for storing and passing of the 50-year 24-hour precipitation inflow design flood without overtopping the dam.

## 5.4 Determination of the Probable Maximum Flood (PMF)

Not applicable.

### *5.4.1 Freeboard Adequacy*

Based on a very simplified evaluation using conservative assumptions, the freeboard appears to be adequate at the Antelope Valley Power Station Ash Ponds.

### *5.4.2 Dam Break Analysis*

Dam break analyses have not been performed for the CCW impoundment at the Antelope Valley Power Station.

## 5.5 Spillway Rating Curves

Not applicable.

## 5.6 Evaluation

Based on the current facility operations, inflow design floods documents, and the limited topographic data available for our review, the Antelope Valley Power Station SDA Pond appears to have inadequate capacity to store and pass the regulatory design floods without overtopping the dam based on the recommended hazard classification for the dam. However, the Antelope Valley Power Station SDA Decantation Pond appears to have adequate capacity to store and pass the regulatory design floods without overtopping the dam based on the

recommended hazard classification for the dam. Based on this simplified evaluation, detailed site drainage and hydrologic studies should be performed to confirm the results for the SDA Pond.

# 6.0 Geologic and Seismic Considerations

Boring logs provided by Basin Electric indicate that the predominant overburden soil consists of brown to gray clay, silty clay and fine sand to gravel. The borings extend to a maximum depth of about 220 feet below the ground surface, and bedrock was not encountered. Geologic information about the underlying bedrock in the area was not available.

We are not aware of any seismic analyses that have been performed on the dams at the AVS. According to the 2008 U.S. Geological Survey (USGS) Seismic Hazard Map of North Dakota, the site has a regional probabilistic peak ground acceleration of approximately 0.025g with a 2 percent Probability of Exceedance within 50 years (recurrence interval of approximately 2,500 years).

# 7.0 Instrumentation

## 7.1 Location and Type

A float style water level staff gauge is installed in the pump-house at the SDA Pond and is read manually. Gauge readings are recorded in inches below top of dike, with zero corresponding to the top of dike elevation. Basin Electric personnel indicated that a weir is present at the sedimentation basins at the south end of the SDA Pond, but GEI did not observe a staff gauge or measurement device for measuring flows into the SDA Pond. There is no instrumentation associated with the SDA Decantation Pond. There are no records of water level readings from the SDA Decantation Pond.

## 7.2 Readings

### *7.2.1 Flow Rates*

Flow rates are not recorded at either of the CCW impoundments.

### *7.2.2 Staff Gauges*

There is a staff gauge located in the pump house of the SDA Pond, as discussed above. The SDA Decantation Pond does not have a staff gauge.

## 7.3 Evaluation

There are no instruments installed at the AVS CCW impoundments, except for the staff gauge at the SDA Pond. It would be beneficial to install a staff gauge at the SDA Decantation Pond and flow measurement devices at both ponds to measure and record water levels in the ash ponds and flows into and out of the ash ponds. Surveyed benchmarks, embankment settlement monuments and piezometers to measure and record any movement of the dikes should also be considered.

# 8.0 Field Assessment

## 8.1 General

A site visit to assess the condition of the CCW impoundments at the AVS was performed on October 19, 2010, by Ken L. Hardesty, P.E., and Gillian M. Hinchliff of GEI. Maria Barnhardt, Chad Edwards, Jeff Hanson, and Mark Nelson of Basin Electric, Diana Trussell and Brad Torgerson of NDDH, and Jeff Berger of the ND State Water Commission assisted in the assessment.

The weather during the site visit (October 19, 2010) was sunny, with temperatures around 50 degrees Fahrenheit. The majority of the ground was dry at the time of the site visit.

At the time of inspection, GEI completed an EPA inspection checklist, which is provided in Appendix A, and photographs, which are provided in Appendix B. Field assessment of the two CCW impoundments included a site walk to observe the dam crest, upstream slope, downstream slope, and intake structures.

## 8.2 Embankment Dam

### *8.2.1 Dam Crest*

The dam crest of the two CCW impoundments appeared to be in good condition. No signs of cracking, settlement, movement, erosion or deterioration were observed during the assessment. The dam crest surface is generally composed of gravel road base material or native grassy vegetation.

### *8.2.2 Upstream Slope*

The upstream slope of the SDA Pond CCW impoundments is protected by a double layer HDPE liner. The SDA Decantation Pond upstream slope consists of an exposed compacted clay liner. Minor erosion, most likely due to surface runoff, was observed on the upstream slope of the SDA Decantation Pond. Temporary erosion control measures are used at the discharge point of the SDA Decantation Pond to control erosion of the upstream slope during filling of the pond. The upstream slopes appeared to be in satisfactory condition. No scarps, sloughs, depressions or other indications of slope instability were observed during the inspection of the two CCW impoundments.

### *8.2.3 Downstream Slope*

The downstream slopes of the two CCW impoundments showed no signs of scarps, sloughs, depressions or other indications of slope instability during the inspection. The downstream

slopes of the SDA Pond are covered with native grassy vegetation, and there were no signs of erosion. The downstream slopes of the SDA Decantation Pond were generally exposed earth with a few patches of native grassy vegetation. Minor erosion of the downstream slope of the SDA Decantation Pond was observed, most likely due to surface runoff.

## 8.3 Seepage and Stability

No evidence of ongoing seepage or potential seepage was observed at any of the two CCW impoundments.

## 8.4 Appurtenant Structures

### *8.4.1 Outlet Structures*

The outlets at the SDA Pond appeared to be in good condition. The pumphouse intake pipes are submerged and were not observed during the field assessment. The SDA Pond has a 6-inch HDPE leachate collection pipe that penetrates the dike. The leachate collection pipe is located beneath the first layer of the double layer HDPE liner. No evidence of erosion was observed. All other outlets are placed over the dikes and do not penetrate the dikes. There are no permanent outlet structures at the SDA Decantation Pond. Temporary outlet pipes are placed over the embankments and do not penetrate the dikes.

### *8.4.2 Pump Structures*

The equipment in the pumphouse located on the northwest edge of SDA Pond appeared to be working properly.

### *8.4.3 Emergency Spillway*

There are no emergency spillways present at the two CCW impoundments.

### *8.4.4 Water Surface Elevations and Reservoir Discharge*

The water level in the SDA Pond was about El. 1934.3, providing about 2.7 feet of freeboard. The water level in the SDA Decantation Pond was not available; however, dredging operations had recently begun at the time of the site visit, and the water level was estimated by GEI to be about El. 1939, providing about 7 feet of freeboard.

# 9.0 Structural Stability

## 9.1 Visual Observations

The assessment team saw no visible signs of instability associated with the dikes of the two impoundments during the October 19, 2010 site assessment.

## 9.2 Field Investigations

Excerpts from Woodward-Clyde Consultant's October 7, 1977 report titled "Additional Geotechnical Services – Antelope Valley Station, Units 1 and 2, Mercer County, North Dakota" were available for our review. It appears three borings were performed in 1976 and 1977 within the SDA Pond and no borings were performed for the SDA Decantation Pond. Borings were also performed for the plant structures and other facilities. Twenty boring logs were available for our review, including the three boring logs for the SDA Pond.

Subsurface soils within the SDA Pond consisted of medium stiff to stiff sandy clay extending to about 48 feet below the ground surface underlain by interbedded lenses of sand, clay and silt. One boring extended to about 220 feet below the ground surface and did not encounter bedrock. Bedrock was not encountered in any of the borings.

No structural stability field investigations have been performed on the two impoundments perimeter dikes.

## 9.3 Methods of Analysis

GEI is not aware of any slope stability analyses for the SDA or SDA Decantation Pond.

The liquefaction potential at the CCW impoundments has not been previously evaluated based on review of the available documents. Conditions necessary for liquefaction include saturated, loose, granular soils and an earthquake of sufficient magnitude and duration to cause significant strength loss in the soil. Based on the 1977 geotechnical report and boring logs prepared by Woodward-Clyde Consultants, it is not likely that the site soils would be susceptible to liquefaction.

# 10.0 Maintenance and Methods of Operation

## 10.1 Procedures

Basin Electric has not formally developed an operations and maintenance manual for the CCW impoundments. The reconstruction and operation of the SDA Decantation Pond is managed and supervised by the plant environmental representative. Inspections of the two CCW impoundments are conducted and documented by NDDH annually.

## 10.2 Maintenance of Impoundments

Maintenance of the two CCW impoundments is performed by AVS staff under the guidance of AVS managers and engineers. Compaction and permeability testing of the compacted clay liner for the SDA Decantation Pond is performed by a testing laboratory retained by Basin Electric. Dam safety-related inspections have not been previously performed by state or federal agencies.

## 10.3 Surveillance

The ash ponds and settling basins are patrolled once per shift by AVS operations personnel. Plant personnel are available at the power plant 24 hours a day, 365 days a year, and on 24-hour call for emergencies that may arise.

# 11.0 Conclusions

## 11.1 Assessment of Dams

### *11.1.1 Field Assessment*

The dams and outlet works facilities associated with the CCW impoundments at the AVS were generally found to be in satisfactory condition. No visual signs of instability, movement or seepage were observed. The SDA Decantation Pond embankment slopes show signs of minor erosion from surface runoff.

### *11.1.2 Adequacy of Structural Stability*

There are no records of a structural stability evaluation of the CCW impoundments. Structural stability analyses are recommended for identifying dam safety deficiencies.

### *11.1.3 Adequacy of Hydrologic/Hydraulic Safety*

Floods of record have not been evaluated and documented for either the SDA Pond or the SDA Decantation Pond.

Based on estimates from limited topographic data provided, the SDA Pond appears to have inadequate capacity to store and pass the regulatory design floods without overtopping the dam based on the recommended hazard classification for the dam and the assumed contributing drainage area. However, the Antelope Valley Power Station SDA Decantation Pond appears to have adequate capacity to store and pass the regulatory design floods without overtopping the dam based on the recommended hazard classification for the dam.

### *11.1.4 Adequacy of Instrumentation and Monitoring of Instrumentation*

The SDA Pond has a staff gauge, but the SDA Decantation Pond has no instrumentation. Instrumentation and monitoring at the two CCW impoundments is considered inadequate. Water levels of the SDA Decantation Pond and flow measurements at both ponds are estimated visually.

### *11.1.5 Adequacy of Maintenance and Surveillance*

The two CCW impoundments at the AVS have fair maintenance and surveillance programs. The facilities are generally adequately maintained and routine surveillance is performed by AVS staff, however there are currently no staff members trained in dam safety inspections. There are currently no scheduled inspections by third-party engineering companies experienced in dam safety inspections.

### *11.1.6 Adequacy of Project Operations*

Operating personnel are knowledgeable and are well trained in the operation of the project. The current operations of the facilities are satisfactory.

# 12.0 Recommendations

## 12.1 Corrective Measures and Analyses for the Structures

1. Re-vegetation efforts and erosion protection measures should be employed along the downstream slope of the SDA Decantation Pond (Erosion Control mats, riprap, grassy vegetation, etc.).
2. A geotechnical exploration program should be performed to classify the embankment soils and the foundation soils. A geotechnical soils testing program should accompany the drilling program and should include index property tests along with strength tests. These test results would provide the necessary information to perform slope stability analysis on the CCW impoundments as described below.
3. Slope stability analyses for the two CCW impoundments should be performed on the maximum section of each CCW impoundment with a phreatic surface representative of steady seepage at normal water surface conditions. The slope stability analysis should be presented relative to the appropriate dam guidelines such as the Army Corps of Engineers, Bureau of Reclamation or the Federal Energy Regulatory Committee (FERC).
4. A hydrologic analysis of the AVS site and the two CCW impoundments should be performed to verify the adequacy of the pond volumes to store the inflow design flood and that the intakes for the CCW impoundments are adequately sized for the design flood. As part of the hydrologic analysis, stage-storage curves should be developed to provide accurate pond volumes for the SDA Decantation Pond.

## 12.2 Corrective Measures Required for Instrumentation and Monitoring Procedures

Staff gages and flow measurement devices (weirs, flumes, etc.) should also be installed in both ponds to allow for measurement and recording of water levels and discharge into and out of each pond. The staff gages should be set to the vertical datum used.

## 12.3 Corrective Measures Required for Maintenance and Surveillance Procedures

Currently, the two CCW impoundments are visually inspected annually by NDDH staff. We recommend Basin Electric develop and document informal annual inspections of the ash ponds by Basin Electric staff trained in dam safety evaluations, and include an inspection at a minimum of every 5 years by a third-party professional engineer with experience in dam safety evaluations. We also recommend a brief daily check inspection of the facilities be conducted by Basin Electric personnel.

## 12.4 Corrective Measures Required for the Methods of Operation of the Project Works

None.

## 12.5 Summary

The following factors were the main considerations in determining the final rating of the two CCW impoundments at AVS.

- The dikes at the SDA Pond are low-hazard structures based on federal and state classifications.
- The dikes at the SDA Decantation Pond are low-hazard structures based on federal and state classifications.
- The two CCW impoundments were generally observed to be in good condition in the field assessment.
- There are no hydrologic analyses indicating the ponds can store the regulatory design flood without overtopping.
- There are no structural stability analyses on record for the two CCW impoundments. Structural stability analyses are recommended for identifying dam safety deficiencies.
- There is currently no instrumentation in place for the two CCW impoundments, except for a staff gauge at the SDA Pond. There is no method of accurately recording water levels in the SDA Decantation Pond, flow volumes or monitoring of perimeter dike performance (i.e. movement, settling, etc.).
- Maintenance, surveillance and operational procedures are considered fair.

## 12.6 Acknowledgement of Assessment

I acknowledge that the management unit(s) referenced herein was personally inspected by me and was found to be in the following condition **(select one only):**

| Management Unit | Rating |
|---|---|
| SDA Pond | Fair |
| SDA Decantation Pond | Fair |

**DEFINITIONS:**

**SATISFACTORY:** No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

**FAIR:** Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

**POOR:** A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

**UNSATISFACTORY:** Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

I acknowledge that the management unit referenced herein:

Has been assessed on October 19, 2010 (date)

Signature: _____

COLORADO LICENSED
KENNETH L. HARDESTY
41700
7-18-11
PROFESSIONAL ENGINEER

List of Participants:

| | |
|---|---|
| Ken L. Hardesty, P.E. | Senior Project Engineer/Task Leader, GEI Consultants, Inc. |
| Gillian M. Hinchliff | Project Engineer, GEI Consultants, Inc. |
| Maria Barnhardt, P.E. | Civil Engineer, Basin Electric |
| Chad Edwards | Operations Supervisor, Basin Electric |
| Jeff Hansen | Environmental Coordinator, Basin Electric |
| Mark Nelson | Basin Electric |
| Diana Trussell | North Dakota Department of Health |
| Brad Togerson | North Dakota Department of Health |
| Jeff Berger | North Dakota State Water Commission |

# 13.0 References


Basin Electric North Dakota, 2009. "CERCLA 104(e) Request for Information Response," prepared for U.S. Environmental Protection Agency, August 27.

Basin Electric Power Cooperative. Monitoring Well Groundwater Levels. 1994 through 2010.

Basin Electric Power Cooperative. Select Design and Construction Drawings, 1993 through 1996, 2010.

North Dakota State Water Commission, Dam Safety Division, 1985. North Dakota Dam Design Handbook, June.

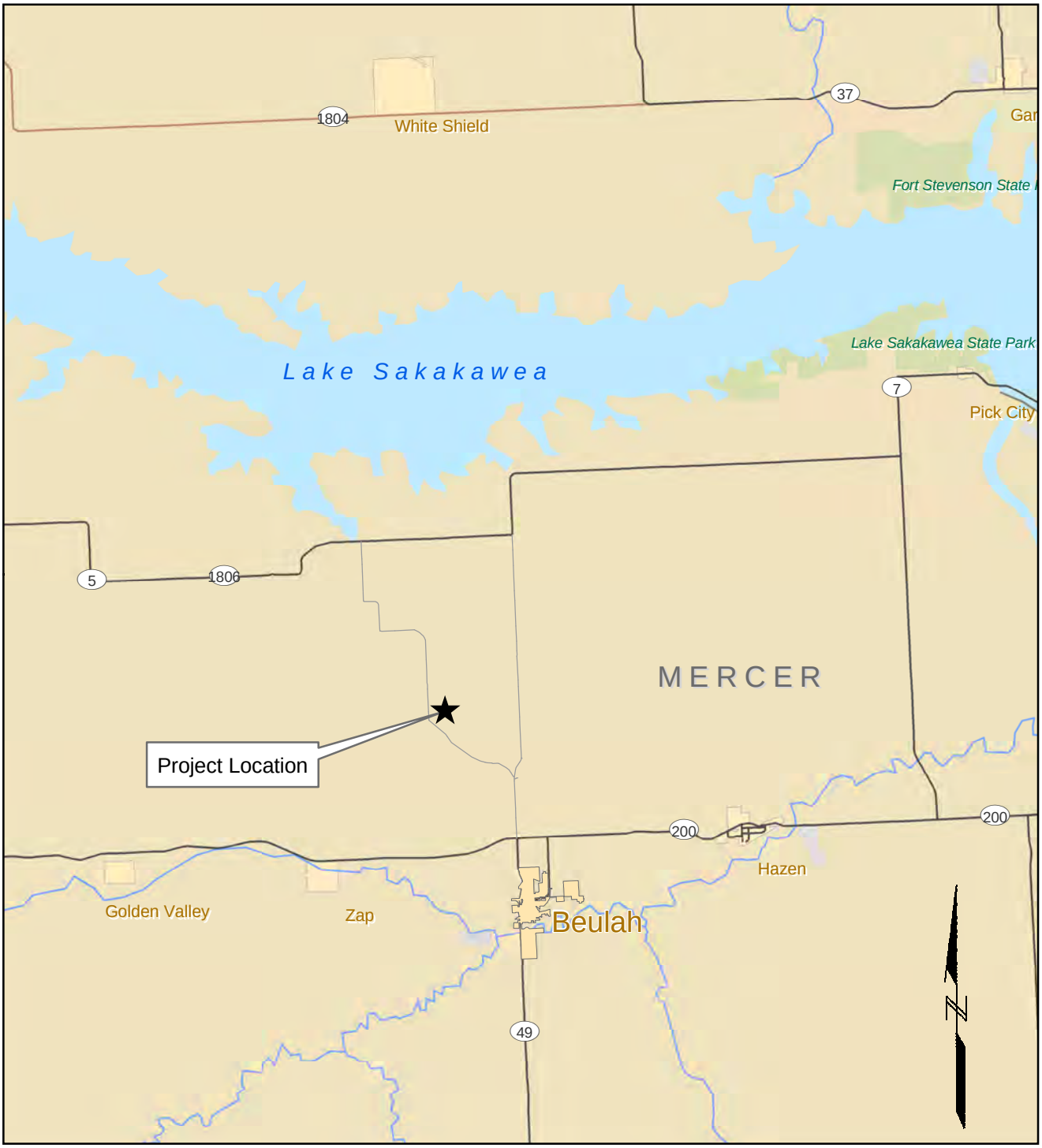
Midwest Testing Laboratory. Clay Liner Thickness Determination Report and Permeability Testing Results, June through August 2010.

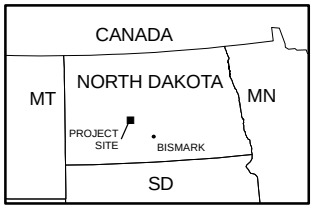
Stearns-Roger Inc. Select Design Drawings, 1977 through 1986.

U.S. Army Corps of Engineers (USACE), 1979. "Recommended Guidelines for Safety Inspections of Dams. ER 1110-2-106." September 26.

Woodward-Clyde Consultants. "Additional Geotechnical Services – Antelope Valley Station, Units 1 and 2, Mercer County, North Dakota". October 7, 1977. Selected excerpts.

# Figures




5 2.5 0 5

Miles

P:\092884 EPA - Antelope Valley\Site Vicinity Map.mxd 11/10

| | | |
|---|---|---|
| Assessment of Dam Safety of Coal Combustion Waste Impoundments at Basin Electric Antelope Valley Station | GEI Consultants | SITE VICINITY MAP |
| Environmental Protection Agency Washington, D.C. | Project 092884 | November 2010 Figure 1 |

***NOTES:***

1. AERIAL BASE MAP PROVIDED BY BASIN ELECTRIC. MAP IS SHOWN NOT TO SCALE.

N

| | | |
|---|---|---|
| Assessment of Dam Safety of Coal Combustion Waste Impoundments at Basin Electric Antelope Valley Station | GEI Consultants | SITE MAP |
| Environmental Protection Agency Washington, D.C. | Project 092884 | November 2010 Figure 2 |

P:\092884 EPA Ash Ponds\Antelope Valley\ Site Map.dwg Nov 2010

# Appendix A

**Inspection Checklists**

**October 19, 2010**

Site Name: **Antelope Valley Station, Beulah, ND** Date: **October 19, 2010**

Unit Name: **Spray Drier Ash Water Make-Up Pond** Operator's Name: **Basin Electric PC**

Unit ID: Hazard Potential Classification: High Significant **Low**

Inspector's Name: **Ken Hardesty/Gillian Hinchliff**

Check the appropriate box below, Provide comments when appropriate. If not applicable or not available, record "N/A", Any unusual conditions or construction practices that should be noted in the comments section, For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

| | Yes | No | | Yes | No |
|---|---|---|---|---|---|
| 1. Frequency of Company's Dam Inspections? | None | | 18. Sloughing or bulging on slopes? | | X |
| 2. Pool elevation (operator records)? | 1934.3 ft | | 19. Major erosion or slope deterioration? | | X |
| 3. Decant inlet elevation (operator records)? | 1923 ft (estimated) | | 20. Decant Pipes | | |
| 4. Open channel spillway elevation (operator records)? | No Spillway | | Is water entering inlet, but not exiting outlet? | | X |
| 5. Lowest dam crest elevation (operator records)? | 1937 ft | | Is water exiting outlet, but not entering inlet? | | X |
| 6. If instrumentation is present, are readings recorded (operator records)? | NA | | Is water exiting outlet flowing clear? | NA | |
| 7. Is the embankment currently under construction? | | X | 21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below): | | |
| 8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)? | NA | | From underdrain? | X | |
| 9. Trees growing on embankment? (If so, indicate largest diameter below.) | | X | At isolated points on embankment slopes? | | X |
| 10. Cracks or scarps on crest? | | X | At natural hillside in the embankment area? | | X |
| 11. Is there significant settlement along the crest? | | X | Over widespread areas? | | X |
| 12. Are decant trashracks clear and in place? | NA | | From downstream foundation area? | | X |
| 13. Depressions or sink holes in tailings surface or whirlpool in the pool area | | X | "Boils" beneath stream or ponded water? | | X |
| 14. Clogged spillways, groin or diversion ditches? | | X | Around the outside of the decant pipe? | | X |
| 15. Are spillway or ditch linings deteriorated? | NA | | 22. Surface movements in valley bottom or on hillside? | | X |
| 16. Are outlets of decant or underdrains blocked? | | X | 23. Water against downstream toe? | | X |
| 17. Cracks or scarps on slopes | | X | 24. Were Photos taken during the dam inspection? | X | |

**Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.**

| Inspection Issue # | Comments |
|---|---|
| **3. Decant inlet elevation** | **3. Decant inlet is at pump house, elevation estimated from topography on drawings provided by Basin Electric.** |
| **12. Decant and trashrack are clear?** | **12. Decant inlet submerged, not observed.** |
| **20. Decant outlet, is water exiting outlet flowing clear?** | **20. Water is pumped back to scrubbers and reused. Water exiting outlet was not observed.** |
| **21. Seepage from underdrain?** | **21. Seepage from underdrain is collected and pumped back into the pond. Seepage is estimated at about 200 gpd. An HDPE liner is present beneath the underdrain.** |

# Coal Combustion Waste (CCW)
# Impoundment Inspection

Impoundment NPDES Permit # NA (closedloop, no discharge) INSPECTOR Ken Hardesty/Gillian Hinchliff

Date October 19, 2010

Impoundment Name Spray Drier Ash Water Make-Up Pond (SDA)

Impoundment Company Basin Electric Power Cooperative

EPA Region 8

State Agency (Field Office) Address 1595 Wynkoop St

Denver, CO 80202

Name of Impoundment Spray Drier Ash Water Make-Up Pond (SDA)

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

| | Yes | No |
|---|---|---|
| Is impoundment currently under construction? | | X |
| Is water or ccw currently being pumped into the impoundment? | X | |

**IMPOUNDMENT FUNCTION:** Fly ash, flue gas emission control residuals (FGD), lime

Nearest Downstream Town: Name NA (no residences downstream subject to flooding)
Distance from the impoundment NA
Impoundment
Location:

| | | | | | | |
|---|---|---|---|---|---|---|
| Longitude | 101 | Degrees | 50 | Minutes | 4.9 | Seconds |
| Latitude | 47 | Degrees | 22 | Minutes | 22.8 | Seconds |
| State | ND | County | Mercer | | | |

Does a state agency regulate this impoundment? YES X NO _____

If So Which Sate Agency? North Dakota Department of Health, Waste Management Division (Permit SP-160)

**HAZARD POTENTIAL** (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL**: Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X__ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

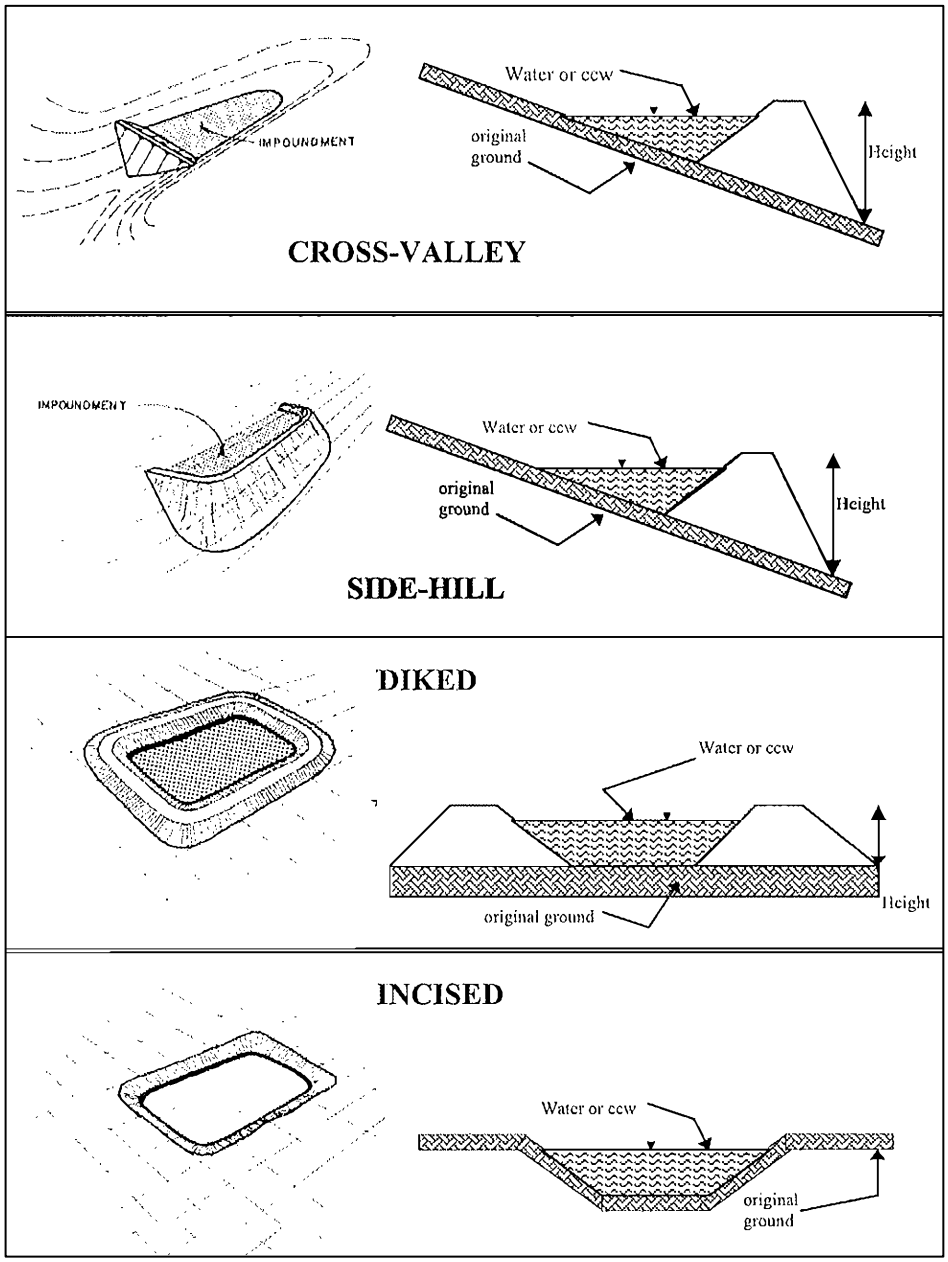
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

**DESCRIBE REASONING FOR HAZARD RATING CHOSEN:**

Antelope Valley Station is not located on a waterway. A failure of the Spray Drier Ash Water Make-Up Pond would release coal combustion ash into areas surrounding the pond. The discharge could flood the Antelope Valley Station railroad track located east of the pond and potentially enter the stormwater ditch located north of the pond that discharges into the north construction run-off pond located on Antelope Valley Station property. Loss of life is not anticipated and environmental/economic damage is anticipated to be low.

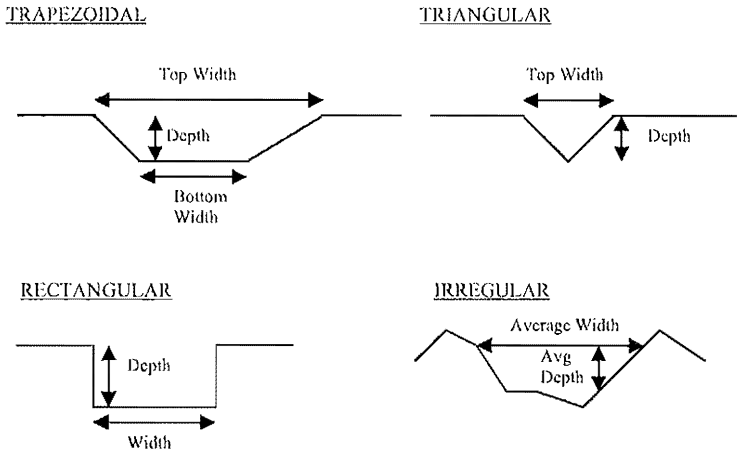
## CONFIGURATION:




_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height __12__ feet  Embankment Material _____Earth_____
Pool Area_____3.1___ acres  Liner_HDPE Double Layer_____
Current Freeboard __2.67__ feet  Liner Permeability_____1e-8 cm/sec_____

**TYPE OF OUTLET** (Mark all that apply)

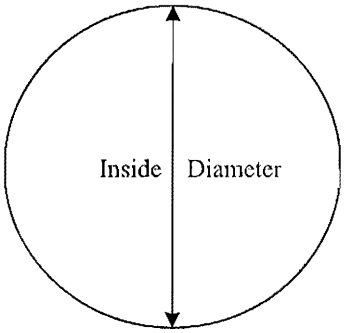



NA **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Triangular

_____ Depth
_____ Bottom (or average) width
_____ Top width

X **Outlet**

TBD inside diameter




Material
_____ corrugated metal
X welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify_____

Is water flowing through the outlet? YES X NO_____

_____ **No Outlet**

_____ **Other Type of Outlet (Specify)** _____

The Impoundment was Designed By NA _____

_____

Has there ever been a failure at this site? YES _____ NO __X__

If So When?_____

If So Please Describe:

Has there ever been significant seepages at this site? YES _____ NO __X__

If So When? _____

If So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO __X__

If So which method (e.g., piezometers, gw pumping, …)? _____

If So Please Describe:

Site Name: **Antelope Valley Station, Beulah, ND** Date: **October 19, 2010**

Unit Name: **SDA Decantation Pond** Operator's Name: **Basin Electric PC**

Unit ID: Hazard Potential Classification: High Significant **Low**

Inspector's Name: **Ken Hardesty/Gillian Hinchliff**

Check the appropriate box below, Provide comments when appropriate. If not applicable or not available, record "N/A", Any unusual conditions or construction practices that should be noted in the comments section, For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

| | Yes | No | | Yes | No |
|---|---|---|---|---|---|
| 1. Frequency of Company's Dam Inspections? | None | | 18. Sloughing or bulging on slopes? | | X |
| 2. Pool elevation (operator records)? | 1939 ft (approx) | | 19. Major erosion or slope deterioration? | | X |
| 3. Decant inlet elevation (operator records)? | No Decant | | 20. Decant Pipes | | |
| 4. Open channel spillway elevation (operator records)? | No Spillway | | Is water entering inlet, but not exiting outlet? | NA | |
| 5. Lowest dam crest elevation (operator records)? | 1946 ft | | Is water exiting outlet, but not entering inlet? | NA | |
| 6. If instrumentation is present, are readings recorded (operator records)? | NA | | Is water exiting outlet flowing clear? | NA | |
| 7. Is the embankment currently under construction? | | X | 21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below): | | |
| 8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)? | NA | | From underdrain? | | X |
| 9. Trees growing on embankment? (If so, indicate largest diameter below.) | | X | At isolated points on embankment slopes? | | X |
| 10. Cracks or scarps on crest? | | X | At natural hillside in the embankment area? | | X |
| 11. Is there significant settlement along the crest? | | X | Over widespread areas? | | X |
| 12. Are decant trashracks clear and in place? | | X | From downstream foundation area? | | X |
| 13. Depressions or sink holes in tailings surface or whirlpool in the pool area | | X | "Boils" beneath stream or ponded water? | | X |
| 14. Clogged spillways, groin or diversion ditches? | | X | Around the outside of the decant pipe? | NA | |
| 15. Are spillway or ditch linings deteriorated? | NA | | 22. Surface movements in valley bottom or on hillside? | | X |
| 16. Are outlets of decant or underdrains blocked? | NA | | 23. Water against downstream toe? | | X |
| 17. Cracks or scarps on slopes | | X | 24. Were Photos taken during the dam inspection? | X | |

**Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.**

| Inspection Issue # | Comments |
|---|---|
| **3. Decant inlet elevation** | **3. Decantation Pond is temporarily filled during dredging of SDA pond. Water is pumped through a temporary pipe back to SDA pond, solids are dredged and transferred to landfill.** |
| **12. Decant and trashrack are clear?** | **12. Trashracks are not present.** |
| **20. Decant pipes** | **20. Water was not being pumped out of the Decantation Pond during inspection. SDA dredged material was being pumped into Decantation Pond.** |
| **21. Seepage around outside of the decant pipe?** | **21. Inflow/outflow are temporary pipes that are placed over the dikes. There are no penetrations through the dikes.** |

# Coal Combustion Waste (CCW)
# Impoundment Inspection

Impoundment NPDES Permit # NA (closedloop, no discharge) INSPECTOR Ken Hardesty/ Gillian Hinchliff

Date October 19, 2010

Impoundment Name SDA Decantation Pond

Impoundment Company Basin Electric Power Cooperative

EPA Region 8

State Agency (Field Office) Address 1595 Wynkoop St

Denver, CO 80202

Name of Impoundment SDA Decantation Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New _____ Update _____

| | Yes | No |
|---|---|---|
| Is impoundment currently under construction? | | X |
| Is water or ccw currently being pumped into the impoundment? | X | |

**IMPOUNDMENT FUNCTION:** Fly ash, flue gas emission control residuals (FGD), lime

Nearest Downstream Town: Name NA (no residences downstream subject to flooding)
Distance from the impoundment NA
Impoundment Location:

| | | | | | | |
|---|---|---|---|---|---|---|
| Longitude | 101 | Degrees | 50 | Minutes | 13.4 | Seconds |
| Latitude | 47 | Degrees | 22 | Minutes | 30.7 | Seconds |
| State | ND | County | Mercer | | | |

Does a state agency regulate this impoundment? YES X NO _____

If So Which Sate Agency? North Dakota Dept of Health, Waste Mgnt Division (Permit SP-160)

**HAZARD POTENTIAL** (In the event the impoundment should fail, the following would occur):

_____ **LESS THAN LOW HAZARD POTENTIAL**: Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X__ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

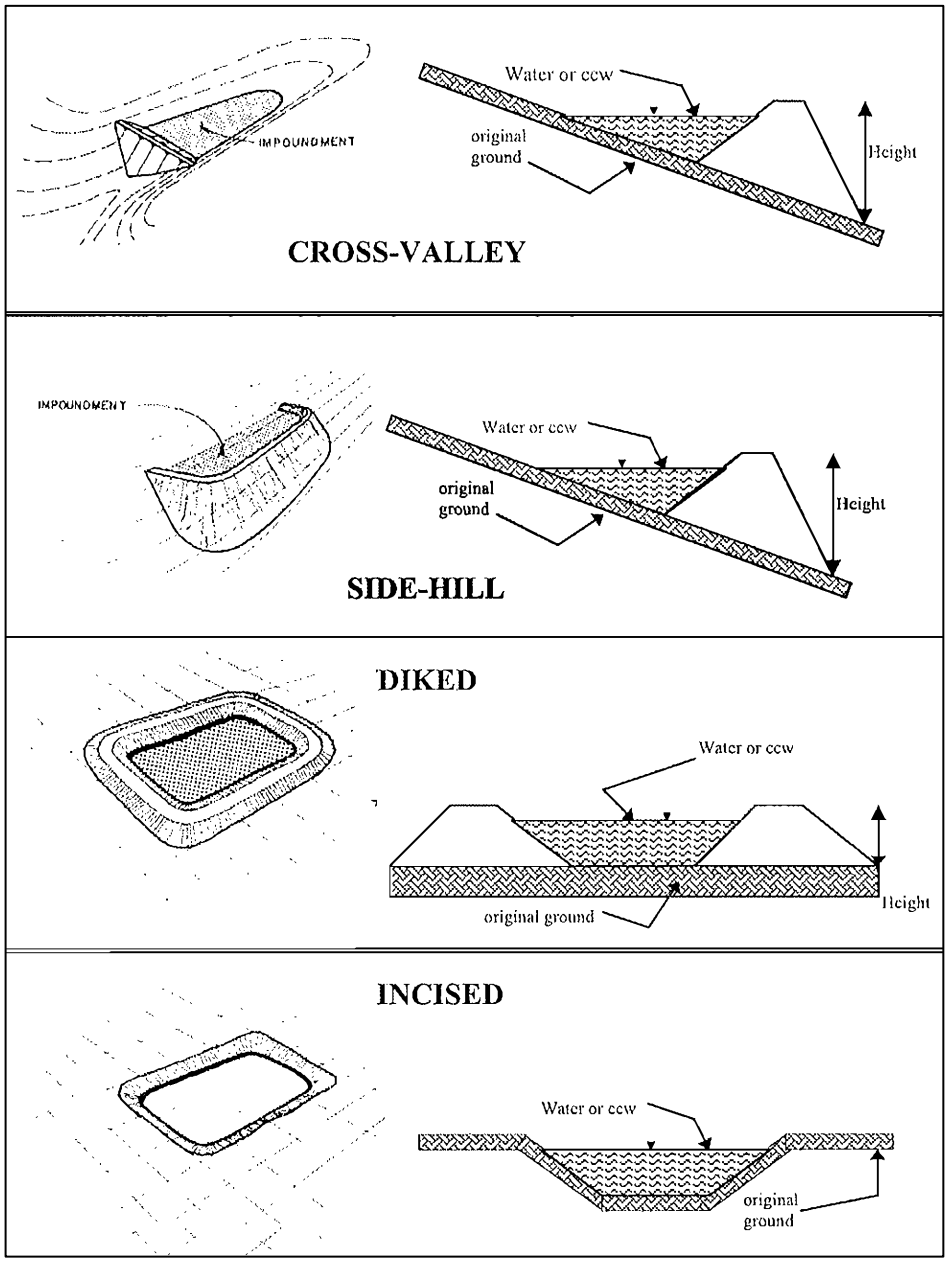
_____ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

**DESCRIBE REASONING FOR HAZARD RATING CHOSEN:**

**Antelope Valley Station is not located on a waterway. A failure of the SDA Decant Pond would release coal combustion ash into areas surrounding the pond. The discharge could flood the Antelope Valley Station railroad tracks located east and west of the pond, and enter the stormwater ditch located north of the pond that discharges into the north construction run-off pond located on Antelope Valley Station property. There is potential a failure could flood Antelope Valley Station equipment storage area located south of the pond. Based on flat topography and small pond capacity, floodwaters would be shallow. Loss of life is not anticipated and environmental/economic damage is anticipated to be low.**

## CONFIGURATION:

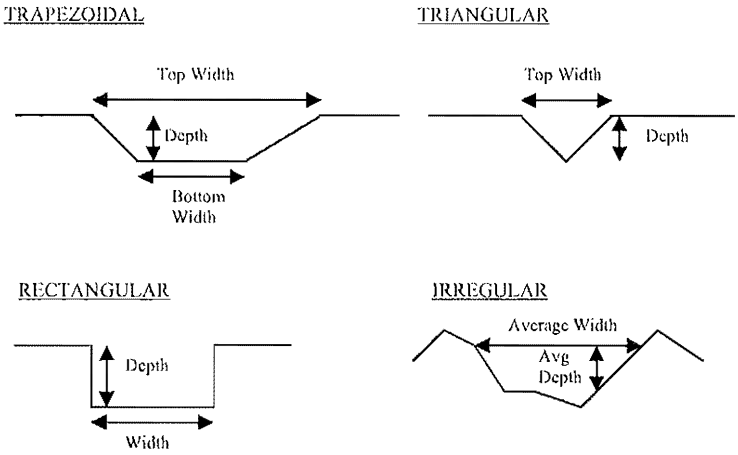



_____ Cross-Valley
_____ Side-Hill
_____ Diked
_____ Incised (form completion optional)
__X__ Combination Incised/Diked

Embankment Height __11__ feet  Embankment Material __Earth__
Pool Area __3.4__ acres  Liner __2ft Compacted Clay__
Current Freeboard __7__ feet  Liner Permeability __1e-5 cm/sec*__

***Permeability of clay estimated from typical values for low to medium plasticity clay**

**TYPE OF OUTLET** (Mark all that apply)



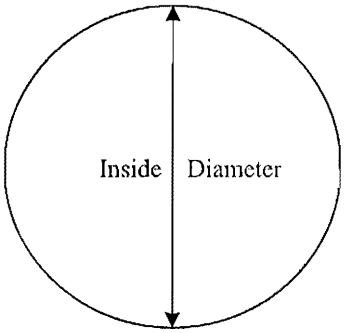

NA **Open Channel Spillway**

_____ Trapezoidal
_____ Triangular
_____ Triangular

_____ Depth
_____ Bottom (or average) width
_____ Top width

NA **Outlet**

_____ inside diameter




Material
_____ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify_____

Is water flowing through the outlet? YES_____ NO X

X **No Outlet**

X **Other Type of Outlet (Specify)** Temporary pipe

The Impoundment was Designed By NA

Has there ever been a failure at this site? YES _____ NO __X__

If So When?_____

If So Please Describe:

Has there ever been significant seepages at this site? YES _____ NO __X__

If So When? _____

If So Please Describe: _____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES _____ NO __X__

If So which method (e.g., piezometers, gw pumping, …)? _____

If So Please Describe:

# Appendix B

**Inspection Photographs**

**October 19, 2010**

**Photo 1: SDA Pond – West dike upstream slope and crest, looking north, note dredging operations.**

**Photo 2: SDA Pond – West dike upstream slope, looking south.**

**Photo 3: SDA Pond – South dike upstream slope, looking east, note inlet pipes.**

**Photo 4: SDA Pond – South dike inlet pipe and west weir, looking east.**

**Photo 5: SDA Pond – West weir and inlet pipe, looking north.**

**Photo 6: SDA Pond – East weir and inlet pipe, looking north.**

**Photo 7: SDA Pond – East weir and inlet pipe, looking west.**

**Photo 8: SDA Pond – East dike upstream slope, looking north.**

**Photo 9: SDA Pond – East dike downstream slope, looking north.**

**Photo 10: SDA Pond – North dike upstream slope, looking west.**

**Photo 11: SDA Pond – North dike downstream slope, looking west.**

**Photo 12: SDA Pond – Pump House, looking southwest.**

**Photo 13: SDA Decantation Pond – Looking north across pond.**

**Photo 14: SDA Decantation Pond – South dike upstream slope, looking east.**

**Photo 15: SDA Decantation Pond – South dike downstream slope, looking east.**

**Photo 16: SDA Decantation Pond – East dike upstream slope, looking north.**

**Photo 17: SDA Decantation Pond – East dike downstream slope, looking north, note inlet pipe over dam crest.**

**Photo 18: SDA Decantation Pond – North dike upstream slope, looking west, note leachate manhole.**

**Photo 19: SDA Decantation Pond – North dike downstream slope, looking east.**

**Photo 20: SDA Decantation Pond – Leachate Manhole.**

**Photo 21: SDA Decantation Pond – West dike upstream slope, looking south.**

**Photo 22: SDA Decantation Pond – West dike downstream slope, looking south.**

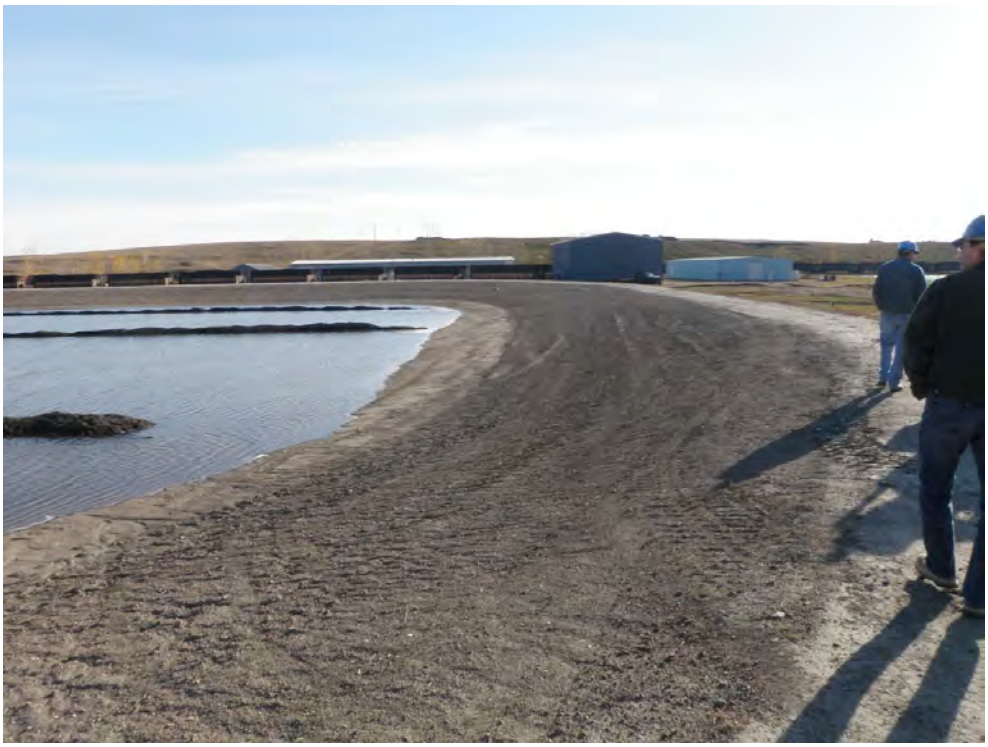


**Photo 23: SDA Decantation Pond – South dike upstream slope, looking east.**

**Photo 24: SDA Decantation Pond – South dike downstream slope, looking east.**

# Appendix C

**Reply to Request for Information Under Section 104(e)**

**BASIN ELECTRIC POWER COOPERATIVE**

1717 EAST INTERSTATE AVENUE
BISMARCK, NORTH DAKOTA 58503-0564
PHONE: 701-223-0441
FAX: 701-557-5336

March 24, 2009

**OVERNIGHT MAIL**

Mr. Richard Kinch
U.S. Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5783
Arlington, VA 22202-2733

Re: Request for Information Under Section 104(e) of the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

This letter is in response to the letter dated March 9, 2009 from Barry N. Breen, Acting Assistant Administrator of the U.S. Environmental Protection Agency (EPA) to the Chief Executive Officer of Basin Electric Power Cooperative (Basin Electric), Bismarck, North Dakota. The March 9, 2009 EPA letter was received by Basin Electric on March 13, 2009.

Basin Electric is a regional generation and transmission rural electric power cooperative based in Bismarck, North Dakota. The cooperative provides wholesale power requirements to 126 rural electric distribution cooperatives throughout a nine state region. These rural electric cooperative member systems in turn serve approximately 2.6 million consumers.

Letters from EPA were also received by the Basin Electric Plant Managers of the Leland Olds Station, located in Mercer County, North Dakota and the Laramie River Station located in Platte County, Wyoming. Responses to the Leland Olds Station and Laramie River Station letters have been sent to you separately.

The March 9, 2009 letter to Basin Electric's Chief Executive Officer, stated as follows:

> *"In addition, pursuant to Section 104(e) of CERCLA, we request that you identify and furnish to EPA a list of any additional facilities in your corporation to whom we have not sent an information request and which have surface impoundments or similar diked or bermed management unit(s) or management units designated as landfills which receive liquid-borne material from a surface impoundment used for the storage or disposal of residuals or by-products form the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. If you have no additional facilities with such units, please respond by indicating that fact."*

*Equal Employment Opportunity Employer*

In addition to the coal based stations identified previously, Basin Electric Power Cooperative also owns and operates the Antelope Valley Station located in Mercer County, North Dakota.

Through its internal assessment, Basin Electric Power Cooperative has identified one management unit at the Antelope Valley Station that may potentially fit the criteria described. This management unit is known as the Spray Drier Ash Water Make-up Pond (SDA) which provides makeup water for the ash water system, the $SO_2$ removal system and the coal-handling dust suppression systems. The pond covers three acres and has a nominal capacity of 28 acre feet. It is designed to a maximum depth of 11 feet. The major waste sources to the pond are the plant's low quality sumps, neutralizing sumps and cooling water blowdown. In addition, the coal-handling area sumps and the $SO_2$ absorber and lime-receiving building sumps discharge to the pond intermittently. The pond was rebuilt in 1995 to replace the existing liner system with a double layer high density polyethylene liner design. Any leakage is collected and pumped back into the pond.

Also associated with the SDA pond is the temporary pond or decant pond. This pond is used when the SDA pond is periodically dredged. This dredging operation removes the solids from the SDA pond and hydraulically transports the material to the decant pond. The decant pond is an above grade pond covering approximately 3.4 acres with a storage volume of 30,000 yards. The pond has been constructed with a clay liner on the base and interior sidewalls. Perforated pipe has been placed on the floor within a filter layer of bottom ash. The base of the pond is sloped to a low collection point where the perforated drain pipes are connected to a sump manhole. This pond is put into service every 5-10 years.

It is unclear to Basin Electric whether this management unit meets the above criteria; however, it is being reported to ensure full disclosure.

If additional information is required, please let us know.

Sincerely,

Ronald R. Harper
CEO & General Manager

rrh/dfl/ds

**CERTIFICATION**

**By**

**Authorized Representative**

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Robert W. Holzwarth

Name: ROBERT W. HOLZWARTH
Title: V. P. PLANT OPERATIONS

**BASIN ELECTRIC POWER COOPERATIVE**

1717 EAST INTERSTATE AVENUE
BISMARCK, NORTH DAKOTA 58503-0564
PHONE: 701-223-0441
FAX: 701-557-5336

**SENT VIA OVERNIGHT MAIL**

August 27, 2009

Mr. Richard Kinch
US Environmental Protection Agency
Two Potomac Yard
2733 S. Crystal Dr.
5th Floor; N-5783
Arlington, VA 22202 2733

Re: Request for Information Under Section 104(e) of the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9604(e)

Dear Mr. Kinch:

This letter is in response to the telephone call on August 11, 2009, from Mr. Craig Dufficy, EPA regarding the status of the two solid waste process ponds located at the Antelope Valley Station. During that phone call, Mr. Dufficy indicated that the ponds met the criteria for an EPA evaluation as a solid waste management unit.

The Antelope Valley Station (AVS) is owned and operated by Basin Electric Power Cooperative (Basin Electric) and consists of two coal-based electrical generation units. AVS uses lignite coal to fuel its two units. Unit 1 became operational in 1984; Unit 2 became operational in 1986.

The coal combustion byproducts that are generated at AVS are fly ash/flue gas emission control residuals and bottom ash. Those wastes are landfilled in Permit SP-160 issued by the North Dakota Department of Health. The management unit that is also associated with Permit SP-160 is the Spray Drier Ash Water Make-up Pond (SDA) and an associated pond used when the SDA pond is dredged and cleaned out called the temporary pond or decant pond.

The SDA pond provides make-up water for the ash water system, the SO2 removal system and the coal handling dust suppression systems. The pond covers three acres and has a nominal capacity of 28 acre feet. It is designed to a maximum depth of 11 feet. The major waste sources to the pond are the plants low quality sumps, neutralizing sumps and cooling water blowdown. In addition, the coal handling area sumps and the SO2 absorber and lime receiving building sumps discharge the pond intermittently. The pond was modified in 1995 to install a double layer high density polyethylene liner. Any leakage is collected and pumped back into the pond.

The temporary pond or decant pond is used when the SDA pond is periodically dredged or cleaned out. The solids from the pond are hydraulically transported to the decant pond. The decant pond is an above grade pond covering approximately 3.4 acres with a storage volume of 30,000 yards. The pond has been constructed with a clay liner on the base and interior sidewalls. Perforated pipe has been placed on the floor within a filer layer of bottom ash. The base of the pond is sloped to a low collection point where the perforated drain pipes are connected to a sump manhole. This pond is put into service every 5-10 years or when needed.

The Plant Manager of the AVS is Mr. John Jacobs who reports to me, the Vice President of Operations for Basin Electric. Enclosed are the specific responses to the Enclosure of the March 9, 2009 EPA letter. If you have any further questions, please advise.

Sincerely,

John W. Jacobs for BOB H.

Robert W. Holzwarth
V.P. Plant Operations

/gmj
Enclosures
cc: Ron Harper (w/enc.)
Dave Glatt (w/enc.)

Antelope Valley Station (AVS) responses to the Enclosure of the March 9, 2009 EPA letter via telephone conversation with Mr. Craig Dufficy, U.S. EPA on August 11, 2009.

**Question 1** **Relative to the National Inventory of Dams criteria for High, Significant, Low or Less-than-Low, please provide the potential hazard rating for each management unit and indicate who established the rating, what the basis of the rating is, and what federal or state agency regulates the unit(s). If the unit does not have a rating, please note that fact.**

Response 1 The Antelope Valley Station management units do not have an official rating that has been assigned by a state or federal regulatory agency. The AVS management units are regulated under North Dakota Department of Health Waste Management Permit SP-160. The North Dakota Department of Health, Waste Management Division inspects the management units.

**Question 2** **What year was each management unit commissioned and expanded?**

Response 2 Exact commissioning dates are unknown. The SDA pond was commissioned between July 1, 1978 and September 1, 1979. The Decant pond was commissioned sometime during 1993.

**Question 3** **What materials are temporarily or permanently contained in the unit? Use the following categories to respond to this question: (1) fly ash; (2) bottom ash; (3) boiler slag; (4) flue gas emission control residuals; (5) other. If the management unit contains more than one type of material, please identify all that apply. Also, if you identify "other," please specify the other types of materials that are temporarily or permanently contained in the unit(s).**

Response 3 The AVS management units are permitted to temporarily accept fly ash and flue gas emission control residuals (FGD).

**Question 4** **Was the management unit(s) designed by a Professional Engineer? Is or was the construction of the waste management unit(s) under the supervision of a Professional Engineer? Is inspection and monitoring of the safety of the waste management unit(s) under the supervision of a Professional Engineer?**

Response 4 Within the management unit the SDA Pond was designed and constructed under the supervision of a Professional Engineer. The SDA Decantation Pond's design drawings are not sealed by a Professional Engineer and records are not available on the QA/QC during the construction. Exhibits have been attached to show both ponds.

**Question 5** **When did the company last assess or evaluate the safety (i.e., structural integrity) of the management unit(s)? Briefly describe the credentials of those conducting the structural integrity assessments/evaluations. Identify actions taken or planned by facility personnel as a result of these assessments or evaluations. If corrective actions were taken, briefly describe the credentials of those performing the corrective actions, whether they were company employees or contractors. If the company**

**plans an assessment or evaluation in the future, when is it expected to occur?**

Response 5 The management units at AVS have not been assessed or evaluated for safety (i.e., structural integrity) by Basin Electric.

**Question 6 When did a State or a Federal regulatory official last inspect or evaluate the safety (structural integrity) of the management unit(s)? If you are aware of a planned state or federal inspection or evaluation in the future, when is it expected to occur? Please identify the Federal or State regulatory agency or department which conducted or is planning the inspection or evaluation. Please provide a copy of the most recent official inspection report or evaluation.**

Response 6 The management units at AVS have not been assessed or evaluated for safety (i.e., structural integrity) by a State or Federal regulatory official.

An inspection of the solid waste facility was last completed by the North Dakota Department of Health on June 12, 2009. A copy of that report is attached.

**Question 7 Have assessments or evaluations, or inspections conducted by State or Federal regulatory officials conducted within the past year uncovered a safety issues(s) with the management unit(s), and, if so, describe the actions that have been or are being taken to deal with the issue or issues. Please provide any documentation that you have for these actions.**

Response 7 No safety issues have been identified with any of the management units at AVS. Please see "Response 7 Attachment 1".

**Question 8 What is the surface area (acres) and total storage capacity of each of the management units? What is the volume of materials currently stored in each of the management unit(s)? Please provide the date that the volume measurement(s) was taken. Please provide the maximum height of the management unit(s). The basis for determining maximum height is explained later in this Enclosure.**

Response 8 The SDA Pond's surface area is 3.1 acres and the total storage capacity is approximately 28 acre-feet. The SDA Decantation Pond's surface area is 3.4 acres and the total storage capacity is approximately 19.4 acre-feet. The SDA Decantation Pond is active while the SDA Pond is cleaned at a frequency of every five to ten years. Prior to its use the clay liner is reconstructed to the criteria shown on the design drawings. A minimum of three feet of freeboard is maintained on the ponds when active. The current volume of material in the SDA Pond is unknown and the SDA Decantation Pond has been excavated and is currently not in use.

**Question 9 Please provide a brief history of known spills or unpermitted releases from the unit within the last 10 years, whether or not these were reported to State or federal regulatory agencies. For purposes of this question, please include only releases to surface water or to the land (do not include releases to groundwater).**

Response 9 There have been no known spills or unpermitted releases from the SDA pond or the temporary pond within the last 10 years.

**Question 10 Please identify all current legal owner(s) and operator(s) of the facility.**

Response 10 The facility is owned and operated by Basin Electric Power Cooperative.

**CERTIFICATION**

**By**

**Authorized Representative**

I certify that the information contained in this response to EPA's request for information and the accompanying documents is true, accurate and complete. As to the identified portions of this response for which I cannot personally verify their accuracy, I certify under penalty of law that this response and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

John W. Jacobs for BOB H.

Name: Robert W. Holzwarth
Title: VP Plant Operations