

**EVALUATION AND PROFESSIONAL OPINIONS REGARDING  
GEOLOGIC AND HYDROGEOLOGIC ASPECTS OF THE 2016  
DRAFT ENVIRONMENTAL IMPACT STATEMENT AS IT  
PERTAINS TO SCHEDULED FACILITY CLOSURE IN  
2019 OR EXTENDING OPERATION UNTIL 2044**

**Navajo Generating Station –  
Kayenta Mine Complex Project  
Navajo Nation, Arizona, USA**

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## **Executive Summary**

This expert report evaluates a Draft Environmental Impact Statement (DEIS) and related documents prepared for the Navajo Generating Station (NGS) and the associated Kayenta Mine Complex (KMC) as part of the regulatory and permitting process required to extend the operational life of the NGS facility and the KMC mines through 2044. The NGS is a 2,250-megawatt, coal-fired electric power plant that began operation in 1974. The NGS is scheduled to stop producing electricity in late 2019 if operation is not extended through 2044. The KMC is the sole source of coal burned at the NGS, and the NGS is the sole user of KMC coal. The Navajo Nation leases 1,786 acres for the NGS facility. Most of the coal ash produced by NGS is disposed 1.5 miles east of the plant at a dedicated landfill totaling 765 acres. The landfill has a nominal capacity of 38 million cubic yards of coal combustion byproduct (CCR). Most of the remaining 1,021 acres are occupied by the NGS power plant.

Evaluation of the DEIS is focused on specific past, present, and future issues regarding water resources and contamination at the NGS. Pollution sources at the NGS plant include several landfills, lined and unlined industrial ponds, and numerous industrial wastewater treatment and storage basins, some of which remain potential contamination sources even though they are no longer in use. By 2014, there was reported to be approximately 18 million cubic yards already in the coal ash landfill, and the area covered by coal ash is approximately 400 acres. However, it is not clear how much CCR is actually disposed at the NGS landfill.

The NGS plant is located upon a geologic unit known as the Carmel Formation that did not contain groundwater prior to operation of the NGS plant. Unintentional leakage of industry-impacted water from this "zero liquid discharge" (ZLD) facility has formed a 'new' aquifer in the Carmel Formation, and groundwater is now located as little as five (5) feet below the NGS plant. Beneath the Carmel Formation is the Navajo Sandstone, and that unit is saturated with groundwater (the "N Aquifer") below the NGS at an average depth of 870 feet. The NGS is actively pumping wells tapping the Carmel Formation to remove contaminated groundwater that contains concentrations of heavy metals, sulfate, and total dissolved solids (TDS), and some of these concentrations exceed federal water-quality standards. For example, water pumped from one well in October of 2015 contained selenium, a toxic heavy metal, at a concentration almost four times (4x) the federal water-quality standard. Shallow groundwater is being pumped continuously from the Carmel Formation because it is a source of mobile contamination that can impact the quality of groundwater in the regionally-important N Aquifer. Some NGS monitoring wells have been abandoned to eliminate possible pathways for the contaminated groundwater to move downward. The full extents of the industry-produced groundwater in the Carmel Formation are not defined, despite the fact that this problem has existed since at least 1979.

Impacts to the N Aquifer at the NGS site include increasing concentrations of sulfate and TDS. Fractures present in the Carmel Formation and the underlying Page and Navajo Sandstones act as preferred pathways for downward migration of contaminated groundwater. Fractured-rock aquifers are notoriously difficult to characterize, monitor, and remediate once they become contaminated. The numerous and obvious fractures in the sandstone bedrock forming the eastern wall of NGS'

unlined coal ash landfill represent preferred pathways for ash leachate to enter the groundwater system. It is important to recognize that it takes time for contamination to migrate from a source and cause a detectable impact.

Semi-annual groundwater monitoring occurring at the unlined coal ash landfill is inadequate. There is only one active N-Aquifer monitoring well (DW-3) located near the northwestern corner of the coal ash landfill, and that well may not be in a location suitable to monitor the impact of coal ash leachate. The DEIS claims that the risk of leachate impacting the N Aquifer is minimal because the coal ash is disposed in a "dry" form, the climate is arid, and the groundwater is approximately 900 feet below grade. However, NGS intentionally placed approximately 200 to 350 million gallons of "plant process water" on the coal ash within the first decade of operation, and at least 70 million gallons of water falls on the coal ash every year as rain and snow.

The current monitoring plan for the coal ash landfill and the Carmel Formation beneath the NGS does not provide adequate safeguards against long-term impacts to the groundwater resources. The list of groundwater contaminants being monitored at NGS do not include several constituents that are commonly produced by coal ash. The NGS plan to comply with federal coal ash landfill rules claims that a more complete monitoring-well network will be in place at the CCR landfill by October of 2017, but the DEIS provides no description of what that network might include. Furthermore, this 'expanded' groundwater-monitoring network excludes the area of known groundwater contamination at the NGS plant site, and the full extent of groundwater in the Carmel Formation is not fully defined.

The DEIS was produced to support extension of operations at NGS through 2044, but some aspects of decommissioning the facilities by late 2019 are also described. Landfills used for soil wastes, asbestos, and other potential contaminants are present at NGS, and plans to evaluate and close those non-ash contaminant sources are nonspecific and vague. At least one large release of fuel oil has occurred at the NGS plant, but that contamination is not described in any detail. The plan describing closure of the coal ash landfill is focused on placing a cover over the ash, and the post-closure maintenance and monitoring plan contains no details beyond stating that NGS will comply with the 2015 federal CCR landfill rules. It is impossible to forecast accurately what it might cost to close, monitor, and (possibly) remediate the coal ash landfill at the NGS site because there are too many unknowns. A planning value of \$100,000 per acre of ash is indicated from the limited data available from other coal ash landfill closures occurring in the United States. That figure does not include the costs of closure and remediation at the NGS plant site, including where contaminated groundwater is documented and where historic waste disposal areas may continue to be a source of contaminants.