TECHNICAL MEMORANDUM

To:	Arizona Public Service Company	**Project No.:**	US0043274.6330
Completed By:	Samantha O'Shea, PMP	**Date:**	2026-03-25
Reviewed By:	Maren Henley, PE (AZ) Rebecca Weaver, PE (AZ)	**CC:**	File

Subject: **ADDENDUM TO GROUNDWATER MONITORING SYSTEM CERTIFICATION REPORT – BOTTOM ASH POND (BAP) GROUNDWATER MONITORING NETWORK MODIFICATION**

Coal Combustion Residuals Rule Groundwater Monitoring System Compliance
Arizona Public Service Company, Cholla Power Plant – Navajo County, AZ

Introduction

This Addendum to Groundwater Monitoring System Certification (the Addendum) documents a modification to the Coal Combustion Residuals (CCR) Groundwater Monitoring System Certification previously certified on January 30, 2023. A Groundwater Monitoring System Certification Report was prepared by WSP USA Environment & Infrastructure (WSP) (WSP, 2023) on behalf of Arizona Public Service Company (APS), which certified the groundwater monitoring system currently in place for the Fly Ash Pond (FAP), Bottom Ash Pond (BAP), Bottom Ash Monofill (BAM), and Sedimentation Pond (SEDI) at the APS Cholla Power Plant (Cholla, or the Site) in accordance with 40 CFR § 257.91(f). The 2023 Report was an update to the original Certification Report for Cholla dated September 19, 2017 (Montgomery and Associates, 2017). Together, the 2017 and 2023 Certification Reports provided justification for and a summary of the CCR groundwater monitoring system designs (including the siting, drilling, construction, and development of wells).

The purpose of this Addendum is to document the basis for removal of monitoring well MW-72M from the BAP-certified CCR groundwater monitoring network based on an updated hydrogeologic evaluation demonstrating that the well does not monitor a potential pathway for releases from the CCR unit, as required under 40 CFR §257.91(a). The Addendum does not alter the remainder of the approved groundwater monitoring system and does not affect compliance with the location, detection monitoring, assessment monitoring, or corrective action requirements of the CCR Rule. As stated in past Certification Reports, results for CCR monitoring wells continue to be routinely evaluated to ensure that

the well network continues to provide a complete and representative data set for each unit. The Addendum reviews information collected since the date the original systems were certified and later updated in 2023. This Addendum documents continued evaluation of the BAP groundwater monitoring system at Cholla and supports certification that the BAP groundwater monitoring system, as modified by the removal of MW-72M, continues to meet the requirements of 40 CFR §257.91.

The Addendum presents background information, a summary of hydrogeologic and geochemical evaluations relevant to the BAP, the technical basis for removal of monitoring well MW-72M, an evaluation of continued compliance with applicable groundwater monitoring system requirements under the CCR Rule, and documentation of the updated BAP groundwater monitoring network.

Background

Downgradient monitoring well MW-72M was originally included in the BAP groundwater monitoring system based on the site hydrogeologic understanding available at the time of the 2023 system certification. Since that time, subsequent data collection and evaluation of hydrogeologic data as part of continued groundwater monitoring and alternative source demonstrations (ASDs) completed at the BAP have provided a refined understanding of site conditions. As part of these efforts, additional geochemical evaluations were performed as part of the ASDs for combined radium and lithium at the BAP in 2025. Specifically, two ASDs were completed following declared statistically significant levels (SSLs) in exceedance of GWPSs of combined radium in downgradient boundary well MW-72M (WSP, 2025a) and lithium in downgradient boundary wells MW-72M and W-306 (WSP, 2025b). The lithium ASD was an update to a 2019 lithium ASD (Wood, 2019).

The ASDs presented lines of evidence indicating that the exceedances of lithium and combined radium at MW-72M were the result of natural occurrence and variability, and not a release from the BAP. An updated ASD was completed following similar exceedances at MW-72M during monitoring conducted in May 2025 (WSP, 2026). These ASDs have identified that groundwater at the MW-72M well screen interval is not hydraulically connected to potential groundwater flow pathways from the BAP. MW-72M is currently designated as a downgradient boundary location for the BAP and was intended to indicate potential releases from the BAP. Based on these evaluations, MW-72M should be removed as a downgradient boundary monitoring location.

Basis for Well Removal

At the BAP, the uppermost geologic units that are expected to influence groundwater flow and contribute to variations in naturally occurring constituent concentrations include, in descending order, the Tanner Wash Alluvium and the Moenkopi Formation (Holbrook, Moqui, and the Wupatki members).

Understanding the hydrostratigraphic setting of these units is necessary to evaluate whether groundwater monitoring wells are representative of potential CCR release pathways. The relevant hydrostratigraphic unit conceptualized beneath the BAP consists of the alluvium and a localized weathered upper portion of the Moqui member.

Consistent with this framework, evaluation of naturally occurring combined radium and lithium at MW-72M indicates that groundwater chemistry at this location is influenced by Site geology and hydrostratigraphy rather than releases from the BAP (WSP, 2025a and 2025b). Detailed descriptions of the pertinent geologic units, hydrostratigraphy, and their influence on groundwater chemistry are presented in the ASDs (WSP, 2025a and 2025b) to support development of the conceptual site model (CSM).

Results of the ASD evaluation provide the technical basis for reassessing the role of MW-72M within the BAP monitoring network. The key findings from the ASD evaluations (WSP, 2025a and 2025b) demonstrated that the source for lithium and combined radium at MW-72M is associated with natural variation in the geologic materials of the Site, primarily evaporite minerals and other natural sources, and the influences of hydrostratigraphy on groundwater chemistry. Specifically:

- Groundwater at MW-72M is geochemically distinct from other CCR-impacted wells, with unique ion ratios and multivariate relationships that do not match other downgradient wells.
- MW-72M is completed in a portion of the Moqui that is hydraulically disconnected from alluvial groundwater and seepage along the Holbrook-Moqui interface.
- Hydrogen and oxygen isotopes indicate that the groundwater sample from MW-72M is not associated with recharge from the BAP, supporting hydraulic separation and natural geologic influence.
- An updated statistical evaluation, along with historical concentration trends of lithium and indicator compounds (boron and sulfate), confirms that the spatial distribution and concentration patterns of lithium in Moqui-screened well MW-72M are not consistent with a lithium source originating from the BAP. Concentrations of CCR indicator constituents boron and sulfate in groundwater at MW-72M are lower than concentrations at the background well (M-64A).
- The presence of gypsum in MW-72M, lithium in MW-72M sediments, and a consistent geochemical signature at the well provides direct evidence of natural evaporite mineral deposits. These deposits are a known geologic source of lithium-bearing impurities and provide a plausible alternative to CCR-related lithium source.
- The region around the Site is enriched with naturally occurring uranium, and to a lesser understood extent thorium, with known ore-grade deposits that undergo radioactive decay to radium. Uranium oxide was detected in sediment from the screened interval of MW-72M in direct contact with groundwater, while combined radium concentrations are not detectable in BAP surface water.

Taken together, this body of evidence demonstrates that MW-72M does not function as an effective downgradient boundary monitoring location for the BAP. Groundwater conditions at MW-72M are controlled by natural geologic and hydrostratigraphic factors, including hydraulic separation from alluvial groundwater and BAP seepage, and are not representative of groundwater passing the waste boundary of the BAP. The well exhibits geochemical and isotopic characteristics distinct from CCR-impacted wells and is influenced by naturally occurring evaporite and uranium-bearing mineral deposits that provide plausible sources of lithium and combined radium. Indicator constituents associated with CCR impacts, including boron and sulfate, are not elevated at MW-72M relative to background conditions.

According to 40 CFR §257.91(a), groundwater monitoring wells should be placed so they accurately reflect the groundwater quality at the relevant compliance point for the CCR unit. Because MW-72M does not monitor groundwater that could reasonably be impacted by a release from the BAP, it does not meet this performance objective.

In addition, MW-72M was part of a paired boundary location in which two wells are screened to evaluate the two hydostratigraphic units below the BAP, with MW-71A monitoring alluvial groundwater and MW-72M monitoring groundwater within the weathered Moqui. The paired alluvial well MW-71A will remain part of the monitoring system. Accordingly, removal of MW-72M will not adversely affect the objectives of the CCR Rule's monitoring requirements, nor will it result in unmonitored potential release pathways. Further refinements to the conceptual site model or additional hydrogeologic data relevant to the CCR groundwater monitoring system will continue to be evaluated and certified in accordance with 40 CFR §257.91, as appropriate.

CCR Unit Groundwater Monitoring System Requirements

This section evaluates whether the BAP groundwater monitoring system continues to meet the requirements of 40 CFR §257.91 following removal of monitoring well MW-72M from the monitoring network. Each applicable regulatory requirement is summarized below, followed by a brief description of how the modified BAP monitoring network continues to satisfy that requirement without reliance on MW-72M.

Monitoring System Performance Standard - §257.91(a)

- **Requirement:** The monitoring system must have a sufficient number of wells, installed at appropriate locations and depths, to yield samples from the uppermost aquifer that accurately represent 1) the quality of background water that has not been affected by leakage from the CCR Unit, and 2) the quality of groundwater passing the waste boundary of the CCR Unit via all potential contaminant pathways.

- **Demonstration:** The BAP monitoring network includes one background well and eight downgradient boundary wells. These downgradient boundary locations continue to accurately represent potential contaminant pathways associated with the BAP.

Basis in Site-Specific Characterization - §257.91(b)

- **Requirement:** The number, spacing, and depth of monitoring system components should be based on characterization of the aquifer underlying a CCR Unit. This includes characterization of 1) aquifer thickness, groundwater flow rate and direction (including seasonal fluctuations), and 2) saturated and unsaturated geologic units or fill materials overlying the uppermost aquifer, comprising the uppermost aquifer, and comprising the confining unit defining the lower boundary of the uppermost aquifer (including thickness, stratigraphy and lithology, hydraulic conductivities, porosities, and effective porosities).
- **Demonstration:** The proposed monitoring network reflects the current understanding of subsurface conditions at the BAP. The network continues to effectively monitor potential releases based on updated hydrogeologic characterization.

Minimum Well Requirements - §257.91(c)

- **Requirement:** The groundwater monitoring system must include, at a minimum, one upgradient (background) well and three downgradient wells, with additional wells as necessary to meet the Monitoring System Performance Standard (§257.91[a]).
- **Demonstration:** The BAP monitoring system includes one background well and eight downgradient boundary locations.

Well Construction Requirements - §257.91(e)

- **Requirement:** Monitoring wells must be cased to maintain integrity of the borehole, screened, and packed with filtration material where necessary, to enable groundwater sample collection. The well annulus must also be properly sealed above the sampling depth to prevent contamination of samples and groundwater. Further, 1) the design, installation, development, and decommissioning of any monitoring device (well, piezometer, other measurement or sampling or analytical device) must be documented, included in the operating record, and accessible for this certification report, and 2) all monitoring and analytical devices (wells, piezometers, other measuring devices) must be operated and maintained such that they perform to design specifications throughout the lifetime of the monitoring program.
- **Demonstration:** All monitoring wells remaining in the BAP certified groundwater monitoring network are properly constructed, sealed, and maintained to ensure representative groundwater sample collection and to prevent cross-contamination. Well design, installation, development, and maintenance documentation is maintained in the operating record and is accessible for purposes of this certification. The integrity and condition of all monitoring wells within the BAP certified monitoring network are evaluated on a semi-annual basis, ensuring continued performance consistent with design specifications.

Monitoring System Certification - §257.91(f)

- **Requirement:** A certification from a qualified professional engineer (or approval from the Participating State Director or the USEPA, where either is the permitting authority) stating the design and construction of the groundwater monitoring system(s) meet all requirements of 40 CFR §257.91. If a system includes the minimum number of wells (§257.91[c][1]) the certification must document the basis supporting this determination.
- **Demonstration:** This Addendum is certified by a qualified professional engineer, documenting that the design and construction of the BAP groundwater monitoring system, as modified by removal of MW-72M, continue to meet all applicable requirements of 40 CFR §257.91. The certification reflects that the monitoring system exceeds the minimum well requirements and therefore does not rely on a minimum well justification under §257.91[c][1]

Recordkeeping Requirements - §257.91(g)

- **Requirement:** Records must be maintained in accordance with 40 CFR §§257.105(h), 257.106(h), and 257.107(h).
- **Demonstration:** This Addendum is maintained in the operating record as documentation supporting the determination that MW-72M is not representative of a potential release from the BAP. All required groundwater monitoring, certification, and demonstration records will continue to be maintained in the operating record, in accordance with the CCR Rule.

Based on this evaluation, the modified BAP groundwater monitoring network continues to meet all applicable requirements of 40 CFR§257.91 without continued monitoring at MW-72M.

Updated Groundwater Monitoring Network

Following removal of MW-72M, the BAP groundwater monitoring system consists of one background well (M-64A) and eight downgradient boundary wells:M-52A, M-53A, MW-71A, MW-73A, MW-74M, W-305, W-306, and W-314. As modified, this groundwater monitoring system meets all applicable requirements of 40 CFR §257.91 and is certified in accordance with §257.91(f).

Bibliography

Montgomery & Associates, 2017. Cholla Power Plant Coal Combustion Residuals Program – Design, Installation, and Evaluation of Completeness of Groundwater Monitoring Networks. Navajo County, Arizona. Document #CH_GW_SystemCert_020_20170919. Report dated September 19, 2017.

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Professional Certification

This Addendum to Groundwater Monitoring System Certification Report – Bottom Ash Pond (BAP) Groundwater Monitoring Network Modification has been prepared in compliance with applicable United States Environmental Protection Agency (USEPA) coal combustion residual (CCR) rule (40 Code of Federal Regulations [CFR] 257 Subpart D) under the direction of a licensed professional engineer with WSP USA Inc (WSP).

By means of this certification, I certify that I have reviewed this Report and find the information presented herein accurate and appropriate and meets the requirements of 40 CFR §257.91(f).

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