

PERMITTING HYDROLOGY

**A Technical Reference Document for Determination
of Probable Hydrologic Consequences (PHC) and Cumulative
Hydrologic Impact Assessments (CHIA)**

BASELINE DATA

Prepared by
the Office of Surface Mining

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IN REPLY REFER TO:

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OFFICE OF SURFACE MINING
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MESSAGE FROM THE DIRECTOR

As the Director of the Office of Surface Mining (OSM), I look forward to working on issues affecting the regulation of coal mining and reclamation activities across the United States. Although there are regional differences in climate, topography, geology and hydrology that singularly and collectively need to be considered in the coal mining permitting process, the control of adverse environmental impacts associated with coal mining starts with the permitting process. I recognize the importance of the permitting process as the first step in balancing the Nation's need for coal as an energy source and controlling environmental impacts to the hydrologic balance.

It is within this context that I am pleased to make available a technical reference document prepared by OSM, entitled *Permitting Hydrology, A Technical Reference Document for Determination of Probable Hydrologic Consequences (PHC) and Cumulative Hydrologic Impact Assessments (CHIA) – Baseline Data*. This document covers a wide range of topics, including: potential hydrologic impacts; baseline information; quality assurance/quality control procedures; technical software and data management; national data bases and regional examples of baseline information summarized from an eastern site, a mid-continent site and a western site.

This technical reference document was prepared in order to provide coal mining regulatory authorities and others with a tool for their use during the permitting process. I encourage you to use this document appropriate to your needs. However, as a reference document, its use is discretionary, and not a requirement.

Sincerely,

Jeffrey D. Jarrett, Director
Office of Surface Mining

Attachment

FOREWORD

Permitting Hydrology, A Technical Reference Document for Determination of Probable Hydrologic Consequences (PHC) and Cumulative Hydrologic Impact Assessments (CHIA), Baseline Data

This PHC/CHIA technical reference document provides a technically sound approach for obtaining geologic and hydrologic information to be used in the review and preparation of coal mine permit applications. The document represents a snapshot in time - thus; it is subject to revision at some future date. While we believe the document represents a sound technical, good-science approach for permit reviewers, CHIA preparers and policy makers, it does not have the power of regulation, and we are not requiring its use by regulatory authorities (RAs). As we discuss in the introduction, the requirements for both PHC and CHIA are set forth as performance standards in the Surface Mining Control and Reclamation Act (SMCRA). Regulators choose how best to meet those standards. They may choose to follow the guidance in this document, or they may adopt an alternative combination of specifications, verifications and controls for hydrologic and geologic baseline data. Whatever approach is chosen, it must provide a framework for technically and scientifically sound and supported hydrologic impact analyses, and it must ensure the hydrologic performance standards of SMCRA are met.

Although this document describes a sound technical approach for meeting baseline requirements for PHCs and CHIAs, there will be cases in which either more or less baseline data are appropriate to characterize an individual site. It may be prudent on the part of the RA to consider the need to justify significant departures from the data and data-related procedures in this document or from established procedures that are no less effective as those in this document.

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DEFINITIONS OF ACRONYMS AND UNITS

<i>ABA</i>	–	Acid base accounting
<i>ADPS</i>	–	USGS Automated Data Processing System
<i>ADTI</i>	–	Acid Drainage Technology Initiative
<i>AMC</i>	–	Antecedent moisture condition
<i>AMD</i>	–	Acid mine drainage
<i>AOC</i>	–	Approximate original contour
<i>APPX</i>	–	Applications Excellence (database) Software
<i>ASTM</i>	–	American Society for Testing and Materials
<i>AVF</i>	–	Alluvial valley floor
<i>AWUDS</i>	–	USGS Aggregate Water-Use Data System, a part of WUDS
<i>BLM</i>	–	U.S. Bureau of Land Management
<i>CCB</i>	–	Coal-combustion byproducts
<i>CEC</i>	–	Cation exchange capacity
<i>CFR</i>	–	U.S. Code of Federal Regulations
<i>CHIA</i>	–	Cumulative hydrologic impact assessment
<i>CIA</i>	–	Cumulative impact area
<i>DECS</i>	–	U.S. Department of Energy Coal Sample
<i>DOG M</i>	–	Utah Division of Oil, Gas and Mining
<i>DQO</i>	–	EPA's Data Quality Objectives
<i>EA</i>	–	Exchangeable acidity

<i>EC</i>	–	Electrical conductivity
<i>EIS</i>	–	Environmental impact statement
<i>EPA</i>	–	U.S. Environmental Protection Agency
<i>EPT</i>	–	EPA Total taxa and particular taxa diversity
<i>ESP</i>	–	Exchangeable sodium percentage
<i>FES</i>	–	Final environmental statement, equivalent to a final EIS
<i>GOES</i>	–	Geostationary Operational Environmental Satellite
<i>GPS</i>	–	Global positioning system
<i>GWSI</i>	–	USGS Ground-Water Site Inventory
<i>HEC</i>	–	U.S. Army Corps of Engineers Hydrologic Engineering Center
<i>IBI</i>	–	EPA Index of Biological Integrity
<i>IC</i>	–	Inorganic carbonates
<i>ID</i>	–	Pipe inside diameter
<i>meq/L</i>	–	Milliequivalents per liter
<i>mg/L</i>	–	Milligrams per liter
<i>mL</i>	–	Milliliters or 0.001 liters
<i>mm</i>	–	Millimeters or 0.001 meters
<i>MPA</i>	–	Maximum potential acidity
<i>MUSLE</i>	–	Modified Universal Soil Loss Equation computer application
$\mu\text{mhos/cm}$	–	Micromhos per centimeter at 25° C, equivalent to microsiemens per centimeter at 25° C ($\mu\text{S/cm}$)
<i>NABA</i>	–	Net Acid Base Account

<i>NCRDS</i>	–	USGS National Coal Resources Data System
<i>NNP</i>	–	Net neutralization potential
<i>NP</i>	–	Neutralization potential
<i>NRCS</i>	–	U.S. Natural Resources Conservation Service
<i>NWIS</i>	–	USGS National Water Information System
<i>OSM</i>	–	U.S. Office of Surface Mining Reclamation and Enforcement
<i>PA</i>	–	Potential acidity
<i>PHC</i>	–	Probable hydrologic consequences determination
<i>QA/QC</i>	–	Quality Assurance/Quality Control
<i>PAP</i>	–	SMCRA permit application package
<i>PSOC</i>	–	Pennsylvania State Office of Coal Research
<i>PVC</i>	–	Polyvinyl chloride plastic
<i>RA</i>	–	Regulatory authority
<i>RUSLE</i>	–	Revised Universal Soil Loss Equation computer application
<i>SAR</i>	–	Sodium adsorption ratio
<i>SDPS</i>	–	Surface Deformation Prediction System computer application
<i>SMCRA</i>	–	Surface Mining Control and Reclamation Act of 1977, Public Law 95-87, 30 U.S.C. 1201, <i>et seq.</i>
<i>TR-55</i>	–	NRCS (previously Soil Conservation Service) Technical Release Number 55
<i>STORET</i>	–	EPA STOrage and RETrieval of parametric data
<i>SWUDS</i>	–	USGS Site-Specific Water-Use Data System, a part of WUDS
<i>TDS</i>	–	Total dissolved solids

<i>TIPS</i> –	OSM’s Technical Information Processing System
<i>TSS</i> –	Total suspended solids
<i>TVA</i> –	Tennessee Valley Authority
<i>U.S.C.</i> –	U.S. Code
<i>USDA</i> –	U.S. Department of Agriculture
<i>USGS</i> –	U.S. Geological Survey
<i>USDI</i> –	U.S. Department of the Interior
<i>UTM</i> –	Universal Transverse Mercator global coordinate system
<i>WAN</i> –	Wide area (computer) network
<i>WRD</i> –	USGS Water Resources Division
<i>WUDS</i> –	USGS Water-Use Data System

INTRODUCTION

The mission of the Office of Surface Mining (OSM) is to carry out the requirements of the Surface Mining Control and Reclamation Act (SMCRA) in cooperation with States and Tribes in order to ensure that:

- Coal mines are permitted and operated in a manner that protects citizens and the environment.
- The land is restored to beneficial use following mining.

Coal mining has the potential to adversely affect the hydrologic balance. SMCRA requires that these adverse impacts be minimized and not cause an unacceptable degree of damage to the hydrologic balance. A permit application for coal mining must contain:

- Baseline geologic and hydrologic information.
- A determination of probable hydrologic consequences (PHC) within the permit and adjacent areas resulting solely from the proposed operation.
- A hydrologic reclamation plan.
- Ground- and surface-water monitoring plans.

The PHC predictions of impacts for all mines in a designated area are the main source of input for the development of the cumulative hydrologic impact assessment (CHIA) prepared by the RA. The CHIA is an assessment of the incremental hydrologic impacts of the proposed operation in combination with the impacts of all other existing and anticipated mining within a defined cumulative impact area. The written finding by the RA that the proposed operation is designed to prevent off-site material damage to the hydrologic balance is based on the CHIA. This material damage finding must be made before a SMCRA permit can be issued.

Although requirements for both PHC and CHIA exist in SMCRA and the permanent program regulations, they are rather general performance-type standards in that they identify hydrologic objectives but do not prescribe exact methodologies for their accomplishment. As such, RA's have ample flexibility to set forth the combination of specifications, verifications and controls needed to produce a technically-sound hydrologic impact analysis and, ultimately, supportable permitting decisions. The reasonable procedural support for the PHC and CHIA would thus include:

- Quality assurance for hydrologic and geologic baseline data.
- Selection of appropriate analytical tools and methodologies.

- Selection of appropriate monitoring stations, parameters and frequencies.

Purpose And Scope

The purpose of this document is to provide new, updated guidance to assist in the review and preparation of the PHC and CHIA hydrologic and geologic portions of coal mine permit applications. This document is intended to promote effective and economic collection of existing and new hydrologic and geologic data to meet the requirements of SMCRA and the permanent program regulation. Adequate data are needed to ensure that reasonable and technically-supportable PHC's and CHIA's are prepared. The technical reference document is intended also to provide a national framework under which more detailed regional or State-specific documents can be developed, if appropriate. Discussions on the following topics are included in the Baseline document:

- Hydrologic impacts of different types of coal mining.
- Baseline geology and overburden requirements including a discussion of acid mine drainage (AMD).
- Baseline information for ground- and surface-water quantity and quality.
- Baseline information for CHIA.
- Quality assurance and quality control (QA/QC) procedures for data collection and analysis.
- Sources of hydrologic and geologic information including national and State/Tribal databases.
- The utility of OSM's Technical Information Processing System (TIPS) to present, characterize and analyze baseline hydrologic and geologic information.
- Examples of baseline information summarized from planned or actual permits representing differing regional settings.

This Baseline technical reference document focuses on baseline data needed to represent ambient conditions at the site prior to starting a proposed mining operation, and is the first part of a two-part independent series. This document is written from the perspective of the permanent program Federal rules. States have approved regulatory programs that are the same or as effective as the Federal rules.

The analysis and prediction document, which will deal with methodologies that can be used to analyze the baseline data and predict hydrologic impacts from a proposed mining operation will be

developed separately. The purpose of both of these two documents is to assist the RAs in the review of PHCs and the preparation of CHIAs so that technically-supportable hydrologic impact analyses and permit findings can be developed.

This document and the analysis and prediction document, if completed, will replace the earlier guidance by OSM (OSM, 1997, 1985a, 1985b, and 1985c).