

ARIES Executive Summary

Introduction

The following document contains an executive summary of key findings from the Appalachian Research Initiative for Environmental Science (ARIES). Further details for these findings may be found in the referenced peer-reviewed publications and project reports. The ARIES body of work was developed from 2011 to 2016. Thus, published ARIES results will not reflect any evolutions in policy and research that occurred after this timeframe. Although some issues may be different today, the breakthrough research conducted by the ARIES community continues to provide invaluable insights into these areas of interest.

In the early 2000s, concerns were raised about the impact of Appalachian coal mining and especially mountaintop mining. These concerns were prompted by various research studies that alleged a direct link between coal mining and various negatively trending aspects of community health. Some studies related coal mining to higher rates of cancer and infant mortality. Other investigations claimed that coal mining perpetuated poverty and harms community character. These reports prompted a significant public outcry that resulted in litigation and regulatory attention toward the coal industry.

In response, a number of meetings and strategic sessions were held in 2009 and 2010 to address these concerns. Major Appalachian coal producers, coal associations, and essential coal infrastructure companies participated in these conferences. After rigorous debate, the participants formed an independent research program designed to address community concerns through objective, focused research. This program was designated the Appalachian Research Initiative for Environmental Science (ARIES).

ARIES would be a consortium that elicited the participation of research institutions across the U.S. The primary objective of this research collaboration would be to investigate the impacts of coal mining and energy production on Appalachian communities. To support this goal, ARIES adopted a research paradigm that delivered objective, robust, and transparent results through the support of industry. This paradigm was composed of four core principles:

- Independent research conducted at universities
- Wide dissemination of results through peer-reviewed publications
- Realistic timeframes for research and reporting
- Applying sound scientific principles

The Virginia Center for Coal and Energy Research (VCCER) at Virginia Tech was tasked to lead and develop ARIES to ensure full transparency, independence, and diverse involvement. Upon inception, ARIES was financially supported by a multi-year commitment from industrial affiliate partners. The resulting grant of \$15 million was established to fund the ARIES program over the first five years. The ARIES program was announced publically on March 31, 2011, which

received immediate support from State governments including direct endorsements by the governors of five Appalachian states.

ARIES research encompassed four topic area categories, which were 1) Impacts on Ecosystems, 2) Waste and Water Management, 3) Environmentally Responsible Mining Technology, and 4) Health, Social and Economic Impacts. A brief description of each category is provided in the paragraphs that follow:

Impacts on Ecosystems - Changes to habitat, water chemistry, and other environmental variables from human development have direct implications for upland and aquatic ecosystems. ARIES researchers evaluated the impacts, if any, of mining activity and possible means for mitigating any negative effects.

Waste and Water Management - Concerns have been raised about the impact of mining operations on the chemistry of surface and ground water, especially implications for aquatic ecosystems and human health. Waste treatment methodology, placement of waste materials, and wastewater flow paths have been shown to affect impacts on surface and ground water. ARIES researchers expanded the current state of waste and water management methodologies by improving management principles and developing new water treatment methodologies/technologies. Additionally, ARIES researchers addressed issues related to the prediction, impacts, and treatment of chemical constituents.

Environmentally Responsible Mining Technology - Mining activities, similarly to any large industrial or commercial project, generally result in significant disturbance of existing natural features. ARIES researchers investigated techniques and technologies that would allow mining activities to be conducted in a manner that minimize effects on air, water, and ecosystems.

Health, Social and Economic Impacts - Among the most controversial issues related to coal mining in Appalachia are the alleged impacts on community health in the context of both economic and human health. In terms of the economy, allegations of a “resource curse” from which poverty is perpetuated with mining has long accompanied this industry. For human health, mining operations have recently been identified as possible causes for a range of diseases from birth defects to cancer. To address these concerns, ARIES researchers evaluated the impacts of coal mining on the Appalachian community. A variety of research approaches were applied including standard epidemiologic, pathway analysis, and factor association techniques to determine specific causes, if any, for these issues.

Research institutions that participated in ARIES included Virginia Tech, West Virginia University, Marshall University, University of Kentucky, Ohio State University, Pennsylvania State University, University of Pittsburgh, the Edward Via College of Osteopathic Medicine, Consultants in Epidemiology and Occupational Health, Georgetown University, Johns Hopkins University, University of Virginia at Wise, and St. Francis University in Pennsylvania. Since 2011, ARIES researchers produced nearly 100 peer-reviewed publications in addition to numerous conference presentations and papers. The research involved more than 75

undergraduate and graduate student researchers, as well as 60 faculty and research associates. The ARIES body of work opened avenues for additional research and topics that continue to be explored. The funds awarded by this project created and reinforced a cadre of researchers whose contributions continue beyond ARIES.