

**U.S. Office of Surface Mining Reclamation and Enforcement**

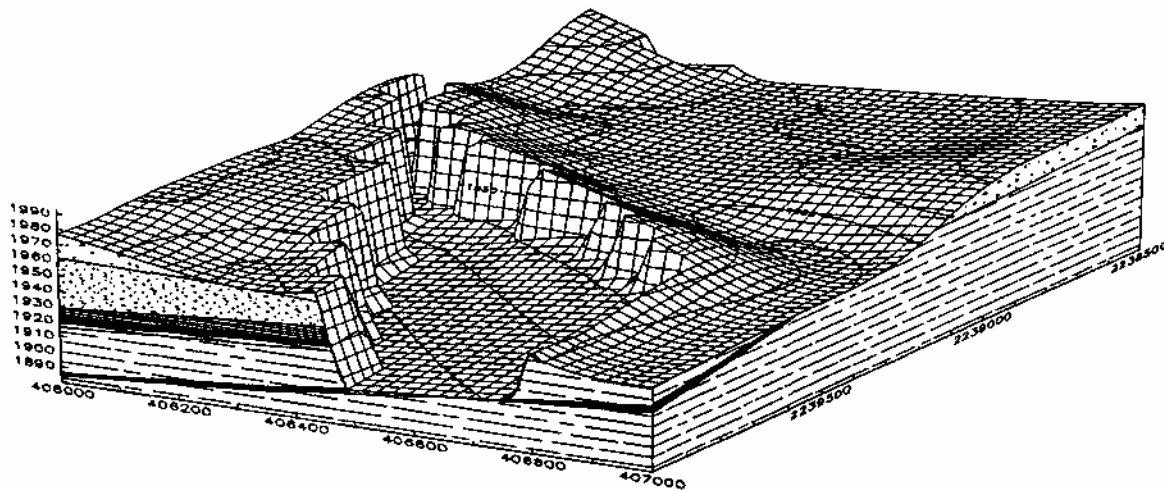
# **Technical Information Processing System**

## **A Toolbox for the Mining and Minerals Professional**

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The Technical Information Processing System (TIPS) is a computer system which has been jointly developed by the Office of Surface Mining Reclamation and Enforcement (OSM) and the States. The system provides the regulatory agencies with a comprehensive set of analytical tools to aid in technical decision-making processes related to the Surface Mining Control and Reclamation Act (SMCRA).

### **TIPS OPERATION**

A TIPS work station consists of a desktop Personal Computer including a suite of technical software, with the added power of a networked link to a superminicomputer located at OSM's TIPS National Computer Facility, Western Field Operations, Denver, Colorado. The work station includes an 80386-based microprocessor with math co-processor, enhanced color graphics card, a color graphics monitor, a digitizing tablet, full

scale plotter, a 130 megabyte hard disk and a 20 megabyte removable hard disk for project backup.

The superminicomputer performs state-of-the-art, numerically intensive applications such as geologic modeling, and 3D spatial analysis of toxic overburden, volumetrics and GIS applications. Efficiency and savings to the taxpayer is achieved by eliminating the need for duplicating these expensive, high-end software applications for each work station location.

TIPS is a tool intended for regulatory agencies to quickly and accurately evaluate proposed and existing mining operations. It is offered exclusively to coal mine regulating agencies in the United States. The use of TIPS is completely voluntary. OSM provides all TIPS- approved hardware and software as well as the telecommunication links to the minicomputer, user support, and user training. TIPS users are responsible for collecting and processing their own data. Project specific assistance is available upon request to OSM.

## OBJECTIVES

### **Enhance technical effectiveness and efficiency.**

Use of advanced computer applications through TIPS can increase the technical knowledge and capabilities of the States and OSM. TIPS' proven computer applications can allow conclusive technical and scientific results to be achieved faster and more efficiently than non-automated methods. This can result in significant time savings in making technical findings.

### **Technology transfer among TIPS users and industry.**

The TIPS work station can provide a common data medium, where complex data can be submitted to the regulatory agency on magnetic disk for faster and more efficient review.

### **Improve communication with outside interest groups and the public through graphic displays of complex technical data.**

Complex technical concepts can be more readily perceived through the visual medium of computer-assisted mapping and computer graphics. Technical concepts on such topics as blasting, hydrology, mine subsidence, etc. are more easily understood when presented graphically.

## USES AND FUNCTIONS

The Surface Mining Act (SMCRA) requires the regulatory agency to evaluate and validate the technical studies and data submitted by mine operators. To evaluate each application, TIPS provides software and hardware tools to conduct an independent analysis or modeling of permit application data, including:

Geologic analysis from borehole data.

Hydrologic effects of the proposed mining operation.

Detailed resource recovery estimates.

Simulation of post-mining topography and analysis of approximate original contour.

Earth moving volumetrics to confirm reclamation costs.

Slope stability analysis.

Statistical analysis of water quality reports and determination of sampling adequacy.

Design of sediment control structures.

Three-dimensional analysis of overburden quality and the extent and volumes of acid or toxic forming materials.

Geographic Information System for storage and graphic representation of site data.

TIPS can be used to prepare environmental assessments, and assist in the design of sound, cost-effective reclamation projects. Included in these capabilities are: aerial survey data reduction; design of drainage control structures; deep mine seals; pollution abatement projects; safe disposal sites; as well as determining areas of unstable geology, landslide potential; mine fire location; flooding potential; and visual and noise impact analysis. TIPS will also support preparation of high-quality plots showing pre- and post-mining conditions for use in official documents, or presentation at public hearings.

## SOFTWARE APPLICATION AREAS

TIPS software is comprised of a suite of off-the-shelf packages to perform the various technical analyses previously described. Many of the software applications interface with one another through common file exchange formats, or are tied to data bases to facilitate efficient data acquisition and minimize redundant data entry.

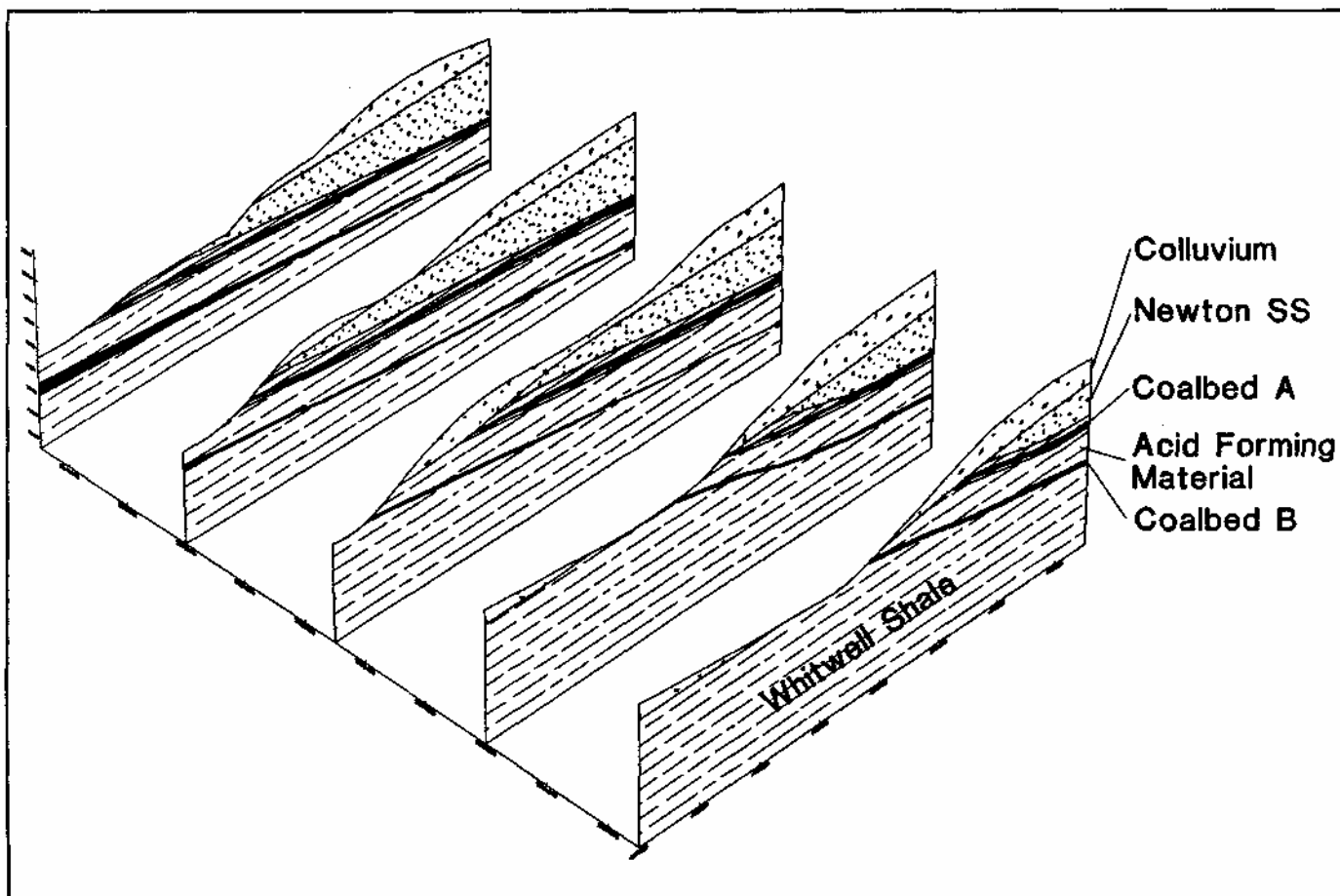
**Geologic Surface Model.** This software package mathematically analyzes spatial data such as, drill-log information, coal and overburden quality data, ground-water quality data, coal-crop information or cross-section data, and displays it as a three-dimensional graphic. Uses of the model include hydrologic impact assessment, subsidence control planning, volumetrics, ground-water contaminant distribution, and three-dimensional toxic- and acid-forming material distribution plots. Output includes generation of complex, camera ready, maps and graphics, and tables related to volumetrics of resources and toxic materials.

**Ground Water Modeling.** These programs predict the consequences of surface and underground mining upon the hydrologic balance by use of Theis and finite difference methods.

**Slope-Stability Analysis.** Determines the static and pseudo-seismic safety factor to evaluate slope design or remedial design, and assess the stability of coal waste and excess spoil fills, backfills, sediment ponds, natural slopes, post-mining slopes, and embankments.

**Geographic Information System (GIS).** Mine-site data can be tied to a base map, to produce regional or local base maps portraying any spatially dependant variable.

**Blasting Impact Analysis.** Determines the amount of



Typical fence diagram generated from Geologic Surface Model

explosive that can be safely used in proximity to critical structures.

**Statistical Analysis.** Provides a powerful tool for defining baseline conditions and quantifying changes from baseline as a result of mining.

**Surface Water Modeling.** Evaluates changes that may occur to small watersheds as a result of mining and analyzes the effectiveness of sediment/erosion control structures in meeting effluent standards.

**Automated Drafting.** Facilitates the production of engineering drawings, illustrations, schematics, and annotated maps.

**Noise Impact Analysis.** Evaluates sound levels during mining using proximity, speed and type of mining equipment. Also predicts maximum air overpressure from blasting.

**Stratigraphic Analysis.** Provides the capability of rapidly correlating complex lithologic data (from bore hole information) to assist in quantifying, the continuity of potentially affected aquifer systems, the likelihood for subsidence, and the extent of acid or toxic forming materials.

**Water Quality Analysis.** Allows the comparison of

water samples by graphically portraying the chemical "finger print" of the water.

For further information regarding TIPS, contact either:

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