NIOSH Updates Spontaneous Combustion Assessment Software

Objective

To update the current SPONCOM software to SponCom 2.0 with a Windows-based platform, using tabs and easy-to-navigate screens for entering or selecting data. These user interface enhancements would continue to make the SPONCOM software an effective tool in determining the relative spontaneous combustion potential of coal, and thereby contribute to safer mining work environments.

Background

Statistics show that in 2011 approximately 15% of all underground coal mine fires are still caused by the spontaneous combustion of coal. Spontaneous combustion fires usually occur in mined-out or gob areas. Fires in these areas are difficult to detect and extinguish, and present a serious safety hazard to mine personnel. Prior knowledge of the spontaneous combustion potential of the mining operation and the factors that increase that risk can be strategic in preventing spontaneous combustion fires.

The previous version of SPONCOM (1.0) is a DOS-based computer program that determines a coal's relative spontaneous combustion potential based on the coal's proximate/ultimate analyses and heating value. The program evaluates the impact of the coal properties, geologic and mining conditions, and mining practices relative to the risk of spontaneous combustion. Since 1994 the SPONCOM program has been distributed to over 300 users and is used throughout the mining industry as the standard for spontaneous combustion assessment. The DOS platform is now considered obsolete, with new computers having limited or no support for DOS programs. SponCom 2.0 ensures the continuing use of the SPONCOM technology in the mining industry as SponCom 2.0, now running on a Windows-based platform, offers the same functionality as the original version.

Approach

The original SPONCOM program (1.0) was developed by the Nationals Institute for Occupational Safety and Health (NIOSH) to aid its researchers and U.S. Mine Safety and Health Administration (MSHA) personnel, mining operators, and consultants in the assessment of the spontaneous combustion risk in an underground mining operation. To develop the program, information was gathered from the literature, from interactions with experts in ground control, ventilation, and geology, and from mine personnel who have experienced self-heating events at their operations. The information from these sources was correlated with NIOSH's experimental studies (on the self-heating tendencies of coals) to form the knowledge base for the program. SponCom 2.0 uses the same data inputs and analyses algorithms as the original SPONCOM program, but improves the user interface.

Figure 1. SponCom 2.0 tabs.

The SponCom 2.0 interface is divided into six sections represented by the following tabs that help the user to easily select a data input or report screen: Header, Coal Properties, Geological Properties, Mining Conditions/History, Mining Methods, and Report (Figure 1).

The first five tabs allow the user to enter data or information; the last tab enables the user to view the results of those entries. The tabs do not have to be accessed in any particular order. However, each section must be properly filled out in order to generate a valid report. The data entry elements consist of those commonly

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found in a Windows format, such as checkboxes, drop-down selections, numerical up-downs, textboxes, and radio buttons. Considerable care was used by NIOSH programmers in making the data entry process easier, which in turn enables users' entry of data to be more accurate and complete.

How it Works

SponCom 2.0 determines the coal's rank and relative self-heating potential based on the coal's proximate and ultimate analyses, heating value, and prior spontaneous combustion history. The coal's proximate and ultimate analysis is critical to generating an accurate, valid report.

Two mechanisms contribute to heat generation by the coal—the heat of oxidation and the heat of wetting. The heat of oxidation is the heat generated by the adsorption of oxygen by the coal. The heat of wetting is the heat generated by the adsorption of water vapor by the coal surfaces. Coal properties that affect the rate of heat generation include the coal's reactivity, its moisture content, friability, and the presence of pyrite and other impurities; these coal properties are entered through the Coal Properties data entry screen (Figure 2). The contribution of each of these factors to the overall spontaneous combustion risk is determined by the SPONCOM software.
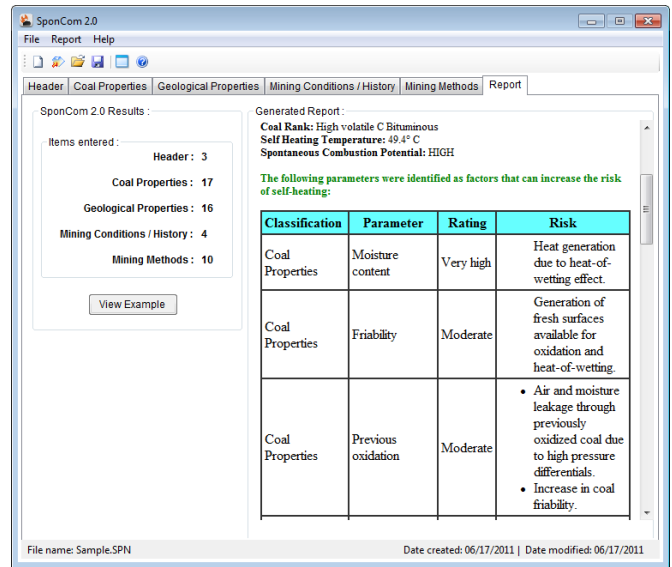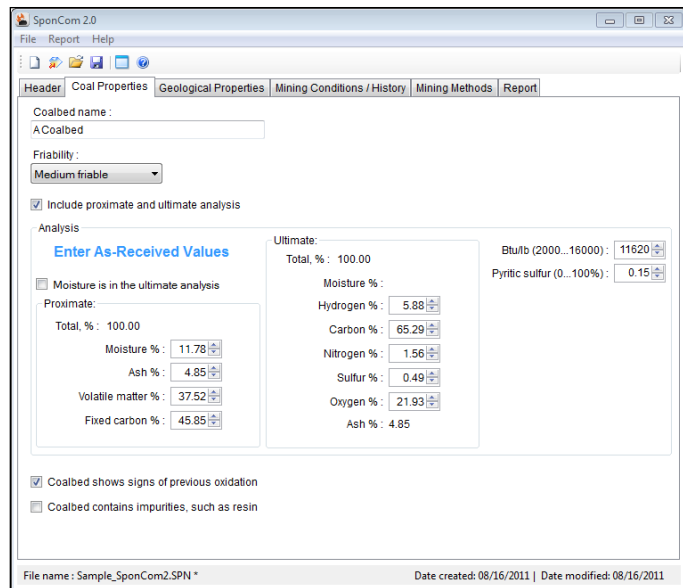

Figure 2. Coal Properties data input screen.

The input data are stored to a data file, from which the data can be recalled and updated as needed. Data files generated from the original SPONCOM program can be imported as desired. The Report tab displays the self-heating risk of the coal and provides details on each of the factors that increase the risk of spontaneous combustion in the mining operation. In addition, a valid report can be printed out as desired (Figure 3).

Figure 3. SponCom 2.0 Results Report screen.

There are three different types of Help included with the SponCom 2.0 software: (1) To view popup Help, click the right mouse button on any screen item, and select the topic from the popup menu; (2) To view a topic from the program's Help File, select Help from the Help menu on the menu bar or press F1; (3) To view the user manual (included with the SponCom 2.0 software), open the appropriate PDF file.

For More Information

The SponCom 2.0 software program can be downloaded from the NIOSH Mining Web site at: http://www.cdc.gov/niosh/mining/products. For more information about the SponCom 2.0 program, contact Alex Smith (412-386-6766, ASmith@cdc.gov), August Kwitowski (412-386-6474, AKwitowski@cdc.gov), or Angela Carilli (412-386-4090, ACarilli@cdc.gov) or the Health Communications Coordinator (OMSHR@cdc.gov), NIOSH Office of Mining Safety and Health Research, P.O. Box 18070, Pittsburgh, PA 15236-0070.