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Technical Communication

Software Update to Better Predict Costs of Treating Mine Drainage

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The U.S. Office of Surface Mining (OSM) is updating a popular software program that helps government agencies and mine water practioners predict what it will cost to treat acid mine drainage (AMD). Developers expect to release the update, AMDTreat Version 4.0, before the end of 2005. The new version will offer additional tools, expanded features, and a better user interface.

AMDTreat was developed as a joint effort by OSM, the Pennsylvania Dept. of Environmental Protection, and the West Virginia Dept. of Environmental Protection. Since its original release in February, 2003, AMDTreat has aided users to look at the problem of mine drainage as a long-term financial issue. More than 2,500 copies of the program have been distributed free on CD. AMDTreat can also be downloaded at: http://amdtreat.osmre.gov. There are currently over 700 registered users from 41 different states and an equal number of countries. Users from outside the U.S. will especially appreciate the integrated metric conversion function in the version 4.0.

From the beginning, the developers of AMDTreat set three major objectives for the software:

1. To provide a detailed framework for calculating site-specific cost estimates;
2. To provide a flexible tool for estimating costs where the user has full control over how and what elements are considered; and
3. To provide an estimating technology capable of generating real-world costs.

In delivering on those objectives, the developers realized that the selection of appropriate treatment technology is inseparable from the issue of long-term costs. The powerful modeling capabilities incorporated in version 4.0 of the program enable the user to efficiently compare the treatment costs of several different effective design approaches and select the least costly long-term solution.

AMDTreat provides a detailed framework for modeling real-world costs. In fact, there are more than 400 user-definable variables in the AMDTreat framework that allow users to adjust the model for site specific conditions. Using this framework, users can employ AMDTreat to model costs from a forward perspective, a reverse perspective, or use it as a tool for what-if modeling. As a forward modeling tool, AMDTreat can project the costs of a planned treatment system. As a reverse modeling tool, AMDTreat can be used to determine what it would cost to build an existing treatment system. As a what-if modeling tool, AMDTreat can be used to compare the costs of several alternative treatment solutions to enable selection of the most cost effective long-term solution. Version 4.0 of the software significantly enhances this framework by enabling the costing of up to 99 iterations of each treatment type.

Because mine drainage treatment is still a changing technology, we wanted the software to continue to be relevant well into the future. Therefore, flexibility was the watch-word during the design process. To insure this flexibility, the developers allow users full control over what costs are included or not included in the model. In fact, users sometimes complain that AMDTreat will let them cost model a treatment type that is totally inappropriate for the water quality and quantity of the discharge. The answer to that criticism is always that this was the intention. Developers of the software place very few input restrictions on the software. A user can zero out a cost if, for example, they already possessed a particular pump or if a needed pond is preexisting on the site. A watershed group may have large portions of a project donated or done at a reduced rate; regardless, the AMDTreat model has the flexibility to always reflect actual costs. In the new version 4.0 of the program, this flexibility is further enhanced by allowing the user to adjust the inflow water parameters for sizing every structure and/or treatment facility in a project.

AMD discharges are commonly long-term events, so it follows that a treatment cost modeling tool should include the capability to look at costs from a long-term perspective. The Recapitalization and Financial Forecasting tools of AMDTreat assist users in projecting costs into the future and comparing the long-term costs of various treatment alternatives. In a recent example, a team of treatment experts used the software to compare long-term treatment costs of several possible treatment solutions with the costs of operating an existing treatment system. In this case, the mine operator wanted to establish a trust fund to insure long-term treatment of the discharge. The high

cost of running the existing treatment system resulted in an unaffordable trust fund amount. AMDTreat was used to reverse cost model the existing system and forward cost model several potential treatment solutions. The financial tools in AMDTreat assisted the team to choose a treatment solution that dramatically reduced annual operating costs over those of the existing treatment system, since annual operating costs greatly influence long-term treatment costs. The result was an affordable trust fund amount. Version 4.0 significantly enhances the financial tools in AMDTreat by incorporating the functionality of the Recapitalization Cost tool with that of the Financial Forecasting tool and adding fields to the Financial Forecasting tool.

The original version of AMDTreat included the capability to:

- Estimate the cost of constructing and operating passive treatment systems such as vertical flow ponds, anoxic limestone drains, anaerobic and aerobic wetlands, and manganese removal beds;
- Calculate the capital cost of constructing chemical treatment systems for caustic soda, ammonia, pebble quick lime, and soda ash;
- Calculate a number of ancillary capital costs such as retention ponds, roads, land access, ditching and engineering costs;
- Estimate annual cost for chemical reagent consumption and cost, sampling, labor, maintenance, pumping and sludge removal; and
- Use financial forecasting to compare long-term costs of treatment systems.

New features that the Team is adding to version 4.0 of AMDTreat include:

- The capability to model costs for multiple treatment structures (up to 99 each) of the same type in series or in parallel using different water parameters for sizing each structure;
- The capturing of up to 1485 itemized other costs (up from 10);
- Inclusion of an integrated metric conversion function;
- Enhancement of the expert help feature;
- A new oxidation cost module;
- A new limestone bed cost module;
- A new Bio-Reactor cost module;
- A tool to help with flow estimates;
- Enhancement of the financial forecasting tool;
- Enhancement of the recapitalization tool;
- Addition of Fe oxidation kinetics as a sizing methodology for aerobic wetlands;
- Addition of a diesel pump section to the pump module;
- Addition of CO_2 to the acidity calculator tool;
- A window management tool to make it easier to switch between open modules; and
- Improved control over the appearance of the program.

The team spent significant time researching the default values in AMDTreat so that a user can get a quick initial estimate when first opening any module of the program, but knowing that these values would not be valid in all geographic areas, we allowed the user the power to permanently change those values. At any time, the user can return the values to the original AMDTreat defaults. A new feature in version 4.0 makes it easier to make global changes to default values.

AMDTreat has an extensive website where additional information can be obtained or the software can be downloaded free of charge. The site includes an FAQ (frequently asked questions) component the help users resolve common problem and a Support page to help the user if they cannot find an answer to their question in the FAQ. The site also includes a list of all bugs found in the software, and a wish list for new features to be included in the next version of AMDTreat. When downloading the software, users are requested (but not required) to register. Registered users are notified of future updates to AMDTreat and of related training and seminar offerings.

In addition to the financial tools, AMDTreat also includes several scientific tools to aid the user in design of treatment systems. Those tools include an acidity calculator, a sulfate reduction calculator, a Langelier Saturation Index calculator, a Mass Balance calculator, a Passive Treatment Calculator, an Abiotic Homogeneous Fe^{2+} Oxidation tool, a Biotic Homogeneous Fe^{2+} Oxidation tool, an Oxidation Tool, a Chemical Cost Conversion Tool, a Flow Calculation Tool and a pH Averaging Tool. Many of these tools are new or enhanced in the version 4.0.

AMDTreat can be downloaded from the Internet at http://amdtreat.osmre.gov, or a CD can be requested by contacting the author.

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