ENVIRONMENT

Effective and Responsible Water Treatment for Sand Mining

By Kyle Hanson and Cliff Blaisdell

Successful sand mining starts with the best interest of the environment in mind.

A small percentage of a sand mine's operating budget is spent on water treatment; however, the way it is implemented has a substantial impact on the bottom line. Done correctly, a good water treatment program minimizes loss of product and compliance verification, while likely eliminating environmental citations.

Careful selection of effective polyacrylamides (PAM) in water treatment, applied consistent with regulatory requirements, minimizes a potential impact of sand mining. While the use of chemicals is never 100 percent safe, PAMs offer an attractive alternative because: 1) of the wide use and application of PAMs; 2) they represent current best practices; 3) their use conserves water; and 4) the highly regulated nature of the product.

Successful sand mining operations start with the best interest of the environment in mind. With this guiding principle, the next step is for sand mine operators, in partnership with water treatment experts, to accurately define water treatment goals. Determining water treatment in an economically and environmentally benign way involves balancing acceptable results with environmental and human safety. With technology advancements, it is possible to use inert alternatives in place of harmful chemicals. This forward thinking environmental focus demonstrates good faith and also streamlines dialogues with regulatory agencies.

Often, finding this balance requires becoming fluent in the vocabulary of the regulating authorities and chemical communities, at least in so far as toxicology and ecology are concerned.

Competent water treatment experts can play a crucial role in educating sand mine owners. Once confidence in the human and environmental safety of the product is established, a water treatment partner can also help to source data about toxicity testing for the products (including test type, duration, species and toxicity levels) to allow mine owners to compare to alternative options.

Knowing and understanding water treatment chemicals and their impact will make mine owners better prepared to have factually driven discussions with regulators or concerned citizens.

PAMs Are Widely Used

The use of PAMs will inherently result in some amount of acrylamide monomer being present. The selection of an appropriate PAM will seek to minimize such acrylamide monomer release.

Moreover, a strong case can be made that the release of acrylamide monomer in the environment does not present a lasting hazard as these compounds can be biologically degraded in both aerobic and anaerobic conditions. While the biodegradability of the acrylamide monomer is readily apparent and well documented, the fate of PAM and acrylamide-containing copolymers has not been thoroughly studied or understood.

Municipal wastewater treatment plants commonly use PAM for management of the micro-organisms (floc) that degrade incoming pollutants. These additives serve to bind floc particles to one another and abbreviate the time needed for gravity settling and/or allowing for the excess floc to be dewatered and efficiently removed from the system.

These applications are not restricted to a specific dosage rate and use anywhere from single digit dosages (ppm v/v) in clarifiers to greater than 300 ppm v/v in some sludge dewatering applications. Designers of modern wastewater treatment facilities are dependent on PAM to reduce plant footprint, reduce sludge hauling traffic and cost, and protect the environment in the face of ever-increasing pressures from growth. Every day, our lakes, streams and rivers are protected in part by the use of these products.
In addition to municipal facilities, many industrial users are also utilizing PAM chemistry. Industrial users are broadly divided into two categories: Pretreaters and National Pollutant Discharge Elimination System (NPDES) types. Pretreaters are managing wastewater parameters set forth by the local publicly owned treatment works rather than (or in addition to) a pollution control authority and typically per the requirements of an industrial waste discharge permit. Some industries include metal finishers and painters (to control heavy metals and suspended solids), pharmaceutical manufacturers, food and beverage, and even some energy facilities.

Often, an industry is obligated to construct a wastewater treatment facility to comply with direct discharge permits. Sometimes these exceed the level of technology present in municipal facilities, yet they are often designed to be dependent upon PAM chemistry. Some food and beverage facilities even recover value from a waste stream by utilizing “generally recognized as safe” (GRAS) acrylamide-based products to recover fats or proteins that would have otherwise been lost to waste.

Many products containing acrylamide are now being manufactured with the intent of reducing residual monomer content. The importance of this is two-fold. First, lowering concentrations of unreacted raw material in the finished products ensures that customers receive high-quality products while preventing a material loss of revenue. Secondly, it allows for acceptance of these products by communities, users and regulators.

Best Practices Support Use of PAMs
For sand mine operators, the selection and proper use of PAM to minimize residual amounts of monomer acrylamide that are present can impact two of a mining facility’s largest process flows. The first being the discharge of treated water to a body of water, and the second being the end fate of the unusable solids precipitated from the treated water. In careful consultation with a water treatment expert, PAM can be part of an environmentally sound water treatment to help address issues raised by environmentalists or local government agencies.

The Center for Disease Control, Environmental Protection Agency and Pollution Control Agency have all conducted studies showing that, upon exposure to the environment, acrylamide and PAM biodegrade or hydrolyze within hours to days (depending upon microbial concentrations, pH levels and temperature) and are gone before reaching most water sources.

Manufacturers have labored to produce products that react and bond tightly with contaminants. Like so many microscopic magnets, these acrylamide compounds cling to soils and are not keen to migrate with water flow. Rather, they are held in sediments or surface soils until decomposition renders them inert.

The alternative to using PAM for water treatment and sand mining involves using vast amounts of fresh water (see discussion below) or other chemicals which present far greater environmental risks and lack PAMs wide use and proven track record.

PAMs Conserve Cleaning Water
For some processes, the only effective alternative to PAM is the use of vast amounts of water. If the water cannot be cleaned, it cannot be reused. Without PAM aiding in the recirculating process, high volumes of water must be discharged. Some companies recirculate 10 million gal. of water per day. If that water cannot be cleaned and reused, that volume would need to be obtained from freshwater sources.

For perspective, the EPA reports an average family of four uses 12,000 gal. per month. With a growing population, it would be environmentally irresponsible to consume the monthly household water needs every few minutes. When necessary, PAMs and other water treatment chemicals help sand mines and other water-dependent industries be respectful of the community’s valuable natural resources.

Keeping your water treatment program operating effectively and efficiently is a good water treatment partner can help sand mine operators address regulatory and environmental concerns with sound, fact-based data. Additionally, mine operators and their water-treatment partners can work together to respond to issues within a timely manner – balancing acceptable results with environmental and human safety.

Kyle Hanson, P.E. is a chemical engineer at Fremont Industries and specializes in wastewater treatment chemical selection and feed optimization. Cliff Blaisdell is an account manager at Fremont Industries and specializes in many aspects of water treatment.

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