

## Blue Sky Q & A

### **Description of the ISM Technology**

- Scientific Basis
- Patent Description

### **Application and Uses**

### **Benefits of ISM Technology**

### **Pilot Test Description**

### **Sample Test Results**



**Bill Whiteside**  
**President & CEO**  
**Blue Sky Water Technologies, Inc.**  
P. O. Box 881  
Folsom, CA USA 95763  
Phone 916-988-1182  
Fax 916-307-5195  
[www.blueskytechnologies.biz](http://www.blueskytechnologies.biz)  
[bill@blueskytechnologies.biz](mailto:bill@blueskytechnologies.biz)

# Overview

Blue Sky Water Technologies, Inc. markets an innovative water treatment technology (Ionic State Modification or ISM) that removes organic and inorganic contaminants, MTBE and other hydrocarbons, and harmful pathogens from waste streams and groundwater at or below Federal Drinking Water Standards.

The patented, proprietary design utilizes a system of electronic, magnetic, and chemical processes wherein contaminants dissociate from water molecules.

This means that the contaminants precipitate out of solution, leaving clean water and a relatively small amount of unclassified or, perhaps, hazardous metal cake material (mining applications).

This technology has been successful at a major tunnel drilling project, several pilot test programs and on extensive bench tests.

Additionally, the ISM technology offers significant improvements in cost and treatment results over most water treatment systems currently in use.

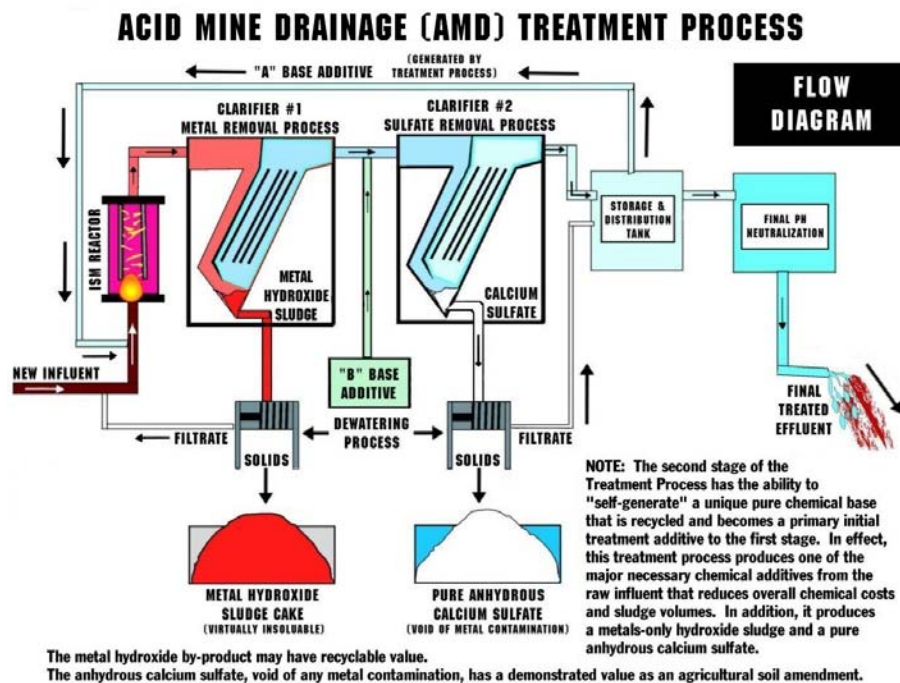


## Question: What is ISM technology and how does it work?

Answer: Ionic State Modification system (ISM) stands for ionic state modification. The ISM process uses magnetic, electrolytic and chemical techniques to break the chemical bonds between contaminants and water molecules, allowing them to precipitate out of solution using conventional precipitation chemistry. Most treatment systems are unable to break the covalent and ionic bonds that hold contaminant materials in solution and fail to meet discharge requirements and are expensive to operate and maintain.

Here are the stages in the ISM Process

1. The contaminated water flows through a magnetic field, created by proprietary equipment inside an ISM reactor, where it is depolarizes the water and destroys the hydration cages that often hide the metal ions. The electrodes within the ISM Reactors, set to specific voltage values, oxidize or reduce the targeted metals so that they are no longer soluble in water.
2. The treated water mixes with a chemical agent that raises or lowers / adjusts the pH to above 7.0 (depending on the nature of the water and the discharge criteria); a polymer is then injected into the water to facilitate separation.
3. The mixture flows into a clarifier where the agglomerated solids precipitate to the bottom.
4. Treatment residue is dewatered with a filter press or pumped out to a pond for air-drying; **IMPORTANT - The metal contaminants are removed IN THIS SEPARATE PROCESS. The resultant metal cake (or sludge) is a solitary by-product and does not contain any sulfate material.**
5. Water is discharged off site, reused in the system or sold to a community water system where applicable.
6. If required by discharge requirements, sulfates are removed in a secondary phase.
7. Lime and another polymer are added to the pre-treated water.
8. The clarified stream flows through a second clarifier.
9. A very pure lime attracts and removes sulfate contaminants (see enclosed diagram).
10. Sludge, in the form of metal-free anhydrous calcium sulfate, is removed from the clarifier and pumped to a filter press to a pond for air-drying.







**Question: If this is so good, why haven't I heard of it before?**

Answer: That's why we're letting you know about it NOW. ISM technology is new and somewhat unknown to the environmental community. Education and acceptance of new water treatment technologies takes a long time.



**Question: Is this anything like another technology I've heard about called \_\_\_\_\_ ?**

Answer: No, it's totally leading edge, unique and unrelated to ANY other treatment technology on the market.



**Question: Please describe the technology generally (understanding you have proprietary information to protect).**

Answer: This technology removes complex contaminants from waste streams that other technologies either fail to remove or, post-treatment, produce hazardous by-products. While it is adaptable to a wide-range of applications, our focus is primarily on removing heavy metals and other ancillary contaminants. So, for example, here is the patent description of the Acid Mine Drainage portion of ISM technology. From the text of U. S. Patent 5698107 (<http://patentpdf.net/US5698107.pdf>)

*"Acid Mine Drainage contains high concentrations of both heavy and light metal ions, each ion species having its own electro negativity. Electro negativity of an ion is a measure of its interaction with a nearest neighbor. In an aqueous solution, electro negativity is a measure of the ability of the ion to attract the surrounding polar water molecules. The water molecules surround and, to some degree, are bonded to the ion forming a layer of molecules referred to as the 'hydration cage'. (Metal ions are usually found within the hydration cage). These water molecules form a layer which affects the behavior of the ion. The hydration cage can, in some cases, significantly inhibit or, in other cases, promote the ability of the ion to take part in standard chemical reactions. We believe that the application of the electric and magnetic fields alters the hydration cage and modifies the degree of behavior of any particular ion in the chemical environment. Formation energies and activation energies are altered to the extent that precipitates of non-naturally occurring metal hydroxides form."*



**Question: What contaminants does your technology successfully remove?**

Answer: In the past, successful utilization of the ISM technology has been confined to mining and industrial sites. However, the flexibility in treatment configurations offers virtually unlimited potential to treat other harmful environmental contaminants. For example, with slight adjustments to the equipment and a very slight increase in operating costs, the process can also kill and/or remove bacteria and some forms of viruses. More testing is required in this area.



**Question: What bench scale tests have been performed and for what treatment applications?**

Answer: The results of the Berkeley Pit, Leviathan Mine, and Iron Mountain mine are enclosed.



**Question: What pilot scale or field demonstration tests have been performed and for what treatment applications.**

Answer: The results of all our bench tests, pilot tests and full-scale projects are enclosed. A video of our full scale project at the Mill/Bull Tunnel site can be viewed on our website at: <http://www.blueskytechnologies.biz/millbullvideo.html> . A 9-minute video of this project is also available at <http://www.blueskytechnologies.biz/Mammothvideo.html> . Please make sure you understand the disclaimer that reads: *“Please be advised that the information on this site is absolutely accurate and valid. This is the exact technology that is wholly owned by IP3LLC and Keystone Environmental Technologies LLC. Blue Sky Technologies has the rights to market this technology from IP3LLC and Keystone. A company known as HPT once had an agreement to market this technology.”*



**Question: Where has this technology been implemented full-scale? What flow rates, water quality, and applications has this been used? Can we contact plant owners and operators (non-Blue Sky affiliates) that have experience with your technology?**

Answer: At the Mill/Bull Tunnel are enclosed, we treated over 51 million gallons of complex drainage from a mountain tunnel drilling site in 20 months. The flow varied from 50 to 300 gpm during the project. No NPDES violation was ever issued on this project. Our equipment ran 24/7/365. We will gladly furnish the names of third-party people to contact that were involved in this or any other project.



**Question: What are the power requirements for full-scale facilities?**

Answer: We typically require a minimum of 200 amp service for our equipment to function. The average draw is 50 amps. This always varies depending on the installation parameters and the nature of the project.



**Question: Can you provide capital and O&M costs from full-scale installations?**

Answer: Once we have the discharge requirements and results from the pilot project, we can provide this information. Regarding operational and maintenance cost comparisons between the ISM system and conventional chemical or filtration systems for full-scale installations, there are staffing requirements with the ISM system. However, power consumption, additive costs and sludge disposal are far lower with the ISM system. The ISM reactors and the power supplies are the only proprietary equipment in our process. Everything else can be purchased on the open market. We would recommend having back up supplies and equipment on relatively short demand times with a vendor.



**Question: What complexities are introduced into system design from the bench/pilot scale to full scale systems?**

Answer: None.



**Question: How are issues with reactor configurations and electrode maintenance addressed?**

Answer: Reactor configurations are relatively set once the discharge requirements are known. If the waste stream varies in contaminant levels, we can easily make slight adjustments to account for the fluctuations. We have never had to replace electrodes during a project.



**Question: What level of operator training and staffing are needed to operate?**

Answer: Some basic plumbing, electrical and chemical knowledge would help. However, on previous projects we trained people without this background to perform all the necessary duties to keep the systems running properly. While the process is complex, these duties are relatively easy to learn. Sampling would be required, periodic HACH tests performed. Etc.



**Question: Describe of how sludge volumes can be estimated.**

Answer: Ideally we can estimate sludge volumes after performing bench tests. However, because of the potential for changes in contaminant levels in the influent, we are more comfortable calculating amounts following a 2 or 3 week pilot test with our mobile equipment at the site.



**Question: What are the types of equipment and reagents needed; any storage or permitting needs for those?**

Answer: The reactors and power supplies are proprietary while the clarifier, tanks, pumps etc. are available from many sources. The reagents necessary are selected based upon the results of bench testing and are widely available. Storage requirements would be based upon usage and procurement lead-time. Permitting is site specific and varies for different states and locations.



**Question: You mentioned the potential for reuse of treatment residue / solids. Can you specify?**

Answer: Where applicable, metal cake with a high enough concentration of constituents could be sold to a smelter. Otherwise, depending on the profile of the waste and disposal requirements for the area, it may have to be disposed of as a classified or hazardous waste. If sulfates are extracted in the secondary process, the anhydrous calcium sulfate (gypsum) would have agriculture benefits as a soil amendment.

## Metal Removal Projects and Bench Tests of Note

### Iron Mountain, Northern CA

	Untreated #6 ppm	Untreated #8 ppm	Treated ppm
Aluminum	1,074	1,058	ND>6
Arsenic	17.6	17.1	ND>1
Calcium	158	163	2.4
Cadmium	4.67	4.59	ND>0.01
Copper	336	326	0.06
Iron	9,543	9,650	ND>0.02
Potassium	70	68	49
Manganese	13	12	0.09
Sodium	81	82	19,220
Selenium	ND <1.0	ND <1.0	N/A
Zinc	609	603	ND>1
Sulfates	35,700	35,100	147
Chloride	51	57	28
NIT	ND	74	97

### Bench Tests

Tests conducted by Lawrence Livermore National Laboratories, 1997

- AMD unusually high in copper, most in Cu+1 ionic state
- Cu+1 was oxidized to Cu+2 prior to hydroxide precipitation
- Very high levels of three other toxic metals: arsenic, cadmium and nickel
- Raised the effluent pH above 9.5 for the formation of insoluble metal hydroxides
- Demetalized AMD needed second treatment stage to reduce residual sulfates
- Two-stage treated water exceeded drinking water standards for heavy metals
- Significantly reduced sulfates

### Berkeley Pit, Butte, MT

	Test Sample Avg ppm	1st Treated ppm	2nd Treated ppm
Aluminum	294	ND	ND
Arsenic	2.6	ND	ND
Cadmium	2.5	ND	ND
Copper	185	ND	ND
Lead	>1.0	ND	10
Nickel	1.0	ND	ND
Zinc	605.5	0.1	ND
Sulfates	10,800	3,800	900

### Bench Tests; Supervised by EPA and MSE

Tests conducted by Lawrence Livermore National Laboratories, 1997

- Dissolved / suspended metals & sulfates reduced by 99.98%
- Method able to remediate AMD with environmentally safe chemical reagents
- While not to EPA std., sulfate level reduced 1/3 compared to std. chemistry results
- Sulfates converted to insoluble anhydrous calcium and magnesium sulfates
- Metals and sulfates were removed in separate processes

### Leviathan, Lake Tahoe Area

	Untreated ppb	1st Phase Treated ppb	2nd Phase Treated ppb
Aluminum	420,000	2500	ND
Arsenic	7,000	33	ND
Copper	3,500	ND	ND
Iron	830,000	540	ND
Nickel	7,400	ND	ND
Sulfates	5,900	-	44

### Bench Tests

Tests conducted by BSK Laboratories, 1999

- Blue Sky method would bypass / make obsolete elaborate ponding measures
  - Filtered treated AMD; produced .825 pounds of 80% moisture metal hydroxide cake
  - Tests of side stream indicated sulfate concentration of 79,700 ppm
  - Treated concentrate converted to 2.2 pounds of an agricultural sulfate product
  - 2.58 pounds of sulfate material per gallon of concentrate generated
- 85.64% sludge reduction vs standard lime treatment processes still in use**

### Mammoth Mine, Northern CA

	Untreated ppb	Treated ppb
Aluminum	58,000	620
Cadmium	110	ND
Copper	5,100	95
Lead	41	ND
Manganese	4,400	20
Zinc	26,000	240
Sulfates	1,600	460

Project ran for 2 1/2 weeks with mobile unit at site

Tests conducted by BSK Laboratories, 1999

- Approx. 100,000 gallons of AMD treated
- Produced approx. 150 gallons of de-watered metal oxide sludge
- Initial lab analysis revealed sulfate levels of 1600 ug/l in the untreated AMD
- Sulfate level of the treated AMD - below 500 ppm
- Metal hydroxides and calcium sulfate were precipitated as a single sludge cake

### Mill/Bull Tunnel, El Dorado County

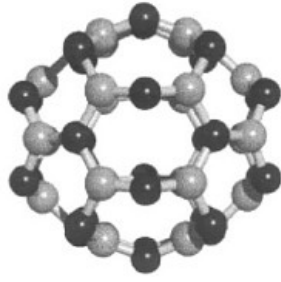
	Untreated Average ppb	Treated ppb
Aluminum	5,150	ND
Iron	8,913	ND
Manganese	173	34

Project ran for 16 months, treated over 51M gallons

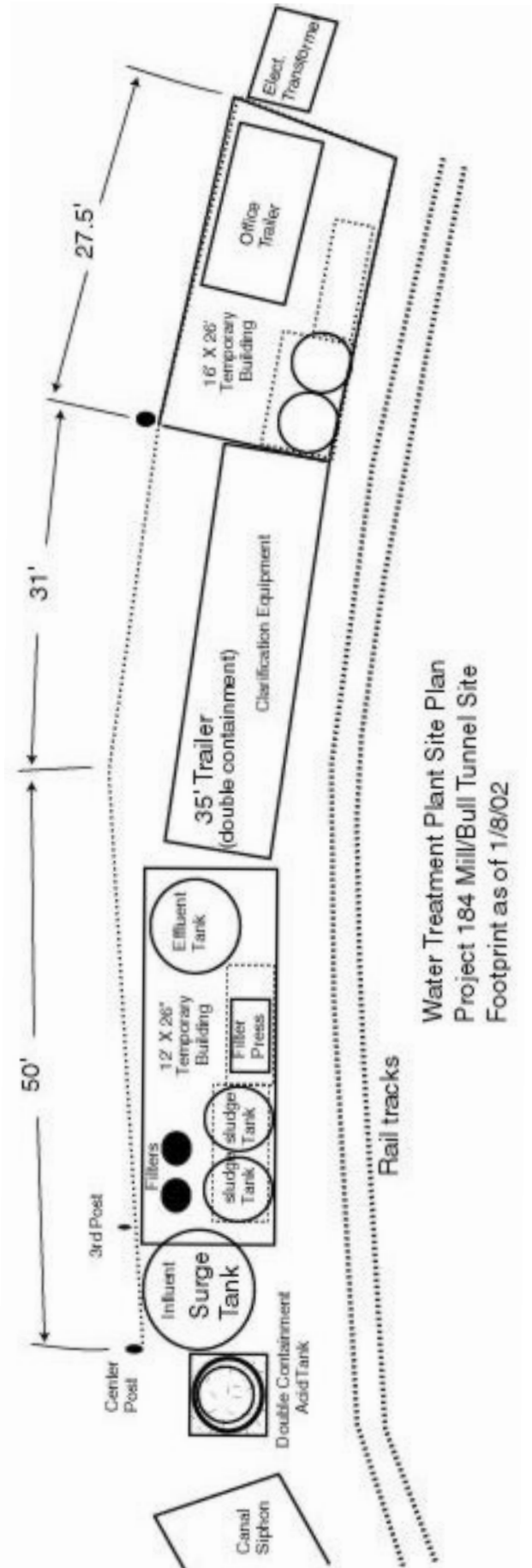
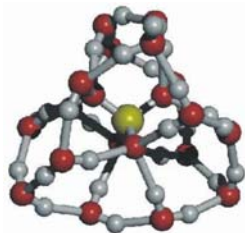
No NPDES violations, Saved project from failure

- Remote tunnel drilling site on USFS land in El Dorado County
- Chemical Costs - >\$.002 per gallon
- Sludge Removed - 360 55-gallon barrels; 1/2 cubic feet / 1000 gallons treated
- Electrical Costs - >\$25,000 for entire project
- Water released into nature at site; No on-site ponding or containment required
- Effluent fluctuations of primary metals

Tests conducted by BSK Laboratories, 2001-2002



SO<sub>4</sub> Hydration Cage



Water Treatment Plant Site Plan  
 Project 184 Mill/Bull Tunnel Site  
 Footprint as of 1/8/02