

## Tailings and Waste Streams



## Surpassing Stringent Discharge Requirements, Enhancing Recovery

Proper treating of mine tailings and waste streams enables miners to meet more stringent discharge requirements and to recover water and additional metals. Dow's range of integrated solutions provide the ability to selectively remove suspended solids, precipitated salts, heavy metals and metal oxides – enabling miners around the world to choose the right technology to meet their local treatment needs.

### The Power of ORE

From increasing cost pressures, to more stringent environmental and safety regulations, to declining ore grades, the mining industry faces numerous challenges impacting profitability. Dow is helping to address these challenges with the Power of ORE – a wide range of products and expertise to address a broad spectrum of mining, mineral processing and remediation challenges.

The Power of ORE gives companies striving to extract more value from mining operations a real choice in the marketplace. Dow can help enable Operational efficiency, boost Recovery enhancement and facilitate Environmental protection.

## Tailings and Waste Management Offerings and Solutions

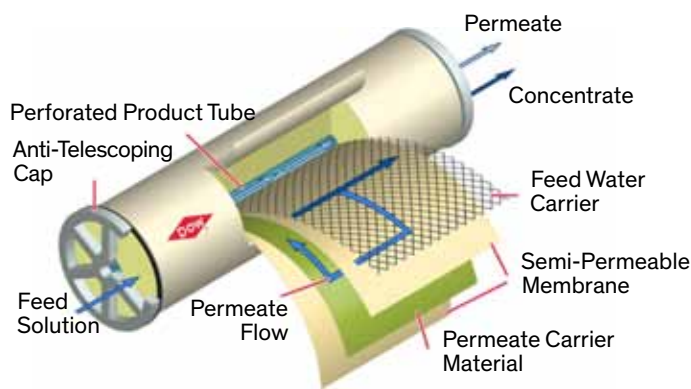
| Function            | Dow Product            | Description   |
|---------------------|------------------------|---|
| Membrane Filtration | FILMTEC™               | RO and nanofiltration membranes   |
|                     | DOW™ Ultrafiltration   | Ultrafiltration membranes   |
| Particle Filtration | TEQUATIC™ PLUS Filters | Combines the power of continuously cleaning, cross-flow filtration with centrifugal separation and solids collection into one device        |
| Ion Exchange Resins | AMBERSEP™              | For the secondary recovery of trace metals, especially the removal of heavy metals. Applicable in a wide range of operations and processes. |
| Flocculants         | UCARFLOC™              | High molecular weight polyethylene oxides (PEOs) that exhibit unique attraction toward colloidal silicates                                  |

Dow strives to be the performance leader in membranes for mining by applying differentiated technology and expertise to solve our customers' most challenging separation and purification problems in mine tailings and waste streams.

FILMTEC™ Reverse Osmosis (RO) and Nanofiltration (NF) Membranes are specially designed for demineralizing brackish water or desalinating salt water for process feed and recycle water streams. FILMTEC Elements offer proven performance, high rejection, high flux and exceptional robustness and durability across a wide range of feed conditions. This results in:

- Excellent water quality
- High yields
- Good cleanability resulting in long element life

These features offer system operators long-term economics and trouble-free operations for NF and RO membrane purification of fouling water.



FILMTEC™ Spiral Wound Filter Element

DOW™ Ultrafiltration (UF) Modules, based on our proven polyvinylidene fluoride (PVDF), outside-in fiber technology, set the standard for suspended solids removal for RO pretreatment and wastewater treatment applications. They are designed to serve as a pretreatment step to FILMTEC RO and NF products. Key features include:

- Low chemical consumption
- High recovery
- Exceptional combination of mechanical properties and chemical resistance

The TEQUATIC™ PLUS Filter is specifically designed to treat difficult feedwater up to 10,000 mg/L of suspended solids without frequent filter changes in the presence of oils and high molecular weight molecules. Key benefits include:

- Lower maintenance costs
- Higher uptimes
- Higher water recovery, typically > 99%
- Decreased consumables costs
- Smaller footprint due to less waste, space and chemical needs



TEQUATIC™ PLUS Filter

AMBERSEP™ products are a family of ion exchange resins with applications in tailings and waste stream recovery. These macroporous, styrene-divinyl benzene, copolymer beads are available with a wide range of functional groups and particle sizes for extracting precious and industrial metallic ions from process solutions.

UCARFLOC™ water-soluble resins are used as flocculating agents in mining operations. UCARFLOC Resins effectively adsorb onto many colloidal materials and perform as efficient flocculating agents. They exhibit a high affinity for a variety of materials, including silica, clays, and oxidized coal fines.

| Application                  | Recommended UCARFLOC™ Products | Dosage                                 |
|------------------------------|--------------------------------|--|
| Clay suspensions             | 302                            | 5 ppm – 0.2 % of total clay suspension |
|                              | 304                            |  |
|                              | 309                            |  |
| Heavy metal ore flocculation | 300                            | 0.01 – 0.1 % of solids                 |
|                              | 302                            |  |
|                              | 309                            |  |
| Oxidized coal slurries       | 302                            | 0.01 – 0.1 % of slurry solids          |
|                              | 304                            |  |
|                              | 309                            |  |
| Phosphate slimes             | 300                            | 0.01 – 0.1 % of clay solids            |
|                              | 304                            |  |
| Silica suspensions           | 302                            | 5 – 10 ppm                             |
|                              | 304                            |  |
|                              | 309                            |  |

### **Dow's History in the Mining Industry**

Since our earliest roots isolating compounds from prehistoric brine in the 1890s, to pioneering chemistries for froth flotation processes, to developing innovative technologies for water treatment and reuse today, Dow has continued to innovate to help customers extract more value in the mining industry.

Dow is a world leader in membrane (RO/NF/UF) and ion exchange technologies, and provides a powerful portfolio of chemistries and solutions to address:

- Mine water management, including tailings and waste treatment
- Slurry management
- Dust control
- Grinding and milling
- Flotation and hydrometallurgy, focused on maximizing metal recovery utilizing select chemistries, polymer additives and ion exchange technologies

### **Commitment to Sustainability**

Dow's commitment to sustainability is infused into the very DNA of our Company. In 2006, we launched our current set of 2015 Sustainability Goals, which focus not only on the Company's footprint in our own operations but also our handprint through the positive impact of Dow products and their role in global sustainable development. Focused on addressing global challenges like water, food, climate change and energy, Dow has made significant progress against these goals. For more information on how sustainability is integrated into all aspects of our business and operations, please visit [www.dow.com/sustainability](http://www.dow.com/sustainability).

### **Product Stewardship and Safety**

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products – from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.



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