yardney WATER FILTRATION SYSTEMS

CASE STUDY: WATER TREATMENT

Yardney System Provides Enduring Filtration For World-Class Underground Research Laboratory

PROJECT DETAILS ::
Water Filtration for Underground Research Laboratory

Project Location	Lead, South Dakota
Project Type	Dewatering of mine
Project Time Frame	Operational in November 2009
End User/Customer	Sanford Underground Research Facility (SURF)
Engineering Firm/ Consultant	South Dakota Science and Technology Authority
Product Name	Multi Media
Model Number	MM-5460-8AS
Targeted Contaminants	Iron
Flow Rate	2,000 GPM
Pressure	80 PSI
ASME Code or Non-Code	Non-Code
Quantity of Systems	1
Vessels Per System	8
Size	54" diameter, 60" side shell
Filtration Media Type	IMA-65

Yardney provides enduring filtration for World-Class Underground Science and Technology Research Facility

In 1876, the Homestake Mining Company established the Homestake Gold Mine in Lead, South Dakota, which eventually became the largest and deepest gold mine in the Western Hemisphere. Barrick Gold acquired the mine 125 years later, in 2001, when it took ownership of the Homestake Mining Company. A year later, Barrick closed the mine due to declining gold prices and the high costs of mining at extreme depths.

Because of its extensive network of deep tunnels and shafts, the mine provided an ideal environment for scientific experiments that require shielding from cosmic radiation. In 1965, chemist Ray Davis began a groundbreaking investigation deep in the mine to detect neutrinos from the sun. His Solar Neutrino Experiment ultimately earned him a share of the Nobel Prize in Physics in 2002, the same year the mine was closed.

Recognizing the mine's potential for scientific research, Governor Mike Rounds and the State Legislature formed the South Dakota Science and Technology Authority (SDSTA) in 2004 to explore converting the mine into a research laboratory. In 2006, Barrick donated the mine to the state of South Dakota, committing over $40 million to the effort. Philanthropist Denny Sanford also pledged $70 million, leading to the establishment of the Sanford Underground Research Facility (SURF).

CHALLENGES

Addressing Iron-Laden Water from Deep Underground

The first priority to establishing a research facility deep within the mine was dewatering. The mine's pumps had been shut off years earlier, causing water levels to rise to approximately 4,530 feet below the collar (top) of the shaft. Since the research labs were planned for a depth of 4,850 feet, a substantial amount of water needed to be removed.

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A bigger challenge related to the water quality. The Homestake Mine is an iron-hosted deposit, and over time, as the water remained in contact with the mine's wall rock, iron dissolved into the water. When pumped to the surface, the iron precipitates into 1 micron-sized iron particles as the water becomes oxygenated.

The mine's donation included Homestake's existing water treatment plant. Since iron precipitation posed problems to the treatment process, SDSTA needed to integrate a treatment solution to remove the iron upstream of the plant. SDSTA's team evaluated different technologies and decided that filtration offered the most promising option. Yardney was then selected as the preferred filtration supplier.

SOLUTIONS

Designing a Long-Lasting Filtration Solution

The mine water exhibited the following characteristics:

- **pH: 7 to 8**
- **Iron concentrations: 20 to 30 mg/L**
- **Ammonia levels: 3 to 4 mg/L**

The water chemistry was influenced by equilibrium with the iron-bearing host rock under reducing conditions and the breakdown of thiocyanate (SCN) into ammonia. Taking these factors into account, Yardney's design experts collaborated with the SDSTA team to develop a reverse-stacked, stratified multi-media filter system. The solution effectively addressed several challenges: managing a high treatment flow rate of 2,000 GPM, achieving a target effluent quality of less than 1 NTU for environmental discharge, and reducing the volume of backwash water generated during filtration.

The filters are regularly backwashed based on pressure differential or elapsed time to remove trapped particulates from the media bed. The backwash water is directed to a secondary holding tank, where polymers are added to coagulate the iron particles, increasing their size. The water then undergoes secondary treatment using a geotextile filter bag to capture the iron before final discharge. This process eliminates the need for dewatering filter presses and belt filters, avoiding high labor and cost requirements.

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Reclaimed water from the Yardney filtration system is blended with other treated water onsite. It is then treated with rotating biological contactors to remove ammonia before being discharged into Gold Run Creek, which flows into Whitewood Creek, a cold-water fishery. Discharged water meets local requirements, with no impact on the water quality or biology of the receiving stream, which is tested annually to monitor overall health.

Today, SURF is a renowned underground research laboratory that advances science in collaboration with hundreds of institutions and thousands of scientists across multiple disciplines. The facility conducts world-leading experiments on particles such as neutrinos and dark matter, seeking answers to some of the universe's most profound mysteries, while also contributing to research that supports ongoing technological advancements globally.

Meanwhile, after being brought online in November 2009, Yardney's full-scale, multi-tank system remains active after 15 years of reliable performance and counting. ***"We are still using the Yardney filters to remove iron from the underground water,"*** said David Johnson, wastewater treatment plant superintendent at SURF Surface Operations and Utilities. ***"Dewatering of the former mine is ongoing to maintain safe water levels for underground operations. The filters have performed well over the years, and we will continue using them until an alternative solution is developed or the need is no longer there."***

ABOUT YARDNEY WATER FILTRATION SYSTEMS

Founded in 1965, Yardney Water Filtration Systems is a recognized leader in water filtration solutions for agriculture, golf, turf, landscape, industrial, commercial, and municipal markets worldwide. Featuring built-to-last fabrication and Made in USA quality, Yardney filters deliver reliable, long-term performance and extended product lifecycles. Yardney's offerings include filtration systems in either ASME code or non-code construction utilizing technologies such as manual and automatic screen filters, centrifugal sand separators, sand media, multimedia, granular activated carbon (GAC), and specialized media to address contaminants such as iron, manganese, arsenic, and PFAS. The company supports a sales network spanning the United States, Mexico, and Europe, bolstered by strategic dealer alliances that ensure a robust global presence.

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