

Overview of Biochemical Reactor One



Introduction

Biochemical reactors (BCRs) use microorganisms, or microbes to facilitate the removal of nitrates and selenium from Mining Impacted Water (MIW). The BCRs at the Brule Mine, are a vertical flow through design which use hay and woodchips, referred to as a solid reactive mixture, to treat Mining Impacted Water. Limestone provides additional neutralizing capacity and to increase substrate permeability.

In November 2021, BCR1 was optimized to improve the efficiency and performance of the water treatment system. The optimization involved moving from a horizontal to vertical flow system, installing pumps to evenly distribute the water across the BCR and the placement of new media including hay which acts as an insulator. Summarized is an overview of BCR system performance between January 2021 – March 2023. The following topics are addressed:

1. BCR 1 system improvements made between 2021 – 2022
2. The change in efficiency performance between 2021 – 2022
3. Site activities and non-routine events

BCR One: Increased Efficiency and Higher Capacity for Removal of Selenium and Nitrates

BCR SYSTEM IMPROVEMENTS

Vertical Downflow Configuration

- Gravel Bed Underdrain System
- Extended Gravel Bed Base
- Sandpipe System
- Plumbed Underdrain
- New Treatment Media with More Woodfibre
- Insulating Hay over Treatment Media
- Additional Pumps



Optimization Benefits

- Higher Treatment Efficiency
- More Uniform Flow
- Uniform Treatment
- Heat Conservation
- Uniform Residence Time
- Increased Treatment Capacity

Change in BCR One Performance Before and After Optimization

■ Nitrate ■ Selenium

Pre-Optimization

BCR #1 Efficiency - 12 Months Prior

Input	Output	Efficiency
10.3 (mg/L)	1.17 (mg/L)	89%
43.8 (ug/L)	12.1 (ug/L)	72%

Post Optimization

BCR #1 Efficiency - Period till March 2023

Input	Output	Efficiency
14.2 (mg/L)	0.03 (mg/L)	100%
40.4 (ug/L)	8.1 (ug/L)	80%

Performance improvement time horizon

Median Value 12 Months Prior

1.17 (mg/L) 12.1 (ug/L)

% Improvement in Removal

97% 33%

Median Value till Mar 26, 2023

0.03 (mg/L) 8.1 (ug/L)



CHANGE

2020

2023

Note: All figures are based on the median value for the respective period.