

Challenge Conditions at the GSI Land-Based RDTE Facility

The GSI's Land-Based Research, Development and Technology Evaluation (RDTE) Facility in Superior, Wisconsin supports full-scale biological evaluations of prospective ballast treatments in fresh-water consistent with IMO testing guidelines, and draft US EPA/ETV guidelines. The facility draws raw intake water and entrained organisms from the Duluth-Superior Harbor at 400 m³/hr to 680 m³/hr (twice the test flow) and then evenly splits the intake flow to supply 200 m³/hr to 340 m³/hr (depending upon the specifications of the treatment vendor) to a treatment line incorporating a prototype treatment system, and an equivalent flow to a control line (no treatment). The ambient waters of this harbor offer ample biological and physical/chemical challenges in their natural state. In addition, GSI has the capacity to artificially augment test waters relative to Total Suspended Solids (TSS) and organisms 10 – 50 μm in dimension (i.e., phytoplankton). Table 1 summarizes the physical/chemical and biological challenge conditions of test water typical of the summer testing season.

Table 1. Typical Range of Challenge Conditions in Duluth-Superior Harbor During GSI's Land-Based Testing Season (July – September).

Challenge Condition	Range
Temperature	9 - 22 °C
Salinity	<1 PSU
Total Suspended Solids (TSS)	4 - 14 mg/L*
Particulate Organic Carbon (POC)	Approx. 0.3 mg/L (range 0-1 mg/L)
Dissolved Organic Carbon (DOC)	Approx. 8 mg/L (range = 6-22 mg/L)
Percent Transmittance at 254 nm	16 – 35 %T
Live Zooplankton (> 50 μm)	Approx. 300,000 – 1,000,000 organisms/m ³
Phytoplankton (10 - 50 μm)	Approx. 500 cells/mL**
Heterotrophic Bacteria MPN/mL	Approx. 1000 - 8000 MPN/mL

* TSS can be artificially augmented to 50 mg/L.

** Phytoplankton can be concentrated and spiked into intake to achieve 1,200 – 1,800 cells/mL.