

## STANDARD OPERATING PROCEDURE: Procedure for Algae/Small Protozoan Sample Collection

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### RECORD OF AMENDMENTS:

<u>No.</u>	<u>Date</u>	<u>Type</u>	<u>No.</u>	<u>Date</u>	<u>Type</u>
1.	_____	_____	7.	_____	_____
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## **STANDARD OPERATING PROCEDURE**

### **Procedure for Algae/Small Protozoan Sample Collection**

#### **BACKGROUND**

The [Great Ships Initiative](#) (GSI) is a collaborative effort to end the problem of ship-mediated invasive species in the Great Lakes-St. Lawrence Seaway System through independent research and demonstration of environmental technology, financial incentives and consistent basin-wide harbor monitoring. To that end, GSI has established research capabilities at three scales—bench, land-based, and shipboard. Each scale is dedicated to addressing specific evaluation objectives, with protocols as consistent with IMO and federal requirements as practicable. Developers of ballast treatment systems apply for GSI research services [online](#), and awards are offered based on an objective review process. GSI incubation/testing will allow meritorious ballast treatment systems to progress as rapidly as possible to an approval-ready and market-ready condition.

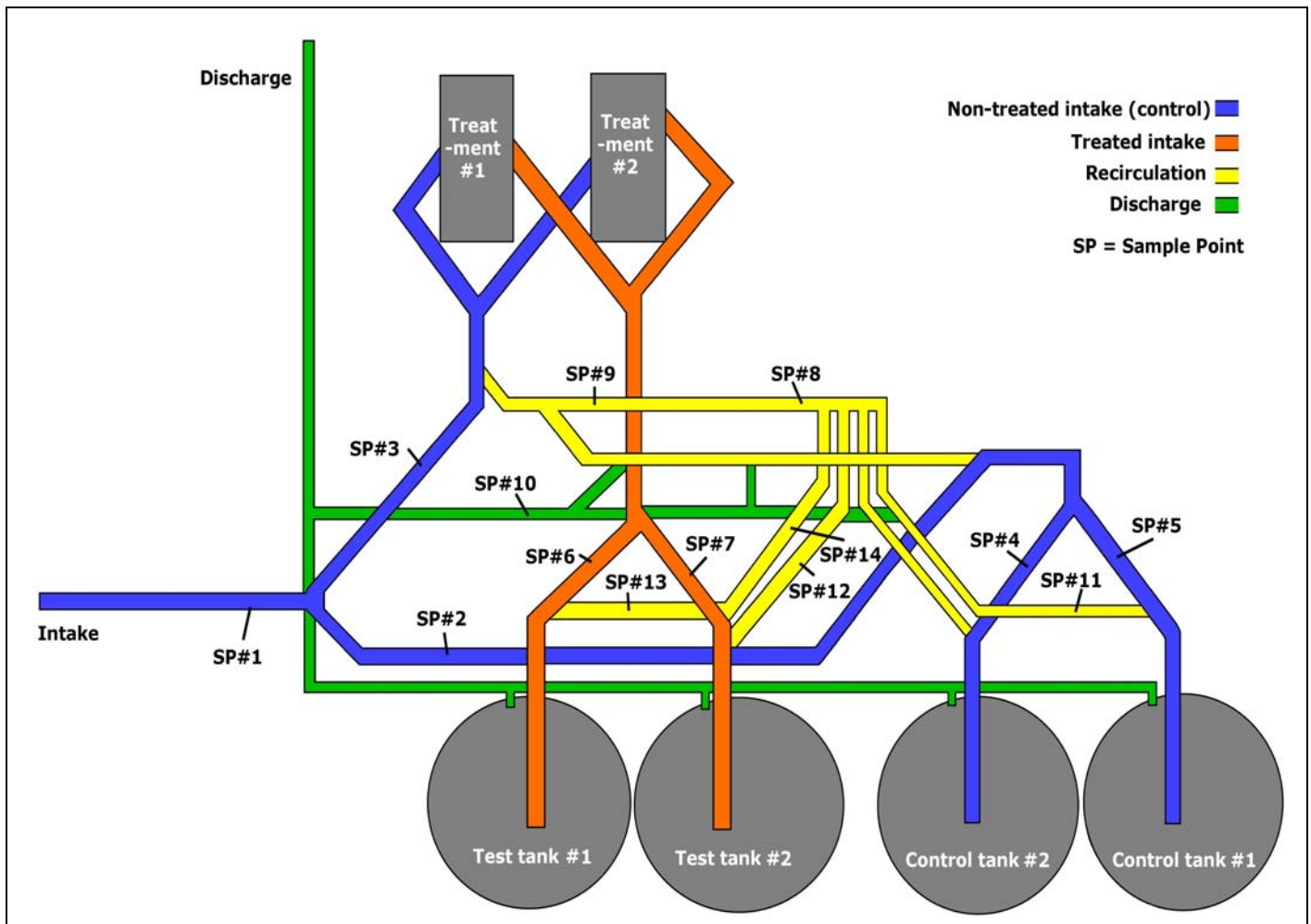
The GSI's Land-Based Research, Development and Technology Evaluation (RDTE) Facility in Superior, Wisconsin is used to conduct full-scale biological evaluations of prospective ballast treatments suitable to Seaway-sized vessels. The facility draws raw intake water and entrained organisms from Duluth-Superior Harbor at up to 680 m<sup>3</sup>/hr. After initial transport through 16 inch HDPE line to the facility, a carefully designed “Y-split” in the intake piping simultaneously channels one half of the flow (up to 340 m<sup>3</sup>/hr) to a treatment track and one half (up to 340 m<sup>3</sup>/hr) to a matched control track (figure 1). Water in the treatment track passes through the experimental ballast treatment system and into one of the 200 m<sup>3</sup> cylindrical treatment retention tanks (test tank #1 or #2; figure 1). Water in the control track by-passes the treatment system and is channeled directly into a matched control retention tank (control tank #1 or #2; figure 1). After storage (duration dependent on test requirements), the water is discharged sequentially from the treatment and control retention tanks at up to 340 m<sup>3</sup>/hr. Depending on the test scenario, the water is either discharged to the harbor or sewer system, into an alternate retention tank, or through the treatment system again for discharge or retention.

Treatment and control intake and discharge water is sampled at pressure/flow controlled in-line sample points (SPs). Intake samples are collected concurrently on the control and treatment tracks respectively (using SP2 and SP3, figure 2). Discharge samples are collected from one of two discharge sample points (SP9 or SP10; figure 2), with sequential sampling of control and treatment water. At each of these SPs there are three replicate sample ports with a center-located 3.8 cm internal diameter (ID) elbow-shaped pitot tube (figure 3) connected to a 3.8 cm ID PVC transfer pipe that carries the sample water to one of six collection tubs located at a centralized sampling station (figure 2). Other SPs shown on figure 5, with one port per SP, are used for calibration testing the facility itself and not typically used for sample collection during a treatment system evaluation.

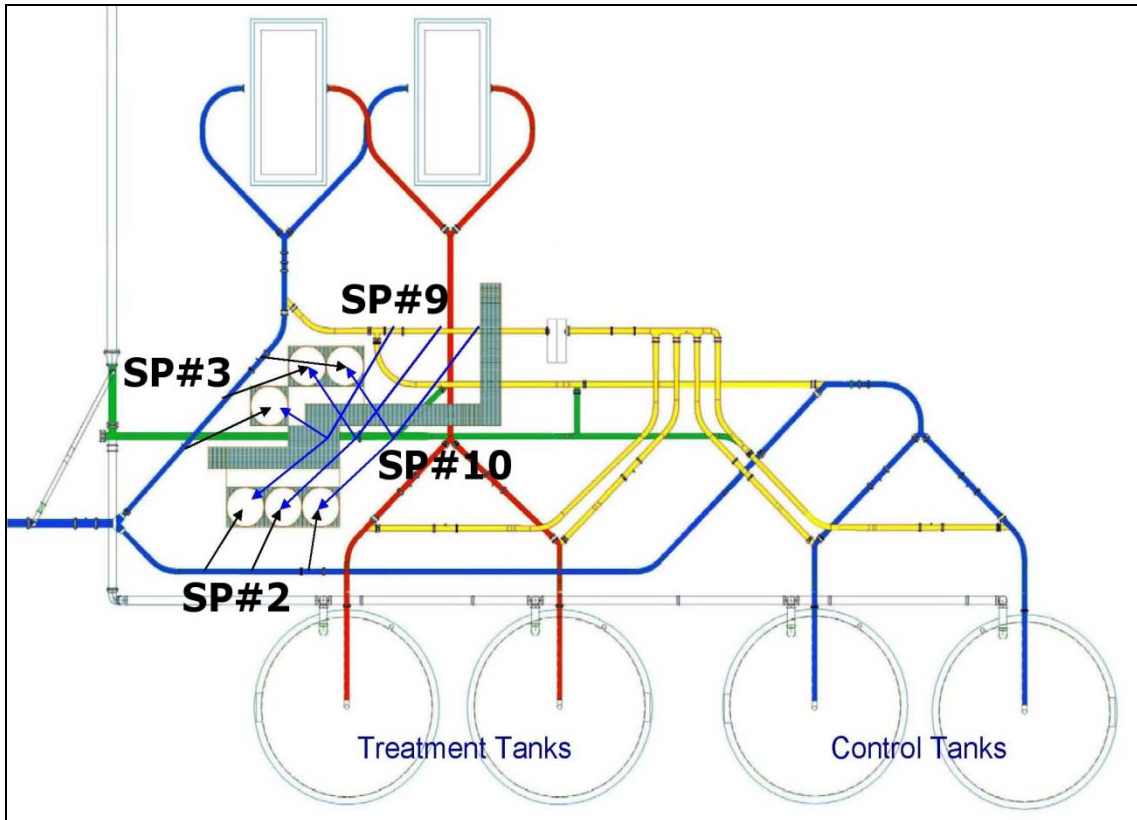
A mobile field laboratory provides bench-scale facilities to support time-sensitive assays associated with tests conducted at the GSI Land-Based RDTE Facility. The laboratory is located

at the facility during testing but may be moved to other sites in the Great Lakes-St. Lawrence Seaway System to support GSI shipboard tests when required. It is climate-controlled, and has enough desk and counter space to allow for simultaneous microscopic and analytical analysis of zooplankton, phytoplankton and bacteria samples. In addition, laboratories of the University of Wisconsin-Superior's Lake Superior Research Institute (LSRI) and the University of Minnesota-Duluth's Natural Resources Research Institute provide non-time sensitive analysis of samples from the land-based tests. Since both facilities are only a few miles from the facility, samples can be easily transported for rapid analysis.

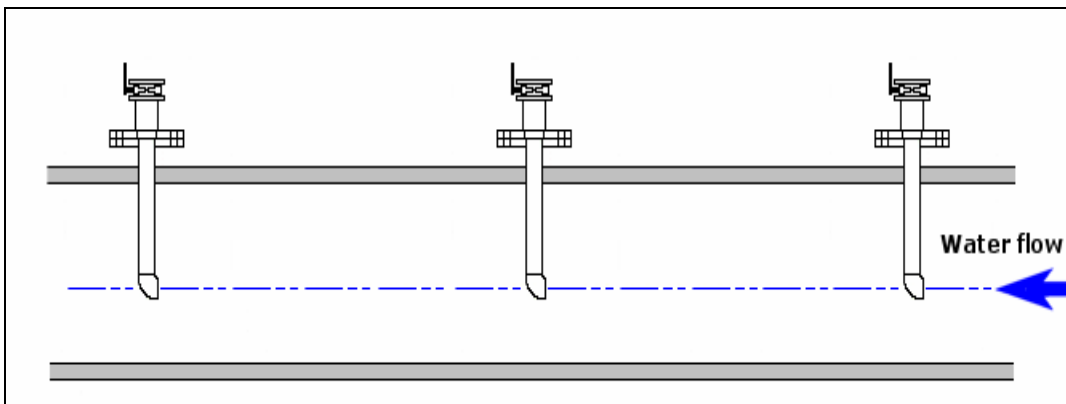
**Figure 1. Simplified Schematic of the GSI Land-Based RDTE Facility.**



**Figure 2. Schematic of the GSI Land-Based RDTE Facility Showing the Location of the Intake and Discharge Sample Points (SPs), Sample Ports, and Corresponding Sample Collection Tubs.**



**Figure 3. Schematic of a Sample Point (SP) Showing the Design of the Three Sample Port Pitots.**



## INTRODUCTION

This GSI Standard Operating Procedure (SOP) describes the methods used to collect samples of organisms at the GSI Land-Based RDTE Facility that meet the 10-50  $\mu\text{m}$  size range requirement of the IMO Convention. These organism assemblages are primarily composed of algae, and smaller numbers of protozoans and rotifers.

## EQUIPMENT LIST

- Six 3.8m<sup>3</sup> sample collection tubs with attached yardsticks, plankton net hooks and flexible drainspout hose with quick-connect fittings.
- One 3.0m<sup>3</sup> stripping tank with attached yardstick, plankton net hook and removable flexible drainspout hose with quick-connect fittings (if stripping tank sampling is relevant to the experiment).
- One removable drainspout nozzle with quick-connect fitting.
- Eight 1-Liter sample bottles; three labeled as “control” and five labeled as “treatment” (washed and re-used).
- Two 5-Liter discard buckets; one for control water, one for treated water (washed and re-used).
- Two 20-Liter composite sample carboys; one labeled as “control”, one labeled as “treatment” (washed and re-used).
- Four 1-Liter final composite sample bottles; two labeled as “control” and two labeled as “treatment” (final samples, bottles not re-used).
- Protective eyeglasses/goggles and gloves (if a chemical treatment is to be tested).
- Colored tape (various colors).
- Preprinted sample bottle labels.
- One clipboard, data sheet and pen for each sampling event.
- One field notebook.
- Cooler (for storage and transport).
- Water for washing (distilled, deionized or “city” water is sufficient).

## PROCEDURE

### Preparation

1. Clean and label sample bottles, composite sample carboys and discard buckets with the relevant sample identification nomenclature and store adjacent to each sampling location (collection tub) prior to sampling.
2. Prepare all data recording sheets and attach to clipboards.

### **Sample Collection**

1. Drain sample water from each sample collection tub by opening the drainspout valve (see GSI/SOP/LB/RA/SC/1 - Procedure for Collecting Biological Samples Via In-Line Sample Ports). Fill a 5-L bucket with the sample water and discard the contents to remove potentially unmixed water from the drainspout piping. Following, direct the sample water flow into a 1-L sample bottle until just overflowing, cap it and place it in a cooler. Record any discarded water volumes on the data sheet (see Appendix 1 of GSI/SOP/LB/RA/SA/1 - Procedure for Algae/Small Protozoan Sample Analysis).
2. For stripping tank samples, collect the water used to fill the 5-L discard bucket and add it to the zooplankton sample that is filtered through the plankton net (see GSI/SOP/LB/RA/SC/6 - Procedure for Zooplankton Sample Collection).

### **Sample Compositing (not required for stripping tank samples)**

1. Prepare control and treatment composite sample collection containers (carboys) by rinsing with water (distilled or “city”) beforehand, draining so that only trace amounts of water remain, and closing any spigots.
2. Combine all relevant intake, discharge and stripping tank samples immediately following collection by pouring the contents of all appropriate (control or treatment), 1-L sample bottles into a labeled carboy. After filling, close and invert the carboy gently approximately six times to mix the composite sample. Open the spigot and allow it to drain onto the ground for three seconds, then collect a 1-L subsample of the composite sample using a 1-L sample bottle. Seal the final sample bottle and discard the remaining water in the carboy.
3. Transfer the 1-L sample to the on-site mobile laboratory for immediate analysis (see GSI/SOP/LB/RA/SA/1 - Procedure for Algae/Small Protozoan Sample Analysis).

### **Following Completion of Sampling**

1. Wash all bottles and carboys used during sampling between sampling events.
2. Document any alterations to standard operating procedures, issues of significance, and remedial actions taken during each sampling event in a daily log in the field notebook.
3. Provide copies of the daily log to the GSI QAQC Officer at the end of the sampling day along with the sample collection records.

## **QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)**

1. Conduct all quality assurance/quality control procedures according to the GSI/QAPP/1 - Quality Assurance Project Plan (QAPP) for Great Ships Initiative Bench-Scale and Land-Based Biological Tests (2009).
2. Follow all procedures outlined in this SOP. Any deviations known ahead of time must be approved by the GSI Principal Investigator or one of the two Lead On-Site Investigators. Any deviations made during the experiment must be recorded and also approved by the GSI Principal Investigator or one of the two Lead On-Site Investigators as soon as practicable.

## **DATA STORAGE AND ARCHIVING**

1. Store and archive data according to GSI/QAPP/1 - Quality Assurance Project Plan (QAPP) for Great Ships Initiative Bench-Scale and Land-Based Biological Tests (2009).
2. Archive all hard- and electronic-copies of data and records generated for a period of five years.

## **REFERENCES AND RELATED DOCUMENTS**

Cangelosi AA (2006). RDTE Facility for the Great Ships Initiative (GSI) (OAR-SG-2006-20000364). Project Proposal to the National Oceanic and Atmospheric Administration/U.S. Fish and Wildlife Service.

Eaton AD, Clesceri LS, Rice EW & Greenberg AE, Eds. (2005). Standard Methods for the Examination of Water & Wastewater.

Great Ships Initiative website: [www.greatshipsinitiative.org](http://www.greatshipsinitiative.org).

Great Ships Initiative Standard Operating Protocols: <http://www.nemw.org/GSI/protocols.htm>.

GSI/QAPP/1 - Quality Assurance Project Plan for Great Ships Initiative (GSI) Bench-Scale and Land-Based Biological Tests (2009).

GSI/SOP/G/RA/SC/2 – Procedure for Labeling Samples Collected at the GSI Land-Based RDTE Facility

GSI/SOP/LB/RA/SC/1 – Procedure for Collecting Biological Samples via In-Line Sample Ports.

GSI/SOP/LB/RA/SC/6 - Procedure for Zooplankton Sample Collection.

GSI/SOP/LB/RA/SA/1 – Procedure for Algae/Small Protozoan Sample Analysis.