Great Ships Initiative

Procedure No. GSI/SOP/LB/RA/SC/1
Issue Date: July 20, 2009
Number of Pages: 11

STANDARD OPERATING PROCEDURE
Procedure for Collecting Biological Sample Water Via In-Line Sample Ports

Compiled By -

Name: Donald Reid

Title: GSI Land-Based RDTE Facility Biological Operations Specialist

Date: July 20, 2009

Approved By -

Name: Nicole Mays

Title: GSI Senior QAQC Officer

Date: July 20, 2009

Cleared For Issue By -

Name: Allegra Cangelosi

Title: GSI Principal Investigator

Date: July 20, 2009

RECORD OF AMENDMENTS:

No.	Date	Type	No.	Date	Type
1.			7.		
2.			8.		
3.			9.		
4.			10.		
5.			11.		
6.			12.		

Procedure No. GSI/SOP/LB/RA/SC/1
Issue Date: July 20, 2009
Number of Pages: 11

STANDARD OPERATING PROCEDURE
Procedure for Collecting Biological Sample Water Via In-Line Sample Ports

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^3/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^3/hr) to a treatment track and one half (up to 340 m^3/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^3 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^3/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). Post-treatment samples are collected from SP15 (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.

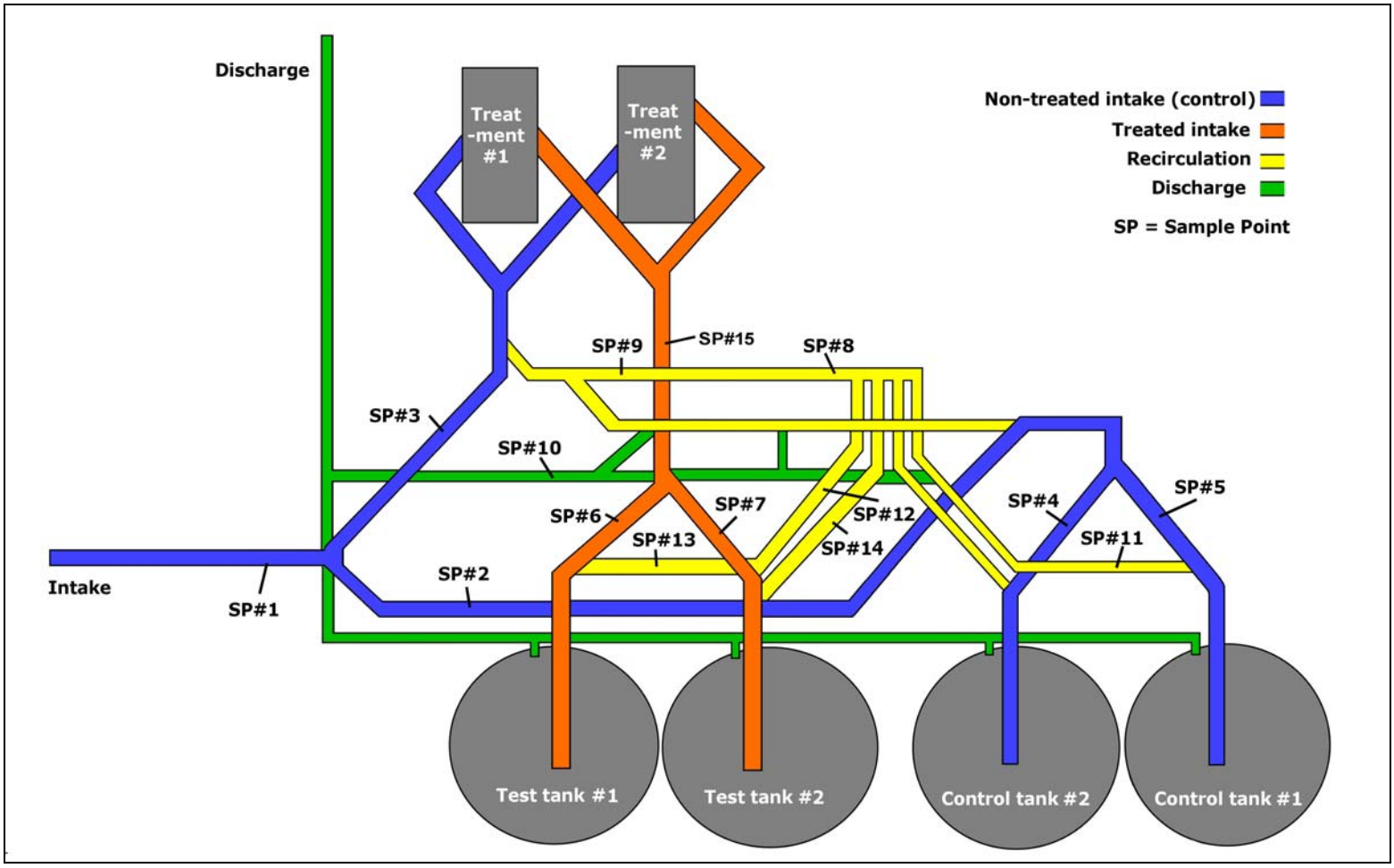


Figure 2. Schematic of the GSI Land-Based RDTE Facility Showing the Location of the Intake and Discharge Sample Points (SPs), Sample Ports, and Corresponding Sample Collection Tubs.

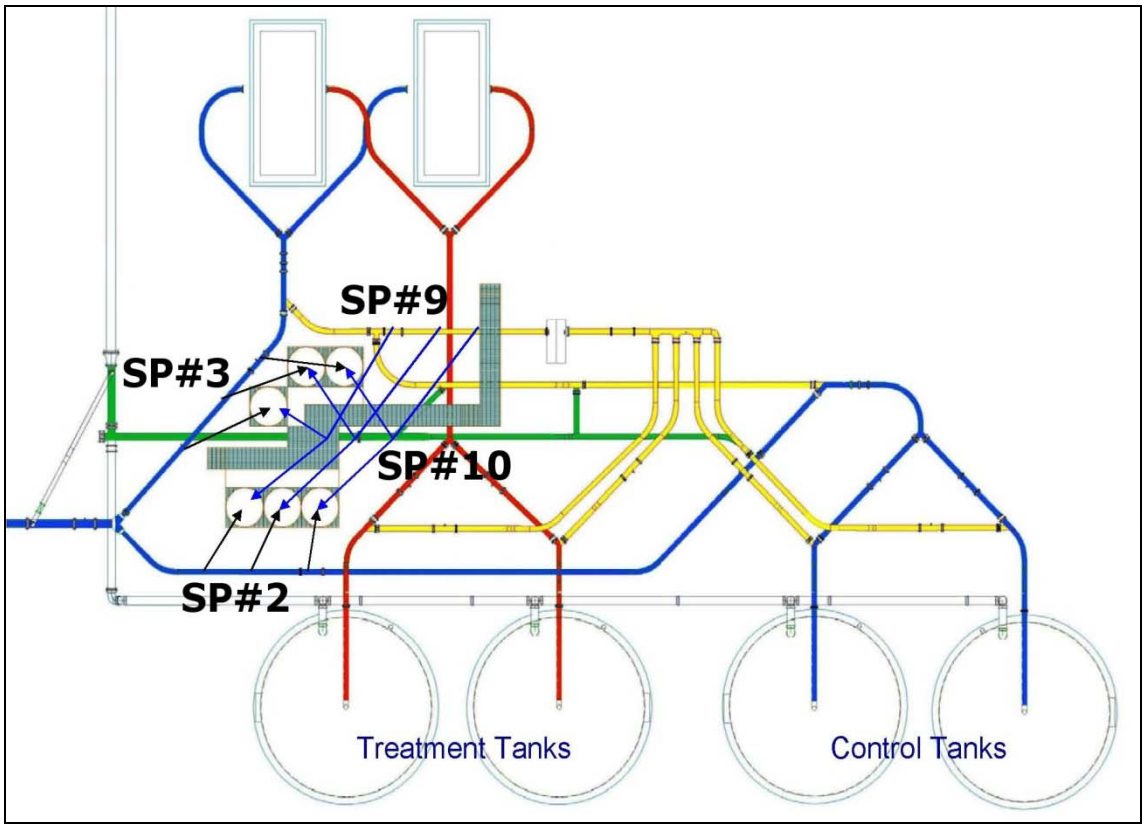
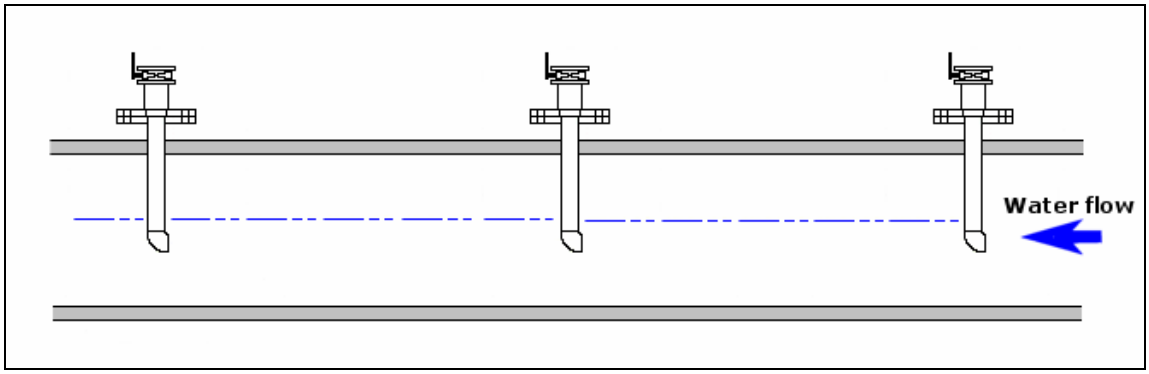


Figure 3. Schematic of a Sample Point (SP) Showing the Design of the Three Sample Port Pitots.



INTRODUCTION

This GSI Standard Operating Procedure (SOP) describes collection of biological sample water at the GSI Land-Based RDTE Facility using in-line sample ports.

EQUIPMENT LIST

- Six 3.8 m3 sample collection tubs with attached yardsticks, plankton net hooks, one drainspout nozzle and two flexible drainspout hoses with quick-connect fittings.
- Six 130 L drainable plankton net reservoirs.
- Six plankton nets (30 cm diameter mouth; 90 cm length; 35 µm mesh) with cod ends.
- Protective eyeglasses/goggles and gloves (if a chemical treatment is to be tested).
- Forty 1 L bottles for chemistry, phytoplankton, microbial and zooplankton samples.
- Preprinted sample bottle labels.
- One clipboard, preprinted data sheet and pen for each sampling event.
- Field notebook.

PROCEDURE

Preparation

Note: The control and treatment retention tanks, sample collection tubs, and all sample collection equipment (net reservoirs, plankton nets with cod ends, sample bottles, etc.) will have been cleaned after the previous sampling event in preparation for the current sampling event as directed in *GSI/SOP/LB/G/O/3 - Procedure for Cleaning the Retention Tanks and Other Equipment at the GSI Land-Based RDTE Facility*. All system piping downstream of the main intake line will have been drained after the previous sampling event in preparation for the current sampling event.

1. Prepare all data recording sheets and attach to clipboards.

2. Label plankton net cod ends, and all chemical, phytoplankton and microbial sample collection bottles with the relevant sample identification nomenclature as directed in *GSI/SOP/G/RA/SC/3 - Procedure for Labeling Samples Collected at the GSI Land-Based RDTE Facility*.

3. Position all collection equipment (net reservoirs, plankton nets with cod ends, cooler with labeled bottles, etc.) by the appropriate sample collection tubs.

4. Ensure that all manual valves in the collection system are properly set for the test scenario (*GSI/SOP/LB/G/O/1 - Procedure for Operating the GSI Land-Based RDTE*

Facility).

5. When preparations are complete, notify the engineer that the system is ready to start the appropriate pump.

Filling the Sample Tubs on Intake

1. Flush the main intake line for three minutes.

2. Following initial line flushing (see *GSI/SOP/LB/G/O/1 - Procedure for Operating the GSI Land-Based RDTE Facility*), open the control and treatment track diaphragm valves, switching the water flow from the intake bypass to the control and treatment tracks.

3. As water begins to flow into the sample collection tubs, record the "start time" on the data sheet (Appendix 1).

4. Fill four sample collection tubs in the following manner: control water directed through SP2A/B fills collection tubs #1 and #2, respectively, water directed from SP3A/B fills treatment track collection tubs #4 and #5, respectively (see figure 3). If required, collection tub #6 can be filled with post-treatment water from SP15. These collection tub fill operations are conducted concurrently and are continuous throughout the entire intake process until the main tank is full and the pump is shut off. Throughout the fill process, monitor the sample collection tubs to ensure that they contain similar volumes of water. Between 1.0 m^3 – 1.5 m^3 of water should be collected in each collection tub.

5. When the main tank is full, close the sample collection tub diaphragm and manual intake valves and record the "stop time" on the data sheet (Appendix 1).

6. Measure the water depth in each tub using the yardstick attached to the side of the tub and record on the data sheet (Appendix 1). Record the volumes of water collected in each collection tub and the total amount of water in each tank from the engineer's operational data and record on the data sheet (Appendix 1).

Filling the Sample Tubs on Discharge or Recirculation

1. See **Preparation** above.

2. Open the treatment (or control) tank discharge valve and start the discharge/recirculation pump.

3. Drain treatment tank and control tank in sequence. Time the second tank drain to

synchronize the second tank's zooplankton sample collection with completion of first zooplankton sample analysis, preferably within 2 hours.

4. Upon commencement of the discharge process from either the treatment or the control tank and as water begins to flow into the sample collection tubs, record the "start time" on the data sheet (Appendix 1).

5. As the treatment (or control) tank is drained, fill collection tubs #4, #5 and #6 (or #1, #2, and #3 for the control tank) with water directed from SP9A/B/C, collecting water throughout the entire discharge/recirculation process. Monitor the sample collection tubs to ensure that they contain similar volumes of water. Between 1.0 m^3 – 3.3 m^3 of water should be collected in each collection tub. Discharge water volumes collected may be increased when plankton densities are low, or where treatment involves the physical removal of organisms.

6. When the main tank has completed draining, and the collection tub diaphragm and manual valves have been closed, record the "stop time" on the data sheet (Appendix 1).

7. Measure the water depth in each tub using the yardstick attached to the side of the tub and record on the data sheet (Appendix 1). Record the volume of water collected in each collection tub and the total amount of water drained from each tank from the engineer's data and record on the data sheet (Appendix 1).

Collecting Samples from the Filled Tubs

1. Once the tubs have been filled, water for chemical, microbial, phytoplankton and zooplankton samples can be taken following procedures in *GSI/SOP/LB/RA/SC/8 – Procedure for Collecting Physical/Chemical Data and Samples at the GSI Land-Based RDTE Facility*, *GSI/SOP/LB/RA/SC/3 - Procedure for Algae/Small Protozoa Sample Collection*, *GSI/SOP/LB/RA/SC/4 - Procedure for Microbial Sample Collection*, and *GSI/SOP/LB/RA/SC/6 - Procedure for Zooplankton Sample Collection*. Note that all chemical, phytoplankton and microbial samples are collected immediately. When water for more than one zooplankton sample has been collected (e.g., on fill) in a single event, the first zooplankton sample is collected immediately after the chemical, phytoplankton and microbial samples. The collection of subsequent zooplankton samples is timed to match the completion of the analysis of the previous zooplankton sample analysis. Record the time that all samples are collected on the data sheet (Appendix 1).

2. After sample collection, clean the sample collection tubs and all sample collection equipment (net reservoirs, plankton nets with cod ends, sample bottles, etc.) in preparation for the next sampling event as directed in *GSI/SOP/LB/G/O/3 - Procedure for*

Cleaning the Retention Tanks and Other Equipment at the GSI Land-Based RDTE Facility.

3. Drain all system piping downstream of the main intake line after the sampling event.

Maintaining the Field Notebook

1. Document the activities of project personnel, as well as 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.

2. Provide copies of the daily log to the GSI QAQC Officer at the end of the sampling day and file it 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.

3. Ensure that a second individual checks the log books and data sheets for completeness following each collection event.

4. Ensure that the volume of water in each replicate collection tub is within 10 % of the mean for that sampling event. If volumes vary greatly, flow rates may need to be adjusted.

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. Northeast-Midwest Institute, Washington D.C.

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.

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/LB/G/O/3 - Procedure for Cleaning the Retention Tanks and Other Equipment at the GSI Land-Based RDTE Facility.

GSI/SOP/LB/G/O/1 – Procedure for Operating the GSI Land-Based RDTE Facility.

GSI/SOP/G/RA/SC/3 - Procedure for Labeling Samples Collected at the GSI Land-Based RDTE Facility

GSI/SOP/LB/RA/SC/3 - Procedure for Algae/Small Protozoa Sample Collection.

GSI/SOP/LB/RA/SC/4 - Procedure for Microbial Sample Collection.

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

GSI/SOP/LB/RA/SC/8 – Procedure for Collecting Physical/Chemical Data and Samples at the GSI Land-Based RDTE Facility.

APPENDIX 1. Data Sheet

Ballast Treatment System Test Fill Line Samples

System Name: _____

Date		**Test # 09**				
Duration	Days		Hours			
Collection Team						

Sample Collection Scenario - Fill Control and Treatment Tanks at same time

Note which tanks are being filled C1 T1 C2 T2

Collect water in 5 tubs	SP2A	SP2B (opt)		SP3A	SP3B (opt)	SP15
Tub #	1	2		4	5	6
Time start line flush		Time start solids injection			Time end fill	
		Time start phyto injection				
Time Tubs start fill						

Total amount of water in tank (US Gal) Control Treatment

	SP2A	SP2B (opt)	SP3A	SP3B (opt)	SP15
Height of water placed in catchment tub					
	1	2	4	5	6
Total amount of water placed in catchment tub (US Gal)					

Collect phytoplankton, microbial and zooplankton samples from Tubs 1, 4 and 6

Time phytoplankton collected					
Phyto discard/sample volume (l)					
Time microbes collected					
Microbial sample volume (l)					
Time chemistry collected					
Chemistry sample volume (l)					
Time zooplankton collected					

Notes: Time: Weather:
Air Temp: Wind:
Water Temp: Water Level: