Great Ships Initiative

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STANDARD OPERATING PROCEDURE
Procedure for Operating the GSI Land-Based RDTE Facility

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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.

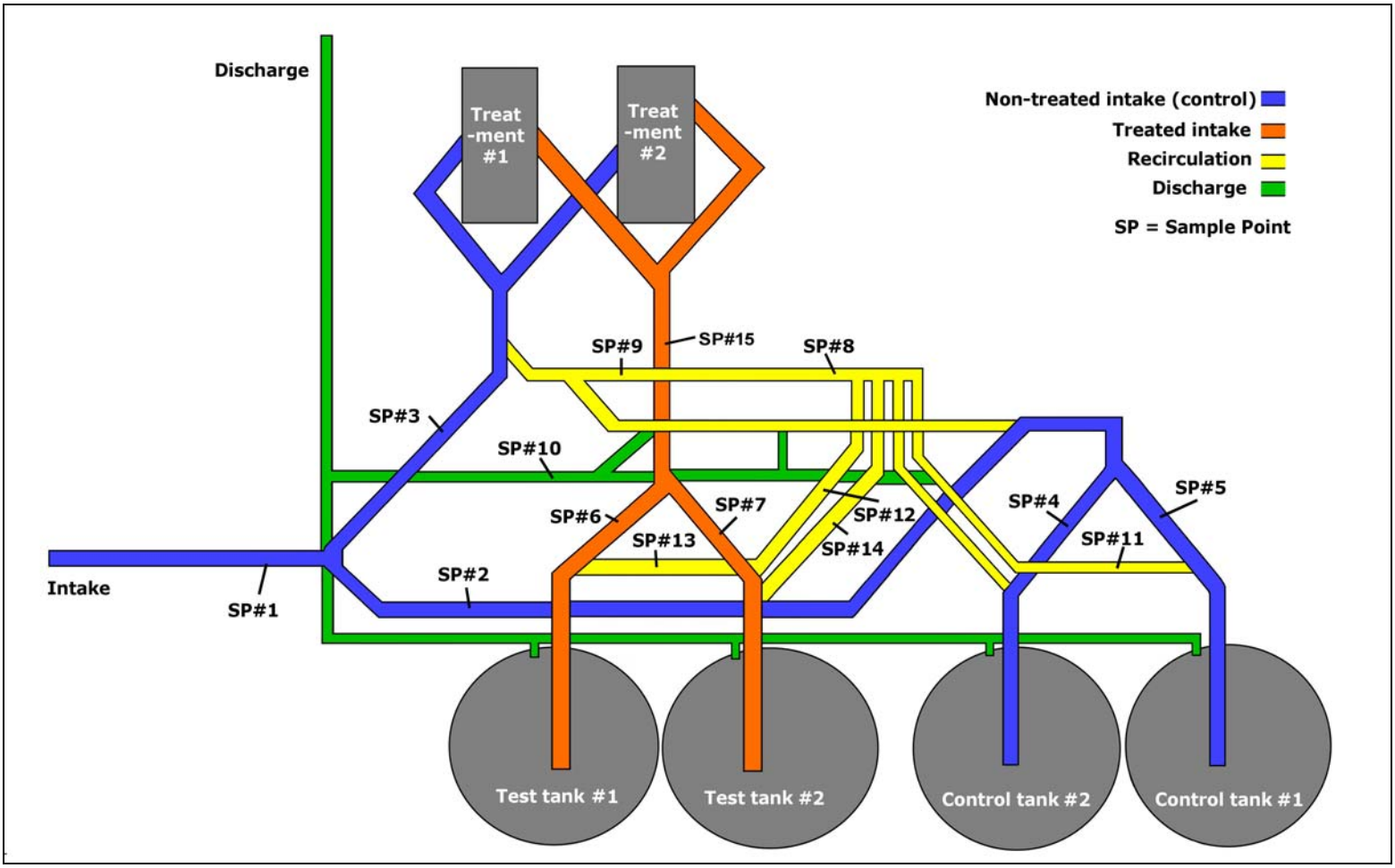


Figure 2. Schematic of the GSI Land-Based RDTE Facility Showing the Location of the Intake and Discharge Sample Points (SPs), Sample Ports, and Corresponding Sample Collection Tubs.

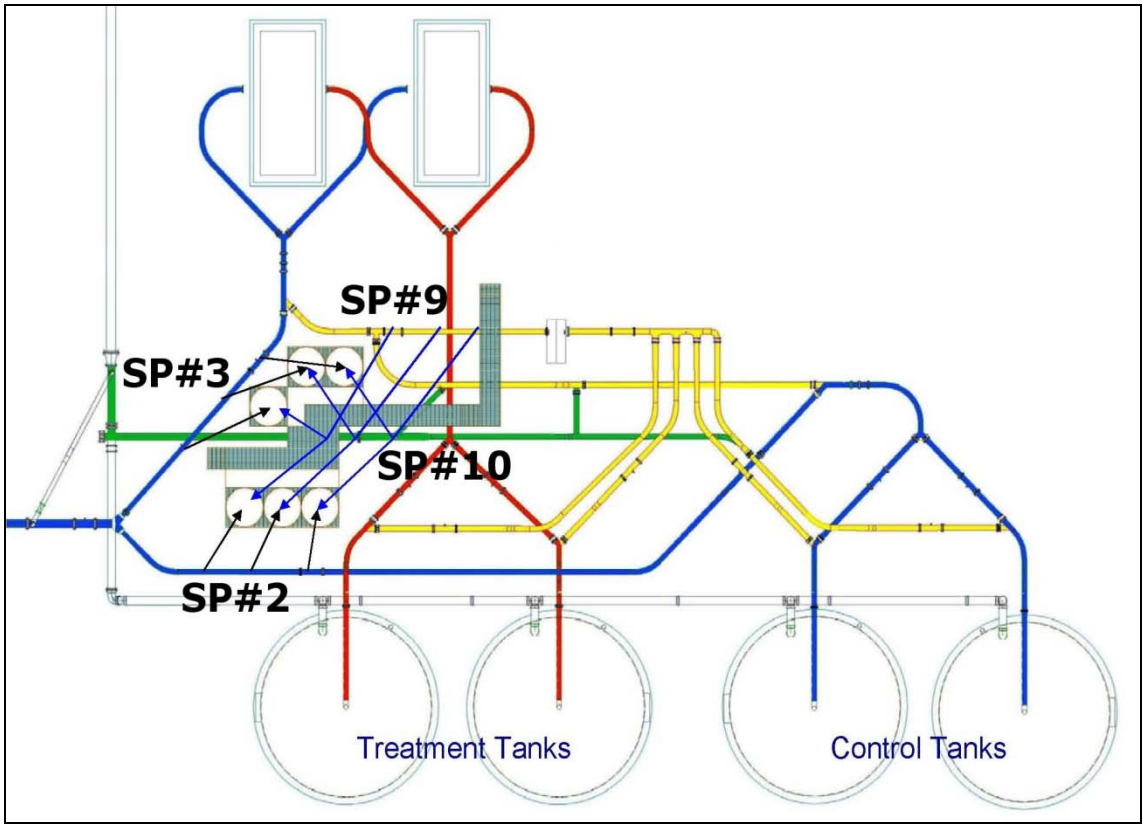
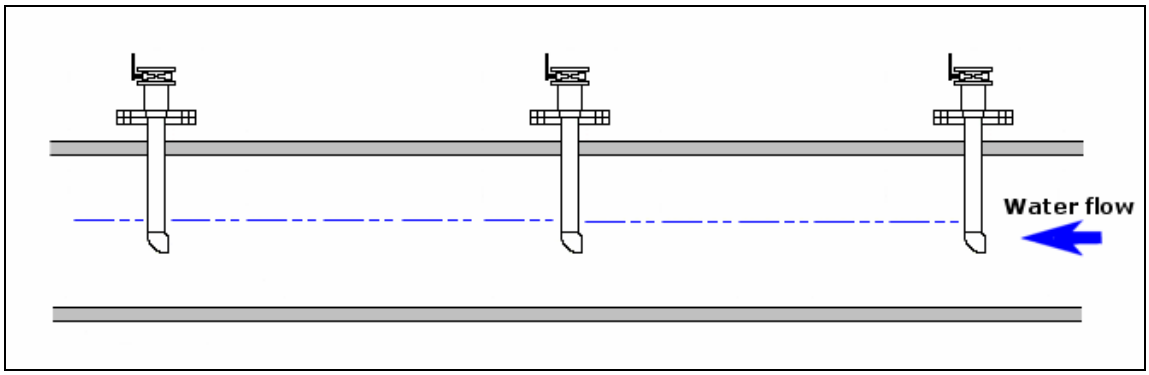


Figure 3. Schematic of a Sample Point (SP) Showing the Design of the Three Sample Port Pitots.



INTRODUCTION

This GSI Standard Operating Procedure (SOP) describes the procedure used to operate the GSI Land-Based RDTE Facility in Superior, WI. It details the facility's equipment, and operational scenarios, as well as outlines maintenance, winterization, safety and quality assurance/quality control procedures.

EQUIPMENT

- Bay Pump.
- Vertical Thrust Motor for Bay Pump.
- Recirculation Pump.
- Recirculation Motor.
- Residual Collection Pump.
- Residual Collection Pump Motor.
- 1000 gal. Residual Collection Tank.
- Air Compressor.
- Human Machine Interface (HMI).
- Two matched pairs of 200 m^3 control and treatment retention tanks.
- 8" and 1.5" electromagnetic flow meters.
- 8" A type flanged Diaphragm valves.
- 1.5" Diaphragm Valves.
- 10,000 gal. Potable Tank.
- Six 1000 gal. Sample Collection Tubs.
- 15 In-Line Sample Points (SP).
- Tank cleaning sprayers.
- Emergency drench shower.
- Three self-contained eyewash stations.

PROCEDURE

GSI Land-Based Facility Operating Scenarios

Scenario 1: Alpha (Sea-Treatment-Sea)

In this scenario, the bay pump pulls water from Duluth-Superior Harbor, sends it through treatment lab #1 or treatment lab #2, and then through the discharge line back to the Harbor. To run this scenario:

1. Ensure that no other scenarios are running.

2. Select the Alpha scenario that corresponds to the treatment lab being used on the "Scenario" screen of the HMI.

3. Read from the HMI what manual valves are applicable to this scenario and which valves need to be changed. Note: Valves in the correct position appear in green and valves in the incorrect position appear in yellow on the valve screen. Hand valves for the stripping line and the sample collection lines do not have limit switches and their positions must be determined by inspection. The HMI's "Valve" screen indicates which manual valves without limit switches are applicable to the scenario and what position they need to be in. The operator must physically look to see what position the valves without limit switches are in and open or close them if required by the scenario. Their position is then verified on the HMI's "Valve" screen.

4. Ensure that the PVC hand valves without limit switches directing water to the sample tubs are in the proper position. Since their usage is critical, have two competent persons check their position.

5. Set the flow rate to be sampled on the HMI "Sample" screen and turn sampling "on" for each of the sample tubs to be used (refer to table 1). Note: Once all the valves are in their proper position, the bay pump controls will become available on the main HMI screen.

Table 1. Sample Points and Pitots Available To Feed Sample Collection Tubs at the GSI Land-Based RDTE Facility.

Sample Collection Tub #	Intake Sample Point and Pitot	Discharge/ Recirculation Sample Point and Pitot
1	SP2-A	SP9-C or SP10-C
2	SP2-B	SP9-B or SP10-B
3	SP2-C	SP9-A or SP10-A
4	SP3-A	SP9-C or SP10-C
5	SP3-B	SP9-B or SP10-B
6	SP3-C	SP9-A or SP10-A

6. Ensure that the air compressor is on and at the proper pressure.

7. Open the "Pump Control" window for the bay pump labeled "M013" found on the main HMI screen. Ensure that there is enough time allowed on the "Pump Control" window, by clicking on the "Run Time" box and entering a desired time. When time runs out the pump will shutdown. Note: The run time can be adjusted once the scenario has begun.

8. Start the pump using the "Start" button on the HMI "Pump Control" window. Allow for a flush time of approximately 3 minutes before collecting samples.

Note: The flush time is used for both flushing the lines and developing the desired flow.

9. Continue to monitor and adjust the system as needed to produce the desired flow and pressure. Note: There is one diaphragm valve in the treatment line that is used to moderate the flow through the lab. There is also a diaphragm valve on the control track to control the flow. The bay pump is a VFD such that variations to the amount of power delivered to it alter the system pressure. These controls can be set to either automatic or manual.

10. Following completion of the Alpha scenario shut down the pump using the "Pump Control" window on the main HMI screen, or wait for the allocated amount of time to run out and the pump to stop.

Scenario 2: Beta (Sea-Treatment-Retention-Sea)

In this scenario, the bay pump pulls water from Duluth-Superior Harbor and sends half the water directly to the control tank and the other half to the test tank via one of the treatment labs. After both tanks are filled they are individually emptied back into the Harbor. The order of which tank (control or test) is emptied first is dependent on the test being run and can be changed. To run this scenario:

1. Ensure that no other scenarios are running.

2. Select the Beta scenario that corresponds to a) the treatment lab being used, and 2) the pair of control and test tanks being filled on the "Scenario" screen of the HMI.

3. Read from the HMI what manual valves are applicable to this scenario and which valves need to be changed. Note: Valves in the correct position appear in green and valves in the incorrect position appear in yellow on the valve screen. Hand valves for the stripping line and the sample collection lines do not have limit switches and their positions must be determined by inspection. The HMI's "Valve" screen indicates which manual valves without limit switches are applicable to the scenario and what position they need to be in. The operator must physically look to see what position the valves without limit switches are in and open or close them if required by the scenario. Their position is then verified on the HMI's "Valve" screen.

4. Ensure that the PVC hand valves without limit switches directing water to the sample tubs are in the proper position. Since their usage is critical there should be two competent persons who check their position.

5. Set the flow rate to be sampled on the HMI "Sample" screen and turn sampling

"on" for each of the sample tubs to be used (refer to table 2). Note: Once all the valves are in their proper position, the bay pump controls will become available on the main HMI screen.

6. Ensure that the air compressor is on and at the proper pressure.

7. Open the "Pump Control" window for the bay pump labeled "M013" found on the main HMI screen. Ensure that there is enough time allowed on the "Pump Control" window, by clicking on the "Run Time" box and entering a desired time. When time runs out the pump will shutdown. Note: The run time can be adjusted once the scenario has begun.

8. Start the pump using the "Start" button on the HMI "Pump Control" window. Allow for a flush time of approximately 3 minutes before collecting samples. Note: The flush time is used for both flushing the lines and developing the desired flow.

9. Continue to monitor and adjust the system as needed to produce the desired flow and pressure. Note: There is one diaphragm valve in the treatment line that is used to moderate the flow through the lab. There is also a diaphragm valve on the control track to control the flow. The bay pump is a VFD such that variations to the amount of power delivered to it alter the system pressure. These controls can be set to either automatic or manual.

10. Following completion of the tank filling process shut down the pump using the "Pump Control" window on the main HMI screen, or wait for the allocated amount of time to run out and the pump to stop.

Table 2. Sample Speeds Required to Reach a Certain Volume in the Sample Collection Tubs.

8" Line Flow (GPM)	Sample Collection Tub Goal Volume		Sample Line Flow Rate (GPM)
	Gallons	Liters	
1000	264.1	1000	4.9
1000	396.2	1500	7.3
1000	528.2	2000	9.8
1000	660.3	2500	12.2
1100	264.1	1000	5.4
1100	396.2	1500	8.1
1100	528.2	2000	10.8
1100	660.3	2500	13.5
1200	264.1	1000	5.9

1200	396.2	1500	8.8
1200	528.2	2000	11.7
1200	660.3	2500	14.7
1300	264.1	1000	6.4
1300	396.2	1500	9.5
1300	528.2	2000	12.7
1300	660.3	2500	15.9
1400	264.1	1000	6.8
1400	396.2	1500	10.3
1400	528.2	2000	13.7
1400	660.3	2500	17.1
1500	264.1	1000	7.3
1500	396.2	1500	11.0
1500	528.2	2000	14.7
1500	660.3	2500	18.3

11. To drain the control tank, ensure that no other scenarios are running.

12. Select the Beta scenario that will drain the desired control tank from the HMI's "Scenario" screen.

13. Read from the HMI what manual valves are applicable to this scenario and which valves need to be changed. Note: Valves in the correct position appear in green and valves in the incorrect position appear in yellow on the valve screen. Hand valves for the stripping line and the sample collection lines do not have limit switches and their positions must be determined by inspection. The HMI's "Valve" screen indicates which manual valves without limit switches are applicable to the scenario and what position they need to be in. The operator must physically look to see what position the valves without limit switches are in and open or close them if required by the scenario. Their position is then verified on the HMI's "Valve" screen.

14. Ensure that the PVC hand valves without limit switches directing water to the sample collection tubs are in the proper position. Since their usage is critical there should be two competent persons who check their position.

15. Set the flow rate to be sampled on the HMI "Sample" screen and turn sampling "on" for each of the sample tubs to be used (refer to table 2). Note: Once all the valves are in their proper position, the recirculation pump controls will become available on the main HMI screen.

16. Ensure that the air compressor is on and at the proper pressure.

17. Open the "Pump Control" window for the recirculation pump labeled "M007" found on the main HMI screen. Ensure that there is enough time allowed on the "Pump Control" window, by clicking on the "Run Time" box and entering a desired time. When time runs out the pump will shutdown. Note: The run time can be adjusted once the scenario has begun.

18. Start the pump using the "Start" button on the HMI "Pump Control" window.

19. Continue to monitor and adjust the system as needed to produce the desired flow and pressure. Note: The variable speed recirculation pump and the actuated butterfly valve are control options.

20. Following completion of the tank discharge process shut down the pump using the "Pump Control" window on the main HMI screen, or wait for the allocated amount of time to run out and the pump to stop.

21. To drain the test tank, ensure that no other scenarios are running.

22. Select the Beta scenario that will drain the desired test tank from the HMI's "Scenario" screen.

23. Read from the HMI what manual valves are applicable to this scenario and which valves need to be changed. Note: Valves in the correct position appear in green and valves in the incorrect position appear in yellow on the valve screen. Hand valves for the stripping line and the sample collection lines do not have limit switches and their positions must be determined by inspection. The HMI's "Valve" screen indicates which manual valves without limit switches are applicable to the scenario and what position they need to be in. The operator must physically look to see what position the valves without limit switches are in and open or close them if required by the scenario. Their position is then verified on the HMI's "Valve" screen.

24. Ensure that the PVC hand valves without limit switches directing water to the sample collection tubs are in the proper position. Since their usage is critical there should be two competent persons who check their position.

25. Set the flow rate to be sampled on the HMI "Sample" screen and turn sampling "on" for each of the sample tubs to be used (refer to table 2). Note: Once all the valves are in their proper position, the recirculation pump controls will become available on the main HMI screen.

26. Ensure that the air compressor is on and at the proper pressure.

27. Open the "Pump Control" window for the recirculation pump labeled "M007" found on the main HMI screen. Ensure that there is enough time allowed on the "Pump Control" window, by clicking on the "Run Time" box and entering a desired time. When time runs out the pump will shutdown. Note: The run time can be adjusted once the scenario has begun.

28. Start the pump using the "Start" button on the HMI "Pump Control" window.

29. Continue to monitor and adjust the system as needed to produce the desired flow and pressure. Note: The variable speed recirculation pump, diaphragm valve and the actuated butterfly valve are control options.

30. Following completion of the tank discharge process shut down the pump using the "Pump Control" window on the main HMI screen, or wait for the allocated amount of time to run out and the pump to stop.

Scenario 3: Delta (Sea-Treatment-Retention-Treatment-Retention-Sea)

In this scenario, the bay pump pulls water from Duluth-Superior Harbor and sends half the water directly to the control tank and the other half to the test tank via one of the treatment labs. After both tanks are filled they are individually emptied with water from the test tank directed back through one of the treatment labs before being sent to the other test tank. Water from the control tank is similarly moved to the other control tank. After the second set of tanks has been filled, they are individually emptied with water sent back to the Harbor. Which tank is emptied first is decided by the requirements of the test. Note: This is an example of the test water being moved between the two test tanks first. To run this scenario:

1. Follow steps 1 through 10 of the Beta scenario procedure as outlined above.

2. To transfer water from the first test tank to the second test tank via one of the treatment labs, select the recirculation scenario on the HMI that will drain the specified test tank and send the water through the specified treatment lab to the other test tank.

3. Read from the HMI what manual valves are applicable to this scenario and which valves need to be changed. Note: Valves in the correct position appear in green and valves in the incorrect position appear in yellow on the valve screen. Hand valves for the stripping line and the sample collection lines do not have limit switches and their positions must be determined by inspection. The HMI's "Valve" screen indicates which manual valves without limit switches are applicable to the scenario and what position they need to be in. The operator must physically look to see what position the valves without limit switches are in and

open or close them if required by the scenario. Their position is then verified on the HMI's "Valve" screen.

4. Ensure that the PVC hand valves without limit switches directing water to the sample collection tubs are in the proper position. Since their usage is critical there should be two competent persons who check their position.

5. Set the flow rate to be sampled on the HMI "Sample" screen and turn sampling "on" for each of the sample tubs to be used (refer to table 2). Note: Once all the valves are in their proper position, the recirculation pump controls will become available on the main HMI screen.

6. Ensure that the air compressor is on and at the proper pressure.

7. Open the "Pump Control" window for the recirculation pump labeled "M007" found on the main HMI screen. Ensure that there is enough time allowed on the "Pump Control" window, by clicking on the "Run Time" box and entering a desired time. When time runs out the pump will shutdown. Note: The run time can be adjusted once the scenario has begun.

8. Start the pump using the "Start" button on the HMI "Pump Control" window.

9. Continue to monitor and adjust the system as needed to produce the desired flow and pressure. Note: The variable speed recirculation pump, diaphragm valve and the actuated butterfly valve are control options.

10. Following completion of the tank discharge process shut down the pump using the "Pump Control" window on the main HMI screen, or wait for the allocated amount of time to run out and the pump to stop.

11. Repeat steps 2 through 10 to transfer water from the first control tank to the second control tank.

12. To drain the test and control tanks and send the water back to the Harbor, follow steps 11 through 10 of the Beta scenario procedure as outlined above.

Data Logging

During each operating scenario, information collected by the HMI is transferred to a separate "Data Logging" computer that is connected to the HMI by an Ethernet cord. Once the information is stored to the Data Logging computer it can be viewed with a spreadsheet program or transferred to another computer for later analysis.

Chemically Treated Water Disposal Procedures

Due to U.S. Environmental Protection Agency and/or Wisconsin Department of Natural Resources (DNR) regulations, water treated with chemicals not covered by the GSI's Discharge Permit with the Wisconsin DNR may not be discharged into the Harbor. When the facility is used to evaluate these chemicals the treated water must be transported to the City of Superior Waste Water Treatment Plant as outlined in *GSI/SOP/LB/G/O/5 – Procedure for Transferring Treated Water to the City of Superior Waste Water Treatment Facility*.

Maintenance

1. The GSI Land-Based RDTE Facility Operations Manager is to ensure that all equipment is operated and maintained according to the manufacturer's manual. He/she is also to have read and understood the manual for each piece of equipment prior to operation and/or maintenance.

Bay Pump

1. The GSI Land-Based RDTE Facility Operations Manager is to conduct daily maintenance of the bay pump. This includes checking the oil level on the side of the motor prior to start-up; checking and adjusting bushings so that there is visible leakage during operation; listening for changes in sounds and responding to any that are unusual; and checking for unintentional leakage of water, grease and oil (i.e., leakage not due to the intentional leakage at the bushing).

2. The GSI Land-Based RDTE Facility Operations Manager is to maintain weekly logs of the bay pump's activities, including data on the total operating time and the estimated water discharged back to the bay.

3. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the bay pump is greased in accordance with the manufacturer's recommendations. He/she should use the weekly maintenance logs to determine if grease needs to be added or if the grease needs to be changed.

4. The GSI Land-Based RDTE Facility Operations Manager is to ensure that all anchor bolts of the bay pump are secure. Checks should be made on a monthly basis with information recorded in the weekly maintenance logs.

Recirculation Pump

1. The GSI Land-Based RDTE Facility Operations Manager is to conduct daily maintenance of the recirculation pump. This includes ensuring that the hand valves to the pressure meter are in the proper position prior to starting the pump;

checking and adjusting bushings so that there is visible leakage (approx. 2 drips per second); listening for changes in sound and responding to any that are unusual; and checking for unintentional leakage of water, grease and oil (i.e., leakage not due to the intentional leakage at the bushing).

2. The GSI Land-Based RDTE Facility Operations Manager is to maintain weekly logs of the recirculation pump's activities, including data on the total operating time and the estimated water discharged back to the bay.

3. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the recirculation pump is greased in accordance with the manufacturer's recommendations. He/she should use the weekly maintenance logs to determine if grease needs to be added or if the grease needs to be changed.

Residual Collection Pump

1. Before using the Residual Collection Pump, the GSI Land-Based RDTE Facility Operations Manager is to ensure that it is enabled on the HMI maintenance screen. He/she is also responsible for ensuring that the pump doesn't pull in air or have zero flow with water present if he/she decides to disable the flow switch that protects the Residual Collection pump on the HMI.

2. The GSI Land-Based RDTE Facility Operations Manager is to conduct daily maintenance of the Residual Collection pump. This includes ensuring listening for changes in sound and responding to any that are unusual, and checking for unintentional leakage of water, grease and oil.

3. The GSI Land-Based RDTE Facility Operations Manager is to maintain weekly logs of the Residual Collection pump's activities, including data on the total operating time and the estimated water discharged to the sample collection tubs.

4. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the Residual Collection pump is greased in accordance with the manufacturer's recommendations. He/she should use the weekly maintenance logs to determine if grease needs to be added or if the grease needs to be changed.

Piping

1. The GSI Land-Based RDTE Facility Operations Manager should ensure that the lines are drained following completion of each trial. He/she should also conduct monthly inspections of the lines for chips in the paint and rust leaking through. Repairs should be made according to the paint manufacturer's instructions.

Cleaning of Retention Tanks and Equipment

1. Test and control retention tanks and other equipment at the facility should be cleaned according to *GSI/SOP/LB/G/O/4 - Procedure for Cleaning the Retention Tanks and Other Equipment at the GSI Land-Based RDTE Facility*.

Site Security

1. The GSI Land-Based RDTE Facility Operations Manager should ensure that the facility is secure when it is not staffed. He/she should also ensure that all gates, doors and tank hatches are secured and locked at the end of every day. All tools, equipment and chemicals should be stored in a safe and secure place.

Winterization

1. At the end of each operating season to prevent damage to the facility over winter, the GSI Land-Based RDTE Facility Operations Manager is to ensure that:

    a) The potable water pump is shutoff and the potable water supply tank is emptied.
    b) The potable water pump and pressure tank are drained and covered with plastic.
    c) The emergency drench shower, and all of the piping leading to it, is drained, and the shower head, alarm and eyewash bowl are wrapped in plastic.
    d) All piping and tanks are drained.
    e) The bay pump and motor are removed and stored off-site in a covered, secure area.
    f) The flow meters and diaphragm valves in the 8” line are removed and stored off-site in a covered, secure area, and the open ends of the pipe are sealed with plastic and duct tape.
    g) Sensitive electrical equipment are disconnected, removed and stored off-site in a covered, temperature-controlled, secure area. This includes pressure monitors, flow switches, tank level transmitters, pressure transmitters, flow switches, control valve actuators, flow meters, touch screen panel, and the PLC modules.
    h) The concrete containment around the labs is drained, and the labs are covered so that no moisture can collect in the containment areas.
    i) The steel troughs on the collection platforms are covered to prevent moisture seeping back into the system.
    j) The automated tank cleaning system and pump are drained according to the manufacturer’s recommendations.
    k) The power is shut-off to all systems that will not be used over the winter at the main breaker. This includes all of the pumps and treatment lab power.

The main power and lighting should be left on as part of the facility's security program.

2. The GSI Land-Based RDTE Facility Operations Manager is to ensure that University of Wisconsin-Superior campus security has been informed that the facility is closed for the year and that there should not be any activity at the site.

Safety

1. The GSI Land-Based RDTE Facility Operations Manager is to ensure that all GSI health and safety procedures are followed as described in *GSI/SOP/LB/G/S/1 - Procedure for Ensuring Worker Health and Safety at the GSI Land-Based RDTE Facility*.

2. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the GSI land-based facility's *Spill Prevention Control and Countermeasure (SPCC) Plan* is followed.

3. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the GSI land-based facility's *Lock Out, Tag Out Policy* is followed.

4. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the GSI land-based facility's *Confined Space Policy* is followed.

5. The GSI Land-Based RDTE Facility Operations Manager is to ensure that the *GSI Land-Based Facility Daily Safety Check List* (see appendix A of *GSI/SOP/LB/G/S/1 - Procedure for Ensuring Worker Health and Safety at the GSI Land-Based RDTE Facility*) is correctly filled out every day prior to the start of testing.

Documents and Records

1. The GSI Land-Based RDTE Facility Operations Manager is to ensure that all documents are updated on a regular basis. This includes, but is not limited to, standard operating procedures, maintenance log books, the SPCC Plan, the Wisconsin Department of Natural Resources (DNR) Discharge Permit, the Wisconsin DNR Cleaning Procedure, the facility's Lock Out, Tag Out Policy, Confined Space Policy, and Daily Safety Check List.

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. The GSI Land-Based RDTE Facility Operations Manager is responsible for ensuring that all forms, documents, logbooks and records associated with this SOP (i.e., confined space entry permit and logbook, daily safety checklist, visitor logbook, and training logbooks) are correctly filled out. He/she is also responsible for maintaining the forms, documents, logbooks and records at the facility and on file; and creating electronic copies and posting to the GSI Sharepoint website for storage, when relevant. QAQC spot-checks of these documents and the processes used to complete and maintain them will be undertaken periodically by GSI QAQC Officers. Problems identified by the spot-checks will be documented and included in a corrective action report.

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 (NOAA). Northeast-Midwest Institute, Washington DC.

GSI/LB/OA/CPP/1 - Confined Space Policy for the Great Ships Initiative Land-Based Research, Development, Testing and Evaluation Facility, Superior, Wisconsin.

Great Ships Initiative website: www.greatshipsinitiative.org.

Great Ships Initiative Standard Operating Procedures:
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/LB/OA/LOTO/1 - Lock Out, Tag Out Policy for the Great Ships Initiative Land-Based Research, Development, Testing and Evaluation Facility, Superior, Wisconsin.

GSI/LB/OA/SPCC/1 - Spill Prevention, Control, and Countermeasure (SPCC) Plan for the Great Ships Initiative Land-Based Research, Development, Testing and Evaluation Facility, Superior, Wisconsin.

GSI/SOP/G/A/RK/1 - Procedure for Record Keeping.

GSI/SOP/LB/G/O/4 - Procedure for Cleaning the Retention Tanks and Other Equipment at the GSI Land-Based RDTE Facility.

GSI/SOP/LB/G/O/5 – Procedure for Transferring Treated Water to the City of Superior Waste Water Treatment Facility.

GSI/SOP/LB/G/S/1 - Procedure for Ensuring Worker Health and Safety at the GSI Land-Based RDTE Facility.