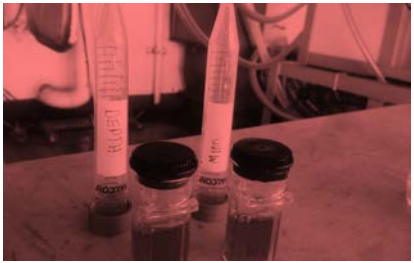
Glosten

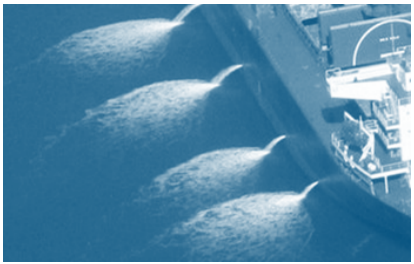
SHIPBOARD TESTING AT GOLDEN BEAR FACILITY

PRESENTED BY: ALAN J. ORTHMANN

16 APRIL 2015

CONTINGENCY BALLAST WATER TREATMENT





OVERVIEW

R&D Testing

What did we learn?

Verification Testing

How did we do?

Program Future

What's next?

PARTICIPANTS

Golden Bear Facility

Moss Landing Marine Laboratories

California State Lands Commission

National Park Service and

Grand Portage Tribe

BACKGROUND

THE EQUIPMENT AND THE SHIP

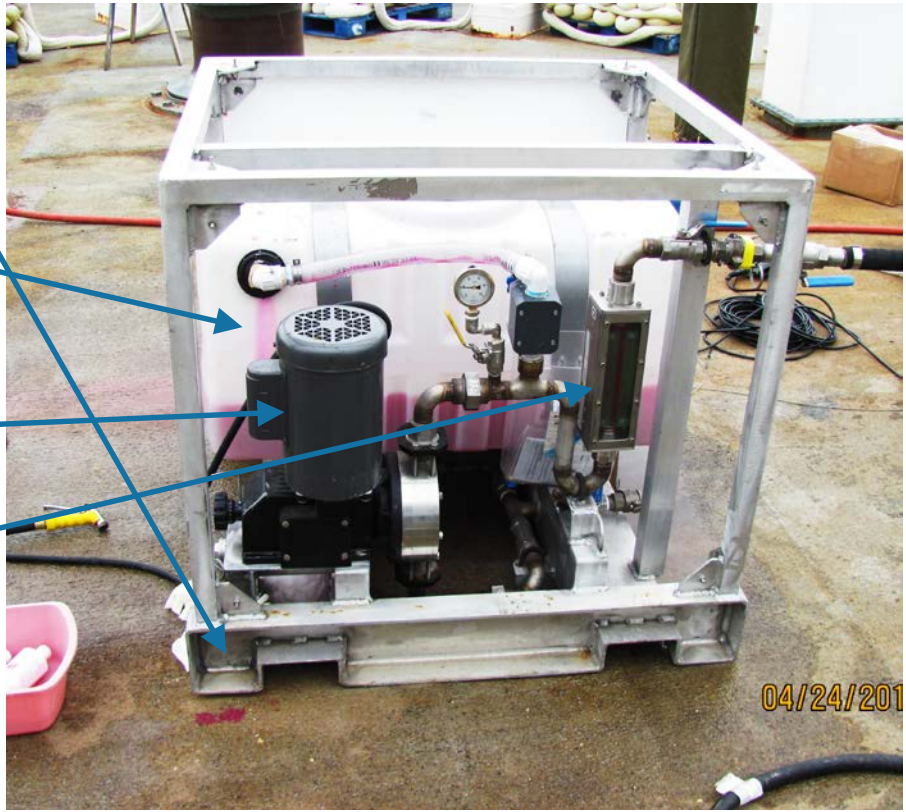
METERING SKID

Portable design

Chemical prep tank

Metering pump

Flow meter



MIXING PUMP

Submersible

300 GPM flow rate

Chemical sparger

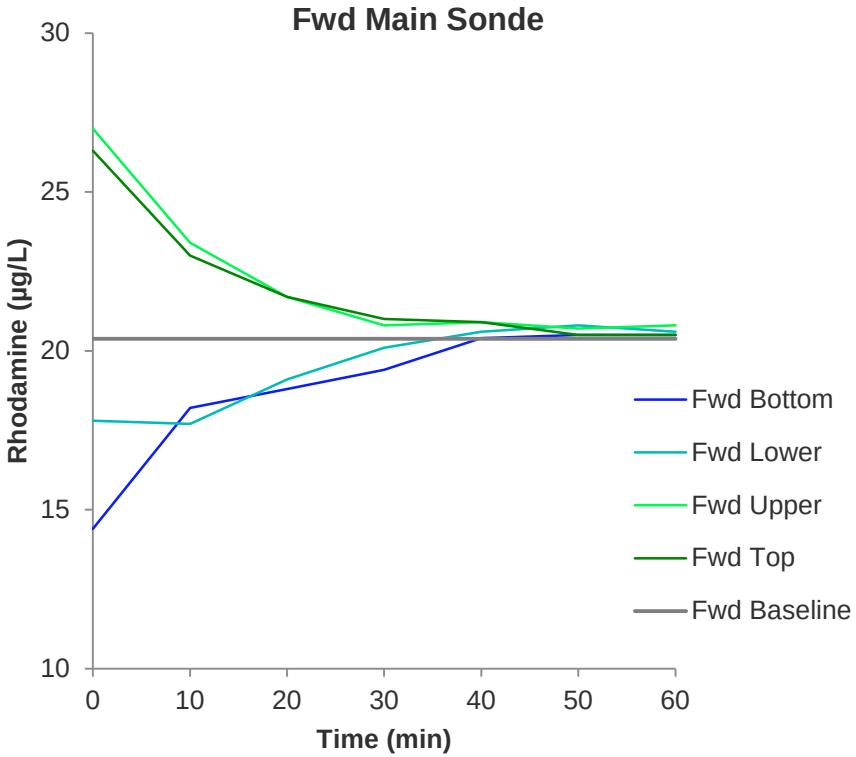
3-way nozzle outlet

Tripod mount

GOLDEN BEAR FACILITY

A quick tour.

DYE MIXING STUDY



R&D TESTING

WHAT DID WE LEARN?

OBJECTIVES

Evaluate 'tank effects' on chemical delivery and concentration.

Refine mixing and dosing standard procedures.

Determine a compliant and practical <u>Sustained Dose/Residence Time</u>.

PARAMETERS

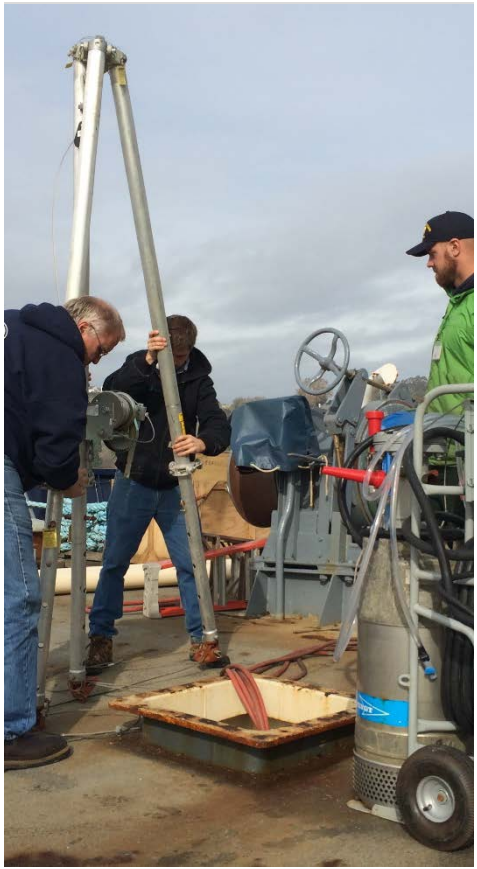
Target Sustained Dose (SD)

Mixing/Dosing Coordination

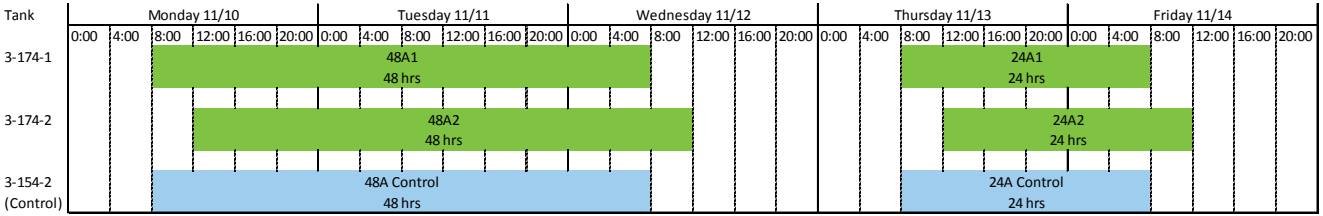
Applied Dose Margin

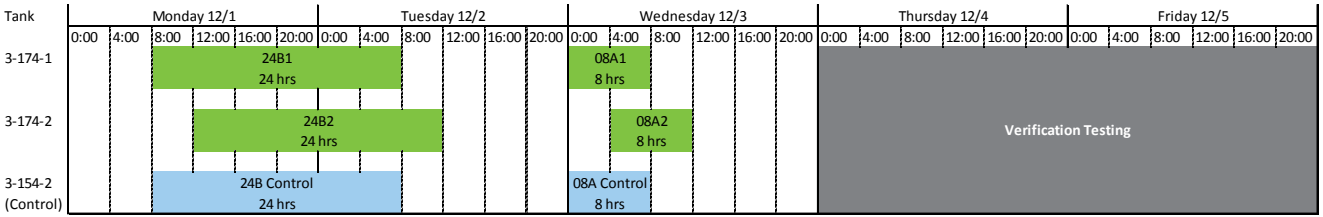
Residence Time (RT)

Monitoring and Re-dose Interval



R&D SCHEDULE


Tank
Monday 11/10
Tuesday 11/11
Wednesday 11/12
Thursday 11/13
Friday 11/14
0:00 4:00 8:00 12:00 16:00 20:00
3-174-1
48A1
48 hrs
24A1
24 hrs
3-174-2
48A2
48 hrs
24A2
24 hrs
3-154-2
(Control)
48A Control
48 hrs
24A Control
24 hrs


Tank
Monday 12/1
Tuesday 12/2
Wednesday 12/3
Thursday 12/4
Friday 12/5
0:00 4:00 8:00 12:00 16:00 20:00
3-174-1
24B1
24 hrs
08A1
8 hrs
3-174-2
24B2
24 hrs
08A2
8 hrs
Verification Testing
3-154-2
(Control)
24B Control
24 hrs
08A Control
8 hrs

PROCEDURE

Bleach

Thiosulfate

BIOLOGY RESULTS

24A Live Phytoplankton, Flow Cytometry (10-50 µm)

600

DISCHARGE						
Residence Time (hrs)	Sample ID	Sustained Dose (mg/L total chlorine)	>50 µm (org/m^3)	10 – 50 µm (org/mL)	<10 µm E.coli (cfu/100mL)	<10 µm Enterococci (cfu/100mL)
48	48A1	4	2.1	1.7	3.0	0.7
	48A2	2	5.5	1.7	3.7	11.0
24	24A1	12	6.9	3.4	0.0	1.3
	24A2	6	14.6	4.2	0.7	5.5
24	24B1	12	8.8	3.4	2.1	2.0
	24B2	12	113.3	9.3	0.0	1.4
8	08A1	12	9.18	1.9	0.3	<1.0
	08A2	12	21.5	1.7	2.4	0.7
18	18A1	12	13.2	0.95	<1.0	0.3
	18A2	12	11.3	1.7	0.7	15.0
18	18B1	12	1.2	1.9	<1.0	2.7
	18B2	12	0.34	1.7	<1.0	24.6

WHAT DID WE LEARN?

Maximize mixing time

- ***Improves distribution to remote take areas***

Provide sufficient margin on applied dose

- ***Evaporation***
- ***Tank and sediment demand***

Re-dose frequently

Work within 24-hour window

VERIFICATION TESTING

HOW DID WE DO?

ADAPTED REVISIONS

+50% margin on applied dose

Target 90-120 minutes mixing on all dose deliveries

Minimize equipment down time

OBJECTIVES

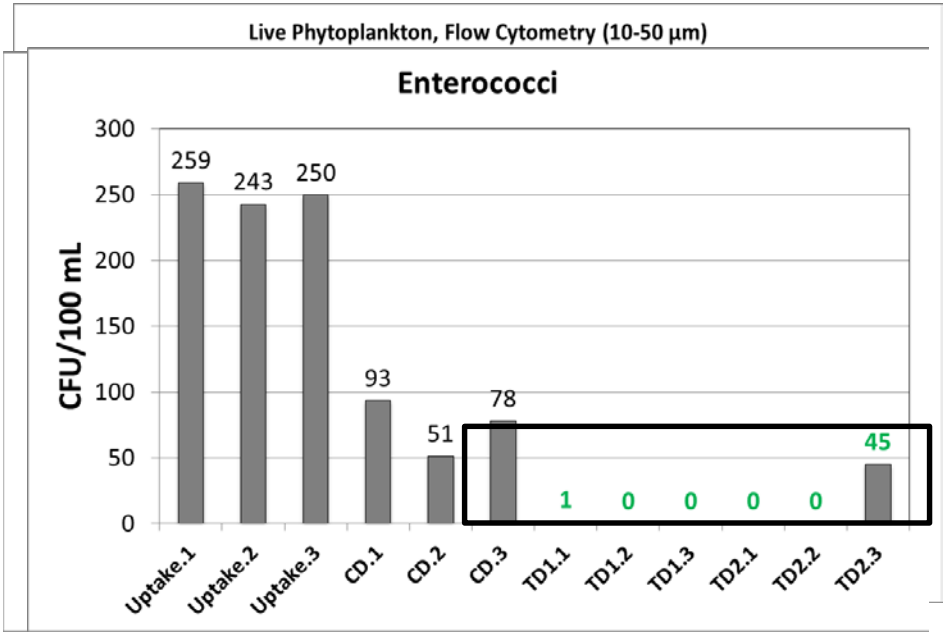
Execute final operating procedure

- *4 tank trials*

Target compliant discharge with Final SD/RT

- *12 ppm over 18 hours (12/18)*

BIOLOGY RESULTS



HOW DID WE DO?

- *Finalized standard procedures*
- *Met USCG discharge standard*

DISCHARGE						
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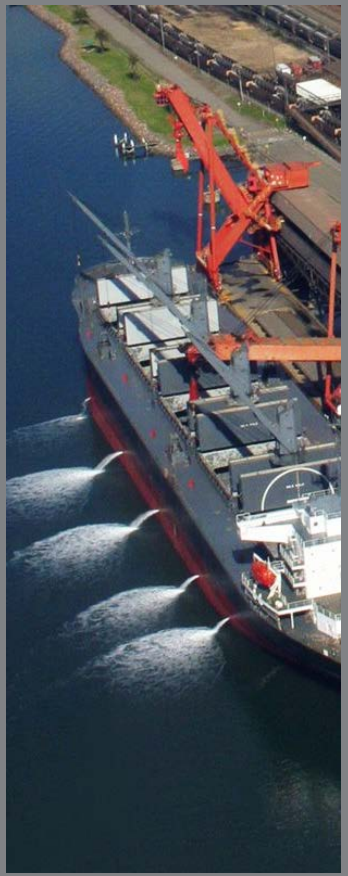

PROGRAM FUTURE

WHAT'S NEXT?

WHAT'S NEXT?

Emergency

System Ready, deployable within 24 hours for Emergency Response

Global Diving & Salvage, West Coast response network

Operator Awareness: contingency solution for vessel planning

GLOBAL
Diving & Salvage, Inc.

WHAT'S NEXT?

Ballast Management Alternative

USCG guidance towards STEP program

Target Vessels

BALLAST SAMPLING TOOL

UPDATE

BALLAST SAMPLING TOOL

Hot-Tap Design for Quick Connection

Single Port for Sampling and Return

Ex-proof System

Rapid Sampling Tool

Sampling Protocol

Further Demonstration