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.
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 Sustained Dose/Residence Time.
PARAMETERS

Target Sustained Dose (SD)

Mixing/Dosing Coordination

Applied Dose Margin

Residence Time (RT)

Monitoring and Re-dose Interval
## R&D SCHEDULE

### Verification Testing

<table>
<thead>
<tr>
<th>Tank</th>
<th>Monday 12/1</th>
<th>Tuesday 12/2</th>
<th>Wednesday 12/3</th>
<th>Thursday 12/4</th>
<th>Friday 12/5</th>
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### Testing Schedule

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<th>Tank</th>
<th>Monday 11/10</th>
<th>Tuesday 11/11</th>
<th>Wednesday 11/12</th>
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### Task Details

- **48A1**: 48 hrs
- **48A2**: 48 hrs
- **24B1**: 24 hrs
- **24B2**: 24 hrs
- **08A1**: 8 hrs
- **08A2**: 8 hrs
- **24A1**: 24 hrs
- **24A2**: 24 hrs
- **24A Control**: 24 hrs
- **08A Control**: 8 hrs
PROCEDURE

3-174-2

Sodium Thiosulfate
# BIOLOGY RESULTS

<table>
<thead>
<tr>
<th>Residence Time (hrs)</th>
<th>Sample ID</th>
<th>Sustained Dose (mg/L total chlorine)</th>
<th>&gt;50 μm (org/m³)</th>
<th>10 – 50 μm (org/mL)</th>
<th>&lt;10 μm E.coli (cfu/100mL)</th>
<th>&lt;10 μm Enterococci (cfu/100mL)</th>
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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

Live Phytoplankton, Flow Cytometry (10-50 μm)

Enterococci

CFU/100 mL

- Uptake.1: 259
- Uptake.2: 243
- Uptake.3: 250
- CD.1: 93
- CD.2: 51
- CD.3: 78
- TD1.1: 1
- TD1.2: 0
- TD1.3: 0
- TD2.1: 0
- TD2.2: 0
- TD2.3: 45
### HOW DID WE DO?

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

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PROGRAM FUTURE

WHAT’S NEXT?
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Emergency

System Ready, deployable within 24 hours for Emergency Response

Global Diving & Salvage, West Coast response network

Operator Awareness: contingency solution for vessel planning
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**