

Shipbuilding and Ship Repair Industry Initiative to Prepare for and Comply with the Residual Risk Ruling

Presented to the NSRP Environmental
Technologies Panel

June 20, 2007

Project Lead
Georgette Nelson



Concurrent
Technologies
Corporation

Objectives

- Ensure continued operations at shipyards pre/post RRR
- Determine current state of welding practices at shipyards
- Perform independent analysis of environmental risk model
- Identify and evaluate technologies/strategies to reduce welding emissions
- Determine economic impact of RRR on shipbuilding industry
- Support sustainable Technical Transition Plan



Project Team

- **Supporting Organizations**
 - National Shipbuilding Research Program (NSRP)
 - Advance Technology Institute (ATI)
 - Chief of Naval Operations (CNO), N45
 - Naval Sea Systems Command (NAVSEA)
 - Naval Surface Warfare Center Carderock Division (NSWCCD)
- **Navy Shipyards**
 - Norfolk Naval Shipyard (NNSY)
 - Puget Sound Naval Shipyard (PSNY)
- **Commercial Shipyards**
 - Atlantic Marine Alabama (AMA)
 - BAE Systems (San Diego and Norfolk Ship Repair)
 - Bath Iron Works (BIW)
 - General Dynamics (GD) National Steel and Shipbuilding Company (NASSCO)
 - Northrop Grumman Newport News (NGNN)
 - Northrop Grumman Ship Systems (NGSS) - PTR
- **Primary Contractor and Subcontractors/Consultants**
 - Concurrent Technology Corporation (*CTC*)
 - Applied Research Laboratory (ARL) - Penn State Univ.
 - Kelley Drye Collier Shannon, PLLC (KDCS)
 - Scientific Resources Associated (SRA)
 - SofTek Systems Inc. (SSI)
 - Emission Testing Consulting Firm (TBD)



Approach - Phase 0

- **Task 1 Prepare a Technology Transition Plan (TTP)**
- **Task 2 Fate and Transport of Emissions**
 - Collect information related to specific welding processes
 - Conduct a parallel independent analysis of the model being used by U.S. EPA
 - Literature review on emission factor calculations
 - Conduct literary and scientific research on the speciation of metals
- **Task 3 Emission Control Technology**
 - Develop a Sampling and Analysis Plan (S&P)
 - Plan a demonstration of a pollutant control technology
- **Upon completion of Phase 0 a Go/No Go Decision will be made**



Phase 0 Accomplishments

Task 1 Technology Transition Plan (TTP)

- TTP was submitted on April 2nd
- ATI comments on the TTP were incorporated and the TTP resubmitted on April 11th.
- The TTP outlines:
 - Expected outcome of the project
 - Critical implementation requirements
 - Milestone schedule
 - Implementation efforts
- Drafted Navy PM Engagement Plan



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

ANPRM & RRR Background

- **Risk and Technology Review (RTR) I and II**
 - Clean Air Act established a two-stage regulatory process to address emissions of toxic air pollutants
- **First stage - RTR I**
 - Focus was on ensuring reductions through available technologies (MACT).
- **Second stage - RTR II**
 - Focuses on reducing any remaining risk "residual" risk



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

RTR II Process

- **RTR II Process**
 - Extract MACT category information from 2002 National Emissions inventory (NEI)
 - Model MACT Categories to obtain:
 - Inhalation cancer risk and incidence
 - Population cancer risk
 - Non- cancer effects (acute & chronic)
 - Key HAP drivers
 - Provide information to the public for comments and data corrections via the Advance Notice of Proposed Rule making (ANPRM)
- **Primary Purpose of ANPRM**
 - Obtain comments and corrections on the 2002 NEI data set to ensure that the regulatory decision is based on the highest quality data.



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

Status of the RTR II

- **Advanced Notice of Proposed Rule-Making (ANPRM)** – Released March 29, 2007
- NSRP was granted an extension to the original 60 day comment period which now ends **June 29, 2007**
- **Anticipated results of notice of proposed rulemaking (NPRM)** pending “ample margin of safety” for human health and adverse environmental impacts id determined – Fall 2007
- **Anticipated Final Action** – Summer 2008



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

- Assisted the National Shipbuilding Research Program (NSRP) Residual Risk Project Team in preparing comments for the U.S. EPA
- Contacted 71 of the 86 shipyards listed in the ANPRM data set
 - Made them aware of the ANPRM
 - Provided facility specific data
 - Provided instructions for recommending corrections to the data set



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

- Collected baseline data
 - Reviewed the ANPRM dataset located on the U.S. EPA's Technology Transfer Network Air Toxics Website
 - Obtained and reviewed the U.S. EPA's Human Exposure Model (HEM-AERMOD)
 - Conducted a literature review and compiled a report on Welding Emissions and Emission Factors
 - Compiled from 11 documents
 - Provides a review on available data on welding emissions and emission factors related to welding processes



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

- Designed a sampling plan to evaluate Cr(VI) fate and mass fraction in weld fumes
 - Results will influence estimates of health risk offsite
 - Cr(VI) speciation will add further clarify and credibility the Cr(VI)/Total Chrome ratio
 - Decay/growth rate constant for Cr(VI)/Cr(III) will be developed for risk modeling
- Submitted to EPA for review and approval on June 14th



Phase 0 Accomplishments

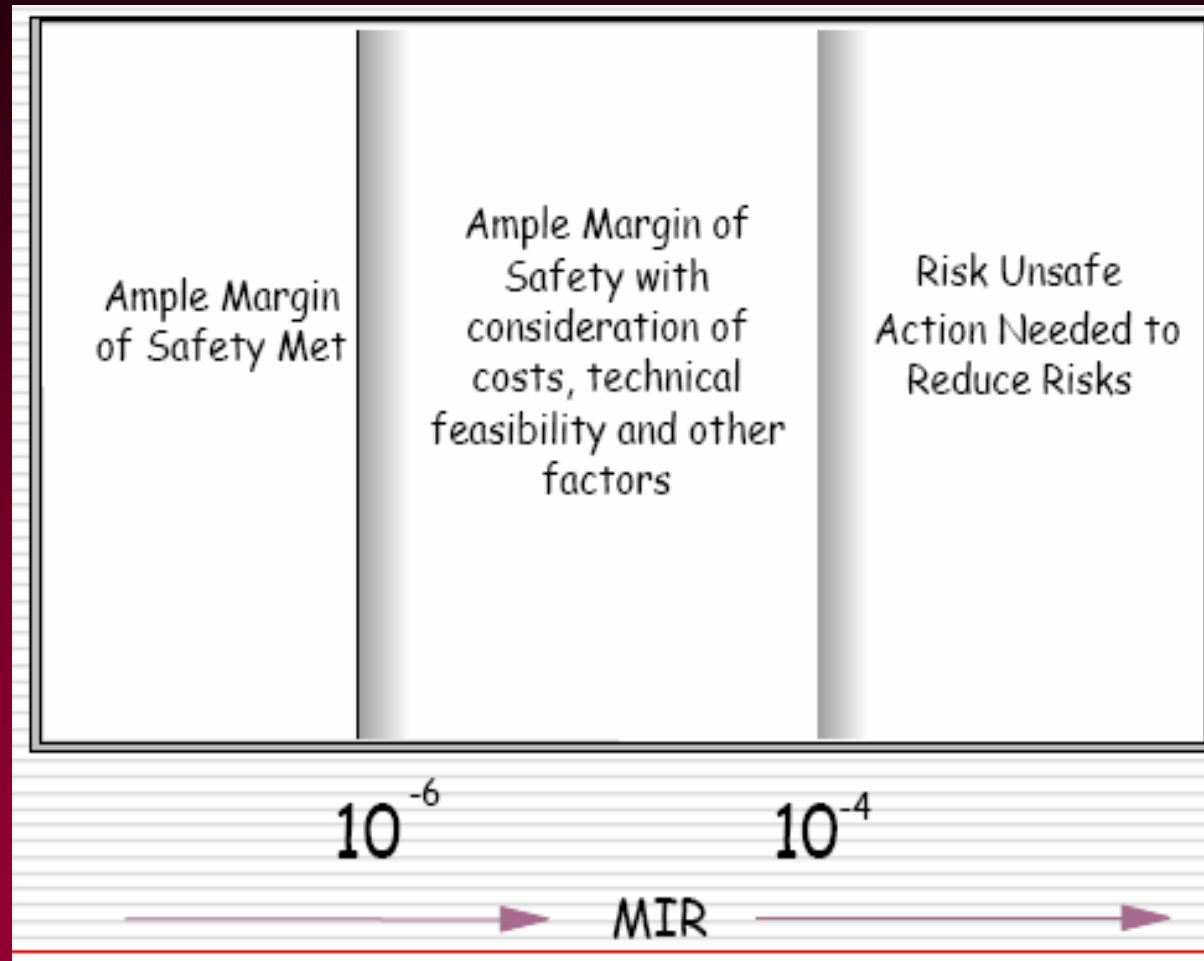
Task 2 Fate and Transport of Emissions

Emissions Modeling

- Attended the U.S. EPA Regional/State/Local Modelers Workshop on May 15, 2007 in Virginia Beach, VA.
- Obtained an advanced copy of the U.S. EPA's risk modeling software HEM-AERMOD
- Evaluated the modeling domain and modeling set-up options used in the Residual Risk and Technology Review Assessments



Relevant Cancer Risk Ranges



(RTR II Assessment Plan – Presentation to the U.S. EPA Science Advisory Board 2006)

Output Data from U.S. EPA's Initial Risk Assessment

1	Facility	facil_id	mx_tot_hi
2	BOLLINGER SHIPYARDS LOCKPORT, LLC	SBG_NEILA0051	33.07671929
3	ORANGE YARD	SBG_NEITXROC0376	10.24884484
4	JEFFBOAT	SBG_NEI31325	7.802029996
5	TRINITY MARINE MADISONVILLE	SBG_NEI6105	3.832357508
6	NORTHROP GRUMMAN SHIP SYS/AVONDALE OPER	SBG_NEI6184	1.749886147
7	BOLLINGER SHIPYARDS LOCKPORT LLC/BOLLINGER GREтна	SBG_NEILA0120	1.609223213
8	BOLLINGER SHIPYARDS LOCKPORT/BOLLINGER LAROSE	SBG_NEI6000	1.391975044
9	DETYENS SHIPYARD MT PLEASANT	SBG_NEIRSCO_0074	1.197772701

Shipyards Ranked by Total Hazard Index

1	Facility	facil_id	mx_can_rsk
2	BOLLINGER QUICK REPAIR L.L.C.	SBG_NEILA0510032	3.50874E-04
3	BOLLINGER SHIPYARDS LOCKPORT, LLC	SBG_NEILA0051	2.89000E-04
4	BOLLINGER SHIPYARDS LOCKPORT/BOLLINGER LAROSE	SBG_NEI6000	1.84030E-04
5	BOLLINGER SHIPYARDS LOCKPORT LLC/BOLLINGER GREтна	SBG_NEILA0120	1.02646E-04
6	NEWPORT NEWS	SBG_NEI310	9.58837E-05
7	NORTHROP GRUMMAN SHIP SYSTEMS INC	SBG_NEI11169	5.21371E-05
8	DETYENS SHIPYARD MT PLEASANT	SBG_NEIRSCO_0074	5.15110E-05
9	TRINITY MARINE GROUP INC/TRINITY YACHTS	SBG_NEILA0710078	3.28188E-05
10	NORTHROP GRUMMAN SHIP SYS/AVONDALE OPER	SBG_NEI6184	2.21704E-05
11	BOLLINGER SHIPYARDS, INC.	SBG_NEI2TX1507	1.90310E-05
12	METAL TRADES: COOPER RIVER	SBG_NEISC2314	1.51647E-05
13	JEFFBOAT	SBG_NEI31325	1.34271E-05
14	EL DORADO SANDBLASTING	SBG_NEICA0732774	1.21619E-05
15	BOLLINGER CALCASIEU LLC/SHIPYARD CLEANING	SBG_NEILA0190100	1.20853E-05
16	USN SUBMARINE BASE	SBG_NEICA0733419	1.16440E-05
17	ORTIZ & ALLDS	SBG_NEICA0733477	7.42730E-06
18	U.S. COAST GUARD YARD - CURTIS BAY	SBG_NEI33201	7.22830E-06
19	NORFOLK SHIPBUILDING AND DRYDOCK - BERKLEY	SBG_NEI314	5.29603E-06
20	SOUTHWEST MARINE INC.	SBG_NEICA0733199	5.25019E-06
21	USN 32ND ST NAV STATION	SBG_NEICA0733205	5.22869E-06
22	USN NORTH ISLAND	SBG_NEICA0732740	5.21539E-06
23	NATIONAL STEEL & SHIPBUILDING	SBG_NEI23077	4.94375E-06
24	TRINITY MARINE MADISONVILLE	SBG_NEI6105	4.66914E-06
25	ALABAMA SHIPYARDS INC	SBG_NEI8608	4.02348E-06
26	MARINETTE MARINE CORP	SBG_NEIWI0755480	3.78527E-06
27	BOLLINGER GULF REPAIR L.L.C.	SBG_NEI2LAT17403	3.21615E-06
28	ATLANTIC MARINE INC	SBG_NEI8609	2.09196E-06
29	NORTHROP GRUMMAN SHIP SYSTEMS INC	SBG_NEIMS1698	2.00892E-06
30	BOLLINGER TEXAS CITY LP	SBG_NEITXRGB0593	1.80709E-06
31	US NAVY - NORFOLK NAVAL SHIPYARD	SBG_NEI779	1.71629E-06
32	BIW RE: MAIN YARD	SBG_NEI6292	1.02376E-06
33	THOMA-SEA SHIP BUILDERS, LLC/LOCKPORT	SBG_NEILA0570062	1.00111E-06

Shipyards Ranked by Maximum Individual Risk (MIR) Cancer Probability



Phase 0 Accomplishments

Task 2 Fate and Transport of Emissions

Emission Modeling – Dry Run & Path Forward

- Modeled Bollinger Gulf Repair L.L.C., located in Orleans Parish, LA (NEI2LAT17403)
 - Test run to compare output data with the U.S. EPA guidance to ensure that the team was using the same modeling domain and modeling set-up options
 - Assures accuracy and credibility in the defined approach

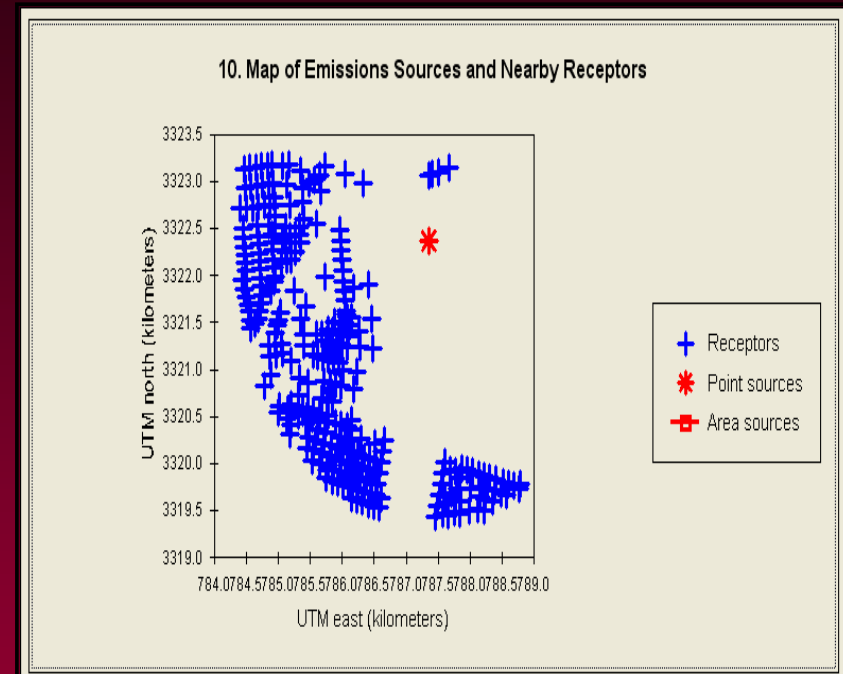


Bollinger Gulf Repair LLC

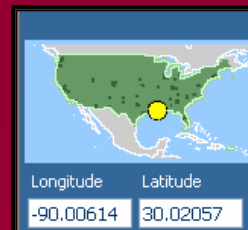
NEI 2LAT17403



Aerial View
Bollinger Gulf Repair LLC



Emission Sources and Nearby
Receptors



Bollinger Gulf Repair LLC NEI 2LAT17403

Modeling Output File Comparisons

1	parameter	value	value rnd	value sci
2	Cancer risk	3.21258E-06	0.000003	3.2 E-6
3	Total hazard index - chronic	0.14195415	0.1	1.4 E-1
4	Respiratory HI	0.007881991	0.007	7.9 E-3
5	Liver HI	0	0	0.0
6	Neurological HI	0.134072158	0.1	1.3 E-1
7	Developmental HI	0	0	0.0
8	Reproductive HI	0	0	0.0
9	Kidney HI	0	0	0.0
10	Ocular HI	0	0	0.0
11	Endocrine HI	0	0	0.0
12	Hematological HI	0	0	0.0
13	Immunological HI	0.005252114	0.005	5.3 E-3
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0

1	parameter	value	value rnd	value sci
2	Cancer risk	3.21258E-06	0.000003	3.2 E-6
3	Total hazard index - chronic	0.14195415	0.1	1.4 E-1
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11	Endocrine HI	0	0	0.0
12	Hematological HI	0	0	0.0
13	Immunological HI	0.005252114	0.005	5.3 E-3
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0

**U.S. EPA Modeling Outputs:
Maximum Individual Risk
(Chronic)**

**CTC Residual Risk Team
Modeling Output:
Maximum Individual Risk
(Chronic)**



Bollinger Gulf Repair LLC NEI 2LAT17403

1	parameter	value	value_rnd	value_sci
2	Cancer risk	3.21258E-06	0.0000032	3.2 E-6
3	Total hazard index - chronic	0.14195415	0.14	1.4 E-1
4	Respiratory HI	0.007881991	0.0079	7.9 E-3
5	Liver HI	0	0	0.0
6	Neurological HI	0.134072158	0.13	1.3 E-1
7	Developmental HI	0	0	0.0
8	Reproductive HI	0	0	0.0
9	Kidney HI	0	0	0.0
10	Ocular HI	0	0	0.0
11	Endocrine HI	0	0	0.0
12	Hematological HI	0	0	0.0
13	Immunological HI	0.005252114	0.0053	5.3 E-3
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0



2	Cancer risk	3.21258E-06
3	Total hazard index - chronic	0.14195415

**CTC Residual Risk Team
Modeling Output:
Maximum Individual Risk
(Chronic)**

Maximum Individual Risk Drivers

Cancer :

98.2% Cr (VI)

1.8% Ni

Total hazard index:

94.5% Mn

3.7% Ni

1.8% Cr (VI)



Bollinger Gulf Repair LLC

NEI 2LAT17403

Modeling Output File Comparisons

1	parameter	value	value_m	value_sci
2	Cancer risk	0.000212917	0.0002	2.1 E-4
3	Total hazard index - chronic	9.408154796	9.4	9.4 E0
4	Respiratory HI	0.52238695	0.5	5.2 E-1
5	Liver HI	0	0	0.0
6	Neurological HI	8.885767846	8.8	8.9 E0
7	Developmental HI	0	0	0.0
8	Reproductive HI	0	0	0.0
9	Kidney HI	0	0	0.0
10	Ocular HI	0	0	0.0
11	Endocrine HI	0	0	0.0
12	Hematological HI	0	0	0.0
13	Immunological HI	0.348089196	0.3	3.5 E-1
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0

1	parameter	value	value_rnd	value_sci
2	Cancer risk	0.00021099	0.00021	2.1 E-4
3	Total hazard index - chronic	9.323038211	9.3	9.3 E0
4	Respiratory HI	0.517660859	0.52	5.2 E-1
5	Liver HI	0	0	0.0
6	Neurological HI	8.805377352	8.8	8.8 E0
7	Developmental HI	0	0	0.0
8	Reproductive HI	0	0	0.0
9	Kidney HI	0	0	0.0
10	Ocular HI	0	0	0.0
11	Endocrine HI	0	0	0.0
12	Hematological HI	0	0	0.0
13	Immunological HI	0.344939996	0.34	3.4 E-1
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0


**U.S. EPA Modeling Outputs:
Maximum Offsite Impacts
(Acute)**

**CTC Residual Risk Team
Modeling Output:
Maximum Offsite Impacts
(Acute)**



Bollinger Gulf Repair LLC NEI 2LAT17403

1	parameter	value	value rnd	value sci
2	Cancer risk	0.00021099	0.00021	2.1 E-4
3	Total hazard index - chronic	9.323038211	9.3	9.3 E0
4	Respiratory HI	0.517660859	0.52	5.2 E-1
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12	Hematological HI	0	0	0.0
13	Immunological HI	0.344939996	0.34	3.4 E-1
14	Skeletal HI	0	0	0.0
15	Spleen HI	0	0	0.0
16	Thyroid HI	0	0	0.0
17	Whole body HI	0	0	0.0



2	Cancer risk	0.00021099
3	Total hazard index - chronic	9.323038211

**CTC Residual Risk Team
Modeling Output:
Maximum Offsite Risk
(Acute)**

Maximum Offsite Risk Drivers

Cancer :

98.2% Cr (VI)

1.8% Ni

Total hazard index:

94.4% Mn

3.7% Ni

1.9% Cr (VI)



Phase 0 Accomplishments

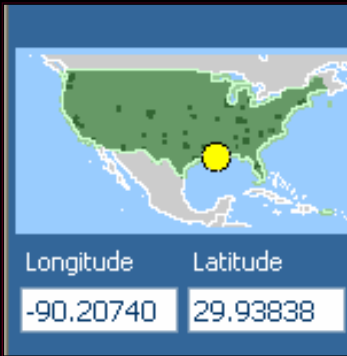
Task 2 Fate and Transport of Emissions

Emission Modeling

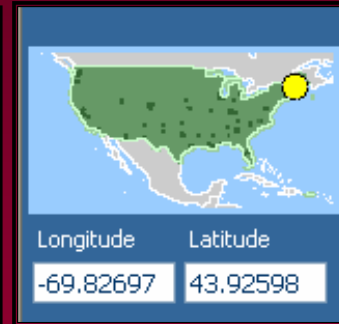
- Selected three shipyards to conduct modeling parallel to the U.S. EPA
 - NEI6292 - Bath Iron Works,
 - NEI6184 – Northrop Grumman Ship Systems/Avondale operation,
 - NEI779 – U.S. Navy Norfolk Naval Shipyard
- Shipyards selection was based on risk characterization (High, Moderate, or Low), location, and seasonal weather changes.
- Risk characterization were based on values for Maximum Individual Risks for Cancer probability and the Hazard Index that were obtained from the U.S. EPA's initial risk assessment output files



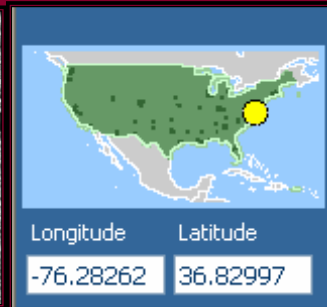
Shipyards Selected for Parallel Modeling



Northrop Grumman Ship Systems/Avondale
Orleans Parish, LA



Bath Iron Works – Main Yard
Bath, ME



U.S. Navy – Norfolk Naval Shipyard
Norfolk, VA

Parallel Modeling Initiative Path Forward

- Model each shipyard using the refined ANPRM dataset
- Model each shipyard using HAP emission data and emission location data provided by the shipyard
- Model each shipyard using a different modeling domain and modeling set-up options
- Consider Alternative Modeling Input Options:
 - Meteorological Data – Apply site-specific data
 - Dispersion Environment – Rural/Urban
 - Average Annual Emission Multiplier (10 used)
 - Surface Characteristics Used:
 - Surface roughness: U.S. EPA value 0.25m
 - Bowen ratio: U.S. EPA value 1.0
 - Albedo: U.S. EPA value 0.15
- Compare and Contrast anticipated U.S. EPA with NSRP Parallel Risk Assessment Project Outputs



Sampling and Analysis Plan

- The Preliminary Draft of the Sampling and Analysis Plan (S&P) was prepared to collect useful data in consideration of the USEPA ANPRM and AWS sampling methodology.
- The SAP was written to evaluate the influence of control technologies on welding admissions, and was written to evaluate the following variables:
 - Welding techniques used;
 - Control technology used; and,
 - Welding rods used.
- The calculations used to determine welding emissions were used to select the analytes of concern.
- The Preliminary Draft of the S&P was submitted to the NSRP members for review and comment.



Sampling and Analysis Plan

- Comments were reviewed and incorporated into the document
- Request for Quote (RFQ) drafted
 - Submitted to six (6) vendors for bid.
 - Two (2) quotes received and being reviewed.



Welding Emission Calculations

- The team is continuing to contact shipyards to query them regarding the calculations used to determine their emissions.
- The responses from the shipyards are being used to build a library of the calculations used and the differences observed among the NSRP responding members.
- Dr. Kura drafted a report “Recommended Procedure for Calculating Welding Emissions” has been received and is under review.



Path Forward

Phase 0

- Complete modeling of three select shipyards
- Complete welding emission calculation recommendations
- Receive approval from EPA and evaluate Cr(VI) fate and mass fraction in weld fumes
- Project team members inform ECB representatives of project progress and support to press on with Phase I activities



Path Forward

Phase I

- **Task 1 Emission Control Technology Demonstrations**
 - Collect emission and open air sampling data
 - ✓ Conducted as detailed in the SAP
 - Assess overall effectiveness of the control technology
- **Task 2 Risk Implementation**
 - Calculate the risk of technology implementation based on output from toxicant and emissions dispersion modeling
- **Task 3 Cost Impact Analysis Support**
 - Evaluate the economic impact of the RRR to the shipbuilding industry
- **Upon completion of Phase I a Go/No Go Decision will be made**



Path Forward

Phase II

- **Task 1 Alternative Welding Process Demonstration**
 - Demonstrate alternative welding processes or emission control technologies.
 - Focus on implementation into the shipyard welding process.
- **Task 2 Technology Transition Activities**
 - Update the TTP upon the results of Phases 0 and I
 - Additional outreach activities will include:
 - Technology demonstrations
 - Presentations at conferences and meetings
 - On – site technology meetings with shipyard personal
 - Technology workshops
- **Task 3 Identification of Alternative Welding Processes**



Contact Information

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Concurrent
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Corporation

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Backup Slides

Cost Effectiveness Analysis Noncompliance

- Compares costs and outcomes related to different risk management options (RMOs)
 1. Identify RMOs
 2. Estimate costs
 3. Compare Compliance v. Noncompliance
- Noncompliance costs
 - Quantitative
 - Enforcement actions
 - Inspections
 - Economic penalties
 - Liability
 - Qualitative
 - Community perception
 - Decreased trust
 - Increased scrutiny by lawmakers



Procedure for Submitting Data Corrections

- The procedure for submitting suggested data correction to the U.S. EPA is explained in the Federal Register / Vol. 72, No. 60 / Thursday, March 29, 2007, and described below.
1. Download the Microsoft Access file containing the ANPRM data set for a source category.
 2. Within this downloaded file, enter suggested revisions in the data fields appropriate for that information.
 3. Fill in the following commenter information fields for each suggested revision:
 - Commenter Name.
 - Commenter E-mail Address.
 - Commenter Phone number.
 - Revision Comments.
 4. Gather documentation for any suggested emissions revisions (e.g., performance test reports, material balance calculations, etc.).
 5. Send the entire downloaded file with suggested revisions in Microsoft Access format and all accompanying documentation to the docket for this ANPRM. Also submit the suggestions to the U.S. EPA directly at RTR@epa.gov.

