PERACLEAN® Ocean
Ballast Water Treatment
-History and Status

September 27, 2006 Cleveland, OH
Presented by Joe Lally,
Degussa Corporation
Applications of PERACLEAN®

Laundry Disinfection / Cleaning

Food & Beverage Industry

Vegetables Disinfection

Animal Hygiene & Health Disinfection

Paper Industry Bleaching / Delignification Slimecontrol

Ballast Water

Medical / Dialysis Disinfection Sterilisation

Chemical Synthesis Oxidation / Epoxidation

Water Treatment Oxidation Slime control

Vegetables Disinfection

H₂O - C - O - OH
Formulations of PERACLEAN®

PERACLEAN® solutions are stabilized mixtures of peracetic acid, hydrogen peroxide, water and acetic acid.

\[
\text{Peracetic Acid} + \text{Water} \leftrightarrow \text{Acetic Acid} + \text{Hydrogen Peroxide}
\]

**PERACLEAN® Ocean** is a proprietary formulation especially created for the Treatment of Ballast Water.
Development History – The Early Days

- Experience with sea side cooling water applications
- Bench Scale trials without filtration
- USS Cape May – Testing without filtration
- Proof of concept trials with Hamann - Pre-separation/Filtration reduces chemical demand
Development History – Recent Work

- Land Based Trails conducted by NIOZ (salt water)
- Pilot trials at Quebec Aquarium conducted by Environment Canada/Transport Canada
- Canadian Prospector Trial by Environment Canada/Transport Canada
- Tank coating polymer manufacturers Relius and Jotun have tested their coatings for compatibility with PERACLEAN® Ocean
Two-stage Ballast Water Treatment

- Ballast Water from the environment
- Physical separation
  - Hydro Cyclone
- Fine filtration (50µm)
- Ballast water tanks
- Discharge over board

SEDNA®

PERACLEAN® OCEAN

degussa.

SEDNA = Safe Effective Deactivation of Non-indigenous Aliens

Sedna is the Inuit Goddess of the Sea
Field Trial in the Parc Aquarium of Quebec City/Canada
Transport Canada/Environment Canada, March 2005

Target
- To assess efficacy under cold temperature conditions (2 °C)
- To assess use of catalase to eliminate residual toxicity

Results
- High efficacy for fresh and salt water despite of low temperature (retention time 72 h)
- In saltwater there is no residual toxicity after 72 h
- In riverwater catalase removed residual peroxide completely

4 PE tanks with 4500 l each
The Canadian Prospector experiment – March 2006

Microtox = 68-189 TU
Fish test = 2 TU

Microtox = 116-156 TU
Fish test = 10-11 TU
Experimental Results on Corrosion

- Typically, the steel structure of a ballast tank is coated with a zinc rich primer under an epoxy top coating.
- Report from BMT Fleet Technology on behalf of Ship Structure Committee (Canada) is available.
  
  “The presence of PERACLEAN® Ocean did not accelerate the damage of typical ballast water tank coatings“

  [30 days testing by BMT Fleetech/Ship Structure Committee, Canada]

- Positive statements from tank polymer coating manufacturers Relius and Jotun are available, too.
Current Testing

● IMO Status
● Hamann Projects for IMO final Approval
● Maritime Innovations - NISOB project
● Corrosion study at the University of Südwestfalen, Iserlohn
IMO status

● MEPC, 53rd Session, London, 18-22 July 2005, Submissions by Germany :
  - Application for approval of PERACLEAN® Ocean as an Active Substance (G9)
  - Application for approval of the SEDNA® System by HAMANN (incl. PERACLEAN® Ocean) as Ballast Water Management System (G8)

● IMO Headquarters, London, 23-27 January 2006, Assessment by GESAMP (IMO’s group of experts) on PERACLEAN® Ocean as Active Substance : “…the Group recommends that a Basic Approval is issued allowing a full-scale development and testing”

● MEPC, 54th Session, London, 20-24 March 2006, Agreement to grant Basic Approval to Active Substance proposal for PERACLEAN® Ocean submitted by Germany
Work With Hamann

- **Permanent full-scale** SEDNA® System incl. PERACLEAN® Ocean storage tank installed on a newly built container vessel
- Installation approved and certified by GERMANISCHER LLOYD
- Ballast Water Management Plan approved by GERMANISCHER LLOYD
- PERACLEAN® Ocean storage tank already filled
- Vessel in regular operation since summer 2006
- Mechanical / electrical fine-tuning of the SEDNA® System successfully finished
- Shipboard Testing according IMO guidelines in preparation
- Landbased testing according IMO guidelines at two different test sites in final preparation
Field Trial at NIOZ / NL
SEDNA® System by Hamann AG

6 Containers as „25 m³ ballast tanks“

Filtration  Hydrocyclone

“Ballast Water“
Pump 500 m³/hour
### NISOB PROJECT CONSORTIUM

<table>
<thead>
<tr>
<th>Organization</th>
<th>Contribution/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDTC</td>
<td>Funding contribution <em>(Subject to final contract negotiations)</em></td>
</tr>
<tr>
<td>IMAR</td>
<td>Project management, engineering</td>
</tr>
<tr>
<td>IMQ</td>
<td>Marine mechanical engineering</td>
</tr>
<tr>
<td>EC</td>
<td>Environmental fate</td>
</tr>
<tr>
<td>DFO</td>
<td>Biological effectiveness</td>
</tr>
<tr>
<td>ISMER</td>
<td>Biological effectiveness</td>
</tr>
<tr>
<td>UQAR</td>
<td>Corrosion and coating analysis</td>
</tr>
<tr>
<td>MBRC</td>
<td>Pathogen and bacterial analysis</td>
</tr>
<tr>
<td>Degussa Canada</td>
<td>Treatment product PERACLEAN</td>
</tr>
<tr>
<td>MD Technologies</td>
<td>Treatment product Ballaclean</td>
</tr>
<tr>
<td>Kinectrics</td>
<td>Pre-treatment-Filtration system</td>
</tr>
<tr>
<td>Gearbulk</td>
<td>Shipping Company</td>
</tr>
<tr>
<td>SLSA</td>
<td>Outreach</td>
</tr>
</tbody>
</table>
New Study on Corrosion

- Extensive study (duration 125 days) performed by University of Süwestfalen, Iserlohn, under supervision of GERMANISCHER LLOYD, Hamburg

- Reporting currently being in progress

- Final Target Certificate by GERMANISCHER LLOYD on the influence of PERACLEAN® Ocean on common ballast tank coatings
Dosing Equipment and Testing Schemes

- Tote dosing unit
- Bulk Storage
- SEDNA trial unit
- Chemical Testing
Storage Onboard of Ships - Docking Station

● Degussa developed storage concepts according to class requirements for
  – built-in tank
  – ISO container
  – and IBC docking station (1000 liters)

● Stainless steel IBC built at our Engineering Department

● Available for ship trials
Worldwide Availability

- Degussa operates 10 production plants for H₂O₂ and 3 for PAA
- Additional tank farms will be installed in selected harbors
- Cooperation with a major chemical distributor will assure just-in-time deliveries
Ballast water pump 500 m³/h

Hydro cyclones; 2 V6-modules

50µm fine filter

Dosing station Peraclean Ocean
Analytics
Easy Determination of Peracetic Acid/H₂O₂ with Test Stripes (Merck Reflectoquant®)

RQflex® pocket photometer from Merck

Blue coloration by Peracetic Acid

Measuring range: 1.0 - 22.5 mg/l Peracetic Acid
0.5 - 25 mg/l H₂O₂
Questions