

Background Material on the subject of On-Shore Treatment of Ballast Water

This document provides a summary of background material on the topic of on-shore treatment of ballast water. These documents were recommended by Andrew Cohen, a member of the EPA's SAB's Ecological Processes and Effects Committee, as augmented for Ballast Water.

For this document:

- **Document citations** are provided in bold font.
- *Content* summaries were provided by Andrew Cohen.
- Availability information is as noted.

Laughton R., T. Moran and G. Brown. 1992. *A Review and Evaluation of Ballast Water Management and Treatment Options to Reduce the Potential for the Introduction of Non-native Species to the Great Lakes*. Pollutech Environmental, Ltd., Sarnia, Ontario, prepared for the Canadian Coast Guard, Ship Safety Branch, Ottawa. (≈320 pages)

Content: This is the earliest report that I'm aware of that attempted to compare different ballast water management approaches including both shipboard and onshore treatment. On-shore treatment ranked 2nd out of 25 treatment and management approaches analyzed in the report.

Availability: Copyright by Pollutech Group of Companies www.pollutechgroup.com.

Gutheridge, Haskins and Davey Pty Ltd. 1993. *Ballast Water Treatment for the Removal of Marine Organisms*. Ballast Water Research Series Report No. 1, Australian Quarantine and Inspection Service, Canberra. Prepared by Gutheridge, Haskins and Davey Pty Ltd. (106 pages)

Content: Compares the cost and effectiveness of shipboard, port-based (=on a treatment ship) and onshore approaches, and concluded that shipboard treatment would be less effective and more expensive than port-based or onshore treatment.

Availability: Copyrighted material, available for a fee from www.daff.gov.au/aqis, and at the Australian National Library <http://catalogue.nla.gov.au/Record/2934346>.

Thompson Clarke Shipping Pty Ltd. 1993. *Ballast Water Management Study*. Ballast Water Research Series Report No. 4, Australian Quarantine and Inspection Service, Canberra. Prepared by Thompson Clarke Shipping Pty Ltd. (254 pages)

Content: Includes a brief discussion of ballast treatment at p. 63 (shipboard) and pp. 66-68 (onshore and port-based).

Availability: Copyrighted material available for a fee from www.daff.gov.au/aqis, and at the Australian National Library <http://catalogue.nla.gov.au/Record/2034859>.

Aquatic Sciences. 1996. *Examination of Aquatic Nuisance Species Introductions to the Great Lakes through Commercial Shipping Ballast Water and Assessment of Control Options Phase II. Final Report.* A report for the Canadian Coast Guard. Aquatic Sciences Inc., St. Catharines, Ontario. (60 pages)

Content: Compares shipboard treatment to "pump-off" treatment (either on onshore or on a treatment ship, the latter sometimes confusingly referred to as "ship based") and "external source" treatment (heated water or other biocide pumped into a ship's ballast tank from an onshore facility or treatment ship). It concluded that shipboard treatment is "logistically, economically, and particularly from the aspect of control, the least attractive method of ballast water treatment" and that "ship based [=treatment ship] or centralized treatment facilities may offer the most economical and practical external treatment option (Conclusions, p. 52)."

Availability: May be available from Aquatic Sciences, Inc. (now known as ASI Group www.asi-group.com).

Marine Board. 1996. *Stemming the Tide: Controlling Introductions of Nonindigenous Species by Ships' Ballast Water.* Committee on Ships' Ballast Operations, Marine Board, Commission on Engineering and Technical Systems, National Research Council. National Academy Press, Washington, D.C.

Content: Discusses onshore treatment at pp. 38-40, noting advantages and disadvantages, and concluding that onshore treatment "remains an option within the amalgam of currently available options for treating ballast water, provided the criteria for safety, environmental acceptability, technical feasibility, practicable operation, and cost effectiveness are met."

Availability: Copyrighted material, at www.nap.edu/catalog/5294.html.

Gauthier, D. and D.A. Steel. 1996. *A Synopsis of the Situation Regarding the Introduction of Nonindigenous Species by Ship-Transporting Ballast Water in Canada and Selected Countries.* Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2380. Marine Environmental Sciences Division, Department of Fisheries and Oceans, Maurice Lamontagne Institute, Mont-Joli (Quebec), Canada. (57 pages)

Content: Briefly discusses shipboard, onshore and port-based (=on a treatment ship) treatment at pp. 37 and 42.

Availability: Copyrighted material. Available from Canada DFO at www.dfo-mpo.gc.ca/Library/199885.pdf.

Victoria ENRC. 1997. *Report on Ballast Water and Hull Fouling in Victoria*. Parliament of Victoria, Environmental and Natural Resources Committee. Victorian Government Printer, Melbourne, Australia. (319 pages)

Content: Brief discussion of onshore treatment at pp. 113-114, with the statement that "the Committee considers that the large scale construction of such facilities in Victoria is likely to be cost prohibitive, however, smaller installations may provide viable options..."

Availability: May be available from the Victorian Government Printer.

Greenman, D., K. Mullen and S. Parmar. 1997. *Ballast Water Treatment Systems: A Feasibility Study*. Report submitted to Worcester Polytechnic Institute. (59 pages)

Content: Student report commissioned by the USCG. Largely reprises the onshore treatment analysis of Gutheridge, Haskins and Davey Pty Ltd (1993), along with brief discussion of some issues at several U.S. ports.

Availability: At www.sgnis.org/publicat/cfriese.htm.

Cohen, A.N. 1998. *Ships' Ballast Water and the Introduction of Exotic Organisms into the San Francisco Estuary: Current Status of the Problem and Options for Management*. A Report for CALFED and the California Urban Water Agencies. San Francisco Estuary Institute, Richmond CA. (84 pages)

Content: Brief discussion of advantages and disadvantages of onshore relative to shipboard treatment at pp 27-28.

Availability: Publicly available document at www.sfei.org/sites/default/files/1998-BallastWater224.pdf.

Reeves, E. 1999. *Exotic Policy: An IJC White Paper On Policies for the Prevention of the Invasion of the Great Lakes by Exotic Organisms*. Documents on Water Law, College of Law, University of Nebraska - Lincoln. (132 pages)

Content: Brief onshore treatment discussion at pp. 50-51, which notes that it "allows for the use of media filtration and settling tanks which cannot be fitted aboard vessels."

Availability: At <http://digitalcommons.unl.edu/lawwater/7>.

Oemke, D. 1999. *The Treatment of Ships' Ballast Water*. EcoPorts Monograph Series No. 18, Ports Corporation of Queensland, Brisbane, Australia. 102 pages.

Content: Onshore treatment is discussed on pp. 47-49 with a discussion of advantages and disadvantages, concluding that it is "clearly feasible" in some parts of the industry, such as VLCCs.

Availability: The report may be available from the Ports Corporation of Queensland.

Dames & Moore. 1999. *Phase I Final Report Ballast Water Exchange and Treatment. A Report for the California Association of Port Authorities, Pacific Merchant Shipping Association, Steamship Association of Southern California, and Western States Petroleum Association. Dames & Moore, San Francisco, CA. (120 pages)*

Content: Brief discussion of onshore treatment at pp. 67-68 states that onshore treatment systems "are considered to be less favorable than on-board treatment options," though it doesn't say who considers it so, or what the reasons are.

Availability: from CA State Lands Commission.

Cohen, A.N. and B. Foster. 2000. The regulation of biological pollution: Preventing exotic species invasions from ballast water discharged into California coastal waters. *Golden Gate University Law Review* 30(4): 787-883.

Content: Onshore treatment is addressed on pp. 12-13 with a discussion of advantages and disadvantages relative to shipboard treatment.

Availability: Publicly available at
<http://www.sfei.org/sites/default/files/2000BiologicalPollution.pdf>

Rigby, G. and A. Taylor. 2001. Ballast water management and treatment options. *Transactions of the Institute of Marine Engineers* 113(3): 79-99.

Content: Very brief discussion of onshore treatment (pp. 89-90) stating that "costs, limited availability, treatment quality control and practical difficulties" would prevent development of this option, but that it might be suitable for tankers already designed to discharge oily ballast to shore facilities.

Availability: Copyrighted material available from the journal.

USEPA. 2001. *Aquatic Nuisance Species In Ballast Water Discharges: Issues and Options. Draft Report for Public Comment – September 10, 2001. U.S. Environmental Protection*

Agency Office of Water, Office of Wetlands, Oceans and Watersheds, Office of Wastewater Management, Washington, D.C. (53 pages)

Content: As far as I know, EPA never issued a final version of this report. There is a brief mention of onshore treatment in a paragraph on page 11, at the end of section on existing onshore reception facilities for oil-contaminated ballast.

Availability: This is an EPA public document, which can be downloaded at www.epa.gov/npdes/pubs/ballast_report_attch5.pdf.

Glosten. 2002. *Pacific Ballast Water Treatment Pilot Project. Ballast Water Transfer Study. Technical Feasibility with Associated Capital Costs.* Prepared for the Port of Seattle, Seattle, WA. The Glosten Associates, Inc., Seattle, WA. (39 pages)

Content: This study estimates upper-bound retrofitting costs for modifying vessels to discharge ballast water to onshore facilities, for five types of vessels that call on Puget Sound.

Availability: This document has been posted, with permission, on the EPA SAB website.

Brown & Caldwell. 2007. *Port of Milwaukee Onshore Ballast Water Treatment–Feasibility Study Report.* Prepared for the Wisconsin Department of Natural Resources. Brown and Caldwell, Milwaukee, WI. (114 pages)

and

Brown & Caldwell and Bay Engineering, Inc. 2008. *Port of Milwaukee Onshore Ballast Water Treatment–Feasibility Study Report. Phase 2.* Prepared for the Wisconsin Department of Natural Resources. Brown and Caldwell, Milwaukee, WI. (98 pages)

Content: These two reports developed design plans and costs estimates for treating the ballast water from overseas vessels discharging at the Port of Milwaukee in treatment plants built onshore and on a barge. They concluded that either approach would be feasible, and that the on-barge system would be less expensive.

Availability: At http://dnr.wi.gov/org/water/greatlakes/projects/WDNROnshoreBallastWaterTreatmentStudy_FinalReport.pdf and

(note that second link may not be active).

<http://dnr.wi.gov/org/invasives/pdfs/ReportMilwaukeeBallastWaterTreatmentPhase2FINAL.pdf>

CSLC. 2009. 2009 Assessment of the Efficacy, Availability and Environmental Impacts of Ballast Water Treatment Systems for Use in California Waters. California State Lands Commission, Sacramento, CA. (180 pages)

and

CSLC. 2010. Draft 2010 Assessment of the Efficacy, Availability and Environmental Impacts of Ballast Water Treatment Systems for Use in California Waters. California State Lands Commission, Sacramento, CA. (149 pages)

Content: These two reports contain generally similar discussions of onshore treatment at pp. 23-24 and 26-28, respectively, mentioning some advantages and disadvantages, and stating that onshore treatment might be suitable for terminals with regular vessel calls such as cruise ships or, citing a recent study, in the Port of Milwaukee. The 2010 report notes (at p. 73) that "there has been recent interest by several entities in developing this option for vessels operating in California and along the West Coast."

Availability: At www.slc.ca.gov/spec_pub/mfd/ballast/final_techreport_revised.pdf. The 2009 report was provided to the committee earlier as one of the Group 1 reports.

The 2010 report is in draft status and not yet available on the CASLC website.

Lee II, H., D.A. Reusser, M. Frazier and G. Ruiz. 2010. Density Matters: Review of Approaches to Setting Organism-Based Ballast Water Discharge Standards. U.S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Western Ecology Division. EPA/600/R-10/031. (114 pages)

Content: This report is generally not concerned with the capabilities of ballast water treatment systems, but notes on p.19 that in regard to "a true zero discharge of all size groups" that "perfect compliance and no failure is practically, if not theoretically, impossible, particularly for microbiological organisms unless ballast water is discharged into a land-based treatment facility or ships are redesigned to eliminate the need to discharge ballast water."

Availability: This is an EPA document. Some excerpts were previously provided to the committee.

The excerpts from the Lee et al. 2010 report ("Density Matters") that were also in the Group 1 documents include a description and analysis of the California ballast discharge standards. Several aspects of that description are incorrect. The best source on the basis for the California standards is the report of the advisory panel that developed the standards (which A. Cohen was a member of). This document may be available on the CSLC website at www.slc.ca.gov/Spec_Pub/MFD/Ballast_Water/Documents/Appendix_A.pdf.

Albert, R., R. Everett, J. Lishman and D. Smith. 2010. *Availability and Efficacy of Ballast Water Treatment Technology: Background and Issue Paper*. U.S. Environmental Protection Agency, Washington D.C. (77 pages)

Content: The only mention of onshore treatment is on p. 15: "Treatment of ships' ballast water can take place either on the vessel or off the vessel following discharge of the ballast to a reception/treatment vessel (where the water would no longer be considered ballast water) or to a land-based reception facility."

Availability: This is an EPA document that was previously provided to the committee.