

## Long Beach Water Department Research Archive on Ocean Desalination

Here is the link to the Long Beach Water Department Desalination Research Archives:

<https://www.lbwd-desal.org/presentations.html>

Long Beach Water Department was a research partner on this project. One of LBWD's contributions was the preparation of an on-line archive of all the research publications and presentations made on its extensive desalination research program. The archive can be accessed here at the Center for Integrated Water Research web site. Following are Professor Brent Haddad's notes on the individual selections in the archive.

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### Professor Brent Haddad's Notes on the Long Beach Water Department Research Archive

1. Long Beach Water Department: Report on Findings from Evaluation of 2-Pass Nanofiltration and RO Processes Conducted at the Prototype Seawater Testing Facility

*I recall discussion of 2-pass nanofiltration technology as part of our analysis of whether and how much the cost of desalination would decline over time. This report provided clear evidence of a downward trend in energy costs of desalination.*

2. Chlorine Dioxide Application for Microbial Control on Polyamide Membranes During Seawater Desalination. *This study addresses our research needs into the technological feasibility of desalination.*

3. Chlorine dioxide addition in seawater: analytical and treatment issues. *More input on technological feasibility.*

4. Analytical Comparison of Effluent Produced from Different Infiltration Rates for Demo-Scale of Under-Ocean Floor Seawater Intake Facility. *This research informs our analysis of offshore ecological impacts.*

5. Seawater Desalination Program Update. *This material is valuable since it provides input for the case study work we did while also help frame the major questions analyzed in the PIM, including energy consumption and offshore ecological impacts*

6. Update of LBWD's Desalination Research. *This presentation is useful for understand the Long Beach experience for the case study.*

7. Prototype Evaluation of NF2 and RO for Seawater Desalination: Water Quality and

Energy Comparisons. *This research informs both energy and Boron/Bromate issues related to desalination.*

8. Update for the Pilot and Demonstration-Scale Research Evaluation of Under-Ocean Floor Seawater Intake and Discharge. *This study discusses water quality of desalination effluent returning to the marine environment, including impacts of tidal flux. This is important for coastal desalination planning.*

9. Issues with Distribution of Desalinated Seawaters: Are Corrosion Indicators Sufficient? *This study enables researchers to help predict the long-term cost of a desalination facility, as well as the optimal materials that should be purchased and used to construct piping infrastructure.*

10. Evaluation of CLO<sub>2</sub> in Seawater Desalination Pretreatment. *This research is an extension of 2 and 3 above, and provides insights into how seawater should be treated before entering NF membranes.*

11. Update for the Pilot and Demonstration-Scale Research Evaluation of Under-Ocean Floor Sewater Intake and Discharge. *This presentation provided insights to both case study and PIM, especially related to construction of desalination facilities near the ocean.*

12. Seawater Desalination Prototype Testing: NF2 and SWRO comparison: this research informs the technology pathway of desalination and implications for energy consumption. *NF2 requires less energy than SWRO, but SWRO is the proven technology, so this research provides insight into which technological future desalination is likely to follow.*

13. Bench-Scale Testing for Controlling Desalinated Seawater Quality. *This research addresses the quality of desalinated water, including presence of disinfection byproducts and chlorine residual. This is important to understand both cost and potential health effects of desalinated water.*

14. Pilot and Demonstration Testing of Subsurface Filtration for Seawater Desalination. *This research discusses possible ways to minimize biological impacts of seawater intakes and visual impacts of coastal desalination facilities. This is of value to any coastal region considering desalination.*

15. Update on Prototype-Scale Performance Comparison of SWRO and Dual-Pass Nanofiltration for Seawater Desalination. *This research builds on # 1 and #7 above and is related to the technological trajectory of desalination.*

16. Singapore International Water Week Poster. *This poster also builds on #'s 1, 7, & 15. It provides case study insights as well as general desalination insights.*

17. Bench-Scale Testing for Controlling Desalinated Seawater Quality. *This research*

*provides insight to the chemicals of interest in seawater desalination and how they interact with membranes, piping, and pumps, including corrosion impacts. This useful when evaluating the costs of desalination.*

18. WQ Monitoring During Full-Scale Seawater Desalination Operations. *This research addresses regulatory questions related to NPDES permitting, including dilution crediting, something of interest to all desalination projects.*

19. Long Beach Seawater Desalination Update. *This research contributes the case study work and is distinct from #5 above.*

20. Comparison of SWRO to Dual-Pass Nanofiltration for Seawater Desalination. *Additional analysis of alternative desalination technologies informs the possible options available to desalination developers.*

21. Perspectives on Seawater Desalination. *Helps frame the major questions related to desalination – cost, technical, environmental, public acceptance.*

22. Full-Scale WQ Comparison of SWRO to Dual-Pass Nanofiltration for Seawater Desalination. – *Additional research results on the topic of desalination technology.*

23. Full-Scale Performance Comparison of SWRO to Dual-Pass Nanofiltration for Seawater Desalination. *This research contributes to our understanding of the operational characteristics of both types of technologies, which is of value to the evaluation of new proposals for desalination.*

24. The Long Beach Seawater Desalination Research and Development Program. *This research provides case-study insights of value to coastal communities interested in pursuing desalination.*

25. LBWD's Experiences with Permitting a Seawater Desalination Prototype Test Facility. *This research provides insights into the regulatory hurdles facing developers of Seawater Desalination, including special focus on RWQCB permitting.*

26. Permitting Issues Associated with a Seawater Desalination Prototype Testing Facility. *This research is parallel to #25 with additional case-study related materials.*

27. LBWD's Testing of Dual-Pass NF and SWRO for Seawater Desalination. *This is another contribution to the extensive research on preferred desalination technology, focusing on comparative testing design. This is valuable to water agencies considering their own prototype comparative tests of desalination technology.*

28. Permitting Issues Associated with a Seawater Desalination Prototype Testing Facility. *This research is part of the combined effort to understand permitting requirements presented in #'s 25 and 26 and is substantially similar to #26.*

29. Emerging Water Quality Concerns Associated with Integrating Desalinated Seawater into Existing Distribution Systems. *This research presents insights related to total trihalomethane (TTHM) generation, reduction, and regeneration, and provides insight into the selection of residual disinfectant for combined seawater desalination/surface water systems.*

30. A Novel Approach to Seawater Desalination using Dual-Staged Nanofiltration Process. *This research is linked to the extensive research effort exploring multiple technological approaches to seawater desalination and provides comparative energy and performance analysis.*

31. Modeling the Performance of Seawater Desalination by Dual-Staged Nanofiltration. *This research is part of the larger investigation of alternative technologies available to remove salts and other elements (especially contaminants such as Boron and Bromide) from seawater and rendering available for human consumption. It also includes a quantitative predictive model of seawater desalination performance. It is of interest to any coastal community and water agency considering this approach.*

32. Prototype Testing Facility for Two-Pass Nanofiltration. *This research describes how to carry out a credible comparative test of alternative desalination technologies. It is done by creating prototypes of the expected actual systems, but making their design flexible enough to test alternative conditions.*

33. Developing an Experimental Protocol for Evaluation of Low-Pressure Desalting Membranes for Seawater Desalination. *This research lays out parameters for testing alternative desalination technologies, including temperature, pressure, and loading rates. These insights would be of value to any community or water agency considering desalination.*

34. Long Beach Water Department's Approach to Seawater Desalination. *This research is valuable as a case study as well as for its links to federal research efforts related to desalination.*