Management of Brine Discharges to Coastal Waters

Science Advisory Panel Recommendations

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State Water Board Workshop August 22, 2012
Background

- SCCWRP contracted by Water Board to convene an expert panel to provide recommendations on technical issues related to brine discharge

- Panel was asked to evaluate four primary questions:
  - How can the effects of these discharges be minimized through proper disposal strategies?
  - What models should be applied in order to predict how these plumes will behave?
  - Can cumulative water quality effects associated with multiple plumes be evaluated with models?
  - What are appropriate monitoring strategies for these discharges?
Process

- Aug. 2011: Established panel with expertise in key disciplines related to brine discharge fate and effects
  - Discharge plume modeling
  - Oceanography
  - Ecological risk assessment/toxicology
  - Marine ecology

- Dec. 2011: Public meeting to brief panel on current science and regional perspectives
  - Input from local scientists, industry, regulators, NGOs
  - Initial panel deliberations

- Dec.-March 2012: Panel discussions and development of recommendations
  - Review of literature and previous studies

- March 2012: Draft panel report
  - Final report released in June 2012
Panel Members

- Philip Roberts (Chair)
  - Georgia Institute of Technology
  - Plume modeling and discharge design

- Scott Jenkins
  - Scripps Institution of Oceanography
  - Plume modeling and oceanography

- Jeffrey Paduan
  - Naval Postgraduate School
  - Oceanography

- Daniel Schlenk
  - University of California
  - Ecotoxicology and risk assessment

- Judith Weis
  - Rutgers University
  - Marine and estuarine ecology
Scope of Review

- Considered the major applications of desalination by reverse osmosis
  - Seawater
  - Wastewater
  - Groundwater

- Focus on brine/concentrate discharge, not intake
  - Biological impacts
  - Discharge technologies
  - Regulatory approach

- Recommendations for future statewide programs
  - Not intended to evaluate specific projects/permits
Biological Impacts

- Existing studies of brine/salinity effects have substantial limitations
  - Limited consideration of sublethal impacts (reproduction) and interactions with chemical constituents in brines
  - Few studies with California species and benthic infauna

- Wide range of methods and salinity effect estimates
  - Effects thresholds from 2 to >10 ppt

- Greatest potential risk to benthic macrofauna and sea grasses

- Salinity change of no more than 2-3 ppt should be protective

- Lab and field monitoring needed to verify limits are effective
Discharge Technology

• Specific site conditions and brine characteristics should be considered

• No single discharge method is recommended, optimum method will depend on site scenario

• Blending of brine with other wastewater/cooling water discharges and use of existing discharge systems is appropriate

• Multiport diffusers are recommended for direct discharge of undiluted dense brine
Regulatory Approach

- Existing regulatory process is sufficient for buoyant discharge plumes
- Regulation of dense plumes should consider site-specific conditions
  - Revised regulatory framework described in report
- The mixing zone should be determined using plume modeling
  - A 100 m mixing zone for dense discharges suggested as a practical default
The regulatory framework should include three components:

- Description of existing conditions near the discharge
- Water quality limits at the mixing zone boundary
- Monitoring program if potential exists for environmental impacts

Field and lab monitoring should consider discharge type and site characteristics:

- Lab toxicity testing using sensitive species, sublethal endpoints
- Water quality monitoring at mixing zone boundary
- Benthic community monitoring using good design principles
Research Needs

- The panel’s review and recommendations were constrained by several data gaps needing further study.

- Effects of salinity
  - Additional data are needed on the sublethal/chronic effects of elevated salinity to sensitive life stages, especially California benthic species.

- Chemical toxicity
  - Data are needed on the potential ecological risk of RO chemical additives and interactions between brine and municipal wastewater constituents.

- Turbulence effects
  - Studies of turbulence impacts on plankton are needed to address concerns regarding diffuser impacts.