California Council for Environmental & Economic Balance

Once Through Cooling Systems

State Water Resources Control Board
Phase II 316(b) Workshop – Oakland, CA
December 7, 2005
Once Through Cooling Systems (OTC)

**Agenda**

- Impacts from Once Through Cooling – Are they Biologically Significant?
- Viability of Alternative Cooling Systems
- Recommendations for State Guidance
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What are the Environmental Impacts at OTCs?

✓ Sources of Impacts

- Impingement (I) of adult fish and shellfish
- Entrainment (E) of larval stages of fish and shellfish

✓ CA facilities with OTC systems use very large quantities of water for power plant cooling

✓ However, large numbers of entrained organisms at OTCs DOES NOT equal significant impacts to adult populations

- There are enormous quantities of planktonic organisms in seawater

- Natural spawning results in huge numbers of eggs & larvae
  - Example: A single female halibut produces as many as 50 million eggs/year for as long as 20 years, or 1 billion eggs over a lifetime

- Natural mortality of larvae is greater than 99.9% in many fishes, and less than 0.1% survival to adulthood is needed to maintain the population
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OTC Impacts are Biologically Insignificant

- Around the late 1970’s and early 1980’s, all power plants using OTC systems were required to perform 316(b) impact assessments to determine if they were having significant ecological impacts.

- These original studies evaluated the impacts to adult fish populations (Adult Equivalent Losses) around these facilities.

- OTC studies have found Adult Equivalent Losses at OTC facilities to be generally less than 1-2% of adult fish stocks.

- CDFG Nearshore Fisheries Management Plan
  - An over-fished stock = 30% of unfished biomass
  - Fishery controls are required at 60% of unfished biomass
  - These thresholds are exclusive to adult fish.
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OTC Impacts are Biologically Insignificant

- More recent studies at many facilities have yielded similar information to the historical studies, but have included an additional modeling technique (Proportional Entrainment).

- OTC studies have found Proportional Entrainment Mortality to be generally low, averaging approximately 10 percent or less of the source water larval populations, varying by species.

- Facts and Findings of these studies demonstrated the following:
  - OTCs are not damaging coastal fisheries
  - OTCs do not adversely affect CA’s present or future populations of marine organisms being entrained
  - OTCs do not adversely affect the beneficial uses of CA’s coastal waters
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Summary Entrainment Impacts from OTC Studies

<table>
<thead>
<tr>
<th>Facility Intake</th>
<th>Adult Equivalent Losses as a percentage of adult source water populations</th>
<th>Average Proportional Entrainment Mortality as a percentage of source water larval populations</th>
<th>Study Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Segundo</td>
<td>0.10 – 0.76 %</td>
<td>NA</td>
<td>1980</td>
</tr>
<tr>
<td>Huntington Beach</td>
<td>NA</td>
<td>0.6 %</td>
<td>2004</td>
</tr>
<tr>
<td>Diablo Canyon</td>
<td>NA</td>
<td>8.6 %</td>
<td>1996-1999</td>
</tr>
<tr>
<td>SONGS</td>
<td>0.01 – 6.9 %</td>
<td>NA</td>
<td>1979-1986</td>
</tr>
<tr>
<td>Moss Landing</td>
<td>NA</td>
<td>13.1 %</td>
<td>1999</td>
</tr>
<tr>
<td>Morro Bay</td>
<td>NA</td>
<td>21.0 %</td>
<td>2000</td>
</tr>
<tr>
<td>Scattergood</td>
<td>0.001 – 0.2 %</td>
<td>NA</td>
<td>1981</td>
</tr>
<tr>
<td>Harbor</td>
<td>0.8 – 1.8%</td>
<td>NA</td>
<td>1981</td>
</tr>
<tr>
<td>Haynes</td>
<td>NA</td>
<td>NA</td>
<td>1981</td>
</tr>
<tr>
<td>South Bay</td>
<td>NA</td>
<td>13.4 %</td>
<td>2001</td>
</tr>
</tbody>
</table>

Note: the values represent only those fish species entrained in the highest numbers as well as recreational or commercial species.
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OTC Impacts are Biologically Insignificant

✓ Small forage (non-fished) fishes, such as gobies, are usually the most abundant larvae entrained by OTCs

✓ Comparisons of original versus newer I&E studies have found goby entrainment rates to be very similar – indicating that adult populations have not declined since the original studies

✓ Goby densities at Agua Hedionda Lagoon (where cooling water is drawn for the Encina Power Station) are higher than the nearby Batiquitos Lagoon, which has no power plant

✓ 20 years of studies at Diablo Canyon have shown no significant declines in nearshore fish populations

✓ Compensatory mechanisms enable species survival in spite of high natural mortality rates and impacts to adults and larvae caused by fishing and other factors
Historically, 316(b) was focused on “impacts” and whether or not those were biologically significant

Phase II 316(b) does not require “impact” assessments

- Instead EPA chose to use I&E reduction standards as a “relatively easy to measure and certain metric” (7/9/2004 FR, pg 41600) to accomplish reductions in impacts
  - Impingement reduction standard = 80-95% reduction
  - Entrainment reduction standard = 60-90% reduction

- Finds that meeting the I&E standards will meet the Best Technology Available requirement of CWA 316(b) and will address I&E impacts
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EPA Does Not Require Retrofit to Wet or Dry Cooling

✓ EPA concluded they would not mandate closed cycle cooling (wet cooling towers) for Phase II facilities (7/9/2004 FR, pg 41605):
   ▶ High retrofit and operating costs are not economically practicable
   ▶ Other technologies available that meet performance standards
   ▶ Very high energy efficiency impacts

✓ EPA concluded that they would not mandate dry cooling at Phase II facilities (7/9/2004 FR, pg 41608):
   ▶ Not an economically practicable option
   ▶ Not an “available” technology for many facilities
   ▶ Would likely cause significant closures of generating stations
   ▶ Extremely high energy efficiency impacts
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Issues with Wet/Dry Cooling Tower Systems

✓ Very High Retrofit Costs and Increased Operating & Maintenance Costs

- LADWP/SONGS Retrofit Cost Estimates:
  - Dry Cooling = $465 - $500 million
  - Wet Cooling = $205 – $400 million

- EPA Cost Estimates (high flow plants):
  - Wet Tower Retrofit Costs = $130 – 200 million
  - Wet Tower O&M Costs = $4 – 20 million

- EPRI Cost Estimates
  - Wet Tower Easy Retrofit = $100K/megawatt
  - Wet Tower Difficult Retrofit = $250K/megawatt

✓ Inadequate real estate at many generating stations

- Located on tight coastal properties
- Limited access to real estate expansion opportunities
Increased Environmental Impacts

- Increased emissions of air contaminants
  - Due to increased firing of fossil fuels to compensate for lost efficiency
  - Particulate Matter directly emitted from wet cooling towers
- Increased community noise impacts
- Visual resources – wet plumes and large equipment footprints & height
- Heavy use of potable and/or reclaimed water supplies
  - Restricts use of these water supplies for other uses (SWB Resolution 75-58)
  - Storage, pumping, and transport of water supplies have their own environmental and social impacts
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Issues with Wet/Dry Cooling Tower Systems (continued)

✓ Energy Efficiency/Energy Penalty Impacts

- Wet Tower efficiency losses range from 2.4 % to 5.3 % (7/9/2004 FR, pg 41605)
- Dry Tower efficiency losses range from 8.6 % to 10 % (EPA 316(b) Technical Development Document)

✓ Assuming wet/dry cooling retrofits were required at all 21 CA facilities using OTC (approximately 24,000 MWs), how would it affect CA power generation supply and cost?

- Wet Towers = 924 MWs of lost capacity (equivalent to two large scale combined cycle plants)
- Dry Towers = 2232 MWs of lost capacity (equivalent to one of CA’s nuclear power plants or 4-5 large combined cycle plants)
- Total Capital Costs to retrofit to wet or dry cooling would range from $1.1 to $4.2 Billion
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316(b) Implementation Guidance is Needed

✓ State role should be to ensure that the federal rule is consistently applied at the Regional Water Boards

✓ Need guidance around areas where the federal rule is vague and/or unclear

✓ A new and different formal policy not needed
  - EPA closely evaluated all available options and concluded Phase II 316(b) is the best rule - Don’t reinvent the wheel
  - Insufficient time to complete policy development
  - Federal rule requires action now
  - Federal rule will significantly reduce I&E at OTCs regardless of the low level of ecological impacts
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316(b) Implementation Guidance is Needed

✓ Potential Topics for State Guidance:

- Calculation Baseline – including alternatives for establishing appropriate credit for existing I&E controls

- Compliance Implementation Challenges – construction permitting and CEQA

- Benefits Valuation – alternatives for cost/benefit analysis

- Restoration Measures – alternatives for developing projects

- Definition of “not significantly greater than” for purposes of establishing compliance cost caps for facilities under the site specific determination option