Industrial Wastewater: 

Discharger Perspective 

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Regional Monitoring Program Annual Meeting
Industrial Wastewater 101

- Petroleum refining and other industries are important contributors to the Bay Area economy
  - 5 Bay Area refineries sustain 88,000 jobs
- Industrial wastewater is highly treated and regulated
- Refinery sources: crude oil processing
- The processes that lead to pollutants in wastewater can be controlled
  - Source reduction
  - Pollutant minimization
- For most pollutants, industrial wastewater is a minor contributor
**SF Bay Refinery Wastewater Treatment**

- Removal of:
  - Ammonia & hydrogen sulfide
  - Oily water and solids
- Biological treatment
- Clarifiers
- Sand filters
- Activated carbon (all by 1990s)
- Advanced treatment to remove selenium (1990s)
- Disinfection (for sanitary waste)

Contaminants are largely removed from waste streams
Selenium in North Bay

- Industrial wastewater is a source of selenium (largest load from the Delta).
- White sturgeon: key indicator of selenium impairment.
- In recent years, RMP focused on improving information on impairment.
- Refineries played a central role in improving understanding of selenium in the North Bay.
  - Monitoring studies
  - Collaboration with Water Board
  - Work Group participation
Studies & Work Group Activities

- North San Francisco Bay Selenium Characterization Study (2012)
- North Bay Selenium TMDL (2016)
- ECoS3 model (2015)
- North Bay Selenium Monitoring Design (2018)
- Fin Rays & Otoliths
- Bird Eggs (for 19 years)
Sturgeon Derby

- Develop methods for non-lethal white sturgeon tissue sample collection and Se analysis, including muscle plugs and fin rays
  - Engaged Dr. Vince Palace, University of Manitoba
- Fin rays have a regular annual growth pattern; concentrations of Se and other elements can be measured in each annual ring and assembled into a time series
- The Derby also presented the opportunity to collect otoliths for comparative analysis to assess the chemical stability of fin ray samples
Selenium in Sturgeon

North Bay Se TMDL Target
Development of the North Bay Selenium Monitoring Plan

- Identify leading indicators of change
- Monitor key selenium indicators of water quality conditions in the North Bay
North Bay Selenium Monitoring: Sampling Design

**Indicators**

- [Image of selenium sample]
- [Image of clams]
- [Image of sturgeon]

**Sampling Stations**

<table>
<thead>
<tr>
<th>ID</th>
<th>Site Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIO</td>
<td>Sacramento River at Rio Vista, CA</td>
</tr>
<tr>
<td>TMS</td>
<td>Threemile Slough near Rio Vista, CA</td>
</tr>
<tr>
<td>JER</td>
<td>San Joaquin River at Jersey Point, CA</td>
</tr>
<tr>
<td>DCH</td>
<td>Dutch Slough below Jersey Island Rd at Jersey Island</td>
</tr>
<tr>
<td>OLD</td>
<td>Old River at Bacon Island</td>
</tr>
<tr>
<td>MRC</td>
<td>Middle River Near Holt, CA</td>
</tr>
<tr>
<td>4.1</td>
<td>USGS Station 4.1</td>
</tr>
<tr>
<td>8.1</td>
<td>USGS Station 8.1</td>
</tr>
</tbody>
</table>

Legend:
- Existing Stations
- Proposed Stations
- USGS Stations

*Delta Stations not funded by SF Bay RMP*
## North Bay Selenium Monitoring: Sampling Design

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Water Column</th>
<th>Bivalve Tissue</th>
<th>Sturgeon Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total, dissolved, particulate Se, TSM, TOC, Chl a</td>
<td>Total Se in bivalve soft tissue; C, N, S isotopes</td>
<td>Total Se, C, N, S isotopes in muscle plugs</td>
<td></td>
</tr>
<tr>
<td>Stations</td>
<td>USGS Stations 4.1 and 8.1</td>
<td>USGS Stations 4.1 and 8.1</td>
<td>Suisun, San Pablo Bays</td>
</tr>
<tr>
<td>Frequency</td>
<td>6 months</td>
<td>6 months</td>
<td>Biennial sampling</td>
</tr>
<tr>
<td>N</td>
<td>1 surface grab</td>
<td>5 composites</td>
<td>60 muscle plugs</td>
</tr>
</tbody>
</table>
Future Work and Challenges

- Evaluate results of selenium monitoring program
  - The monitoring program is entering its second year of the “pilot” phase and will be refined as needed
- USEPA may issue requirements to enhance treatment technologies
- Water recycling and reuse
  - Evaluate opportunities on an ongoing basis
- Sea level rise and climate change
  - Vulnerability analyses and adaptive management strategies