CUMBRE BINACIONAL DE SANEAMIENTO
FRONTERIZO Y CALIDAD DEL AGUA
Los Retos de Hoy, las Oportunidades del Mañana

Today’s Challenges, Tomorrow’s Opportunities
BINATIONAL BORDER SANITATION AND
WATER QUALITY SUMMIT

San Antonio, Texas
March 16-18, 2011
South Bay International Wastewater Treatment Plant

PRESENTATION AGENDA:

- Project History & Overview
- Project Challenges
  - Design
  - Construction
  - Start-up
- Opportunities to Optimize Plant Operation
- Answer Questions
South Bay International Wastewater Treatment Plant (SBIWTP) is the result of Bi-national cooperation between the US and Mexico to provide a long-term solution for environmental protection of the Tijuana River.

- Located on border between Tijuana and San Diego
- 1990 – United States and Mexico approve Minute No. 283
- 1992 – Pre-design investigations started
- 1993 – Design started
- 1995 – Construction of primary treatment plant started
- 1997 – Advanced primary treatment plant placed on line
- 2008 – Construction of secondary treatment plant started
- 2010 – Secondary treatment plant placed on line
- 2011 – Court order compliance date met
South Bay International Wastewater Treatment Plant is a state-of-the-art facility designed to meet USEPA secondary treatment standards

<table>
<thead>
<tr>
<th>PLANT CAPACITY</th>
<th>PRIMARY TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ 25 mgd average flow</td>
<td>➢ Primary sedimentation</td>
</tr>
<tr>
<td>➢ 48.75 mgd peak flow</td>
<td>➢ Anionic polymer polymer addition</td>
</tr>
<tr>
<td></td>
<td>➢ Ferric chloride addition</td>
</tr>
<tr>
<td></td>
<td>➢ Disinfection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRELIMINARY TREATMENT</th>
<th>RESIDUAL SOLIDS HANDLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Mechanical bar screens</td>
<td>➢ Unstabilized primary sludge storage</td>
</tr>
<tr>
<td>➢ Aerated grit chamber</td>
<td>➢ Belt filter press dewatering</td>
</tr>
<tr>
<td></td>
<td>➢ Lime stabilization</td>
</tr>
<tr>
<td></td>
<td>➢ Disposal in Mexico</td>
</tr>
</tbody>
</table>
South Bay International Wastewater Treatment Plant is a state-of-the-art facility designed to meet USEPA secondary treatment standards

**PLANT CAPACITY**
- 25 mgd average flow
- 48.75 mgd peak flow

**SECONDARY TREATMENT**
- "Selector" modified activated sludge
- Secondary sedimentation
- Disinfection

**RESIDUAL SOLIDS HANDLING**
- Dissolved air flotation thickening
- Unstabilized primary/secondary sludge storage
- Lime stabilization
- Disposal in Mexico
South Bay International Wastewater Treatment Plant Faced Many Challenges

WASTEWATER CHARACTERIZATION
- Constituents not fully quantified
- Concern about inhibitory/toxic constituents

SITE AND GEOTECHNICAL ISSUES
- 75-acre site
- Located in “active” seismic area
- Underlain with “liquefiable” soils
- Site located in Tijuana River flood zone
Extensive Wastewater Characterization and Treatability Studies Were Required to Define Influent Wastewater Loading and Design Criteria to Mitigate Potential Treatability Concerns

**ROUND 1 WASTEWATER SAMPLING & CHARACTERIZATION PROGRAM**
- Conducted from August 1992 to October 1992
- Over 130 composite and grab samples taken and analyzed

**ROUND 2 WASTEWATER SAMPLING & CHARACTERIZATION PROGRAM**
- Completed from November 1992 to September 1993
- Over 100 composite samples taken and analyzed
Extensive Wastewater Characterization and Treatability Studies Were Required to Define Influent Wastewater Loading and Design Criteria to Mitigate Potential Treatability Concerns

CHEMICALLY ASSISTED PRIMARY SEDIMENTATION LABORATORY SCALE PROGRAM
- Studies conducted in October 1992 and November 1992

ACTIVATED SLUDGE LABORATORY SCALE TREATABILITY PROGRAM
- Studies conducted in October 1992 and November 1992
- Studies performed by Arizona State University

Above Programs Defined Constituent Loading Criteria and Need for “Selector” Modified Activated Sludge System
Site Liquefaction Concerns Required Mitigation Before Site Grading Could Begin

- Deep Dynamic Compaction (DDC) Selected Best Option
- Crude but Effective Mitigation Method
- Energy Imparted on Entire Site to Consolidate Liquefiable Soils
  15’ to 20’ Below Grade
Site Location in the Tijuana River Flood Zone Required Extensive Mass Grading and Rip-Rap Protection Before Start of Construction
Schedule Acceleration Caused Significant Construction and Operations Challenges

CONSTRUCTION CHALLENGES

- Secondary plant completion scheduled for April 2011
- Court order compliance date set at January 5, 2011
- Secondary plant schedule accelerated in December 2009
- All parties accelerate activities to meet compliance date
- Compliance date is met
Schedule Acceleration Caused Significant Construction and Operations Challenges

OPERATIONS CHALLENGES

- Secondary treatment plant started-up in mid-November 2010
- Automatic controls and monitoring not ready
- Facilities operated in manual mode
- O&M manuals lagged start-up
- Operator training lagged start-up
- Compliance schedule met
Opportunities to Optimize Plant Operation Center Around “Chemically Assisted” versus “Conventional” Primary Sedimentation

- Ferric Chloride
- Anionic Polymer
- Air

“Chemically Assisted” Primary Sedimentation

Primary Sludge
- 24.8 dry tons/day

Activated Sludge

Combined Sludge
- 33.6 dry tons/day

Dewatering

Lime Stabilization

Disposal in Mexico
- 38.9 dry tons/day
- 158 yd³/day
- 8 to 9 truck loads/day

Secondary Sludge
- 8.8 dry tons/day

Secondary Sedimentation

Ocean Outfall
Opportunities to Optimize Plant Operation Center Around “Chemically Assisted” versus “Conventional” Primary Sedimentation

“Conventional” Primary Sedimentation → Activated Sludge → Secondary Sedimentation → Ocean Outfall

Primary Sludge:
- 20 dry tons/day

Combined Sludge:
- 35.9 dry tons/day

Secondary Sludge:
- 15.9 dry tons/day

Dewatering

Lime Stabilization

Disposal in Mexico:
- 42.3 dry tons/day
- 219 yd³/day
- 12 to 13 truck loads/day
The Ratio of Primary Sludge and Secondary Sludge in the Total Sludge Mass Impacts the Dewaterability of the Sludge

<table>
<thead>
<tr>
<th>Method</th>
<th>Primary Sludge</th>
<th>Secondary Sludge</th>
<th>Primary/Secondary Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemically Assisted Primary and Secondary</td>
<td>24.8 dry tons/day</td>
<td>8.8 dry tons/day</td>
<td>73% / 27%</td>
</tr>
<tr>
<td>Conventional Primary and Secondary</td>
<td>20.0 dry tons/day</td>
<td>15.9 dry tons/day</td>
<td>55% / 45%</td>
</tr>
</tbody>
</table>
Secondary Sludge is More Difficult to Dewater than Primary Sludge

BFP Cake Solids vs. % Primary/Secondary Sludge (dry weight basis)

Range With PST Chemical Addition

Range Without PST Chemical Addition
Secondary Sludge Requires More Polymer to Dewater Than Primary Sludge

BFP Polymer Dosage vs % Primary/Secondary Sludge (dry weight basis)

Range With PST Chemical Addition

Range Without PST Chemical Addition
Secondary Sludge Requires More Lime to Stabilize Than Primary Sludge

Lime Dosage vs % Primary/Secondary Sludge (dry weight basis)

Range With PST Chemical Addition
Range Without PST Chemical Addition
“Chemically Assisted” versus “Conventional” Primary Sedimentation Impact Chemical, Power, and Sludge Disposal Costs

### COMPARISON OF “RELATIVE” CHEMICAL COSTS

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Chemically Assisted Primary Plus Secondary</th>
<th>Conventional Primary Plus Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST Ferric Chloride</td>
<td>$758,000</td>
<td>N/A</td>
</tr>
<tr>
<td>PST Anionic Polymer</td>
<td>$77,000/yr</td>
<td>N/A</td>
</tr>
<tr>
<td>DAF Cationic Polymer</td>
<td>$60,000/yr</td>
<td>$110,000/yr</td>
</tr>
<tr>
<td>BFP Cationic Polymer</td>
<td>$567,000/yr</td>
<td>$730,000/yr</td>
</tr>
<tr>
<td>Lime</td>
<td>$233,000/yr</td>
<td>$267,000/yr</td>
</tr>
<tr>
<td>Total</td>
<td>$1,695,000/yr</td>
<td>$1,107,000/yr</td>
</tr>
</tbody>
</table>
**Chemically Assisted** versus **Conventional** Primary Sedimentation Impact Chemical, Power, and Sludge Disposal Costs

**COMPARISON OF “RELATIVE” ELECTRICITY COSTS**

<table>
<thead>
<tr>
<th>Process</th>
<th>Chemically Assisted Primary Plus Secondary</th>
<th>Conventional Primary Plus Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST Chemical Addition Equipment</td>
<td>$70,000/yr</td>
<td>N/A</td>
</tr>
<tr>
<td>Activated Sludge Blowers</td>
<td>$1,930,000/yr</td>
<td>$2,479,000/yr</td>
</tr>
<tr>
<td>Total</td>
<td>$2,000,000/yr</td>
<td>$2,479,000/yr</td>
</tr>
</tbody>
</table>
Opportunities to Optimize Plant Operation Center Around “Chemically Assisted” versus “Conventional” Primary Sedimentation

**Comparison of “Relative” Total Costs**

<table>
<thead>
<tr>
<th>Cost Component</th>
<th>Chemically Assisted Primary Plus Secondary</th>
<th>Conventional Primary Plus Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals</td>
<td>$1,695,000/yr</td>
<td>$1,107,000/yr</td>
</tr>
<tr>
<td>Electricity</td>
<td>$2,000,000/yr</td>
<td>$2,479,000/yr</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$3,695,000/yr</td>
<td>$3,586,000/yr</td>
</tr>
<tr>
<td>Sludge/Disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trucks/day</td>
<td>8 to 9</td>
<td>12 to 13</td>
</tr>
<tr>
<td>Cost</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
The South Bay International Wastewater Treatment Plant is a Successful Bi-National Project that Meets the Goals Established by the U.S. and Mexico 21 Years Ago to Protect Our Environment

MORE OPPORTUNITIES TO BE EXPLORED:

- Secondary effluent return to Mexico
- Anaerobic digestion to reduce sludge volume
- Co-generation to offset power costs

QUESTIONS?