IPRO It takes a team
INTERPROFESSIONAL PROJECTS PROGRAM

IPRO 302
Zero Liquid Discharge

Sponsored by:

Sargent & Lundy LLC

Overview

- Problem
- Goals
- Team organization
- Options
- Challenges Ahead

Our Problem

- Zero Liquid Discharge systems bypass the stringent permits
  - Difficulty getting permits for facilities that generate electricity and also discharge processed waste water.
  - How can we eliminate the power plant's waste water discharge stream?

Our Goal

- Identify, evaluate, and prioritize technologies that can be used to eliminate waste water output
  - Water balance of power plant in Nevada.
  - Size, capital cost and operating cost
  - Creative options for reusing treated discharge water.

Team Organization

Advisors: Don Chmielewski, Myron Gottlieb **Sponsor**: Sargent & Lundy

Team Leader: William Pattermann

Preliminary Research Teams

1. **Evaporation Pond**
   - Angela Ng (L)
   - Alex Ong
   - Danny Beissinger
2. **Deep Well**
   - Will Pattermann (L)
   - James Lai
   - Mitchell Isoda
3. **Brine Concentrator**
   - Ray Ballard (L)
   - Sahar Ashrafi
   - Woo Sung Shin
4. **Emerging Technology**
   - Ross Hill (L)
   - Catherine Latour

Extensive Research Teams

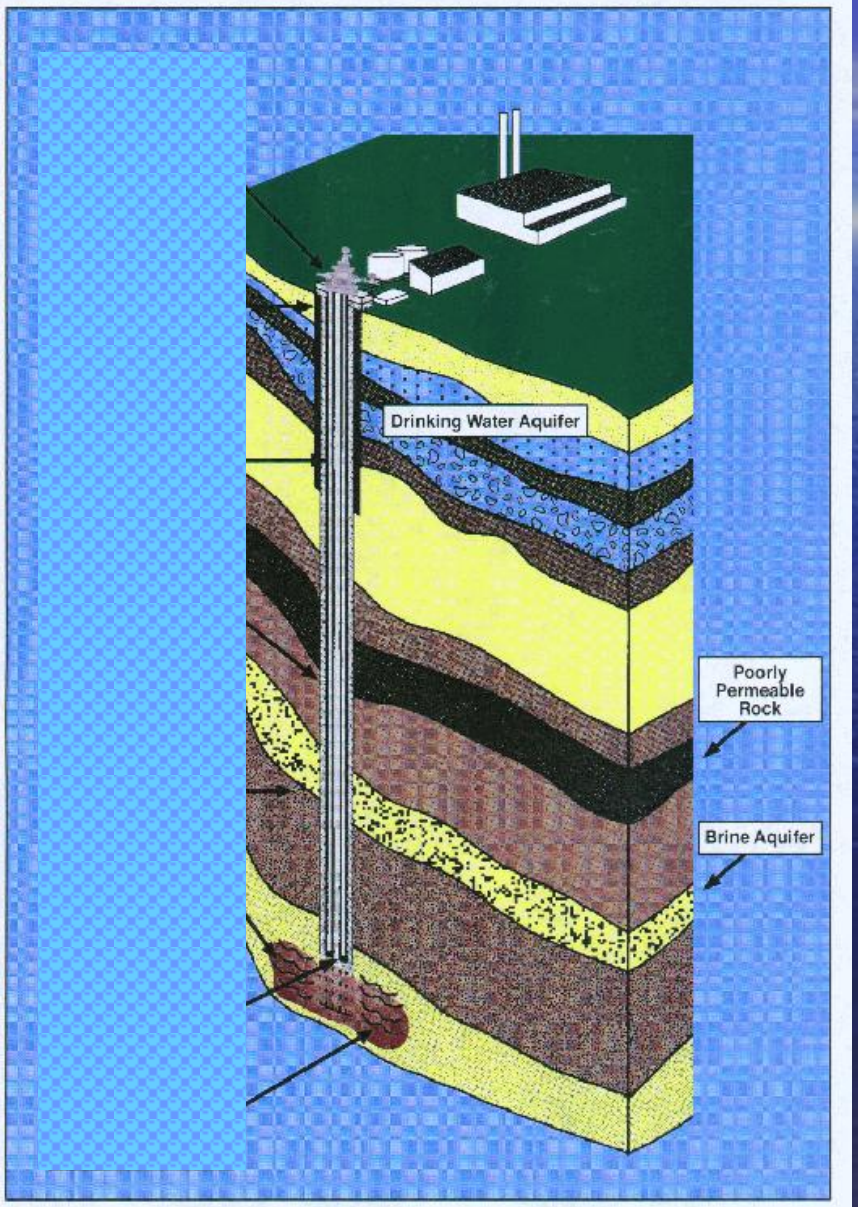
1. **Physical Team**
   - Alex Ong (L)
   - Angela Ng
   - Woosung Shin
2. **Regulatory Team**
   - James Lai (L)
   - Danny Beissinger
3. **Technological Team**
   - Sahar Ashrafi (L)
   - Ray Ballard
   - Catherine Latour
4. **Financial Team**
   - Mitchell Isoda (L)
   - Ross Hill

Final Teams

1. **Final Presentation Team**
   - Ray Ballard (L)
   - Angela Ng
   - Will Pattermann
   - Ross Hill
2. **Final Report Team**
   - Sahar Ashrafi (L)
   - Mitchell Isoda
   - Catherine Latour
3. **Poster Team**
   - Danny Beissinger (L)
   - Woosung Shin
4. **Brochure Team**
   - Alex Ong (L)
   - James Lai

Proposed Technologies

- Deep Well
- Evaporation Pond
- Brine Concentrator



Deep Well

- **Definition**: Man-made wells to inject fluid into the ground, either for disposal or to extract other material from the ground
- **Goal:** Assess how a deep well could help reduce waste water discharge from a coal power plant
- **Resolution**: Deep wells are not a feasible solution for zero discharge in Nevada --- all possible injection wells are prohibited by Nevada law

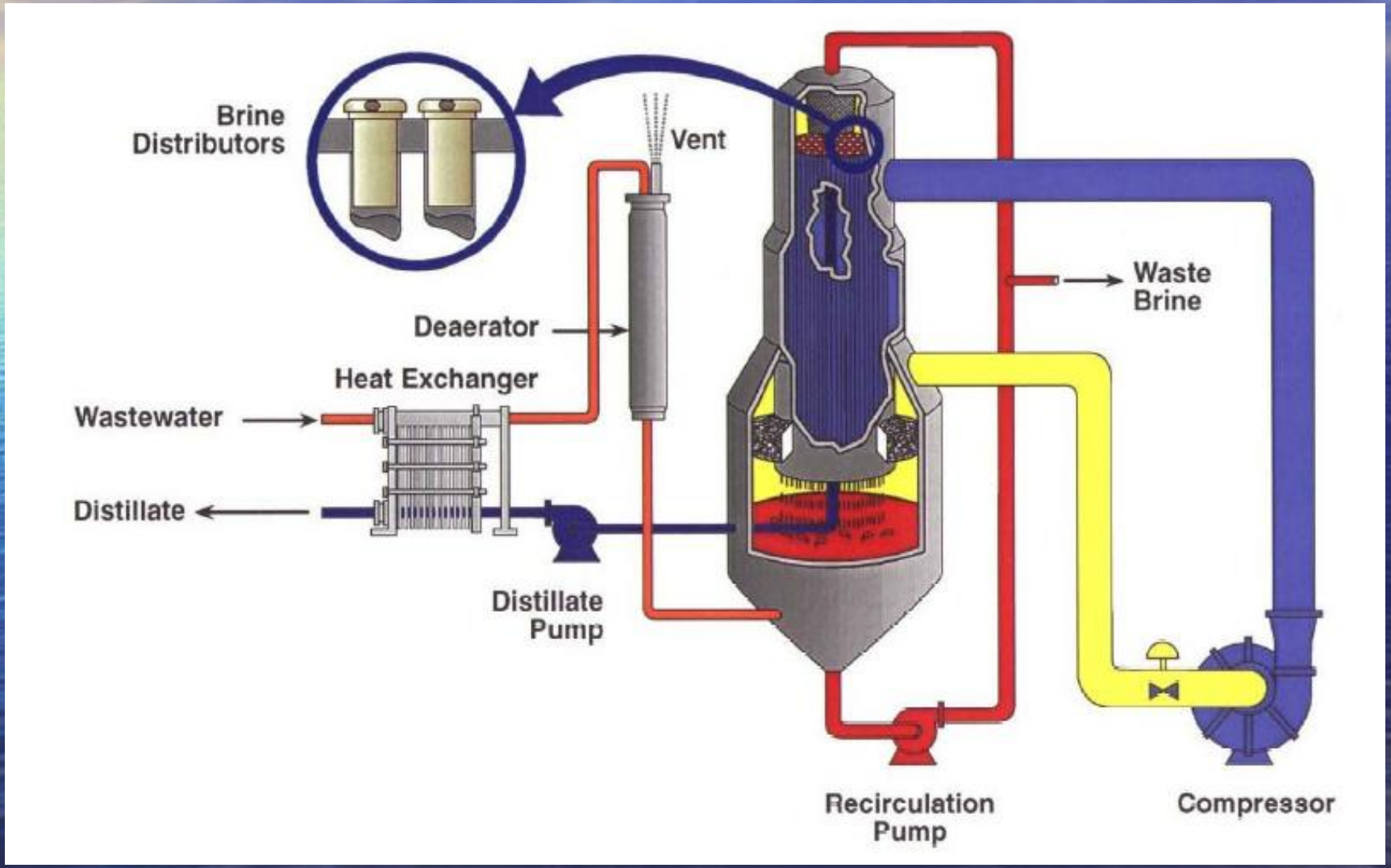
Evaporation Pond

- **Definition**: Shallow dugout with very large surface areas to evaporate water by sunlight and exposure to ambient temperatures.
- **Pros**:
  - Relatively cheaper compared to other technologies.
  - Easier and cheaper to maintain
- **Cons**:
  - Land consuming
  - Threaten wildlife
  - Low feasibility
  - Lining cost

Brine Concentrator

- **Definition:** Takes waste water and separates it into outlet streams of clean water and sludge.
- **Pros:**
  - Recovers 95% of plant wastewater
  - After addition of crystallizer, we can reduce the last 5% to dry solids and have zero liquid discharge
- **Cons:**
  - High Capital Costs
  - High maintenance costs
  - Solid Disposal

Brine Concentrator



Additional Technologies

- Advanced Membrane Systems
  - Pros:
    - very high efficiency, >99% of water recovery, minimal maintenance, low risk of fines or malfunction.
  - Cons:
    - high initial cost, membrane clogging

- Crystallizer
  - Pros:
    - finishes processing concentrated waste stream, leaves only solid waste, able to sell crystals/other solids.
  - Cons:
    - very expensive, maintenance, large size

Challenges Ahead

- Based on knowledge acquired, we can further evaluate zero liquid discharge solutions.
- Analyze and evaluate each system, determine the:
  - Material Requirements
  - Water Balance/Water Reuse
  - State Regulations
  - Costs (capital, operating, and opportunity)
- Determine a Modeling Equation

Any Questions?