WEST COAST REGIONAL CARBON SEQUESTRATION PARTNERSHIP
westcarb.org

# WESTCARB Annual Business Meeting

## Arizona Utilities $CO_2$ Storage Pilot

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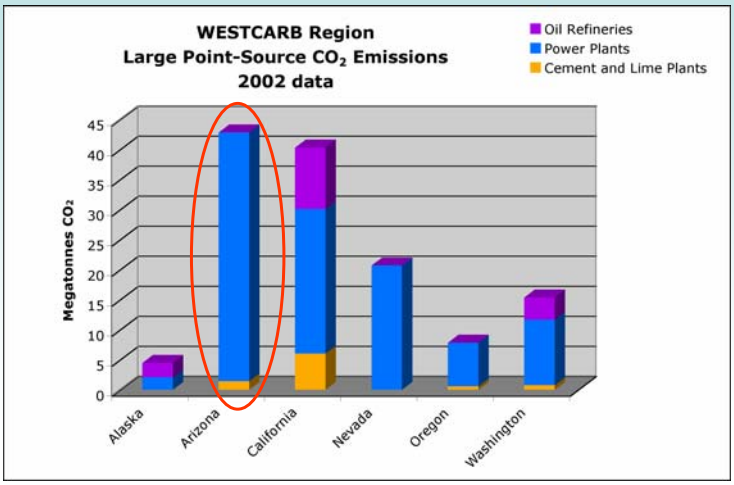
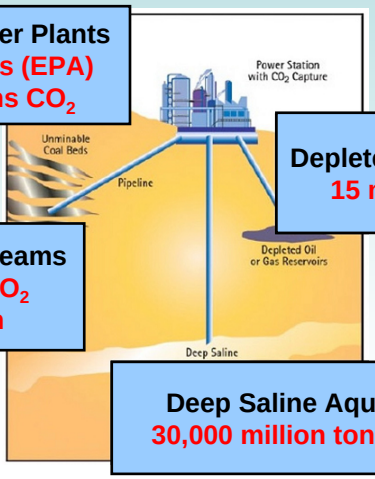
*Seattle, WA*
*November 27, 2007*

## Arizona $CO_2$ Emissions Are Primarily From Coal-Fired Power Plants



## Arizona Geologic Storage Potential
**(Arizona Geological Survey)**

**All Arizona Power Plants**
**2002 Emissions (EPA)**
**45 million tons $CO_2$**




**Depleted Oil & Gas Fields**
**15 million tons $CO_2$**

**Unmineable Coal Seams**
**Not a potential $CO_2$ storage option**

**Deep Saline Aquifers**
**30,000 million tons $CO_2$**



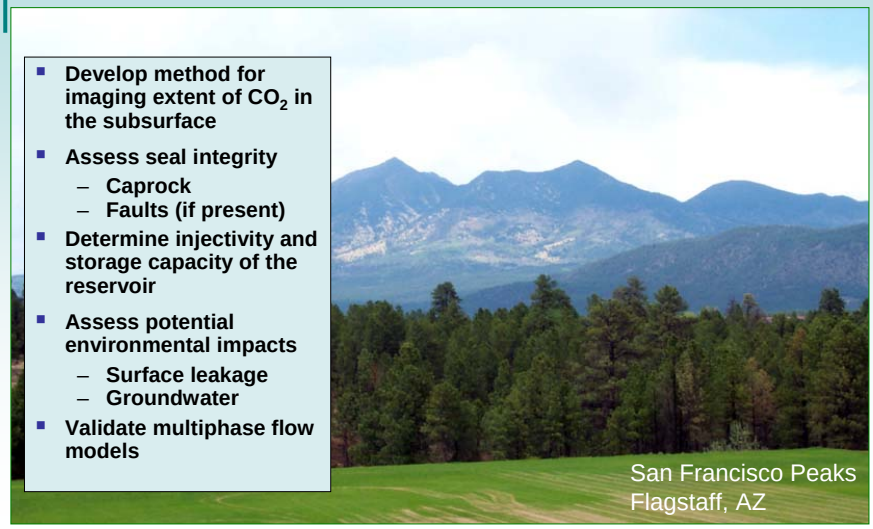
## Arizona Utilities and Collaborators

- Arizona Public Service Company
- Salt River Project
- Tucson Electric Power
- Electric Power Research Institute
- Lawrence Berkeley National Laboratory
- California Energy Commission
- U.S. Department of Energy

EPRI ELECTRIC POWER RESEARCH INSTITUTE

## WESTCARB Pilot Test Objectives

- **Develop method for imaging extent of $CO_2$ in the subsurface**
- **Assess seal integrity**
  - **Caprock**
  - **Faults (if present)**
- **Determine injectivity and storage capacity of the reservoir**
- **Assess potential environmental impacts**
  - **Surface leakage**
  - **Groundwater**
- **Validate multiphase flow models**


San Francisco Peaks
Flagstaff, AZ



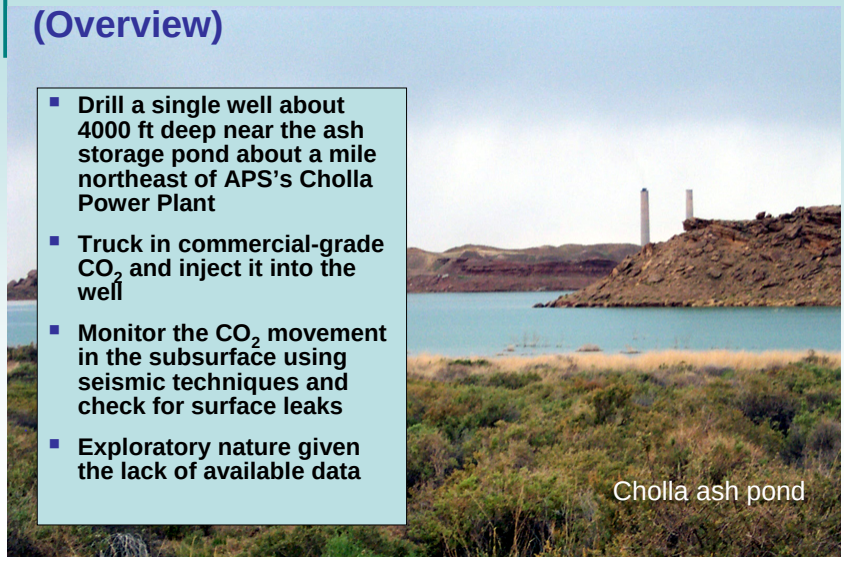
## Arizona Pilot-Specific Objectives

- Evaluate $CO_2$ sequestration opportunities in the Colorado Plateau Province
- Injection test simulates a commercial operation where a single deep injection well may be the only well present
- "Greenfield" saline formation injection
- Focus on monitoring

Arizona

## What Are We Proposing to Do? (Overview)

- **Drill a single well about 4000 ft deep near the ash storage pond about a mile northeast of APS's Cholla Power Plant**
- **Truck in commercial-grade $CO_2$ and inject it into the well**
- **Monitor the $CO_2$ movement in the subsurface using seismic techniques and check for surface leaks**
- **Exploratory nature given the lack of available data**






## What Are We Proposing to Do? (Overview)

- Share our results with the community and public officials; compare our results with those from 25 similar tests across the United States and Canada
- Seal the well upon completion of the project
- Conduct outreach to educate and receive input from the public regarding climate change and geologic sequestration

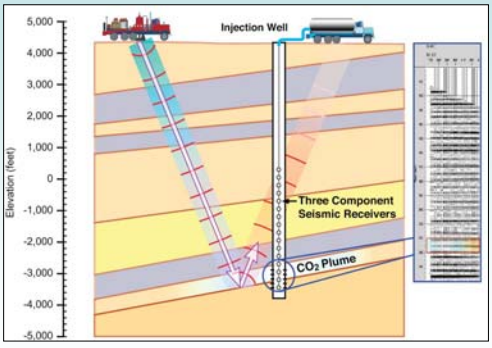
## What Will This Accomplish? The Test Will Show That…

- $CO_2$ can be safely stored in porous geologic formations containing nonpotable saline water
- Computer models developed by national laboratories and Arizona geologists can predict how $CO_2$ will move into, and interact with, northeast Arizona saline formations
- Multiple types of instruments can measure the $CO_2$ injected underground and detect leaks
- State and federal regulators know how to permit and inspect $CO_2$ storage projects



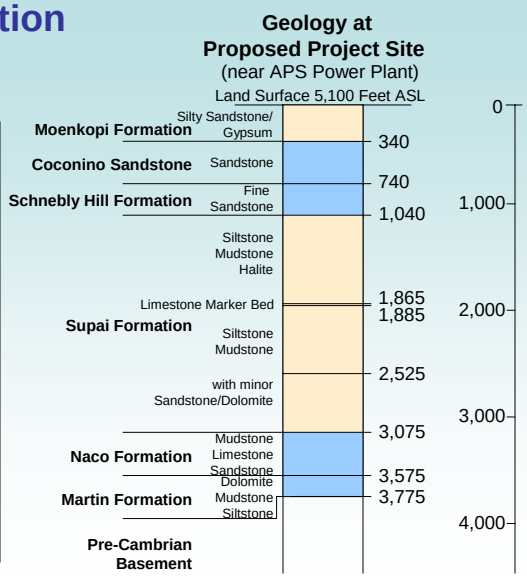
## Project Details — Phased Approach

- Phase I: Select site and obtain permits
- Phase II: Drill and test exploratory well
- Phase III: Injection
  - Inject up to 2000 tons of $CO_2$
  - Monitor $CO_2$ movement in the subsurface



## Phase I: Site Selection and Planning

- Planning, outreach and characterization
  - Geological reconnaissance and site selection
  - NEPA documentation
  - Detailed site geology and hydrology
- Reservoir simulation
  - Estimation of injectivity and plume migration
  - Detailed test plan development




*Source: Errol L. Montgomery & Associates*



## Phase II. Geological Exploration and Characterization

- Pre-drilling planning, safety and outreach
- Site characterization, well drilling and logging
  - Prepare site and drill exploration well
  - Obtain well logs; baseline P and T, water samples
  - Field scale permeability measurements
- Assess data and decide whether to perform $CO_2$ injection

Drilling and logging at Frio $CO_2$ Pilot
(photos from S Hovorka)

## Phase III. $CO_2$ Injection

- Pre-injection simulation, permitting and safety
- Prepare well for $CO_2$ injection
- Prepare injection equipment
- Obtain baseline geochemical and seismic (VSP) measurements
- Install downhole P & T, passive seismic transducers
- Inject about 2000 tons

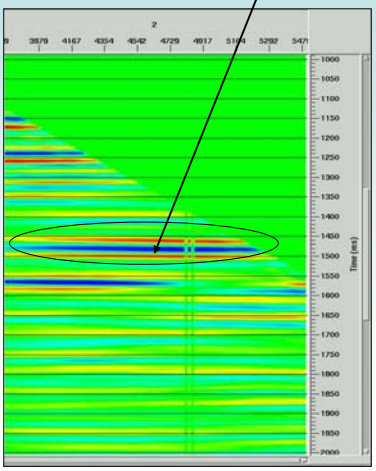
Seismic Equipment (VSP) and $CO_2$ injection at the Frio Pilot



## Phase III. (cont.) Post Injection Activities

- Post-injection monitoring
  - Wireline logs
  - Post-injection seismic
- Data analysis and reporting
  - Analyze data
  - Prepare technical reports, including assessment of storage capacity
  - Prepare "lessons learned" report
  - Disseminate results
- Site Restoration and Well Closure

Reflection from $CO_2$ plume



VSP Results from Frio Pilot

## Proposed Research Project Will Comply With Federal and State Requirements

- ✓ National Environmental Policy Act (NEPA)
- ✓ U.S. EPA Underground Injection Control (UIC)
- ✓ Arizona Aquifer Protection Program (APP)
- ✓ Arizona Oil & Gas Commission drilling permit

We are assessing potential impacts on:

- ✓ Land Uses
- ✓ Geology/Soil Conditions
- ✓ Vegetation and Wildlife Resources
- ✓ Socioeconomic and Infrastructure Conditions
- ✓ Historical/Cultural Resources
- ✓ Visual Resources
- ✓ Atmospheric Conditions/Air Quality
- ✓ Hydrologic Conditions/Water Quality
- ✓ Solid and Hazardous Wastes
- ✓ Health/Safety Factors
- ✓ Environmental Restoration and/or Waste Management

Historical/Cultural Resources



## Arizona Utilities Pilot — Summary

The WESTCARB project is …

- Preparing permit applications
- Providing information to state and federal regulators
- Reaching out to the community through public meetings
- Developing detailed budgets and schedules
- Soliciting qualifications/bids for a site test manager

…and will begin

- … Drilling and testing in Fiscal Year 2008–2009

## How to Get More Information

- Visit our website (www.westcarb.org)
- Contact our project leaders
  - Geologic Pilot Program Manager Rob Trautz
    (510) 486-7954, rctrautz@lbl.gov
  - WESTCARB Technical Director Larry Myer
    (916) 651-2073, larry.myer@ucop.edu

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