



# Praxair Walden CO2 Plant

October 22, 2013



- CO2 processing plant; no benzene is produced
- Constructed in 1983-1984 and Praxair acquired in 1996
  - No known environmental assessments performed
- Bonanza supplies raw CO2 gas feed through underground line
  - Raw feed contains methane, ethane, propane, butane, BTEX
    - B – 41 ppm
    - T – 32 ppm
    - E – 0.4 ppm
    - X – 2 ppm
- Praxair processes the CO2 through a series of knockouts, dryers and strippers to condense and heat the CO2
- All equipment inside building on concrete slab

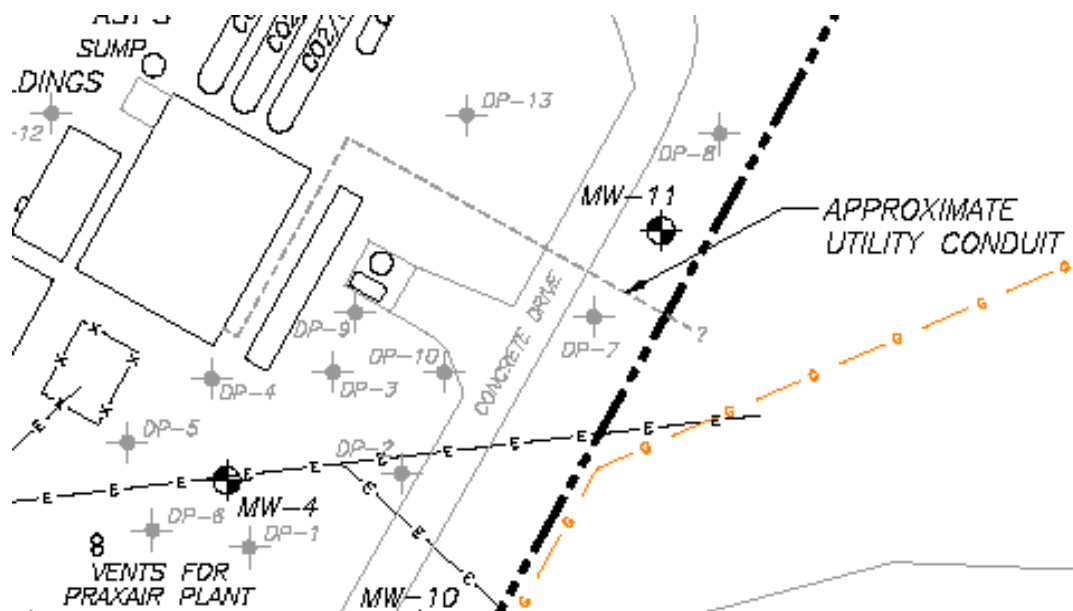


- Condensate returned to Bonanza through underground lines
  - CO2 89%
  - Isobutane, butane, isopentane, pentane, hexane, heptane 11%
- Gas that does not condense is vented
  - Vent #1: Carbon Beds
    - CO2 70%, Methane 15%, Nitrogen 14%, Hydrogen/Argon 1%
  - Vent #2: O2 stripper
    - CO2 99%, Oxygen 1%
- Purified CO2 goes into storage
  - CO2 is not 100% pure and contains impurities including:
    - BTEX
    - Propane, butane, pentane
    - Isopentane, isobutane, ethane
  - BTEX is not stripped from CO2 but rather flows through to final product



# Summary of Underground Pipes

- Incoming raw CO<sub>2</sub> feed from Bonanza
- Incoming liquid oxygen from the Praxair aboveground storage tank on site
- Incoming non-potable water from Bonanza (originates from Canadian River)
- Outgoing ethane/propane to Bonanza
- Outgoing condensate to Bonanza





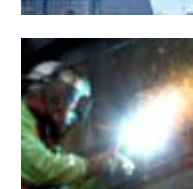
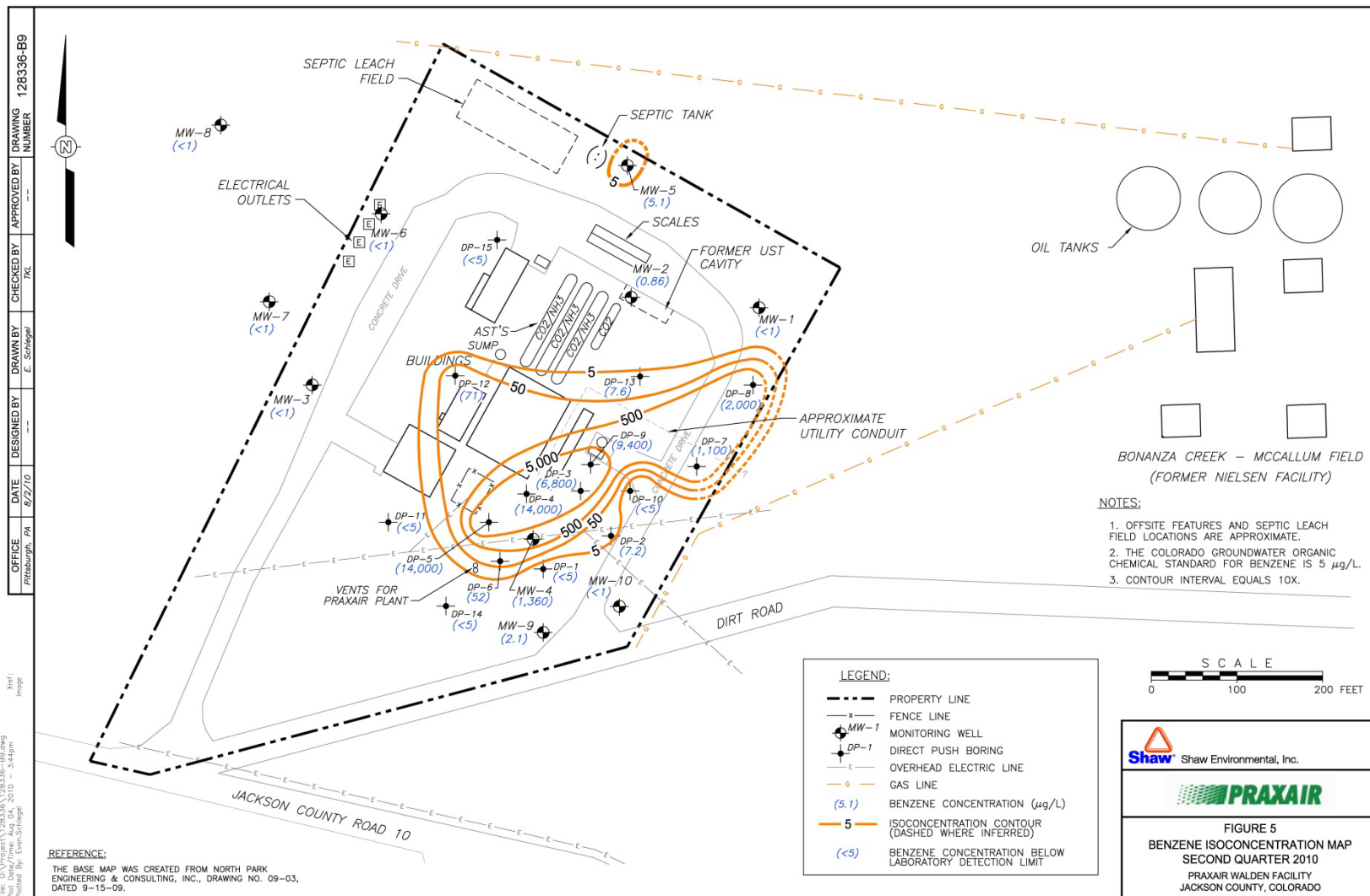
- Petroleum discovered in septic tank and associated leach field
- Result of bad plumbing in plant, has been corrected
- Aug 2007 field excavated, dewatered field and groundwater treated with ORC
- MW-5 through MW-8 installed
- Area of soil and groundwater impacts limited
- Benzene concentrations within standard
- Xylenes are issue
  - Indicates older spill



- Discovered high concentrations in May 2008
  - No historical data from surrounding area to pinpoint source
- Installed up gradient MW-9 and MW-10 in Aug 2009
- No indication of release in those wells
- Conducted extensive investigation in May 2010
  - 15 borings and groundwater samples collected
  - Source appeared to be near SE corner of plant
  - DP-7 and DP-8 on eastern property boundary
    - Benzene concentrations: 2,000 and 1,100 ug/L
  - DP-14 near vent pipes
    - Benzene concentration: <5 ug/L
- Concluded vent pipes were not source
- Plume migrating onsite from east
  - Installed MW-11 in Aug 2011 to confirm

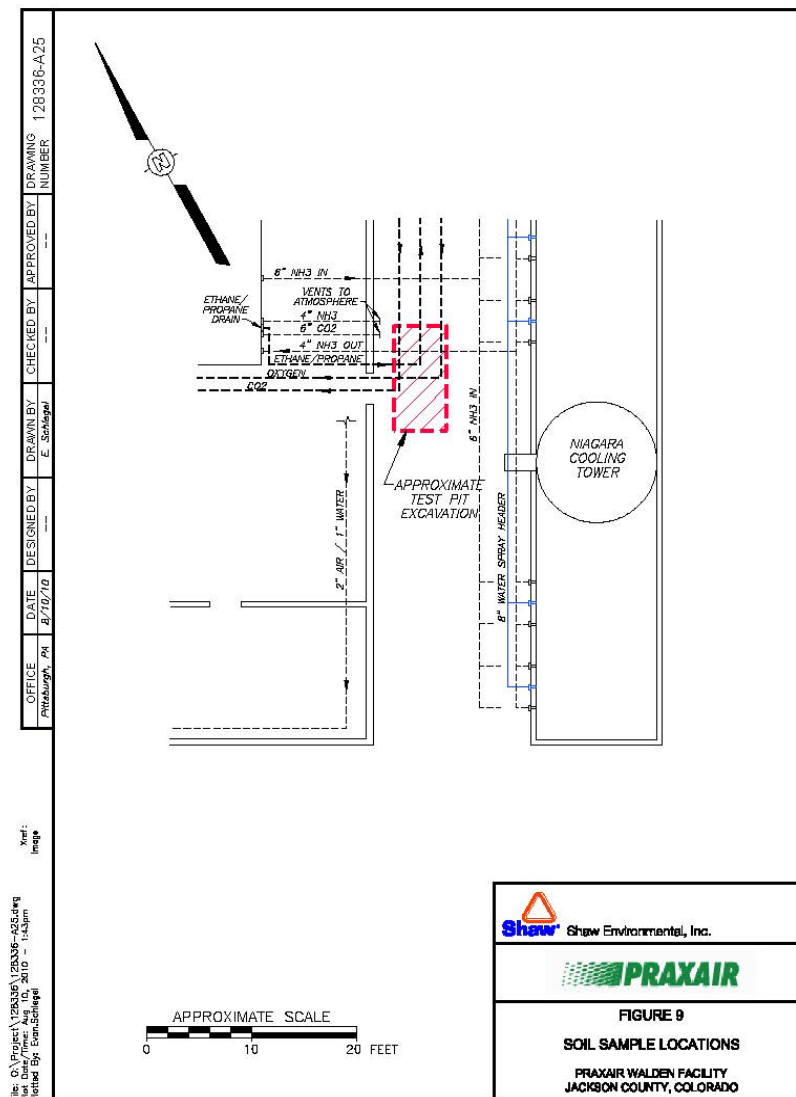


# MW-4 Investigation: Benzene Plume Map





- Focused investigation on underground piping where pipes elbow coming out of plant
- June 2010
- Hand digging to uncover pipes
- Hand augering
  - collect samples below pipes
- No petroleum impacts
  - No odors
  - No staining
  - No hits on PID





- Oct 2010 - CCTV on ethane/propane return line for 50' including three elbows
  - All other lines active so no test could be conducted
- No breaches or holes visible; bottom half of pipe in good condition
- Concluded MW-4 impact not from underground lines
- Installed iSOC unit in MW-4 in Nov 2010
- Significant drop in BTEX concentration after 6 months of operating
  - 1,450 ug/L to 1.1 ug/L
- Concentrations have rebounded after initial decline

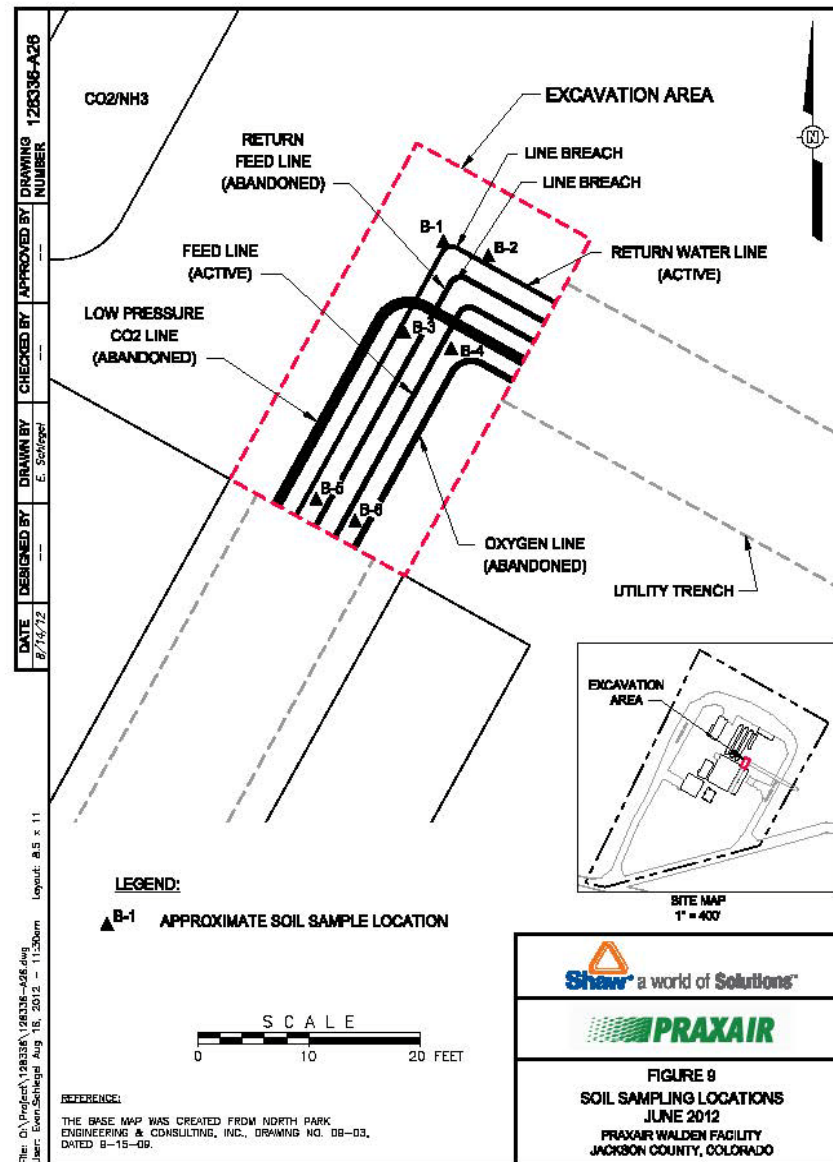


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- June 2012 pressure line test
- Breaches occurred in return water and return gas lines at elbow NW of plant
- Excavated impacted soils and determined limited area of impact
- Impacted soils to a depth of 6' bgs
- Release did not impact groundwater
- Concluded that breaches from pressure test were not the source of MW-4 nor MW-11 which is up gradient





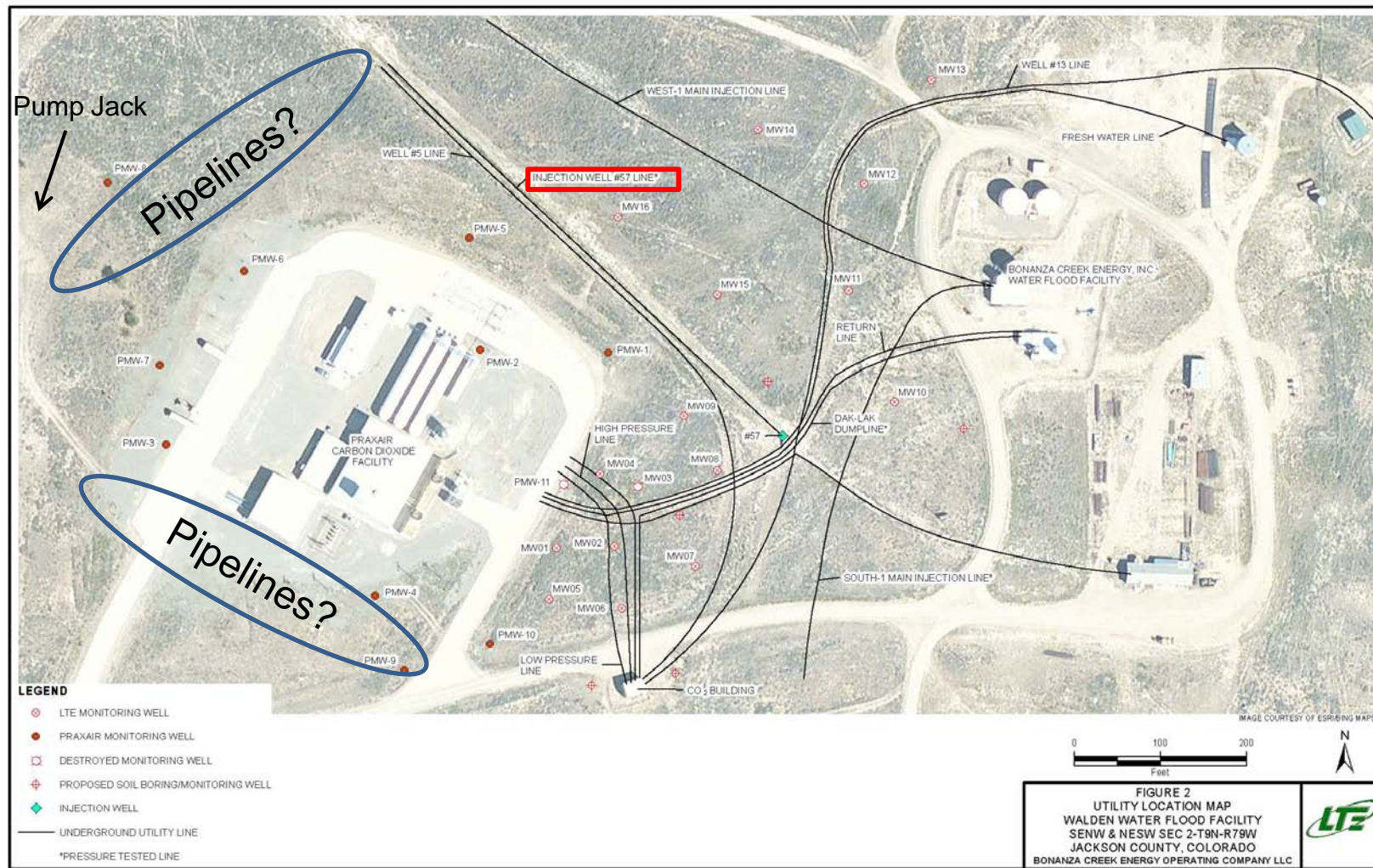


- Offsite plume based on groundwater flow
  - Impacted MW-11
- Pockets of petroleum in groundwater in oil field from historical operations?
  - Seep approximately ¼- mile north of MW-8
- Injection well #57 and/or conveyances?
- Pump jack near MW-8?
- All plant equipment on concrete slab with no visible signs of cracking



- What type of product was found in monitoring wells?
  - Crude or processed?
- Injection well #57 and line
  - What is the use? How often?
- Location of lines connected to pump jack near MW-8?
- Location of lines on south and west sides of Praxair?





- Further investigations to determine source?
- What if specific source cannot be determined?
- Site or maybe oil field specific standards?
- Environmental covenant?
  - Discussed with BLM but they had no knowledge
  - Lease states return land to original condition
  - What is Bonanza lease with BLM?
- CDPHE/OGCC closure procedures?

