



# How Best Practices Reduce the Impact of Unconventional Gas on Water Resources

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# Agenda

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- Why Unconventional Gas?
- What is Hydraulic fracturing (fracking)?
- Key Challenges in Saudi Arabia
- Environmental Potential Risks
- Best Environmental Protection Practices Related to Water Resources



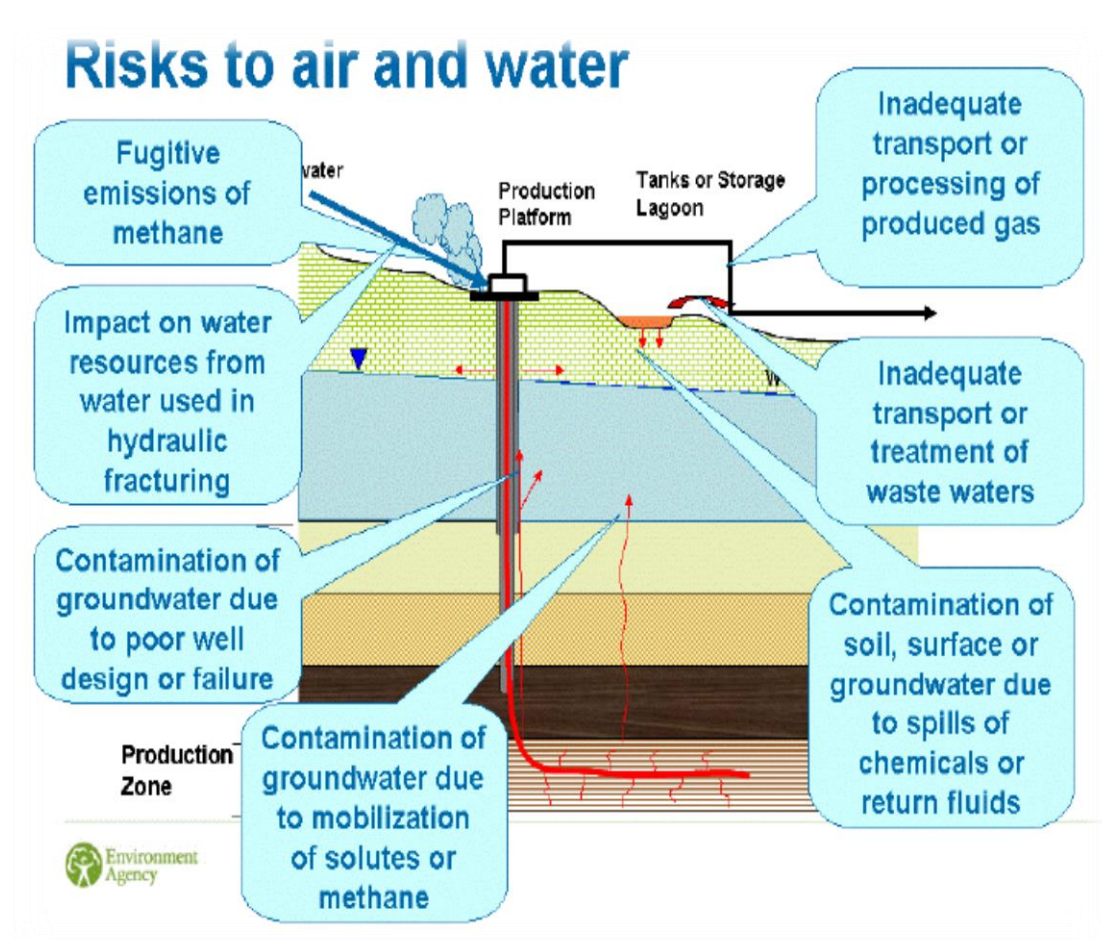
# Key Challenges in Saudi Arabia

- Water scarcity
  - Very little rain
  - Limited usable aquifers
  - Agriculture & mining use
- Lack of environmental service providers
  - Distance from urban areas
  - Difficult terrains
- Biodiversity impact
  - Many wells
  - Wild life and grazing land impact
- Lack of regulation & enforcement



# Environmental Potential Risks

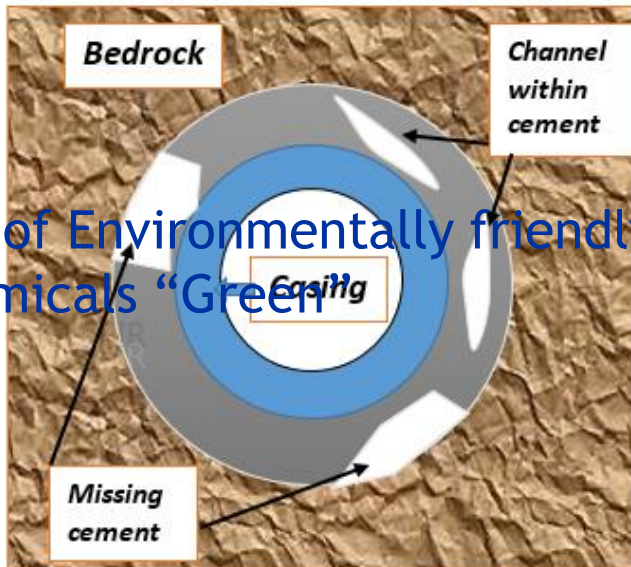
- Groundwater Consumption
- Groundwater Contamination
- Land contamination (spills)
- Wastewater Treatment and disposal impacts
- Air Pollution



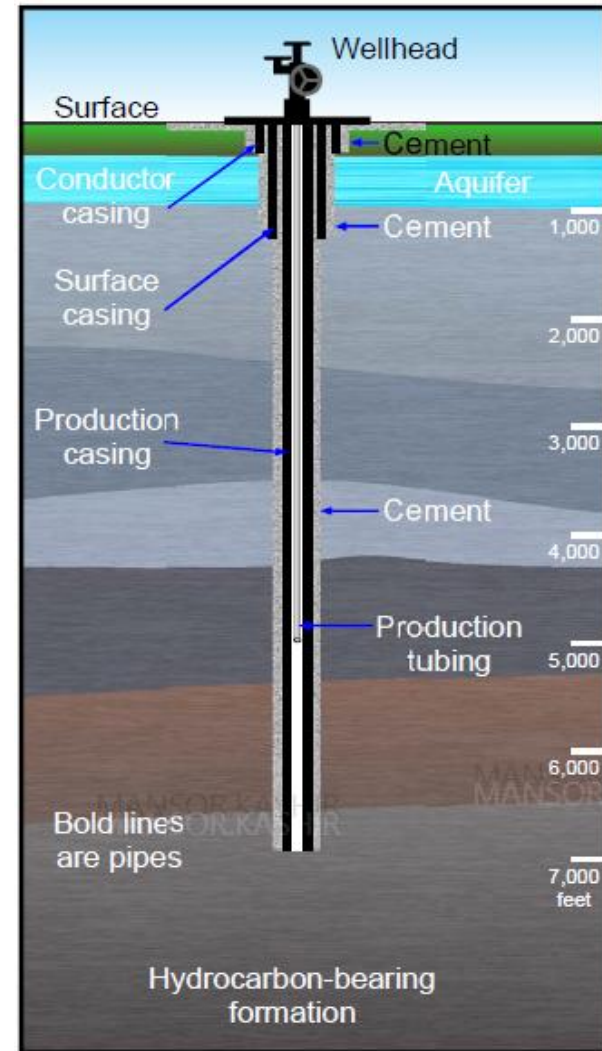
# Best Practices To Reduce Environmental Impact

- Well Construction

- The use of multi casings
  - Well Structural Support
  - Corrosion protection
- Integrity testing (pressures)



Source: EPD, Saudi Aramco



Source: EPA, 2013

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- Use of Environmentally friendly chemicals “Green”

# Best Practices To Reduce Environmental Impact

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## Water Accounting Plan (WAP)

- Allocate the appropriate volumes for each end use.
- Assess; Sourcing, Transportation, Storage, Treatment, Consumption and Disposal
  - Facilitate more informed decision making leading to improved water conservation
  - Ability to assess costs, water-related management options, and water loss
  - Reduced costs associated with water supply, handling, and management

## Aquifer Protection

- Perform aquifer pumping tests to determine optimal producing rates
  - Minimize number of water wells drilled
  - Maximize pumping efficiency
  - Preserve water quality and long-term productivity of aquifers
  - Maximize economical production of groundwater
- Consider exploring for saline aquifers as sources of makeup water for drilling and completion fluids

# Best Practices To Reduce Environmental Impact

## Water Storage

- Tanks instead of ponds Less evaporation
  - Less liner damage & leaks
  - Easy to reconstruct
  - Centralized water supply areas
- Use of covers





# Best Practices To Reduce Environmental Impact

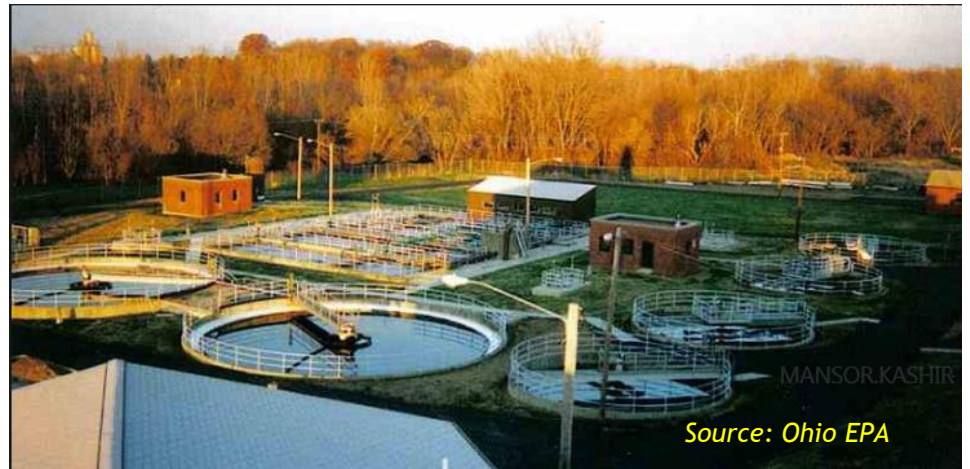
## Water Transportation

- Pipelines instead of trucking
- Type of material to use
  - Durability, resistance
  - Less Labor intensive
  - Longevity
  - Fewer leaks



# Best Practices To Reduce Environmental Impact

- Recycled/reuse produced water
  - On site fracking water
  - High saline groundwater water
- Alternatives to groundwater
  - Sea water
  - Municipal wastewater treatment



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# *Questions*

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*Thank you*

# Unconventional versus Conventional Resources

