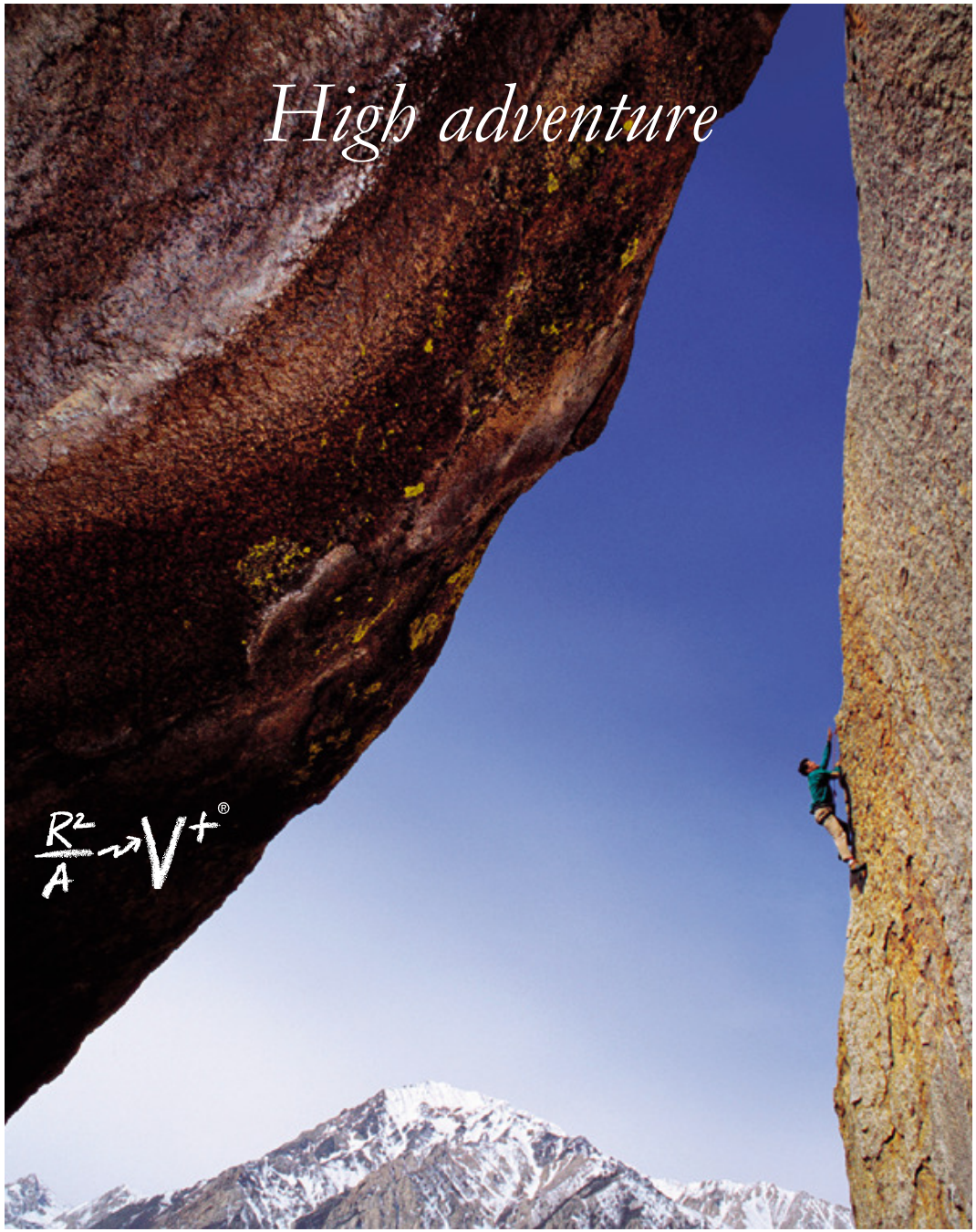

Southwestern Energy®

Evolving Environmental and Social Issue in Drilling and Completion Operations in Unconventional Resources

Washington D.C
January 25, 2011

James Bolander
Vice President of Health, Safety and Environmental

Finding Balance – The Paradigm Shift

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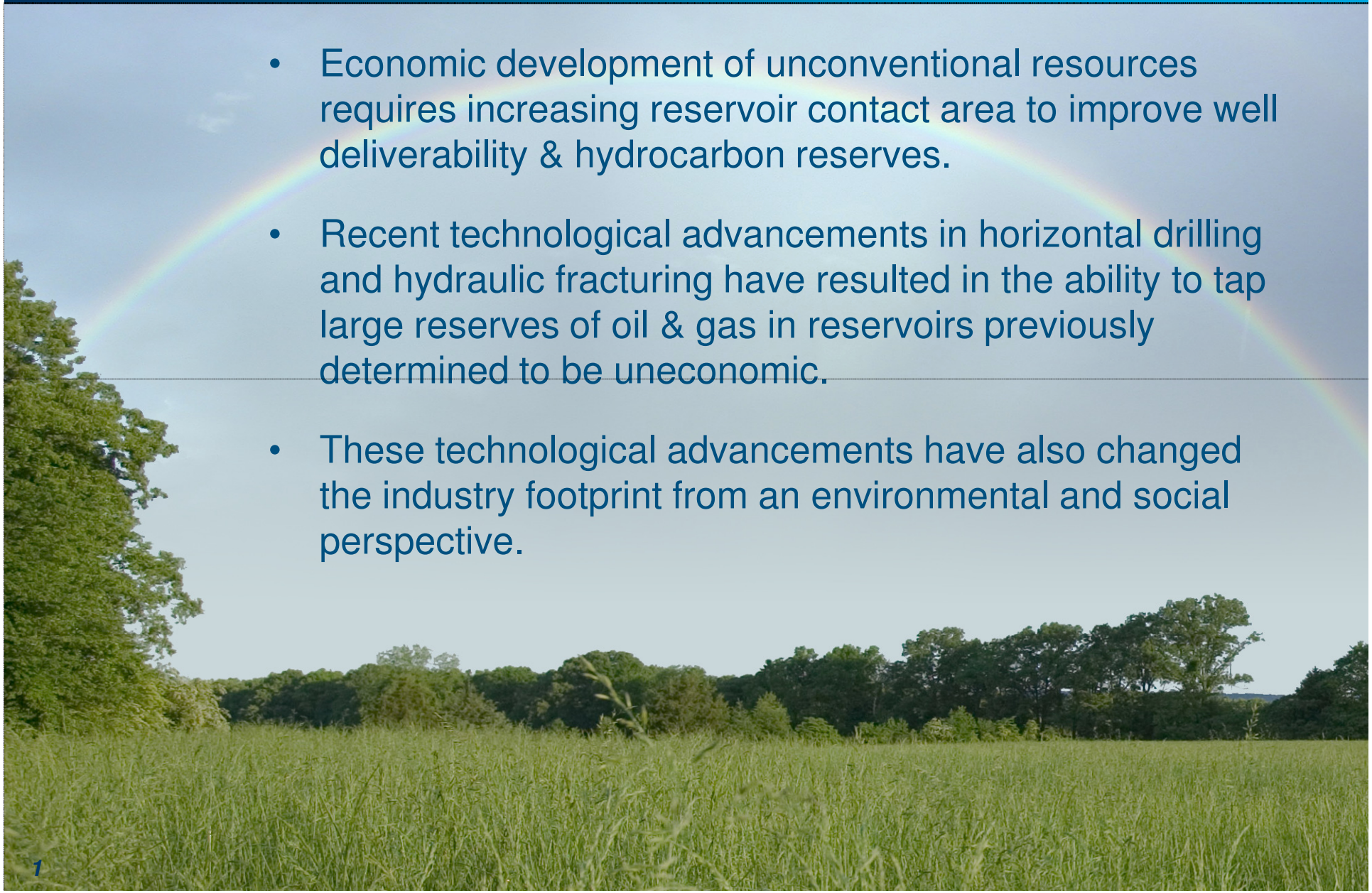
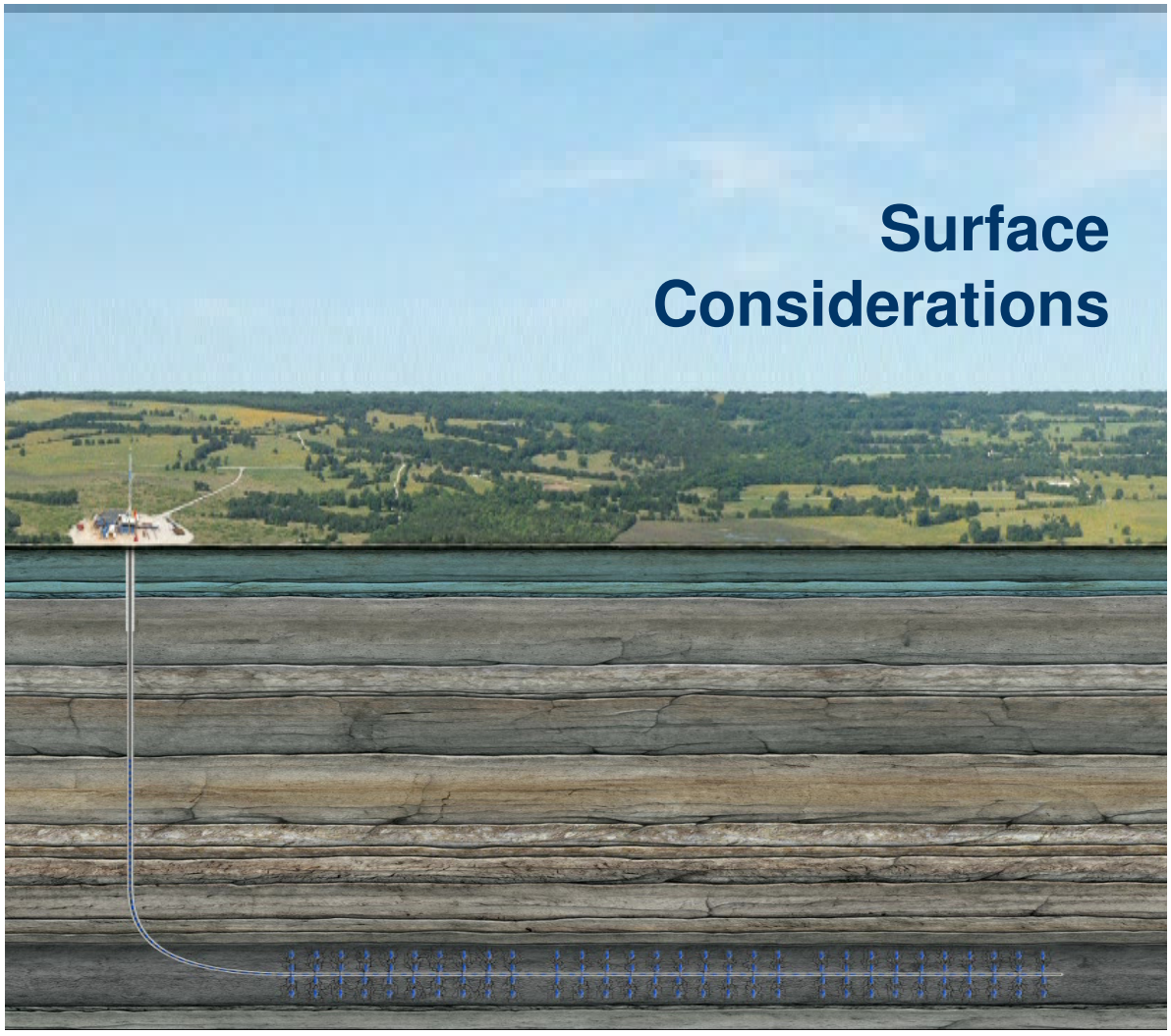


- Economic development of unconventional resources requires increasing reservoir contact area to improve well deliverability & hydrocarbon reserves.
- Recent technological advancements in horizontal drilling and hydraulic fracturing have resulted in the ability to tap large reserves of oil & gas in reservoirs previously determined to be uneconomic.
- These technological advancements have also changed the industry footprint from an environmental and social perspective.

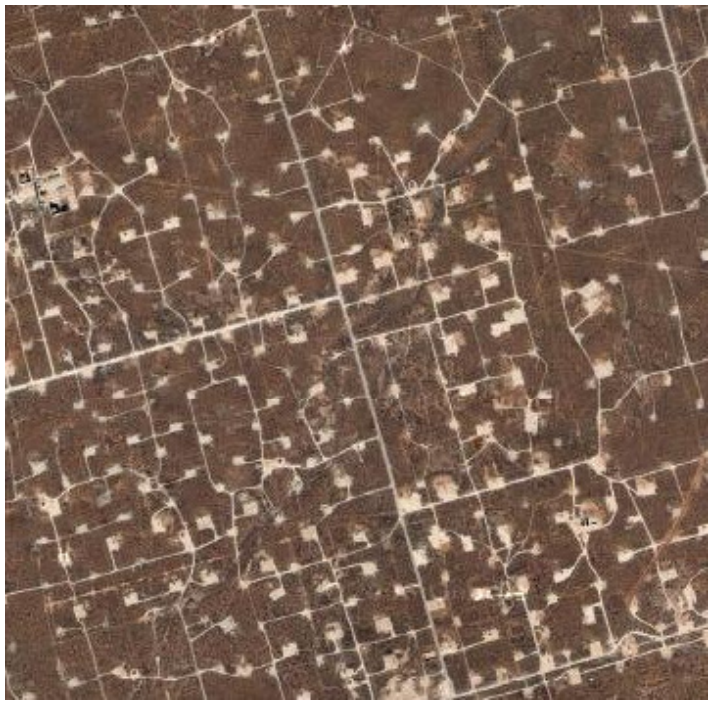
Drilling and Production Operations



- ***Focus on Surface Operations:***
- **Surface Impact**
  - **Drilling Locations (Pit Construction; Chemical Storage; Erosion Control)**
  - **Infrastructure (Roads; Compressors; Pipelines; Water Treatment Facilities)**
  - **Truck Traffic and Road Damage**
- **Water Handling, Supply and Disposal**
- **Air Emissions**

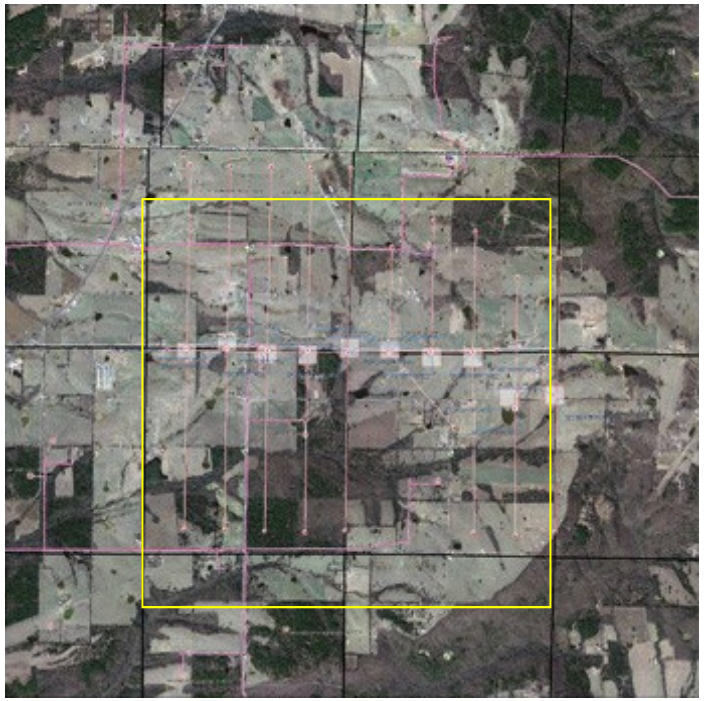
Surface Impact

Vertical Development, Single Pads



- 10 to 40 Acre Spacing
- Minimum 16 pads per section
- Potentially 64 pads per section
- **80 acres of affected surface area (12.5%)**

Hz Development, Shared Pads



- 2 – 6 wells drilled from each pad
- 11 pads to develop 4 sections
- < 3 pads average per section
- **~13 acres of affected surface area (2%)**

Surface Impact

- The use of horizontal drilling has resulted in the need for fewer wells and well pads.
  - 84% overall reduction in surface acreage footprint
  - 65% reduction in truck traffic during drilling operations as per Arkansas State Highway and Transportation Department

Well Site Management

- Soil stabilization and restoration
  - Development of Best Management Practices for stabilization
  - Re-seeding with grasses and other vegetation to restore well pad sites to near original condition

Drilling Technologies

- *What technologies have allowed for the economic success of horizontal drilling??*

- Target Resolution
  - 3D seismic
  - Core & log analysis
  - Geosteering

- Specific Drilling Practices
  - Mud systems
  - Bit technology
  - Hole cleaning
  - Hole size
  - Real-time directional data

Completion Technologies

- *What technologies have allowed for the economic success of horizontal completions??*
- Core and Log Analysis
- Microseismic
- 3D/2D seismic
- Hydraulic Fracturing Design
  - Slickwater & Hybrid designs to create complex fracture system
- Water Sourcing & Recycling
- Reduced emission or “green” completions

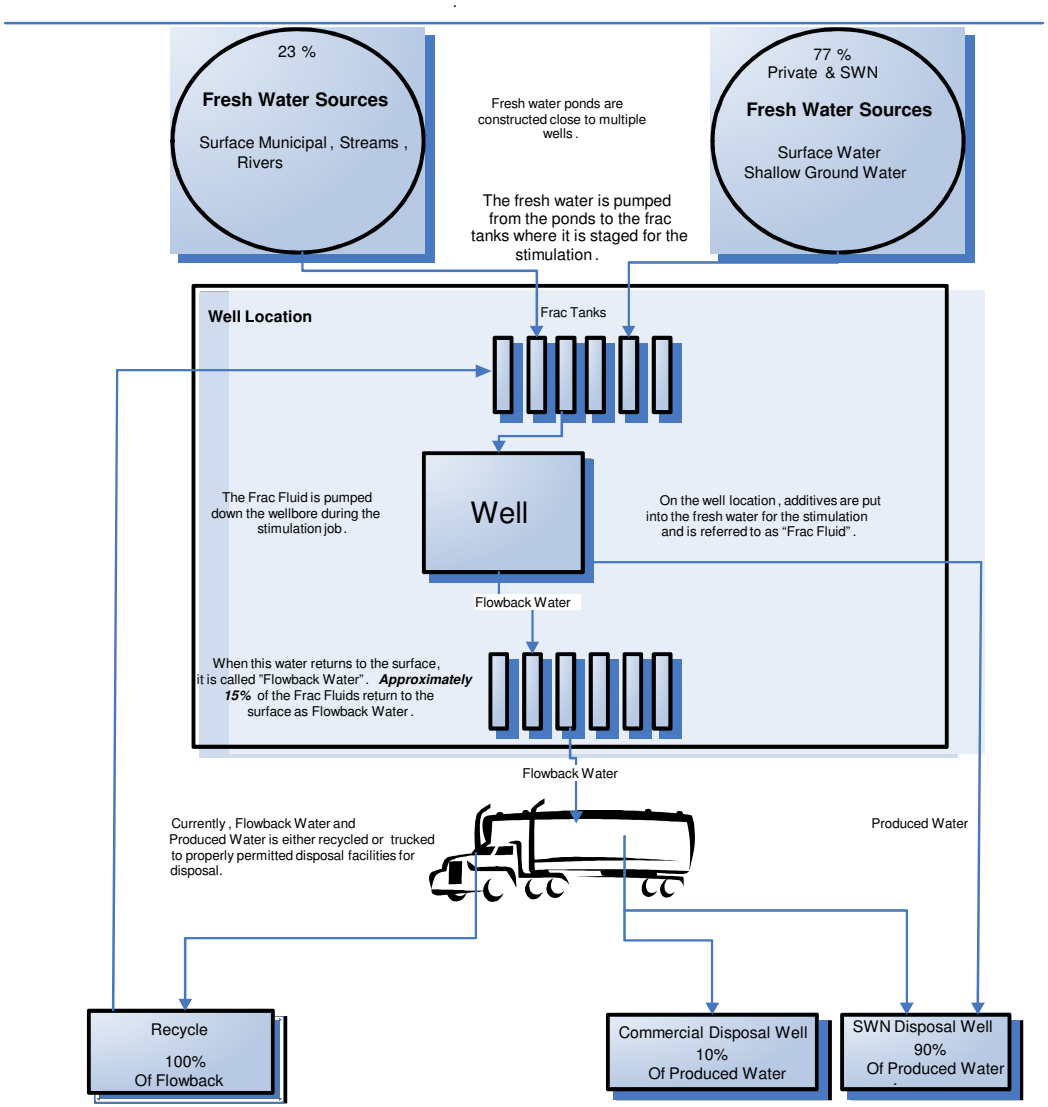
Water Sourcing Pond - Example

Water Management

Prudent water management includes

- Sourcing water – local and sustainable
- Transporting water – minimize and type
- Reusing water – maximize
- Disposing of water – minimize

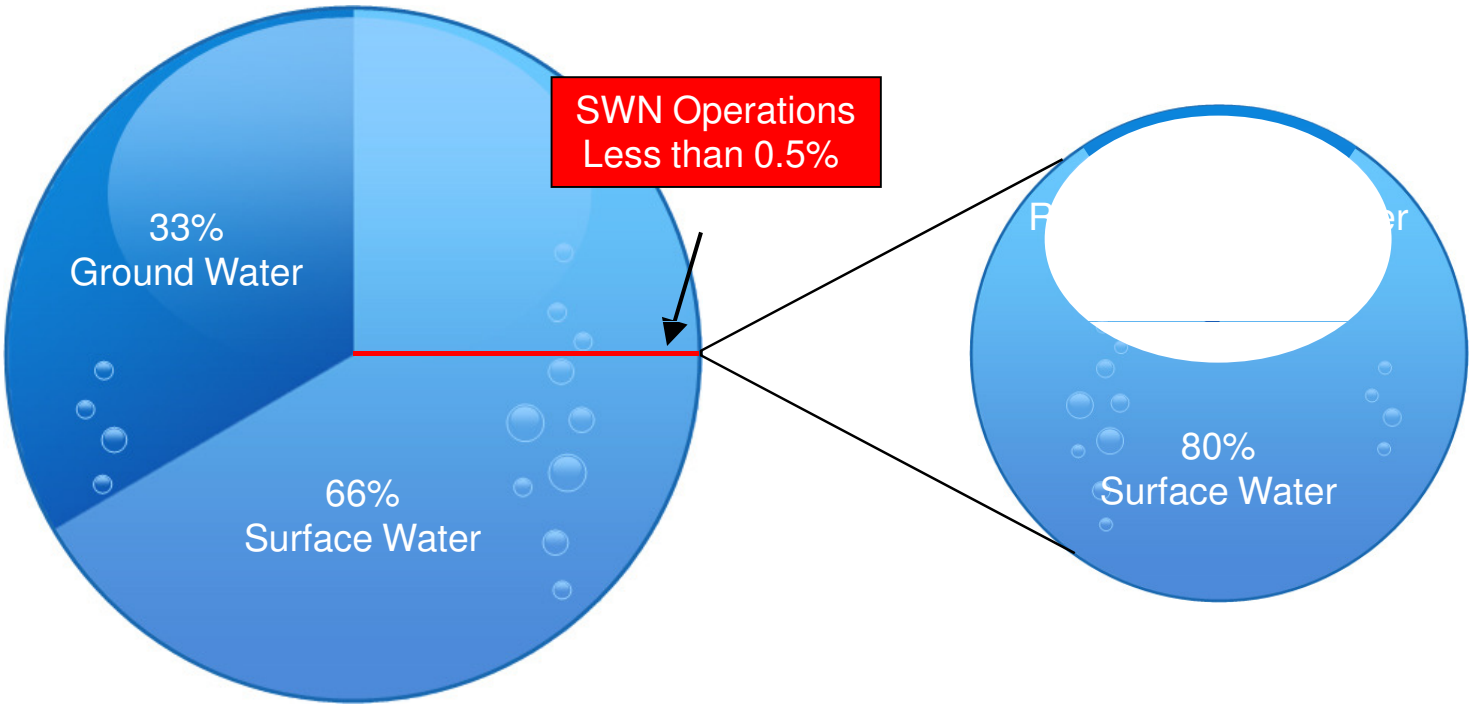
Water Cycle Diagram



Water Demand: Perspective

Statewide:
11,500 million gallons/day

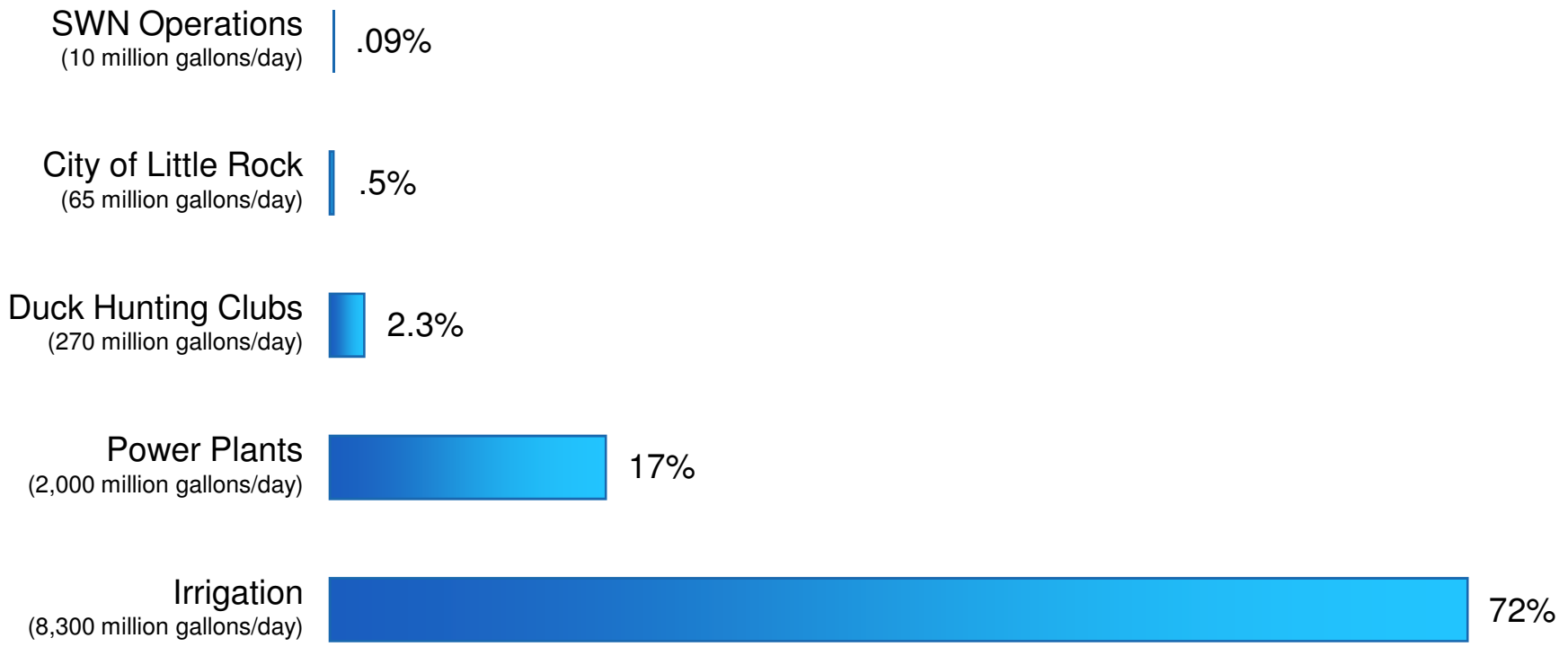
SWN Operations:
10 million gallons/day (600 Wells/year)



Source: U.S. Geological Survey, Central Arkansas Water, Southwestern Energy estimates.

Daily Water Demand

Percent of Arkansas Statewide Water Consumption (not all categories included)



Total Statewide Consumption: 11,500 million gallons per day

Source: U.S. Geological Survey, Central Arkansas Water, Southwestern Energy estimates.

Water Supply: SWN Ponds

Water Transfer Operations from Pond to Stimulation Job

- Use of ponds has significantly reduced transportation
  - Typical well uses ~120,000 bbls (~920 trucks)
  - Transfer operations have reduced transportation by 80 -90%

Water Management
Treatment for Recycling Water

- Recycling accounts for approximately 20% of water used in hydraulic fracturing treatment.
  - Methods to utilize flowback water (FBW) include blending with freshwater on location and treatment

- SWN FBW Pilot Test
  - Treated FBW to eliminate bacteria
  - Treated FBW to reduce scaling tendencies
  - Treated FBW for clarification

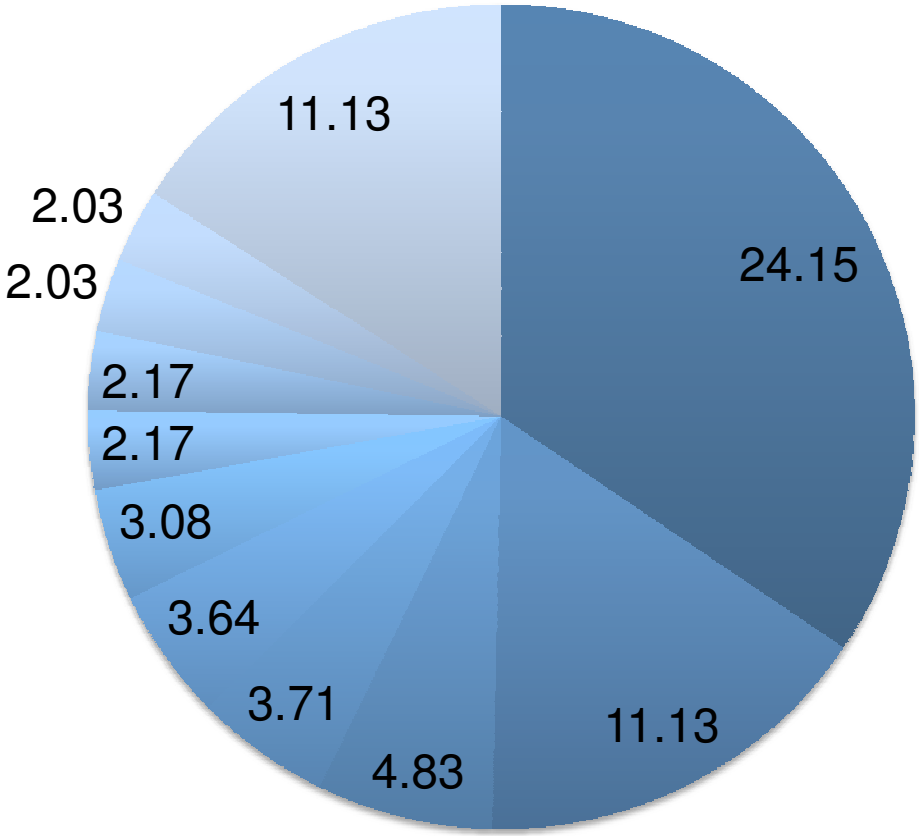
EPA Natural Gas STAR Program

- A voluntary alliance with EPA designed to reduce Greenhouse Gas (GHG) emissions
  - **Reduces emissions through technology, operating equipment and Best Management Practices**

http://www.epa.gov/gasstar/

Production Sector Emissions Reductions

2009 - 70 BCF Reductions



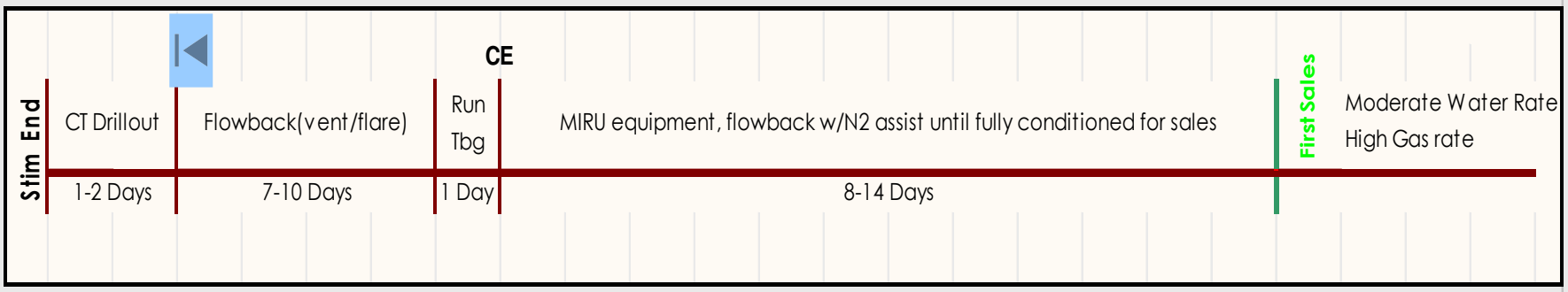
- Green Completions
- Plunger Lifts
- Replace Pneumatics
- Smart Lifts
- Foaming Agents
- Vapor Recovery
- Air Systems
- Artificial Lifts
- Solar Pumps
- Flash Tanks
- Other

Air Emissions

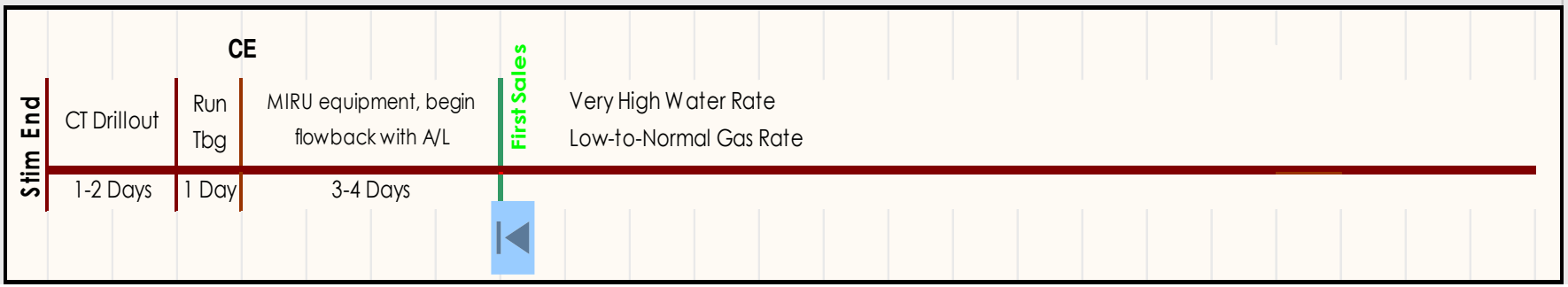
- Primary technology used in O&G to reduce emissions has been the use of “reduced emission completions”.
- Reduced emission completions involves the reduction of vented gas during the completion flowback phase of the well drilling and completion cycle.
  - Equipment is installed on the well that allows for separation of gas, liquids and solids. Gas is placed into the sales system and liquids and solids are captured and disposed at state permitted facilities.
- Reduced emission completions in 2009 resulted in a reduction of 24 BCF of methane emissions
  - SWN reported 1.87 BCF for 2009 due to reduced emission completions (71.4% of total reductions for year)

Flowback Timeline: Various Methods (after stim end)

Conventional (Old) Method (estimated 16 mmcf vented)



Gas Capture Method (little or no gas vented)

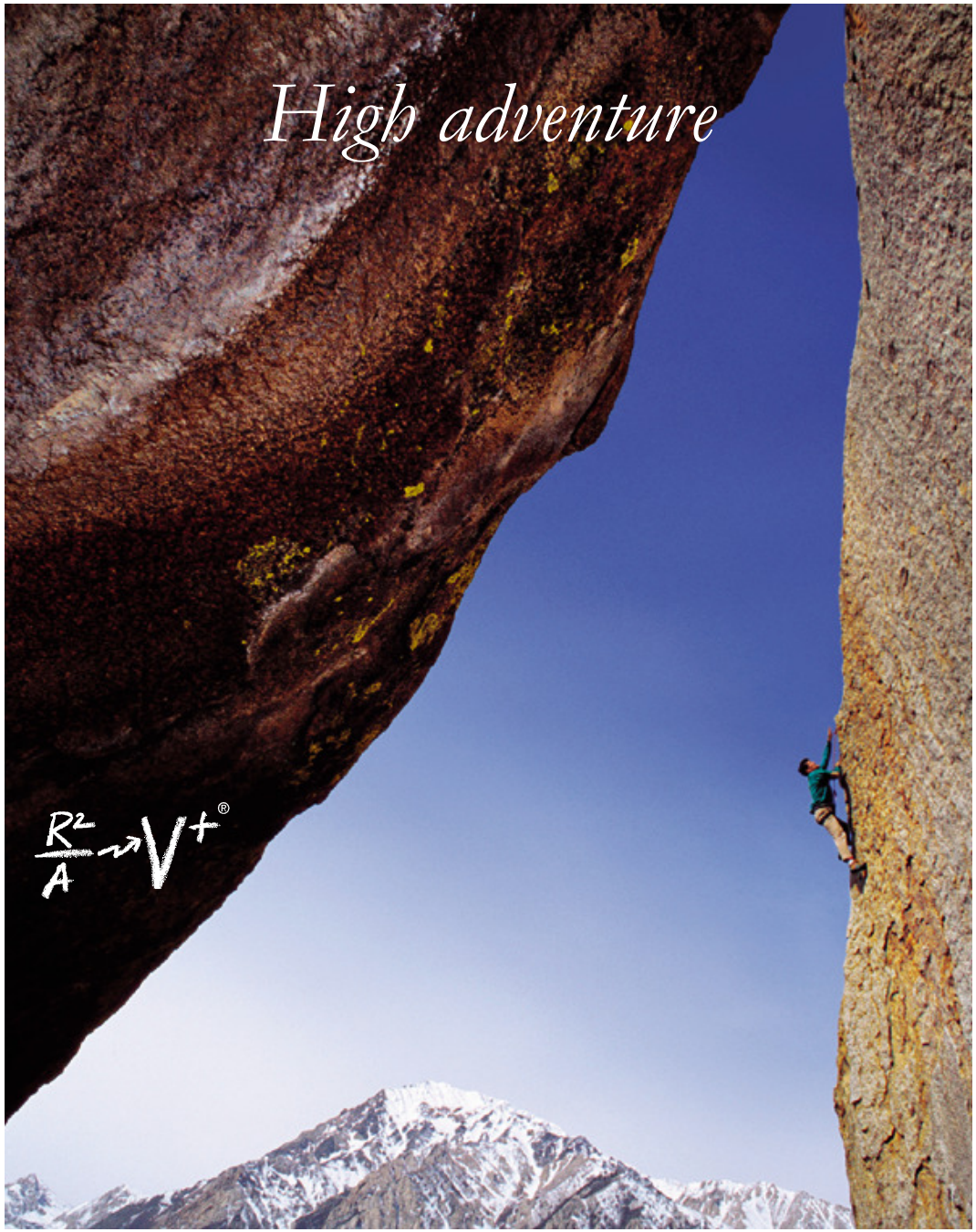


= Start of flowback

Lessons to be Applied Everywhere

Right People doing the Right Things

- Stay disciplined, focused and optimize both surface and subsurface operations
- Out-of-the-box thinking
- Capture value throughout the entire wells development process



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