NRC's New Generic Environmental Impact Statement and Its Impacts on In Situ Leach Facility Licensing

Prepared for the 2009 NMA/NRC Conference

Prepared by Thompson & Simmons, PLLC:

Christopher S. Pugsley, Esq. (Presenter)

INTRODUCTION

- **The Nuclear Regulatory Commission (NRC) Indicated the Generic Environmental Impact Statement (GEIS) for In Situ Leach Facilities is Needed Due to a Number of Agency Challenges:**
  - **Large Number of Proposed Applications (Approximately 30) by 2012;**
  - **Limited Agency Human and Financial Resources;**
  - **Need for Site-Specific Environmental Impact Statements (EISs) for New Facility Licensing Under 10 CFR Part 51**

INTRODUCTION

- **NRC Conducted an Open Scoping Process on the Proposed GEIS:**
  - **Three Public Scoping Meetings (Casper, Wyoming, Albuquerque, New Mexico, Gallup, New Mexico)**
- **NRC Received Public Comment From Several Sources:**
  - **Public Scoping Meetings;**
  - **Regulatory Agencies;**
  - **Industry Groups;**
  - **Interested Stakeholders**

INTRODUCTION

- **In July of 2008, NRC Issued Its Draft Generic Environmental Impact Statement for In Situ Leach (ISL) Facilities (NUREG-1910) for Public Comment;**

- **Comments Were Submitted to NRC From a Number of Interested Stakeholders:**

  - **Eight (8) Public Comment Meetings;**
  - **Federal Agencies;**
  - **States and State Agencies;**
  - **Industry Members and Groups;**
  - **Members of the Public**

INTRODUCTION

- **Availability of NUREG-1910 Now Provides NRC Staff With Regulatory Pathway to "Tier" Site-Specific Environmental Reviews Off NUREG-1910 Analyses and Conclusions:**
  - National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) Regulations Allow "Tiering";
  - Provides Additional Efficiencies in the New Facility Licensing Process;
  - Provides License Applicants and Licensees With Guidance on Preparing Environmental Reports (ERs):
    - License Applicants and Licensees Should Reference NUREG-1910 Where Appropriate to Facilitate Timely Review

INTRODUCTION

- **On June 4, 2009, NRC Issued Its Final Version of NUREG-1910 Including:**
  - **Purpose and Need for the Proposed Action;**
  - **ISL Uranium Recovery and Alternatives;**
  - **Description of Affected Environment (Four Regions);**
  - **Potential Environmental Impacts;**
  - **Cumulative Effects;**
  - **Environmental Justice;**
  - **Mitigation Measures;**
  - **Environmental Monitoring;**
  - **Consultations and Summary**

INTRODUCTION

- **The Final NUREG-1910 Included Additional Information in its Appendices**:
  - Scoping Summary Report;
  - Potentially Applicable Statutes and Regulations;
  - Conventional Uranium Milling Technologies;
  - Cultural and Historical Resource Management;
  - Hazardous Chemicals;
  - Cumulative Effect Review;
  - ***Response to Public Comments***

NUREG-1910: RESPONSE TO COMMENTS

- **A Number of Important Regulatory/Policy Considerations Are Found in The Response to Comments:**
  - **ISL Site Development is "Phased & Iterative";**
  - **Regional Analysis Can Be Applied to Other Geographic Locations;**
  - **Clarification of Regulatory Requirements;**
    - **Wellfield Collection Data For License Applications v. Post-License Issuance;**
    - **Excursion Detection Requirements**
  - **Conformance of GEIS Terms to the GEIS Glossary;**
  - **Recognition of Aquifer Exemptions, Restoration Requirements and Associated Safeguards as Effective Means to Protect Adjacent, Non-Exempt Aquifers**

NUREG-1910: RESPONSE TO COMMENTS

- **Several Critical Points Made by NMA Were Not Added or Revised by NRC**:
  - Greater Description of Performance-Based Licensing and License Conditions;
  - Acknowledgment That 10 CFR Part 40, Appendix A, Criterion 5B Does Not Apply to ISL as a Matter of Law;
  - Re-Evaluation of “Toll Milling” of Ion-Exchange (IX) Resins, Including Those From Water (Mine, Drinking, Other) Treatment Operations

NUREG-1910 DIRECT & INDIRECT IMPACTS

- **The Final NUREG-1910's Analyses & Conclusions Have Direct and Indirect Impacts on Other Licensing Processes:**
  - New Facility Licensing;
  - License Amendments & Renewals;
  - Satellite ISL Facilities;
  - Specific Exemptions for Pre-Licensing Site Construction

NUREG-1910: NEW FACILITY LICENSING

- **The Final NUREG-1910 Has Direct Impacts on New Facility Licensing:**
  - Generic/Programmatic Review of Newly Proposed Facilities;
  - Site-Specific Environmental Reviews

NUREG-1910: NEW FACILITY LICENSING

- **NUREG-1910 Continues to Offer a Generic/Programmatic Approach to ISL Facility Licensing:**
  - **CEQ & NRC Regulations Continue to Endorse "Tiering";**
  - **NRC Staff Continue to Espouse the Use of "Tiering";**
  - **Generic Regional Analyses Still Considered to Be a Source of Efficiencies in License Review Process:**
    - **Mitigate Need for "Full Blown" EISs for Each New Facility**

NUREG-1910: NEW FACILITY LICENSING

- **However, NRC Staff Has Altered the Original Approach to Environmental Reviews:**
  - **The Original Approach Was to Prepare NUREG-1910 and Then "Tier" Site-Specific Environmental Assessments (EAs) for Each New Proposed Site;**
  - **NOW, the New Approach is to "Tier" Site-Specific Supplemental Environmental Impact Statements (SEISs) for Each New Proposed Site;**
  - **Change Made to:**
    - **Address Public, NGO Concerns;**
    - **Provide Strong Legal/NEPA Basis for Environmental Reviews**

NUREG-1910: NEW FACILITY LICENSING

- **As a License Applicant, What Does This Mean for Me?:**
  - **License Review Process Will Require Additional Time:**
    - **10 CFR Part 51: Requires That the Following Be Conducted for an SEIS:**
      - **Notice of Intent to Prepare the SEIS (Mandatory);**
      - **Scoping (Discretionary) (NRC Has Determined that NUREG-1910 Negates the Need for Detailed Scoping Due to Its Elongated Scoping Process (Targeted Scoping)**

NUREG-1910: NEW FACILITY LICENSING

- **As a License Applicant, What Does This Mean for Me?:**
  - **License Review Likely Will Require Additional Financial Resources (Typically an SEIS is More Expensive Than an EA);**
  - **License Review May or May Not Be Conducted Within the Proposed Two-Year Timeframe**

NUREG-1910: LICENSE AMENDMENTS AND RENEWALS

- **Currently, the Availability of NUREG-1910 Allows NRC Staff to "Tier" Site-Specific Environmental Reviews for License Amendments and Renewals, But Questions Remain:**
  - **Which Form Will the Site-Specific Review Take?:**
    - **EA?;**
    - **SEIS?;**
    - **EIS?**

NUREG-1910: LICENSE AMENDMENTS AND RENEWALS

- **Why Should License Amendments or Renewals Default to an EA?:**
  - **Prior NRC Practice Was to Start With an EA and Determine if a Finding of No Significant Impact (FONSI) Was Appropriate (NUREG-1748);**
  - **10 CFR Part 51 Does Not Require an EIS for a License Amendment or Renewal:**
    - **("(b) The following types of actions require an environmental impact statement or a supplement to an environmental impact statement: (8) Issuance of a license to possess and use source material for uranium milling or production of uranium hexafluoride pursuant to part 40 of this chapter.");**
  - **Amendment or Renewal Applications Typically Do Not Involve Nearly as Much Site-Specific Analysis as a New Facility License**

NUREG-1910: SATELLITE ISL FACILITIES

- NRC Also Has Raised Potential Shifts in Licensing Policy for Satellite ISL Wellfields/Facilities;

- Policy Question: Do Satellite Wellfields Require a New License or a License Amendment to an Existing License?

NUREG-1910: SATELLITE ISL FACILITIES

- **While NRC Has Not Rendered a Policy Decision on the Parameters for Whether a License or License Amendment is Required, That Decision Has Important Implications for Environmental Reviews:**
  - **New *Licenses* Trigger the 10 CFR Part 51 Requirement for an EIS; Unclear Based on New Facility License Requirement for SEISs Whether Satellites Will Require an SEIS;**
  - **Satellite ISL Wellfields Typically Do Not Involve a Significant Amount of Site-Specific Analyses:**
    - **No Central Processing Plant;**
    - **Few, if Any, Administrative/Process Structures;**
    - **Minor Need for Radiological Dose Assessments Due to Limited Facilities**

NUREG-1910: SATELLITE ISL FACILITIES

- **Question: Why Should Satellite ISL Wellfields or Facilities Default to an EA?:**

- **Answer: Use NUREG-1910 Analyses and Conclusions to Default to an EA:**

  - **If a New License is Implicated, NUREG-1910 Should Mitigate Need for an SEIS and Conform to NRC's Original Environmental Review Approach of a "Tiered" EA;**
  - **If a License Amendment is Implicated, No Part 51 Requirement for an EIS and, Thus, an EA with NUREG-1910 Should Be More Than Sufficient**

CONCLUSIONS

- **The NUREG-1910 Development Process Has Resulted in Significant Changes to the License Application Review Process:**
  - **Started with Proposed "Tiered" Environmental Assessments (EA;**
  - **Now, Final Review Process Implicates SEISs Adding Time and Cost to the License Review Process**
- **New Review Processes Implicate Potential Use of New Site Construction Approaches;**
- **Next 12-18 Months Will Result in Important Re-Shaping of the Uranium Recovery Industry**

EPA Update: NESHAP Uranium Activities

Reid J. Rosnick
Environmental Protection Agency
Radiation Protection Division (6608J)
Washington, DC 20460

NMA/NRC Uranium Recovery Workshop
July 2, 2009

Overview

- General requirements applicable to Subpart B and Subpart W
- EPA regulatory requirements for underground uranium mining operations (Subpart B)
- EPA regulatory requirements for operating uranium mill tailings (Subpart W)
- Status update on Subpart W activities
- Some Conclusions

General Requirements Applicable to Subpart B and Subpart W

- Subpart B and W facilities are subject to the general requirements of 40 CFR 61.01 - .19
  - Approval to operate
  - Application for construction and modification
  - Notification of startup
  - Compliance with monitoring/maintenance requirements
- Subpart W facilities are subject to the design and ground-water requirements of 40 CFR 192.32(a)

EPA Regulatory Requirements for Underground Uranium Mining Operations (Subpart B)

EPA Regulatory Requirements for Underground Uranium Mining (Clean Air Act)

- 40 CFR 61.20, Subpart B regulations limiting radon emissions from underground uranium mines include:
  - Applies to 10,000 tons/yr ore production, or 100,000 tons/mine lifetime
  - Ambient air radon standard not to exceed 10 mrem/yr to any member of the public-compliance determined with COMPLY-R, or equivalent, approved code
  - Annual reporting requirements – by 3/31 each year, emissions calculations for the year, monthly if not in compliance
  - Record keeping requirements: Five years

EPA Regulatory Requirements for Operating Uranium Mill Tailings (Subpart W)

EPA Regulatory Requirements for Operating Uranium Mill Tailings (Clean Air Act)

- 40 CFR 61 Subpart W requirements apply to facilities licensed to manage uranium byproduct materials (after 12/15/89) during and following the processing of uranium ores
  - Preconstruction approval, 40 CFR 61.07
  - Impoundment construction and operation requirements in 40 CFR 192 cross referenced in Subpart W
  - Limit on number/size of impoundments
    - Phased Disposal – lined impoundments no more than 40 acres, no more than two in operation at any time
    - Continuous Disposal – tailings are dewatered and immediately disposed, no more than 10 acres uncovered at any time

EPA Regulatory Requirements for Uranium Operations (Clean Air Act)

Subpart W Requirements (continued)

- Radon emission standard of 20 pCi/m^2/sec -- annual reporting requirements, notification in advance of testing
- The radon emission standard is for existing sources only (existing before 12/15/89)
- All operators must comply with 40 CFR 192.32(a) See http://www.epa.gov/radiation/neshaps/subpartw/index.html for more information

Status Update on Subpart W Activities

Status of Subpart W Review Activities

- Per Clean Air Act Amendments of 1990, EPA is obligated to review, and possibly revise Subpart W
- A workgroup has been established
  - Members from across the Agency
  - Represent ORIA, OGC, ORD, OSWER, OECA, OPEI, OW, Regions 6, 7, 8 and 10
  - Workplan, Communications Plan, Analytic Blueprint have been completed, basically, how are we going to approach the task

Status of Subpart W Review Activities

- We are conducting historical research on the risk assessment work originally done in support of the 1989 standard
- We have begun a survey of existing technologies
- Office of Enforcement and Compliance Assurance has sent information request letters to numerous uranium recovery facilities
- Answers better inform the workgroup of the universe of facilities, and the types of uranium recovery processes that exist
- We have also requested that ISL facilities provide radon flux data from their evaporation ponds

Status of Subpart W Review Activities

- We are researching if Method 115 continues to be current, or whether other methods could be employed for monitoring and analysis of radon flux
- We are planning to work with all stakeholders in reviewing/revising the standards
- The Agency continues to believe that conventional tailings piles, certain evaporation ponds from ISL operations, and heap leach piles, are subject to the requirements of Subpart W
- We base our decision on a review of existing regulatory language

Applicability of Subpart W (Clean Air Act)

- 40 CFR 61.250 –

"The provisions of this subpart apply to owners and operators of facilities licensed to manage uranium byproduct materials during and following the processing of uranium ores, commonly referred to as uranium mills and their associated tailings. This subpart does not apply to the disposal of tailings."

Subpart W Definition of Uranium Byproduct Material

- 40 CFR 61.251 (g) –

"*Uranium byproduct material or tailings* means the waste produced by the extraction or concentration of uranium from any ore processed primarily for its source material content. Ore bodies depleted by uranium solution extraction and which remain underground do not constitute byproduct material for the purposes of this subpart."

EPA Regulatory Requirements for Uranium Operations (Clean Air Act)

- What is an impoundment (per 40 CFR 192.32, which cross references 40 CFR 260.10)?
  - "…a facility or part of a facility which is a natural topographic depression, man-made excavation or diked area formed primarily of earthen materials (although it may be lined with man-made materials) which is designed to hold an accumulation of liquid wastes, or wastes containing free liquids, and which is not an injection well. Examples of impoundments are holding, storage, settling, and aeration pits, ponds and lagoons."

Some Conclusions

- We are in the process of reviewing and possibly revising Subpart W
- Owners/operators of ISL facilities that utilize evaporation ponds containing byproduct material produced by the extraction or concentration of uranium should assume you are subject to the requirements of Subpart W
- We appreciate the assistance of all stakeholders to inform and enable us to craft a protective and enforceable rule.

Questions?

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Hydrology Issues at ISR Facilities

Elise A. Striz, Ph.D.
Hydrogeologist
Uranium Recovery and Licensing Branch
US Nuclear Regulatory Commission

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Ground Water

- **Hydrogeologic Characterization (Section 2.7)**
- **ISR Processes (Section 3.1)**
- **GW Monitoring (Section 5.7.8)**
- **GW Restoration (Section 6.1)**

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Hydrogeologic Characterization

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Issues

- Surficial aquifer characterization
- Unconfined (unsaturated) aquifer characterization
- Fault characterization
- Missing confining layers

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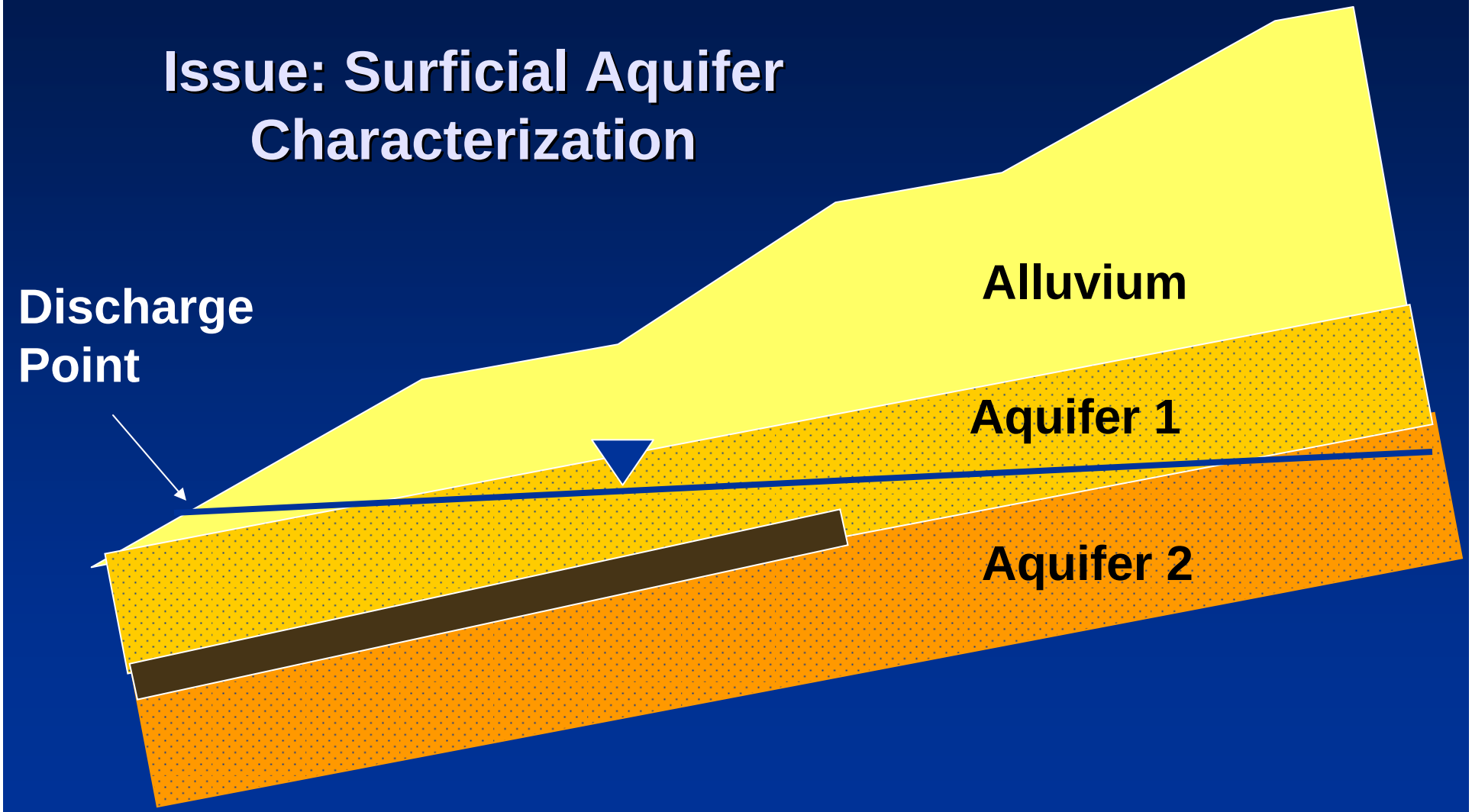
Issue: Surficial Aquifer Characterization



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Characterizing surficial aquifer

- Provide maps of depth to water below ground surface to surficial aquifer
- Indicate which formations act as the surficial aquifer
- Characterize water quality of each formation which acts as the surficial aquifer
- Include any connection of surficial aquifer to surface water such as in alluvium near drainages

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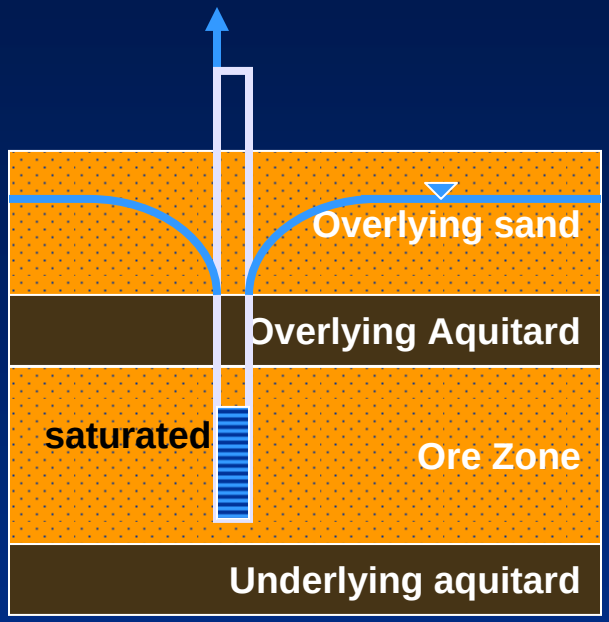
Issue: Unconfined Aquifer Characterization

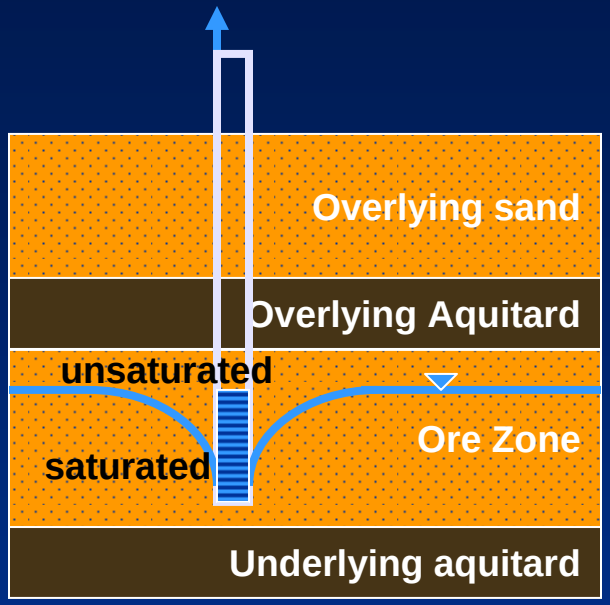
Why is an unconfined ore zone setting different from confined?

Confined aquifer: Water to meet pumping rate is released by compression of sediments and expansion of water so much larger volume of aquifer is impacted.
Produces "pressure cone of depression."

Unconfined aquifer: Water to meet pumping rate is released by dewatering so much smaller volume of aquifer is impacted.
Produces "dewatered cone of depression."

Drawdown in confined vs. unconfined aquifer





Confined drawdown equation

$$s = \frac{264Q}{T}\log\frac{0.3Tt}{r^2S}$$

Unconfined drawdown equation

$$s = \frac{264Q}{T}\log\frac{0.3Tt}{r^2S_y}$$

S=coefficient of storage

S= Sy= Specific Yield

s=drawdown (ft) Q=pumping rate (gpm) T =transmissivity (gpd/ft)

t=time (days) r=distance of observation from pumping well (ft)

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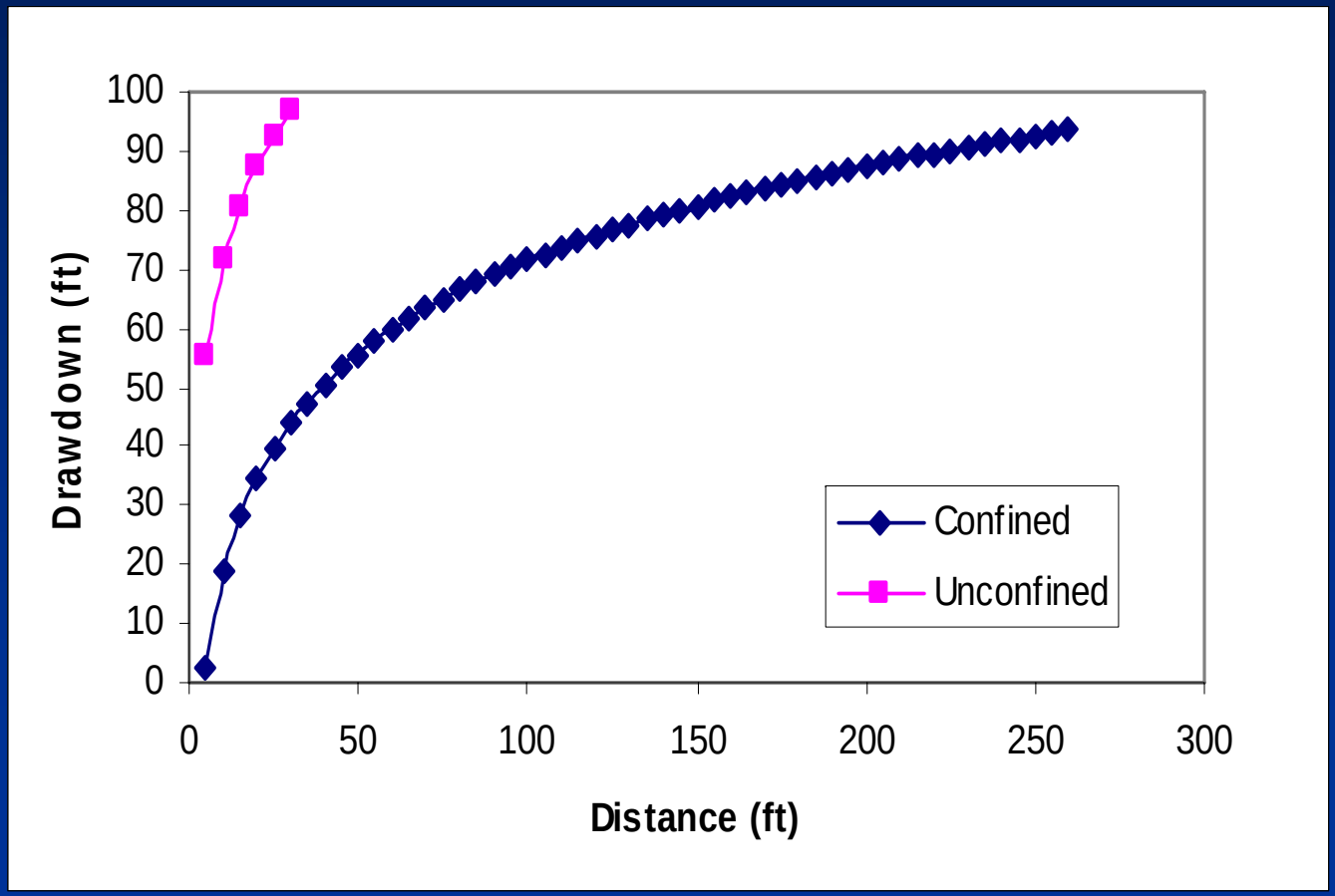
Example: Well Q=20 gpm, T=200 gpd/ft, t =1 day, S=.0005 (confined), Sy=.05 (unconfined)



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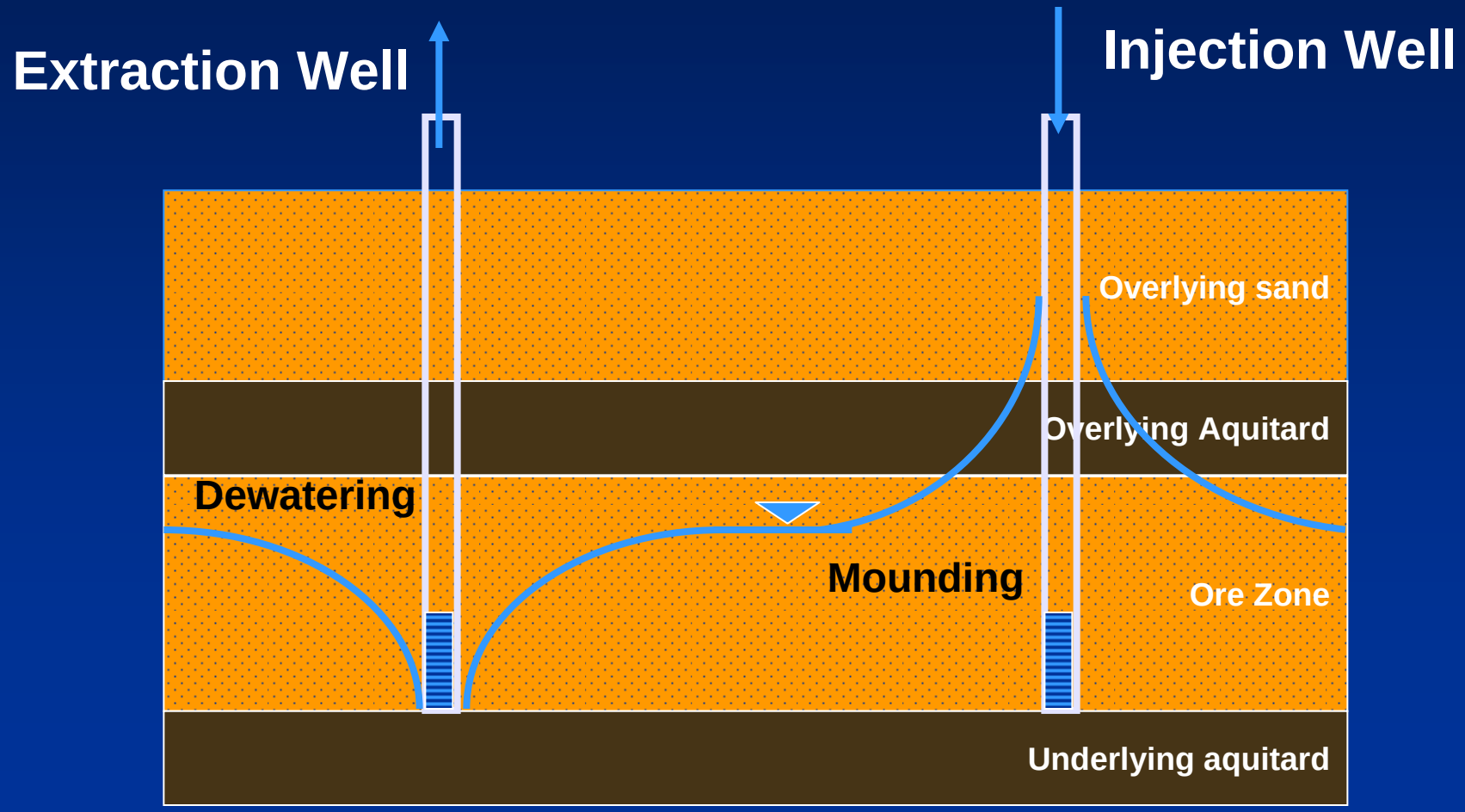
Water levels in unconfined aquifer in response to extraction/injection



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Characterizing ore zone unconfined aquifer

- **Determine water levels for ore zone aquifer and assess whether unconfined or confined**
- **Design pumping tests for appropriate conditions (unconfined: closer observation wells, longer test time)**
- **Analyze results with the appropriate methods: confined or unconfined. Calculate S for confined, Sy for unconfined**
- **Groundwater flow modeling can be very useful to predict and verify field behavior**

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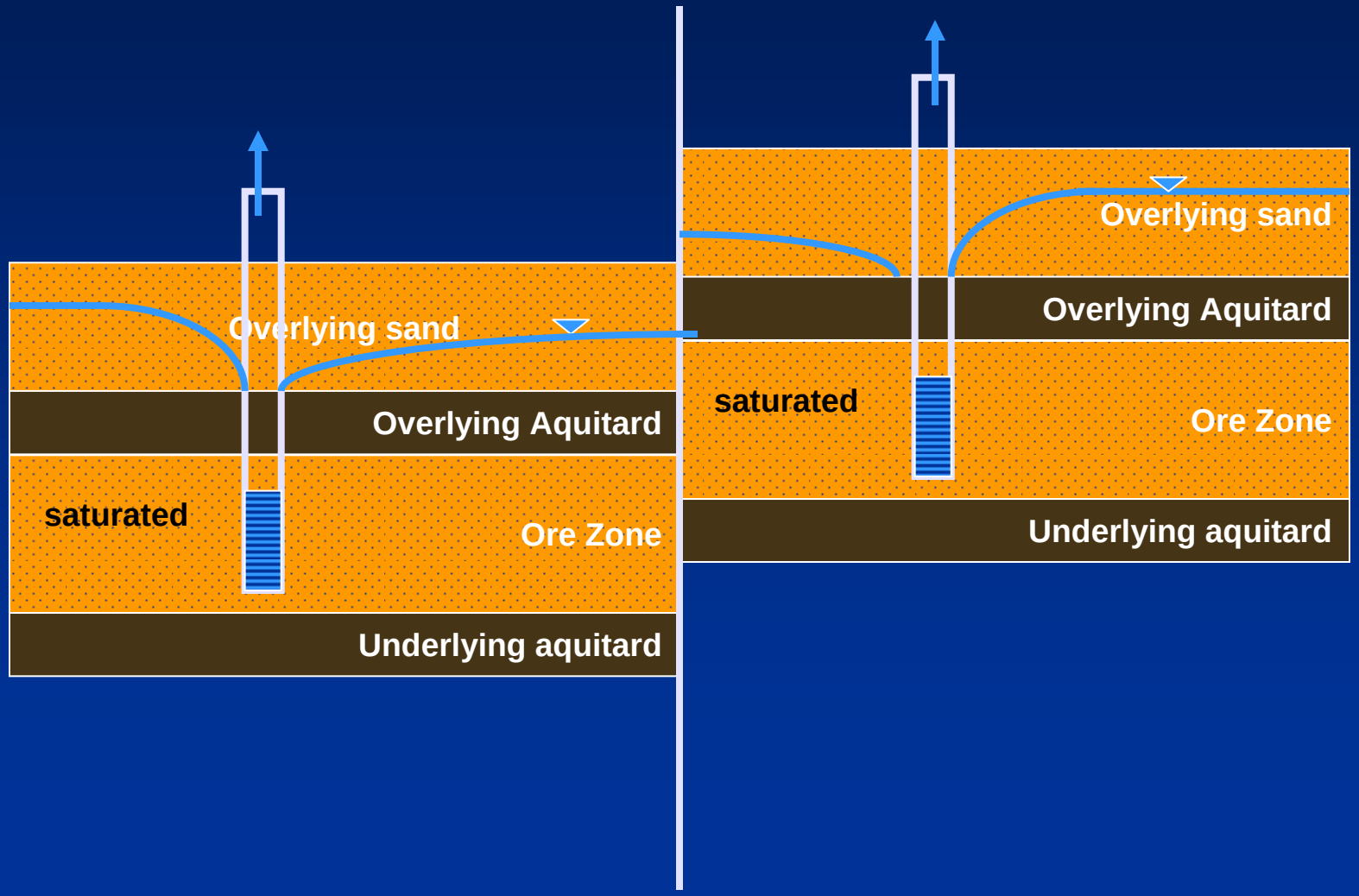
Issue: Fault Characterization



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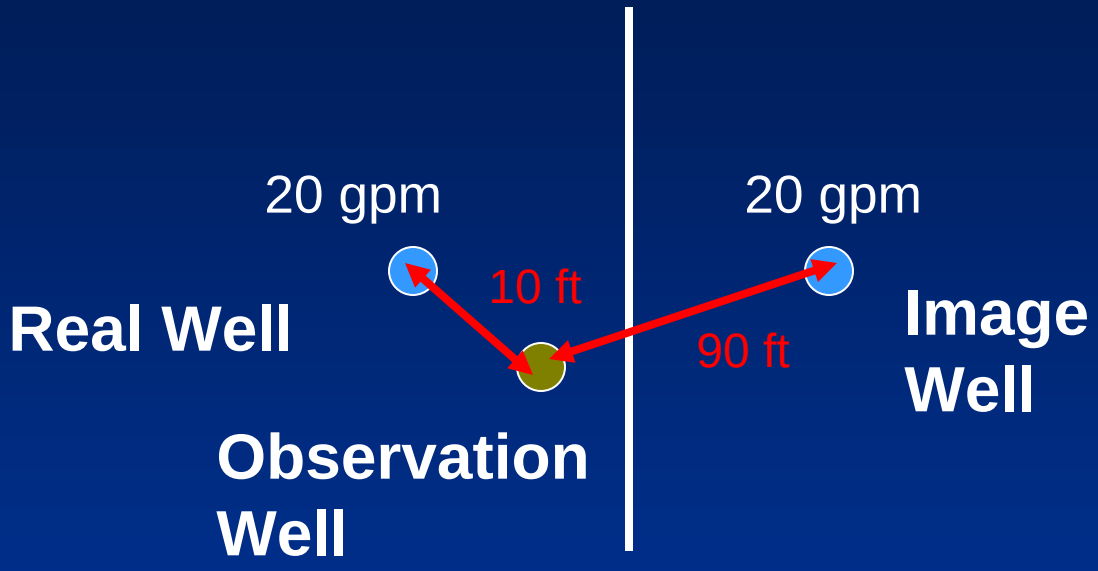
Drawdown near a Sealing Fault



Add drawdown from combined wells at observation well

$$s_T = \frac{264\ Q}{T}\log\frac{0.3Tt}{r_i^{\,2}S} + \frac{264\ Q}{T}\log\frac{0.3Tt}{r_r^{\,2}S}$$

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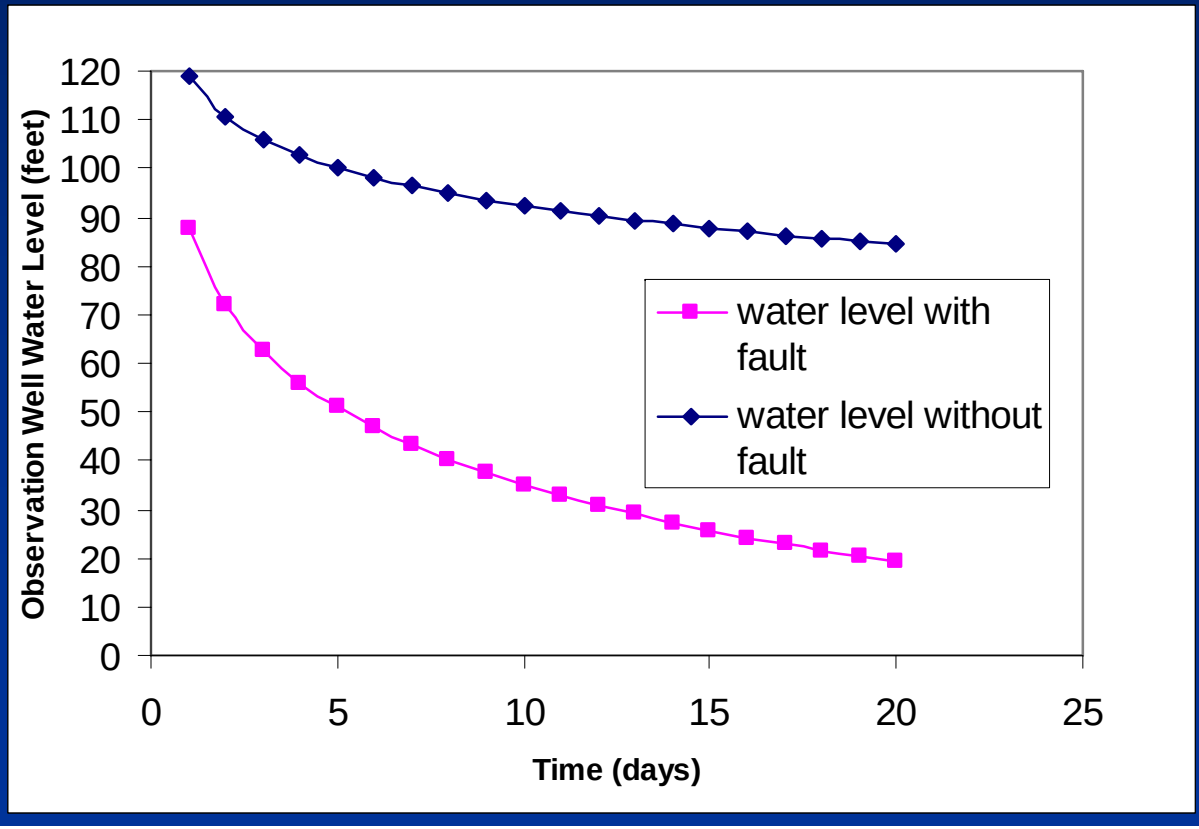
Example: Q=20 gpm, T=200 gpd/ft, t=1 day at observation well 10 ft from real well and 90 ft from image well (r_r=10 ft, r_i=90ft)

$$s_T = \frac{264(20\,gpm)}{200\,gpd/\,ft}\log\frac{0.3(200\,gpd/\,ft)(1day)}{(90\,ft)^2(.0005)} + \frac{264(200\,gpm)}{200\,gpd/\,ft}\log\frac{0.3(200\,gpd/\,ft)(1day)}{(10\,ft)^2(.0005)}$$

Image well drawdown Real well drawdown



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Characterizing Faults

- **Provide structural maps of faults and show offsets on cross sections**
- **If faults are present, design pumping tests to take into account fault behavior and analyze pumping test results with an awareness of the impact of the fault**
- **Consider using groundwater flow models to characterize and predict behavior**

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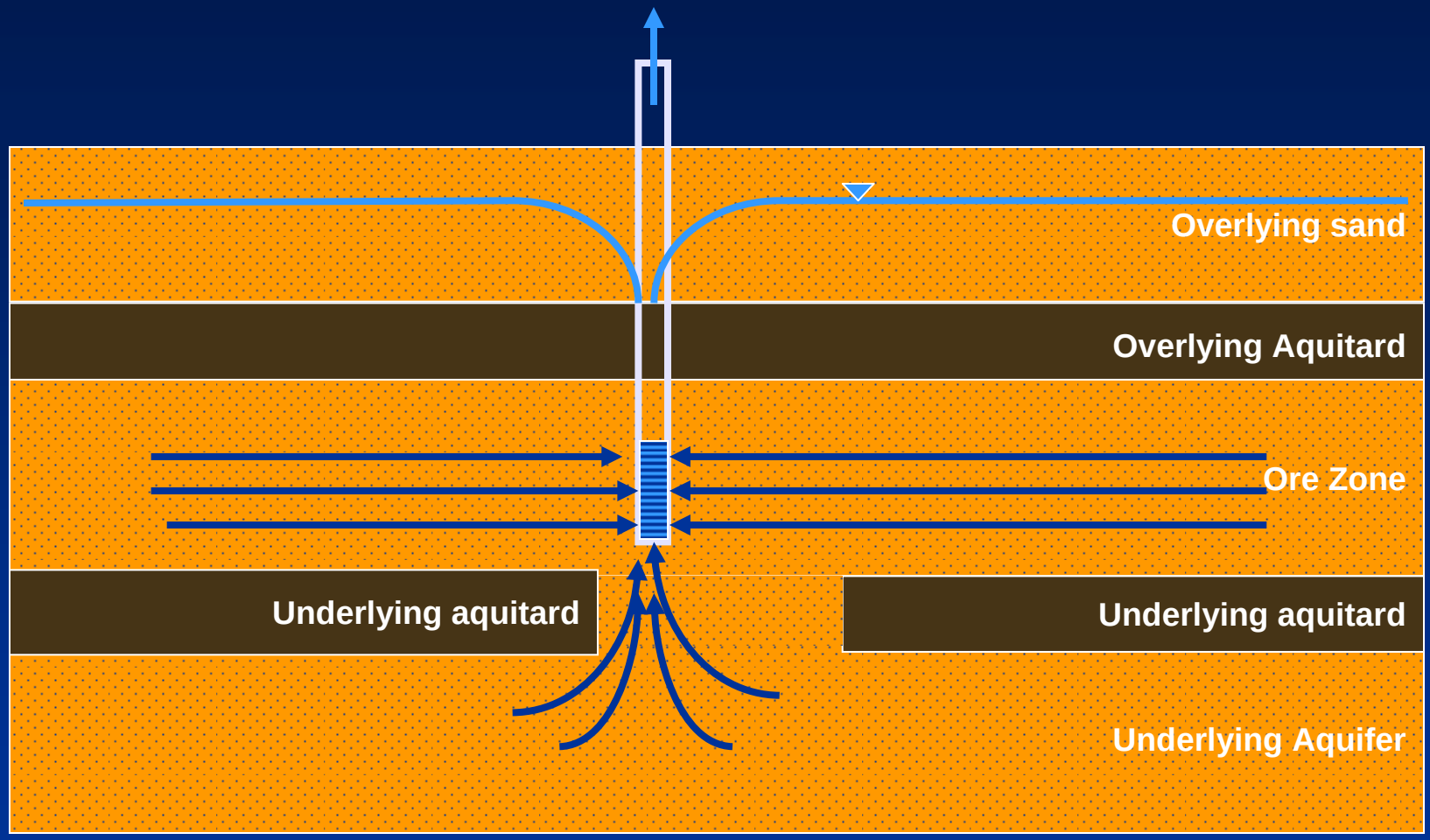
Issue: Missing confining layers



Pumping tests will show reduced drawdown as underlying aquifer provides recharge

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Characterization when confining layers are missing

- **Provide well defined isopachs of overlying aquifer, overlying aquitard, production zone aquifer, underlying aquitard using well boring logs/cores.**
- **Be aware that pumping test analysis is affected by flow from connected aquifer (s).**
- **Consider using groundwater flow models to characterize and predict behavior in these locations.**

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ISR Processes

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Issues

- **Unconfined aquifers**
- **Faults**
- **Lixiviant composition and gas lock**

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Why is the unconfined aquifer setting of concern as a safety issue?

- Extraction causes dewatering of aquifer - can limit rates
- Cone of depression has limited areal extent- demonstration of cone of depression and communication across ore zone and with monitoring well ring requires more pumping wells
- Dewatering and limited extent of cone of depression may make it more difficult to capture excursions
- Low hydrostatic head can impact dissolved oxygen solubility in ore zone and impact conductivity- “gas lock”

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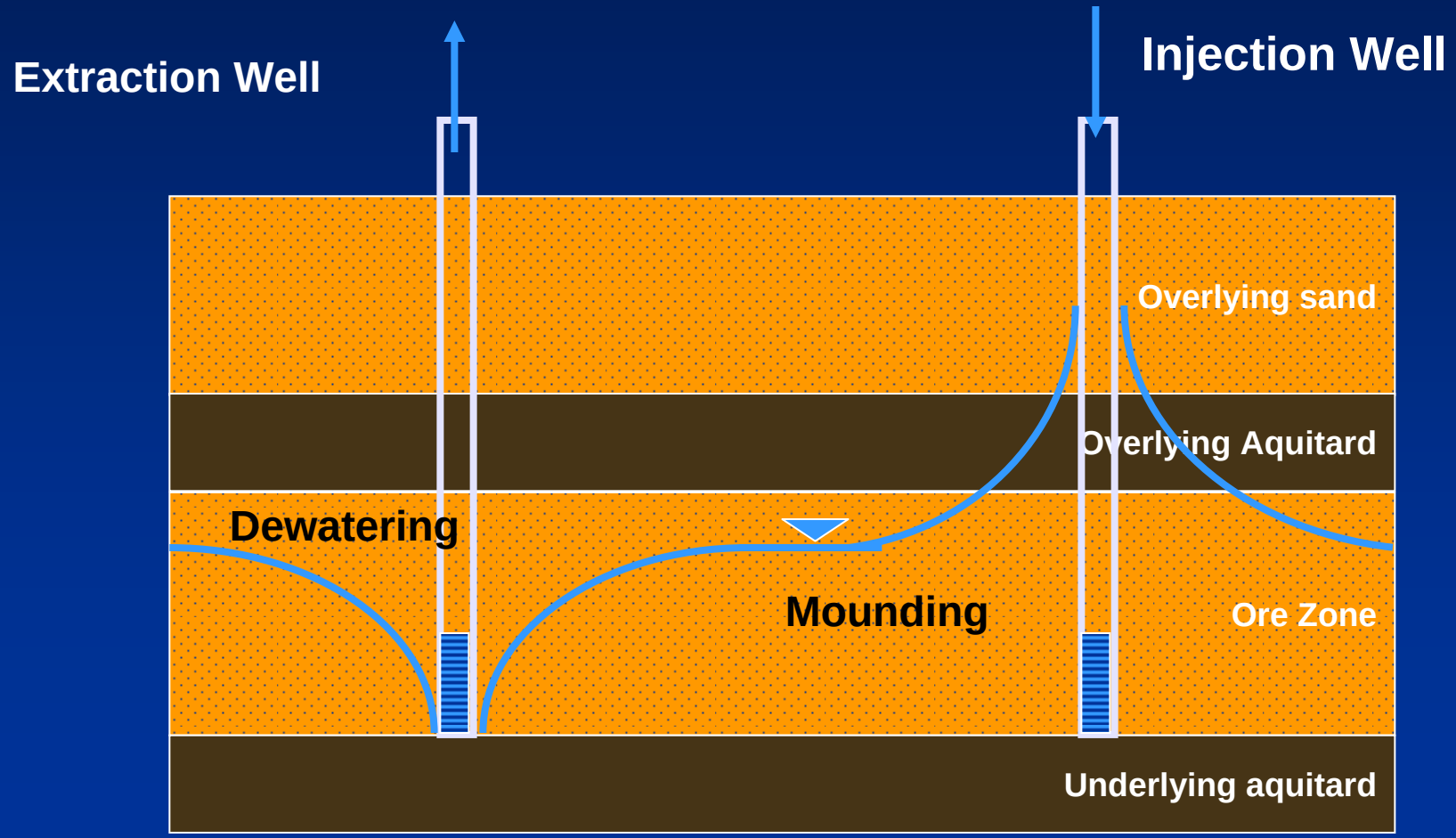
Injection/Extraction= Dewatering/Mounding
Dewatering can limit extraction rates



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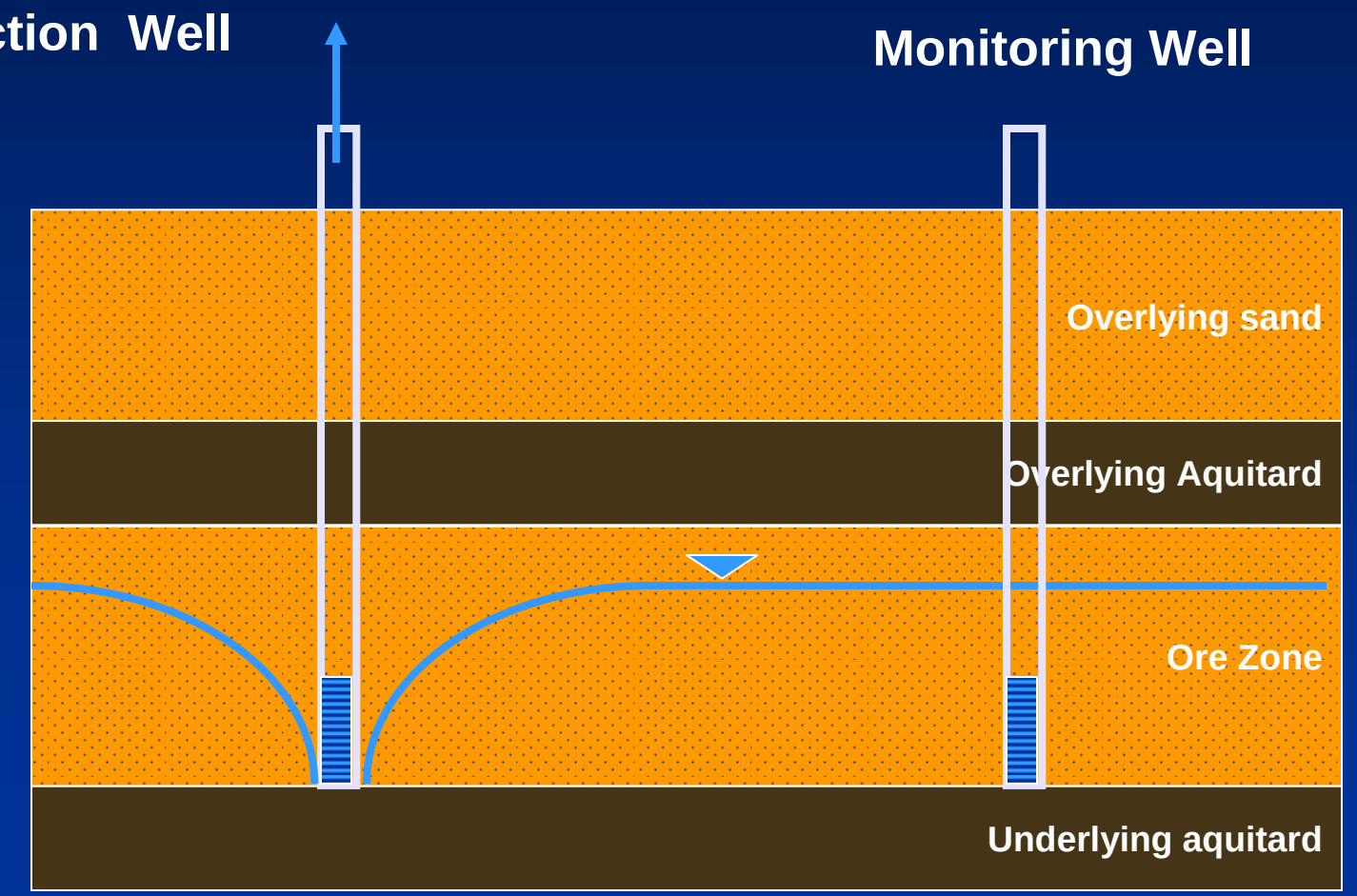
Dewatering limits areal extent of drawdown- impacts cone of depression inward gradient



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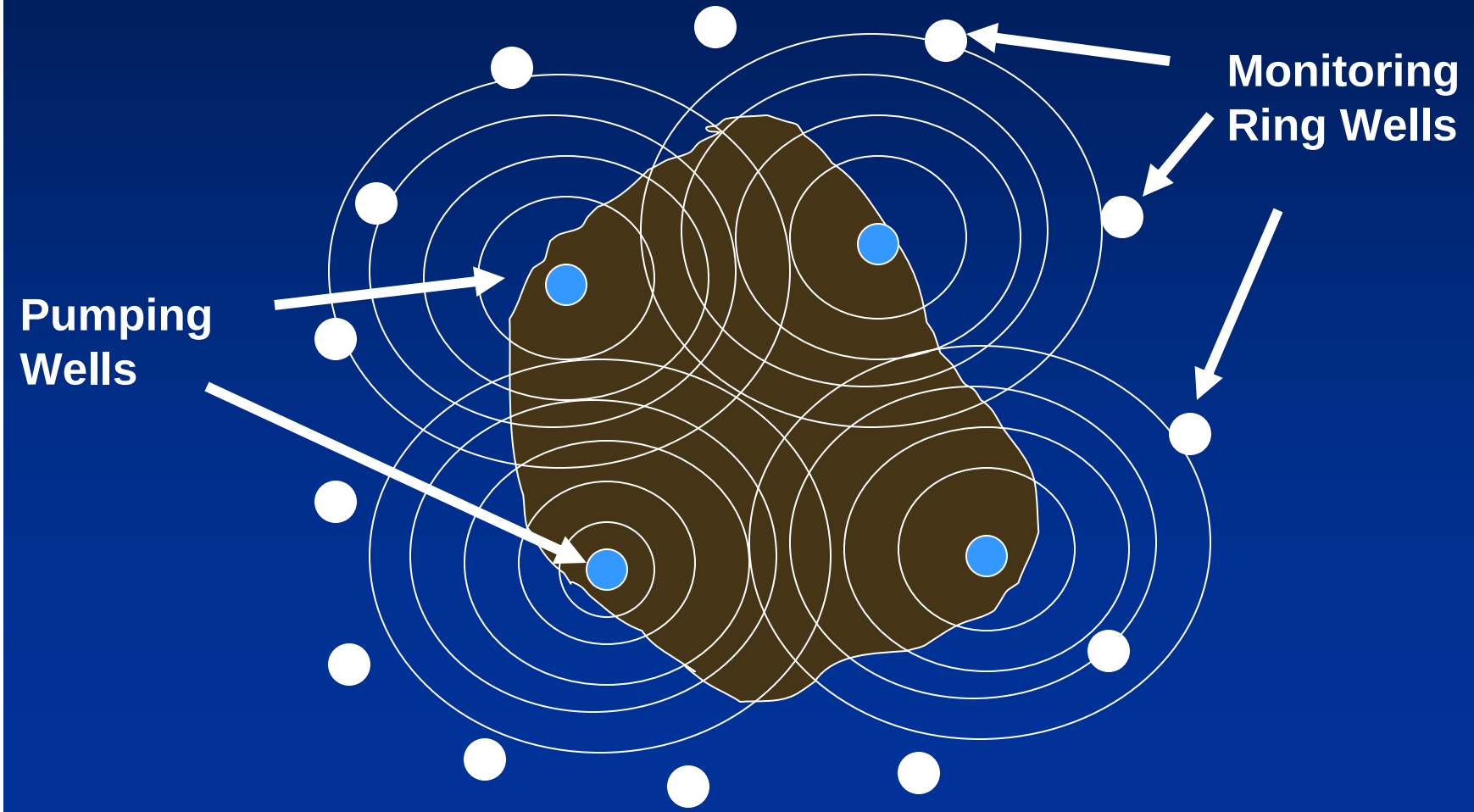
To demonstrate communication across wellfield may take several pumping wells acting simultaneously



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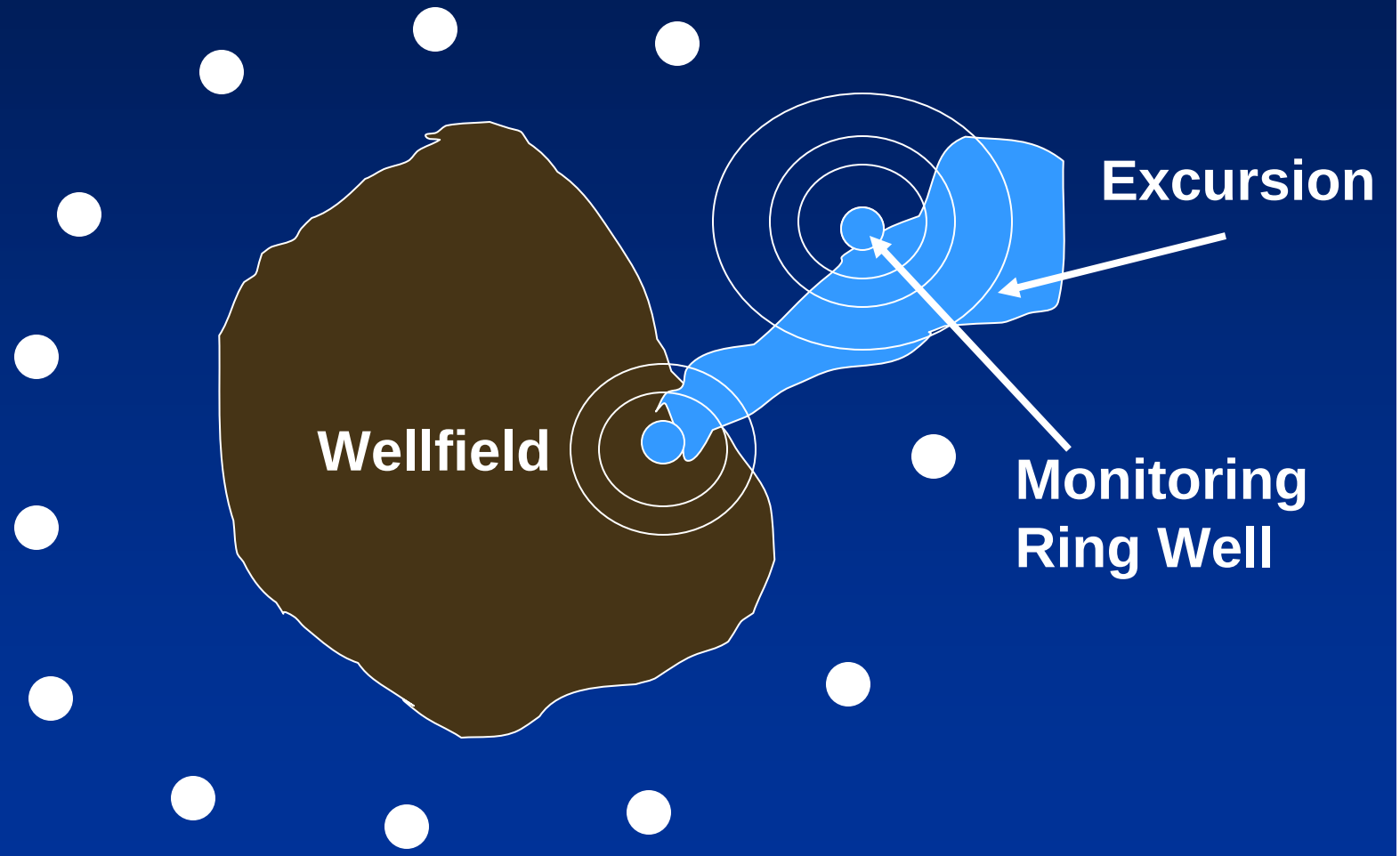
Excursion capture may be limited by extent of dewatered cone of depression and extraction rate



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Characterizing ISR operations in an unconfined aquifer

- Determine limiting extraction rate to avoid dewatering (step rate tests)
- To demonstrate communication, design pumping tests which consider limited extent of drawdown at each well
- Provide strategies for how to capture excursions given limited extraction rates and cones of depression
- Consider groundwater flow modeling to demonstrate unconfined aquifer behavior (cone of depression, operations, restoration)

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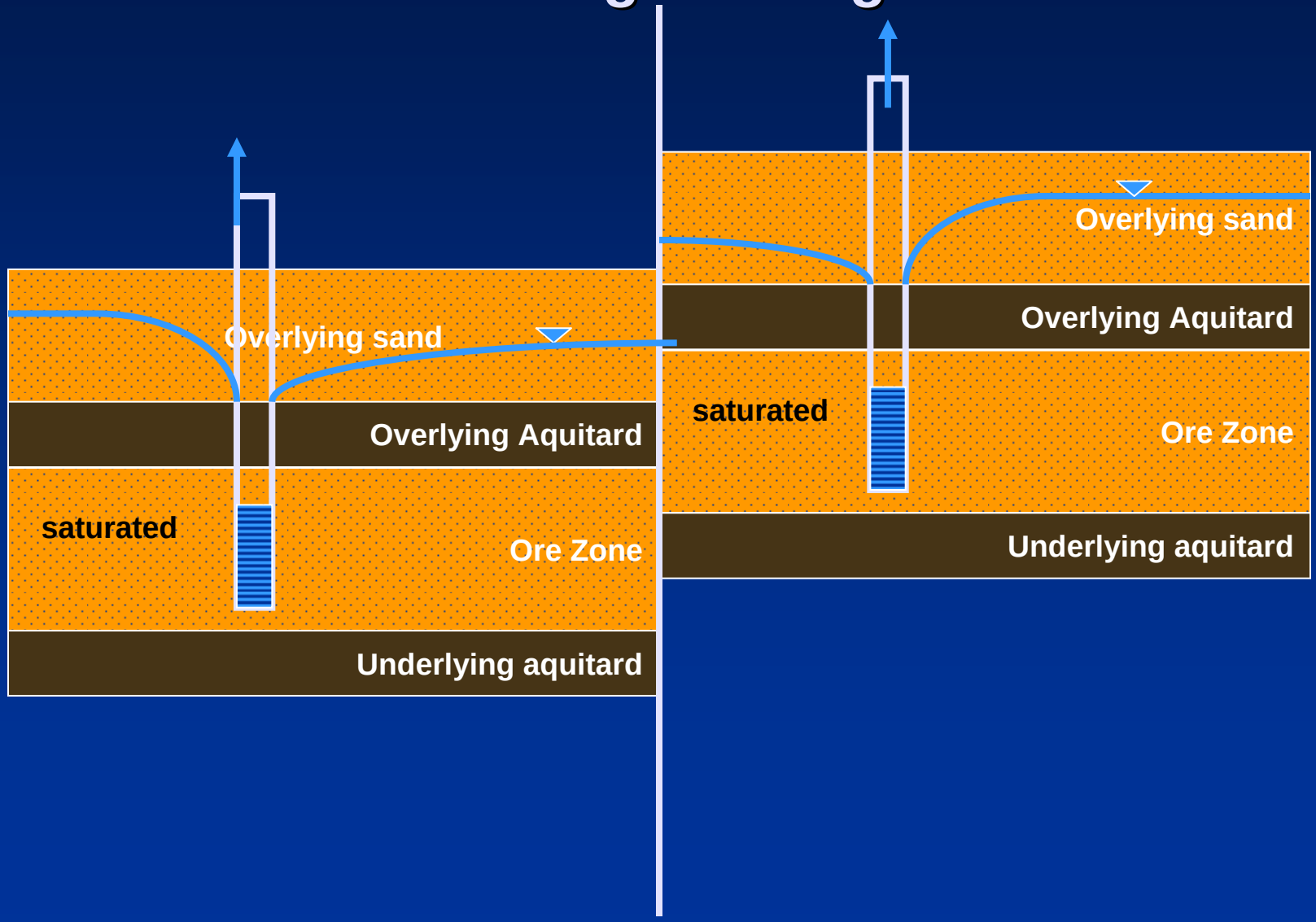
Issue: Sealing/Leaking Fault



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Characterizing ISR operations near a fault

- **Use pumping tests to address behavior of fault and assess impact of fault on wellfield cone of depression**
- **Use pumping tests to assess connectivity of offset layers to ore zone to modify cone of depression**
- **Consider groundwater flow modeling to demonstrate behavior around fault (cone of depression, operations, restoration)**

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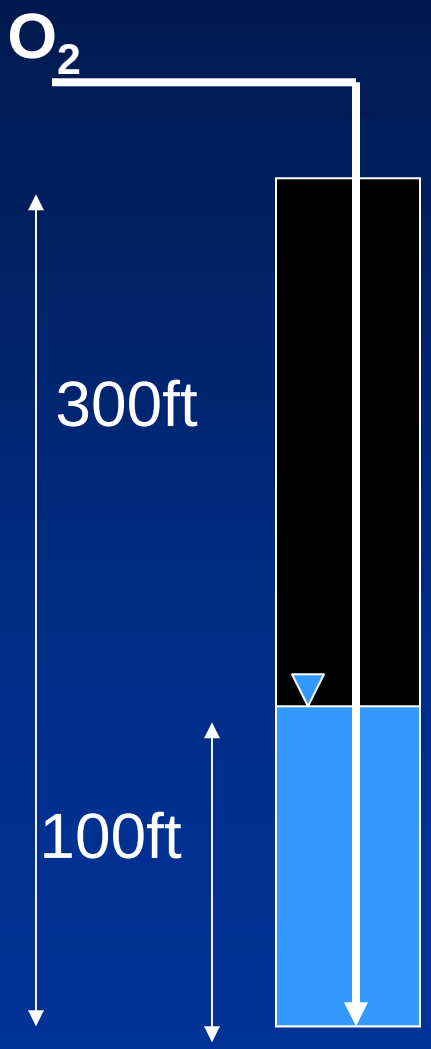
Issue: Lixiviant composition and gas lock

- Bicarbonate
- Carbon Dioxide
- Oxygen
- Hydrogen Peroxide

Oxygen solubility



Rule of thumb:
1 ppm dissolved oxygen/ foot of head

EXAMPLE: Injection Well

- **Fracture gradient limitation 1 psi/ft, so max injection pressure is 300 psi.**

- **Max well head pressure is therefore 300 psi-(300 ft*.433 psi/ft)=170psi.**

- **170 psi=392 feet so max O_2 can be 392 ppm at well head.**

- **If inject 392 ppm and solubility is 100 ppm (100ft): 292 ppm will come out of solution into ore zone**

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Hydrogen peroxide in lixiviant

Hydrogen peroxide decomposes to form free oxygen, O_2, in the presence of pyrite, Fe S_2:

$$FeS_2 + 7.5H_2O_2 = Fe^{3+} + 2SO_4^{2-} + H^+ + 7H_2O$$

$$Fe^{3+} + 0.5H_2O_2 = Fe^{2+} + H^+ + 0.5O_2 \uparrow$$

Free Phase Oxygen

Chirita, P., " A kinetic study of hydrogen peroxide decomposition in presence of pyrite," Chemical and Biochemical Engr Quarterly, Vol. 21, No. 3, pp. 257-264, 2007

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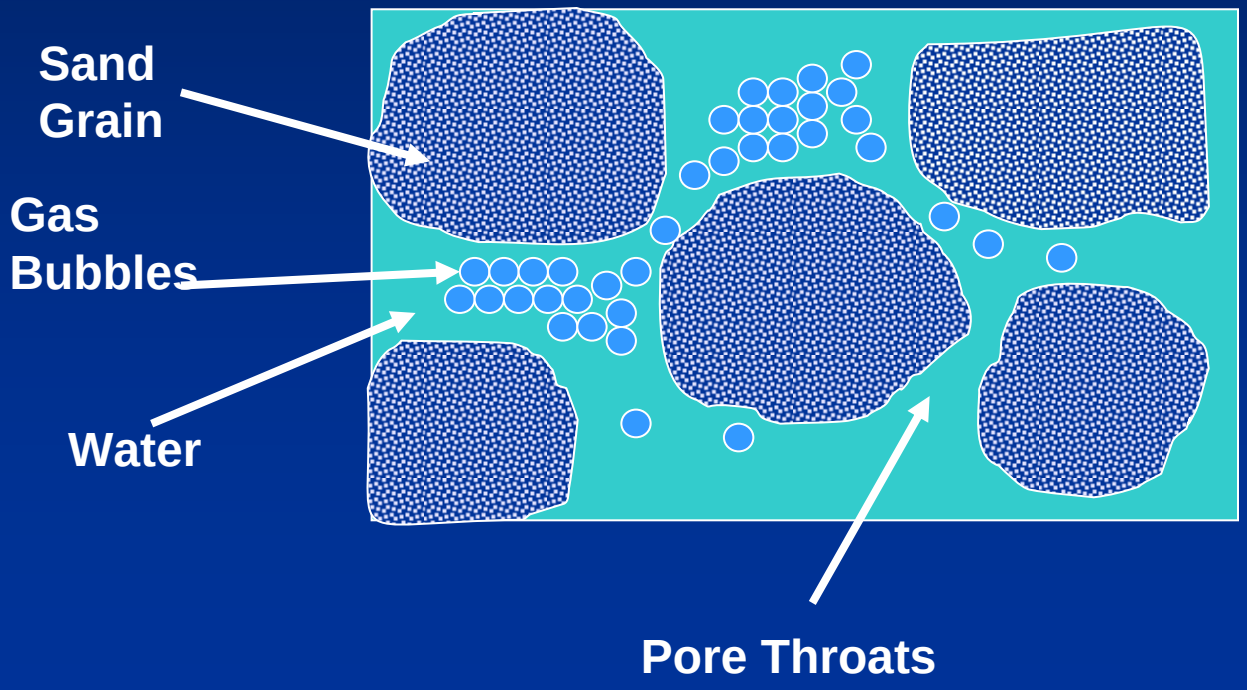
Dissolved oxygen bubbles out of lixiviant when hydrostatic head reduced (unconfined or shallow confined aquifer) or hydrogen peroxide interacts with pyrite



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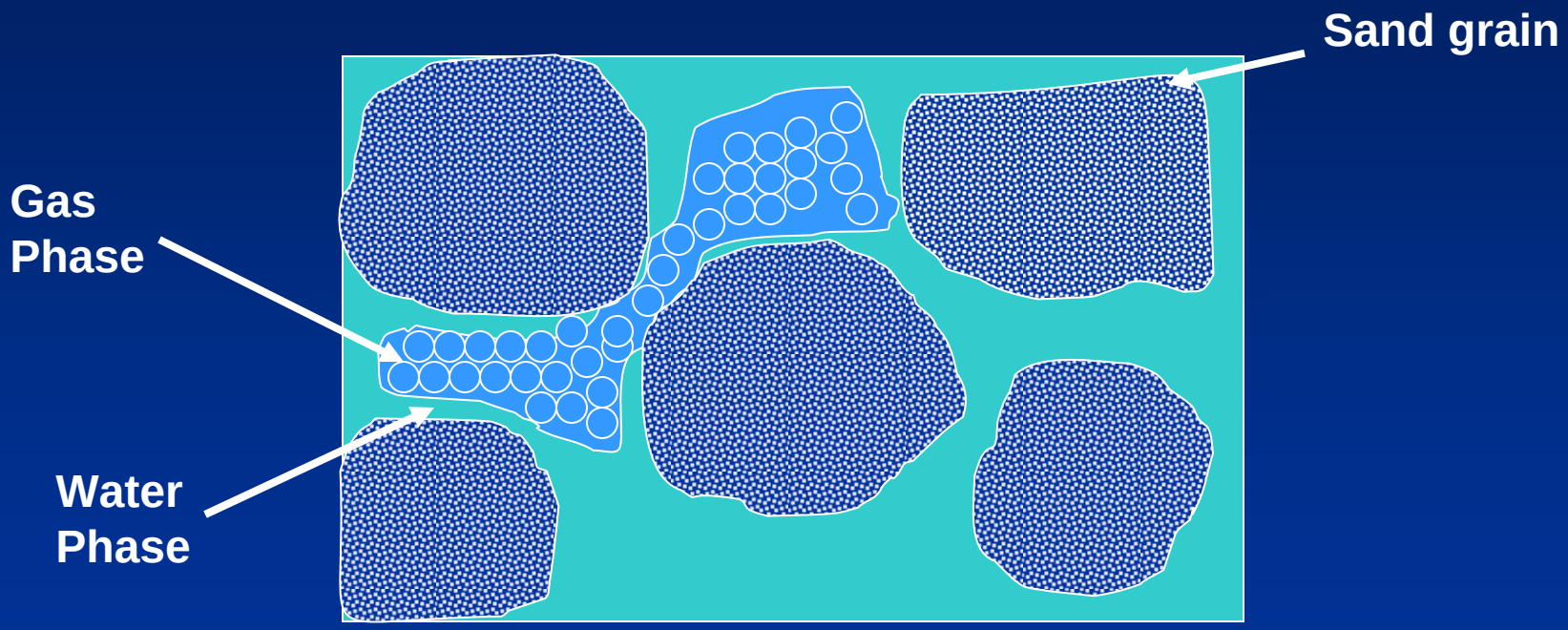
As gas bubbles continue to come out of solution, they combine to block pore throats or separate the water phase into smaller channels.



This creates a reduction in conductivity, known as “Gas Lock,” which is dependent on saturation of the water and gas phases

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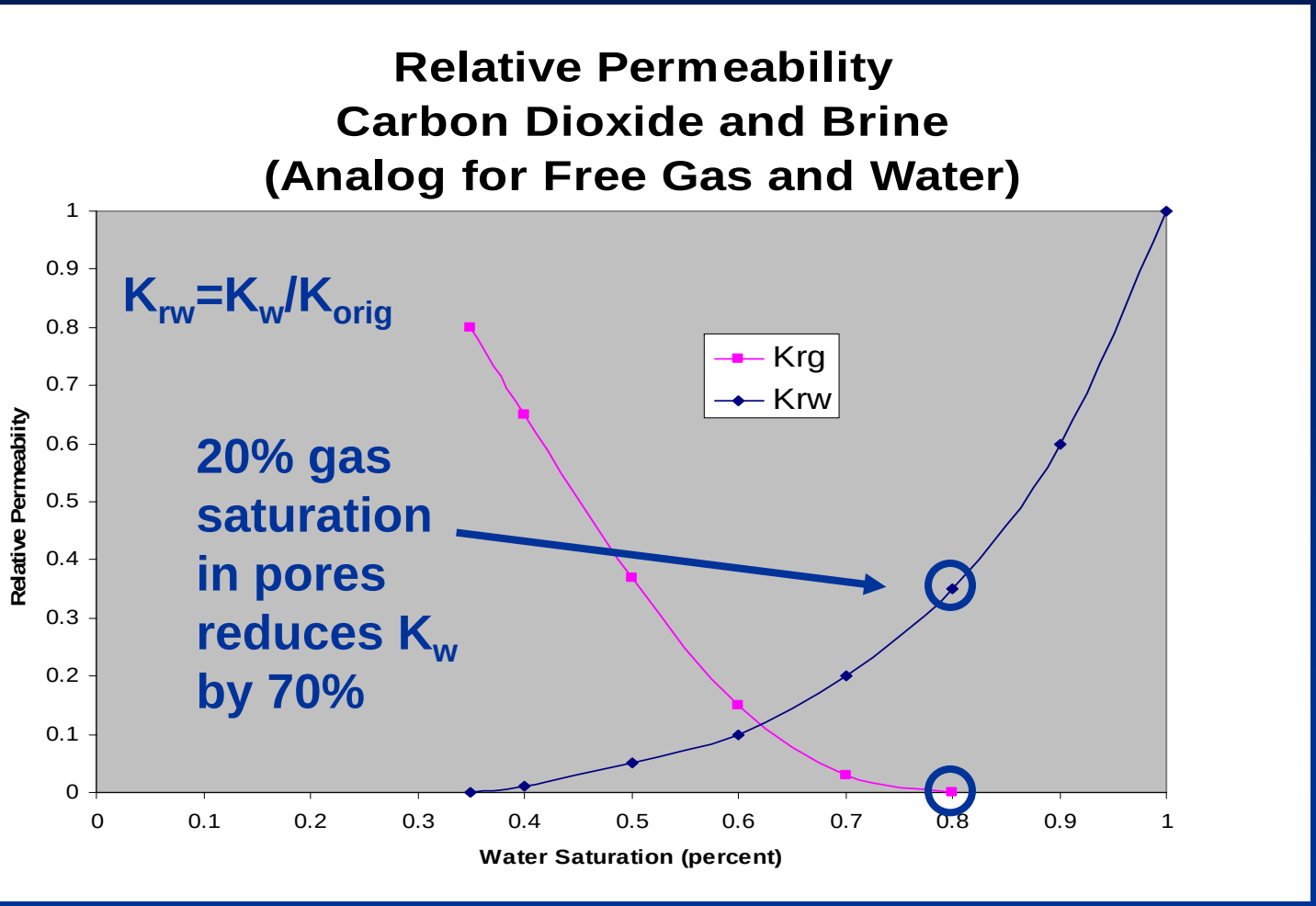
How much is the conductivity reduced?



From Benson et al, Lawrence Berkley National Lab, 2005

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Gas Lock

Why is it a Safety Issue ?

- **If free gas is released at the injection well, it can reduce injectivity and create back pressure which can quickly damage well if not detected.**
- **Gas produced at production well can cause simultaneous gas and water two phase flow that can damage piping, cause cavitation in pumps and affect pressure/flow measurements.**
- **Reductions in conductivity of ore zone can change flow system in an unpredictable manner which can influence flow control and may lead to excursions or bypassed zones.**

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Addressing gas lock

- Assess solubility limits of dissolved oxygen in lixiviant and use oxygen concentrations which prevent gas from being released from solution at injection wells or ore zone
- Avoid use of hydrogen peroxide in low hydrostatic head aquifers with pyrites
- Watch for gas in produced water at extraction wells
- Cycle wells from injection/extraction to change pressure conditions
- Install pressure gauges on each well to detect pressure changes in wells and pipes directly

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Monitoring and Excursions

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Issues

- **Lack of confining layers**
- **Faults**

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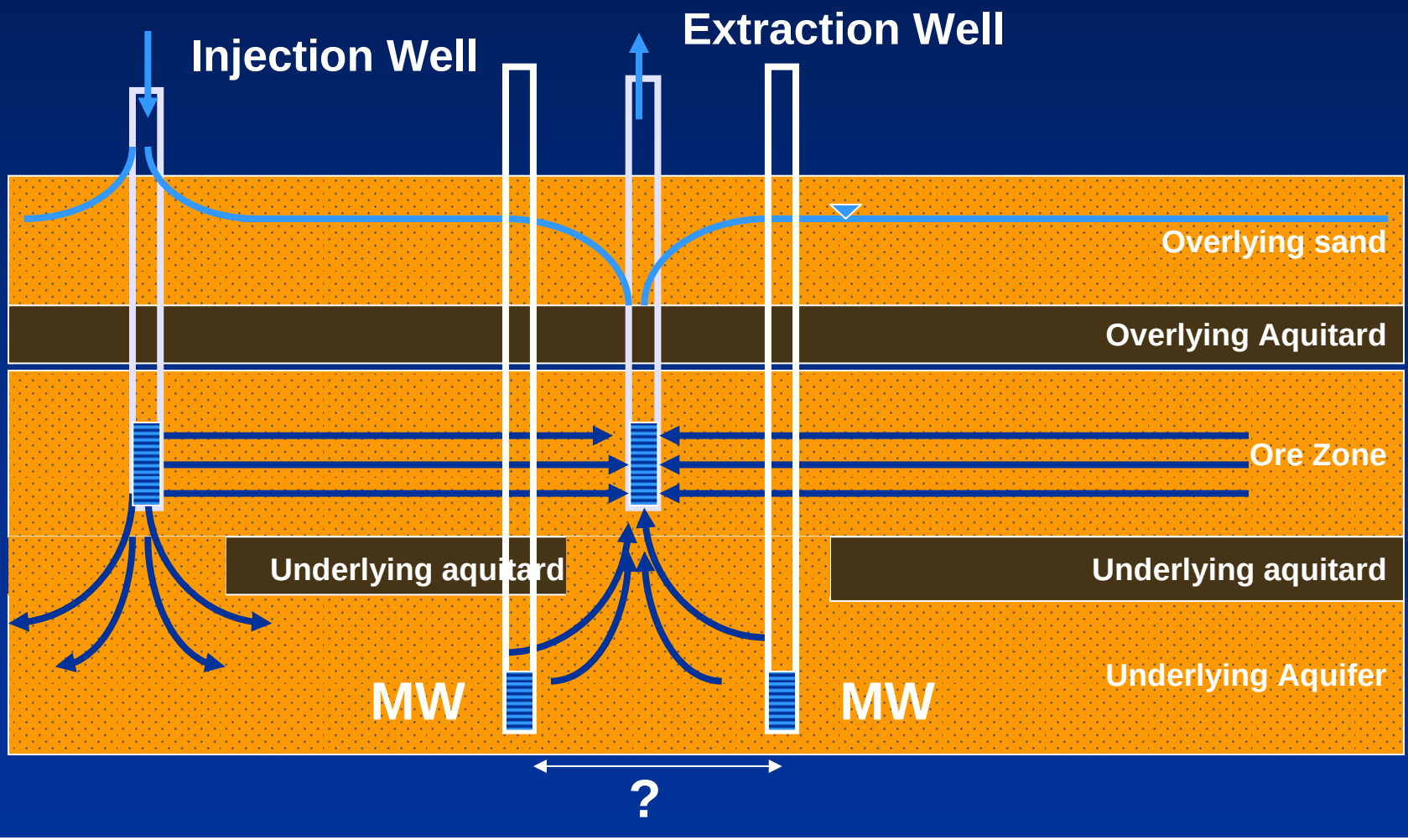
Where do you place the monitoring wells with lack of vertical barrier?



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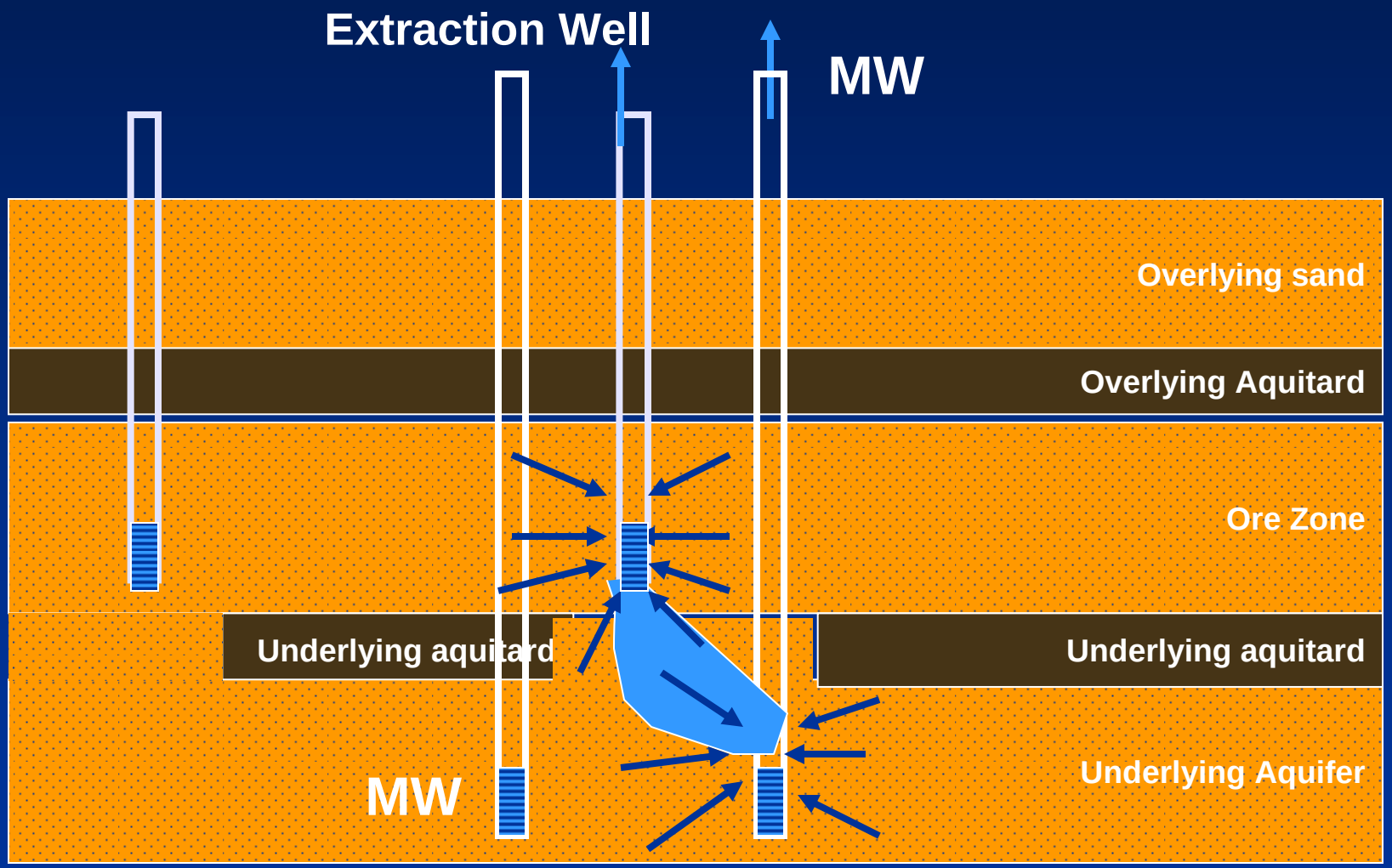
How do you capture an excursion?



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Monitoring and excursion capture with missing confining layers

- Assess how to place monitoring wells to detect vertical excursions in the absence of barrier (analogous to MW ring for horizontal excursions)
- Address how a vertical excursion to underlying aquifer would be captured
- Include underlying aquifer as part of production zone
- Consider groundwater flow modeling to demonstrate monitoring and capture

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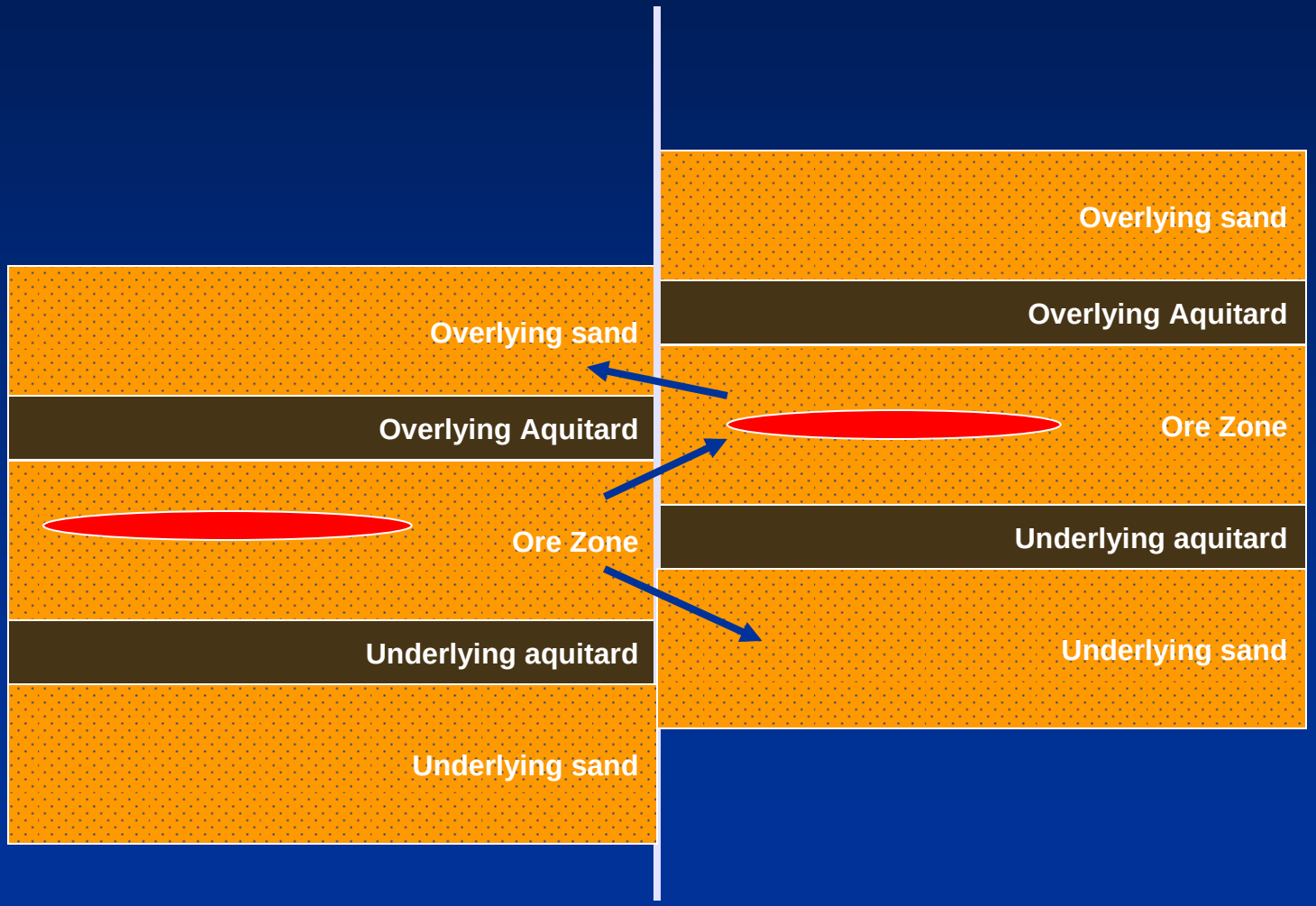
Issue- Faults: Sealing or Leaking



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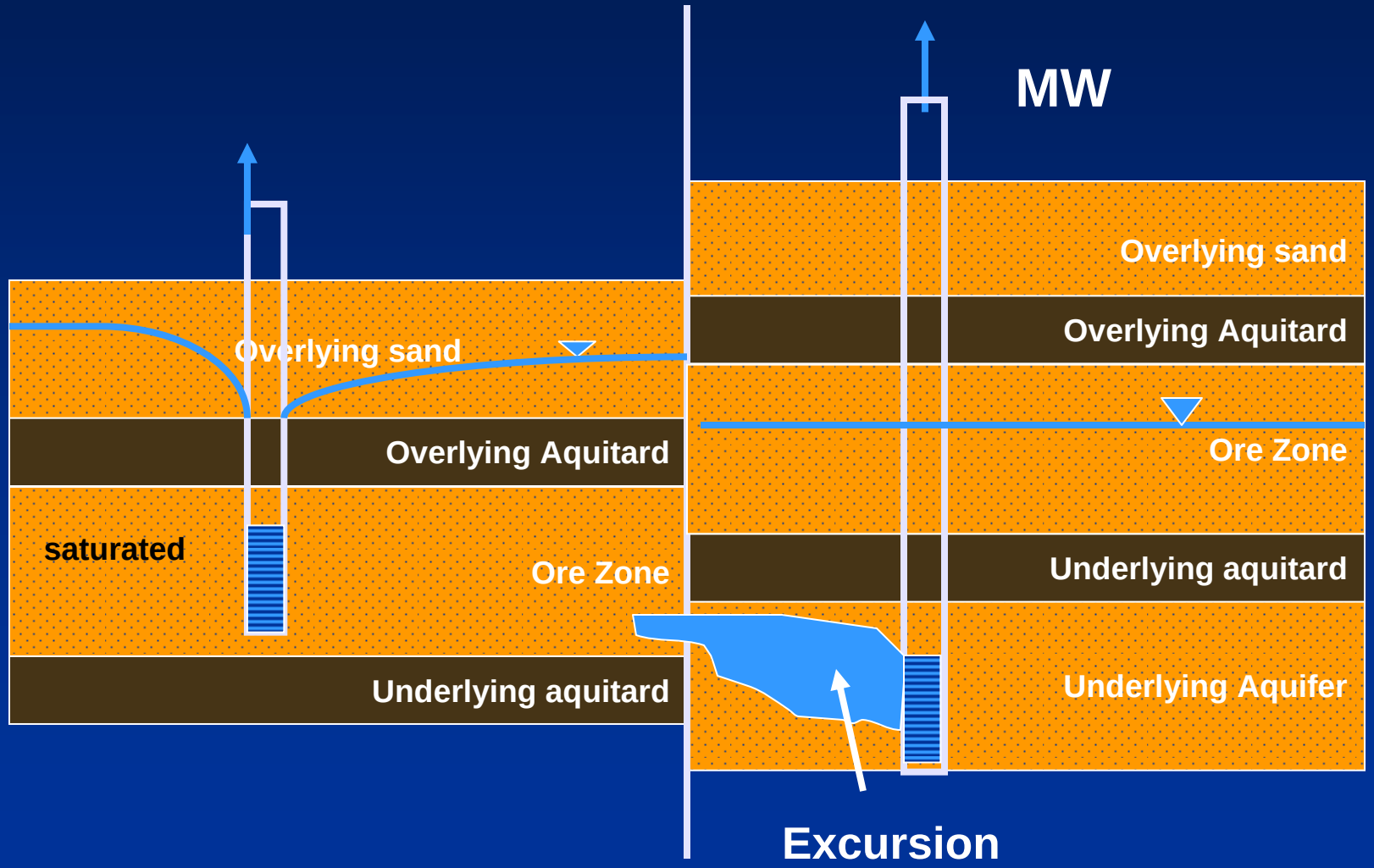
Where do you place a MW and how do you capture an excursion near a fault?



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Monitoring and excursion capture near a fault

- Assess how to place monitoring wells to detect excursions across fault to offset overlying and underlying aquifers
- Address how excursions across faults would be captured
- Consider groundwater flow modeling to demonstrate monitoring and capture

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Restoration

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Issues

- **Pore volume calculation using saturated thickness vs. average completed thickness in unconfined aquifers**
- **Dewatering/mounding effects on saturation and contact of ore zone in unconfined aquifers**

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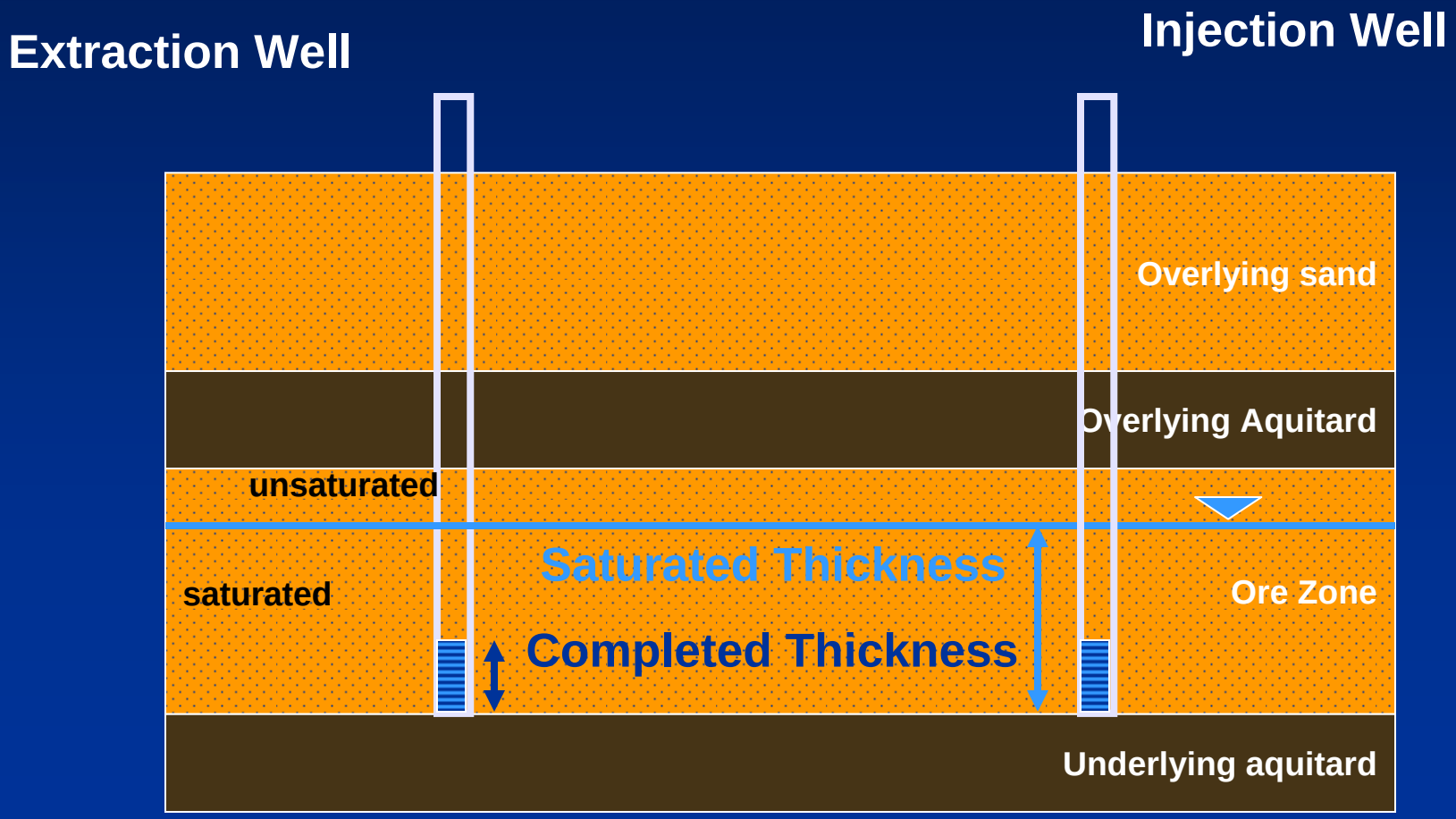
Issue: Pore Volume in Unconfined Aquifer

PV= Area * *Average Completed Thickness* * Porosity * Flare



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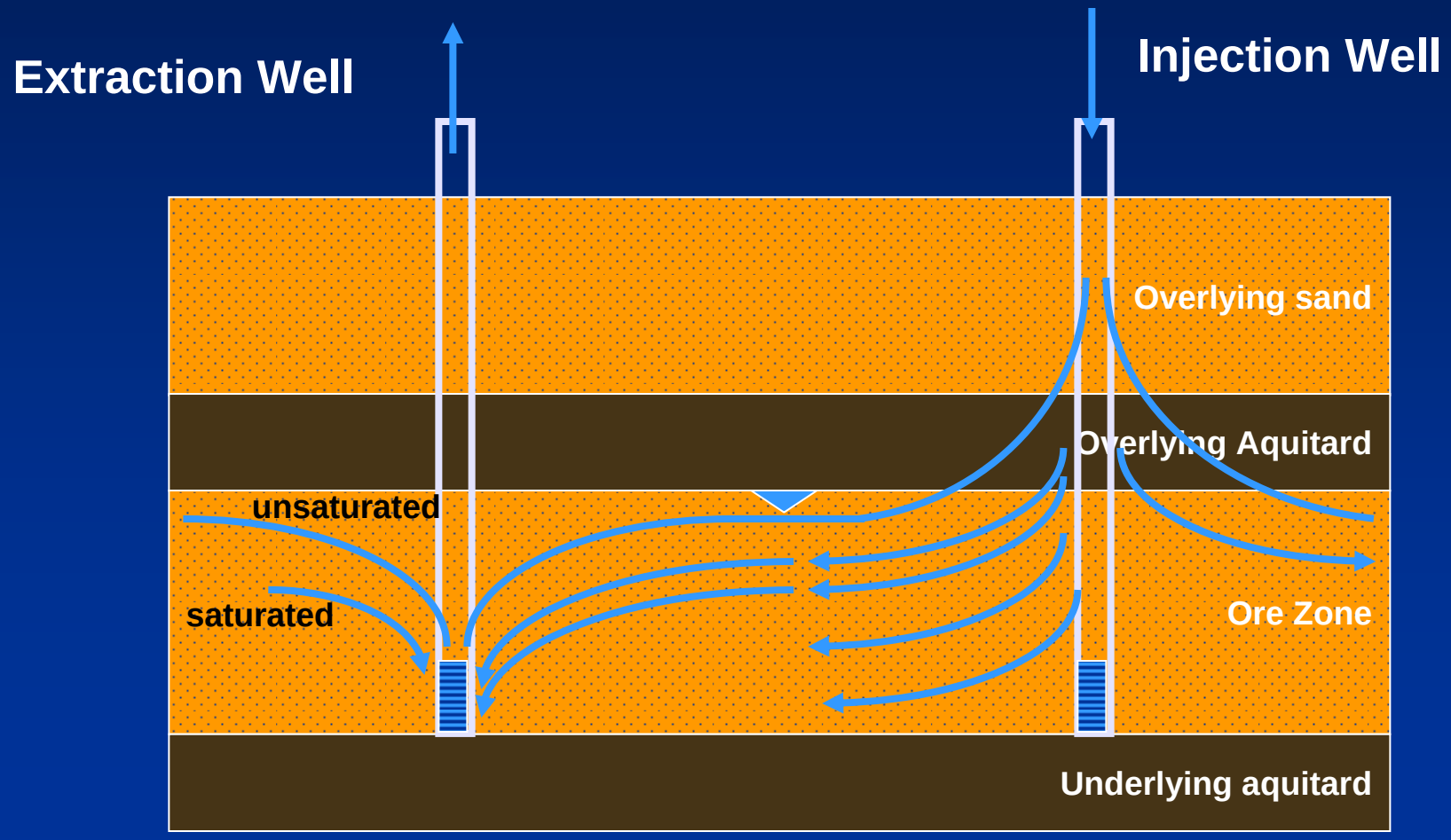
Injection/Extraction in Unconfined Aquifer : Vertical flow contacts more than completed thickness

PV= Area * *Saturated thickness* * Porosity * Flare



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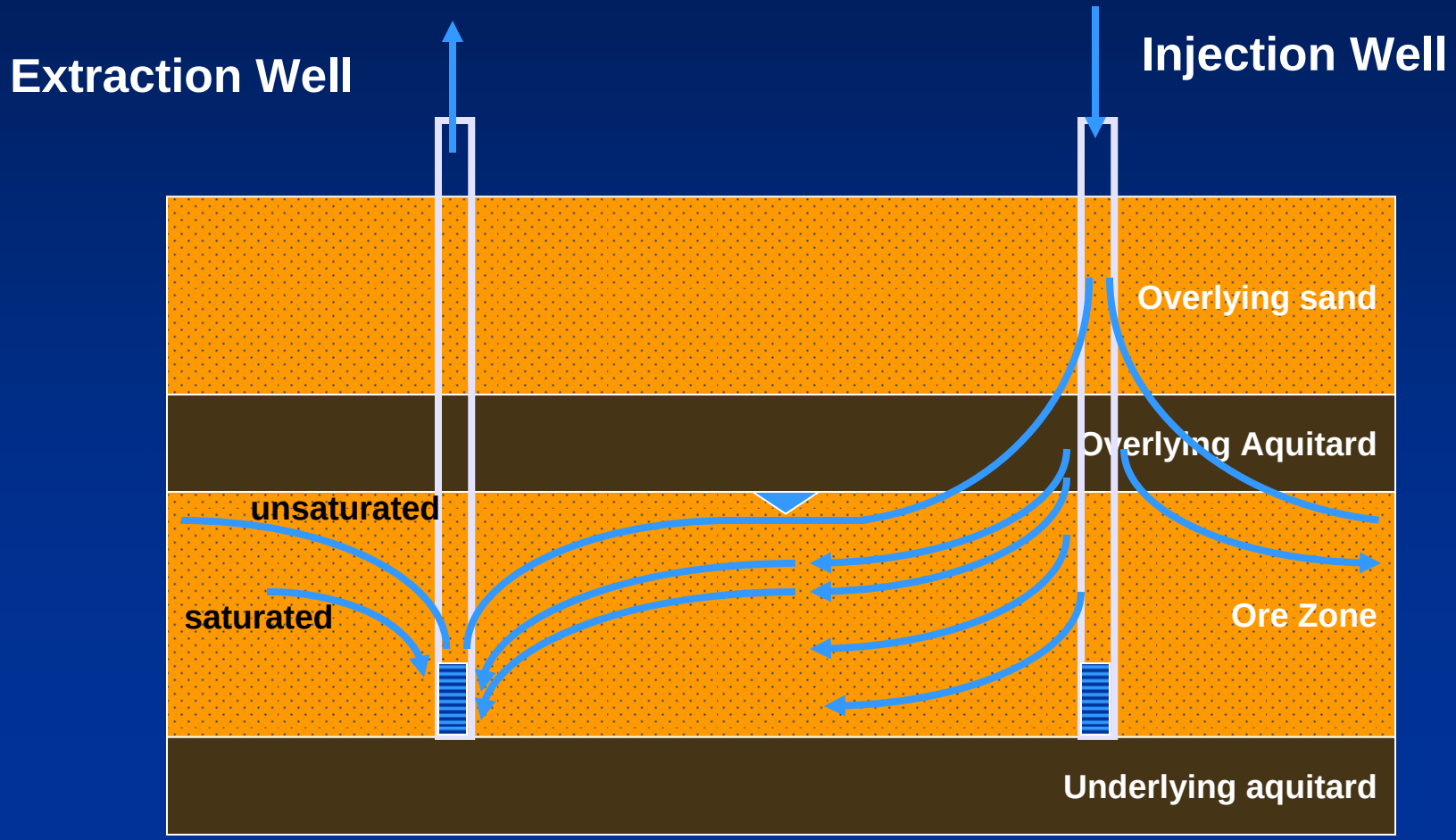
Issue: Unconfined aquifer saturation/desaturation impacts sweep/contact of ore zone with restoration fluids.



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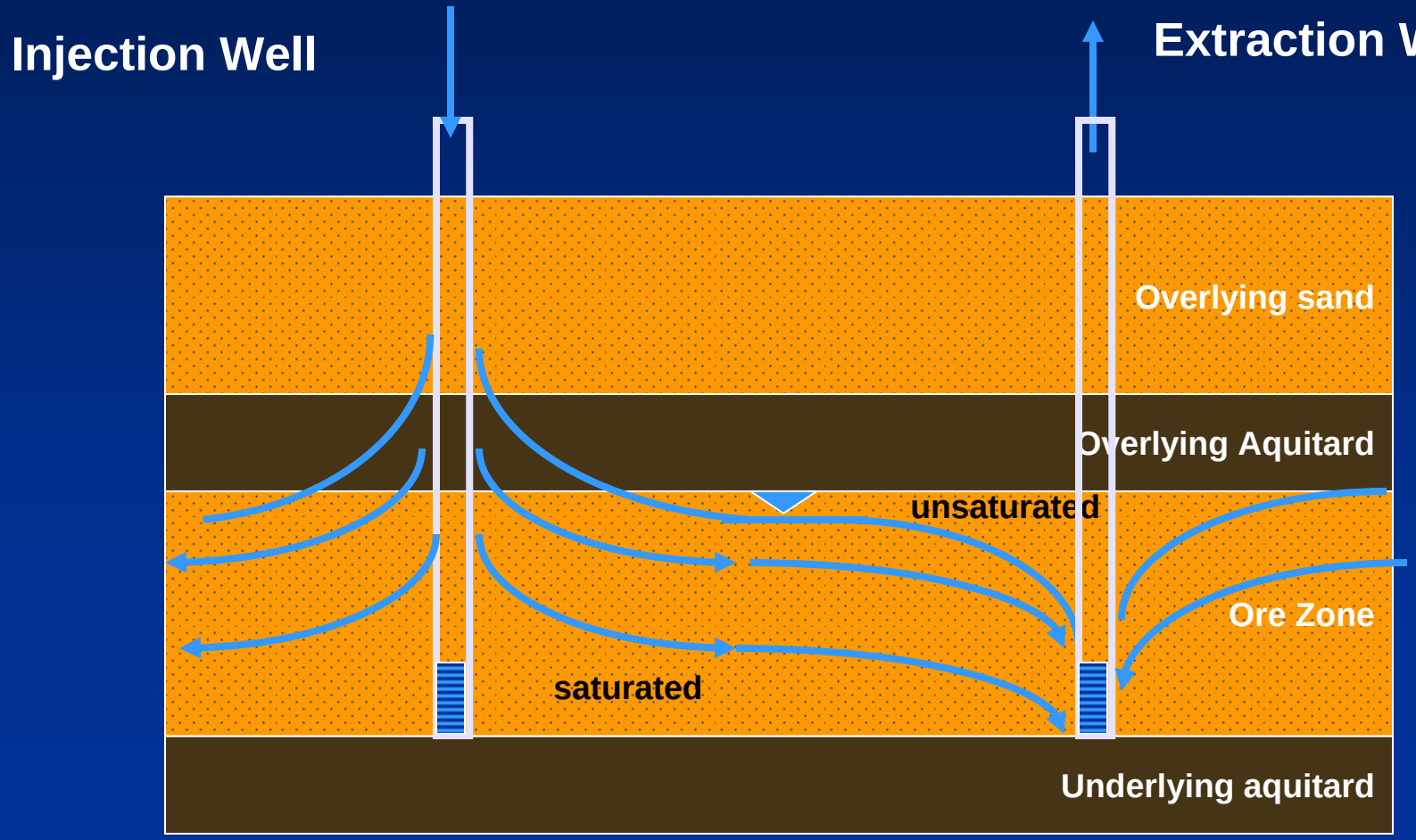
Flip/pulse wells to ensure contact of all portions of aquifer with restoration fluids.



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Conclusion - Issues

- **Surficial Aquifers**
- **Unconfined Aquifers**
- **Faults**
- **Missing Confining Layers**

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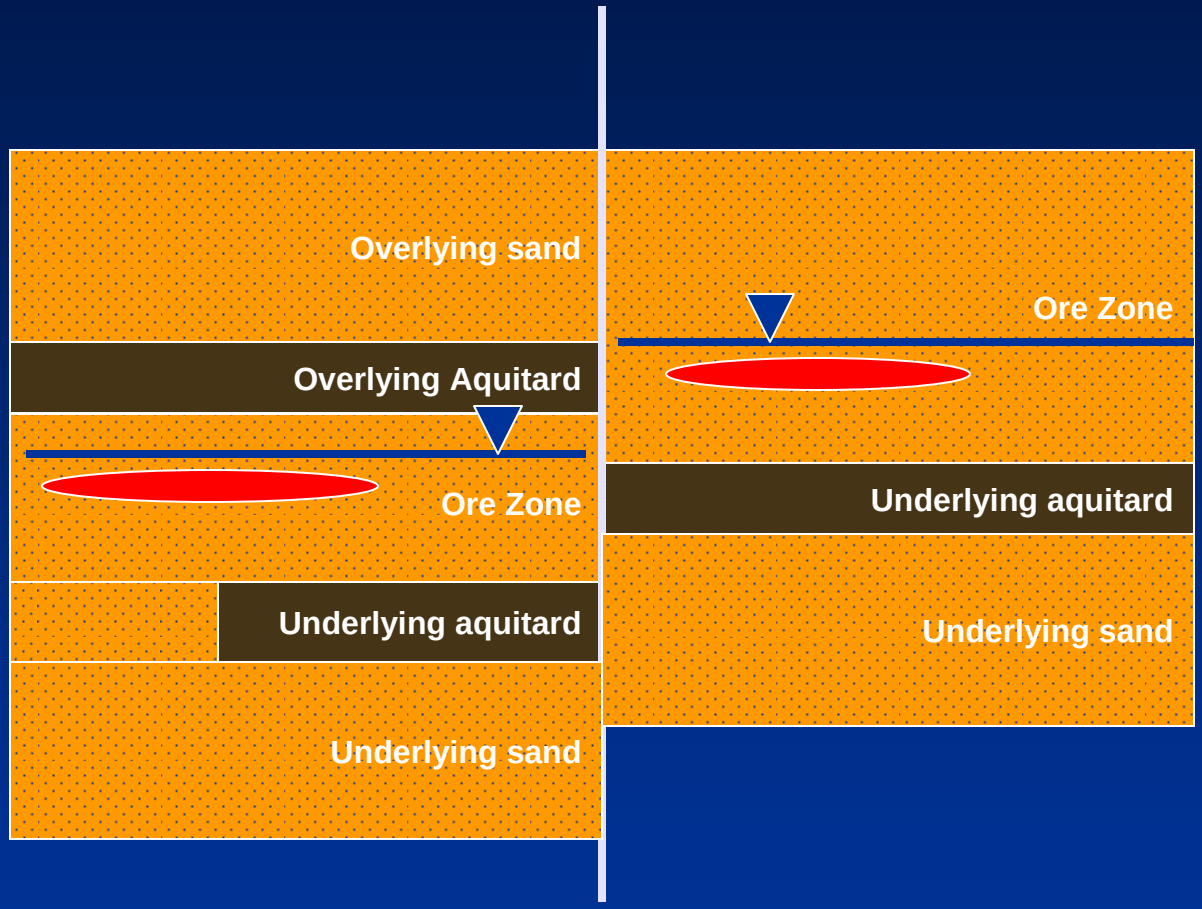
All four issues at one site



Characterization, Flow Behavior, Monitoring, Excursion Capture, Restoration

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Resources

- **William Walton, “Groundwater Pumping Tests: Design and Analysis”**
- **Johnson Controls, “Groundwater and Wells”**
- **Michael Kasenow, “ Aquifer Test Data: Analysis and Evaluation”**

Industry Perspectives on the Application of 40 CFR Part 61, Subpart W to Uranium Recovery Facilities

Prepared for the 2009 NMA/NRC Conference

Prepared by Thompson & Simmons, PLLC
Anthony J. Thompson, Esq. (Presenter)
Christopher S. Pugsley, Esq.

INTRODUCTION

- At the 2008 Nuclear Regulatory Commission (NRC)/National Mining Association (NMA) Conference, the Environmental Protection Agency (EPA) Announced a New Scope for 40 CFR Part 61, Subpart W's Application to Uranium Recovery Facilities:
  - Subpart W Applies to:
    - Uranium Mill Tailings Impoundments;
    - Evaporation Ponds;
    - Other Non-Tailings Impoundments (e.g., Settling Ponds)

INTRODUCTION

- **The Domestic Uranium Recovery Industry Was Surprised and Dismayed by This Pronouncement:**
  - **Existing Conventional Mills Have Only Reported Radon Flux Data From Uranium Mill Tailings Impoundments:**
    - **EPA Method 115 Assumes Water Covered Sources in Such Impoundments to Be a Zero Source Term**
  - **In Situ Leach (ISL) Facilities Do Not Have Uranium Mill Tailings Impoundments and Have Not Reported in the Past**

INTRODUCTION

- **NMA Responded to This Pronouncement on Behalf of Industry:**
  - **Met with NRC to Discuss Its Position on This Issue;**
  - **Met with EPA Headquarters Task Force on This Issue;**
  - **Prepared a Detailed Analysis of the:**
    - **Subpart W Administrative Rulemaking Record; and the**
    - **Current Status of Subpart W's Application to Uranium Recovery Facilities**

INTRODUCTION

- **EPA Responded to NMA By Stating:**
  - **EPA is Evaluating the Scope of Subpart W with a Potential Rulemaking in Mind;**
  - **EPA Has Sent Letters to Numerous Uranium Recovery Facility Operators (Both Conventional and ISL):**
    - **Demands for Information on Site Operations**
    - **Demands for Testing on Existing Site Facilities**

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- Congress Enacted the Clean Air Act of 1977 (CAA) in Part to Address Radionuclides as Potentially Hazardous Air Pollutants and To Have EPA Develop National Emissions Standards for Hazardous Air Pollutants (NESHAPs);

- March 7, 1989: EPA Proposes Standards at 40 CFR Part 61 as Follows:

  - Subpart T: *Inactive* Uranium Mill Tailings Piles/Impoundments;
  - Subpart W: *Active* Uranium Mill Tailings Piles/Impoundments;
  - Subpart B: Underground Uranium Mines;
  - Others

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- December 15, 1989: EPA Promulgates Final Rules for Subparts T, W, and B:
  - All Three Subparts Must Be Considered When Evaluating the Scope of Subpart W:
    - All Three Were Proposed/Promulgated at the Same Time;
    - All Three Address Radon Emissions for Which EPA's Radionuclide Risk Factor Assumptions Would Be Equally Applicable;
    - Subpart T was Eventually Rescinded After Extensive Negotiations Addressing Numerous Mill Tailings and Related Process Issues;
    - EPA Conclusions and Statements in Subparts T and B are Relevant As Their Conclusions Relate Directly to Subpart W as Finally Promulgated

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- **The Rescission of Subpart T Plays a Critical Role:**
  - **Settlement Negotiations Explicitly Raised the Evaporation Pond and Non-Tailings Impoundment Issue (Proposed Rule):**
    - **"The regulations contemplated by this notice seek to control the emission of radon-222 by requiring the installation of an earthen cover over the disposal piles as expeditiously as practicable considering technological feasibility. However, there are other aspects to the UMTRCA regulatory scheme, including the long-term maintenance of the piles (once controlled) against erosion, and the reclamation and maintenance of groundwater….*These actions entail the use of evaporation ponds that in some instances….have been placed directly upon the disposal site*.";**
    - **"EPA does not intend that the expeditious radon cover requirement extend to the areas where evaporation ponds are located, *even if on the pile itself*, to the extent that such evaporation pond is deemed by the implementing agency (NRC or an affected Agreement State) to be an appropriate aspect to the overall remedial program for the particular site involved."**

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- **The Rescission of Subpart T Plays a Critical Role (CONTINUED):**
  - **Settlement Negotiations Explicitly Raised the Evaporation Pond and Non-Tailings Impoundment Issue (Proposed Rule):**
    - **"*the ponds themselves serve as an effective radon barrier*, thus this decision is bolstered by the absence of any evidence that there is a significant public health risk presented by the radon emissions from these evaporation ponds during the period they are employed as part of the overall remediation of the site.";**
    - **"EPA believes the overall public health interest in comprehensively resolving the problems associated with each site is best served by requiring that the radon cover be expeditiously installed in a manner that does not require interruption of this other aspect of remediation….*Rather, EPA believes that provided all other parts of the pile are covered with the earthen cover, compliance with the 20 pCi/m2 standard will result*…."**

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- **EPA Amendments in 1993 Regarding Agreement States and NRC-Licensed Uranium Mill Tailings in the Response to Comments:**
  - "***EPA reiterates that the Agency does not intend the expeditious radon cover requirement to extend to areas where evaporation ponds are located,*** even if on the pile itself, to the extent that such evaporation pond is deemed by the implementing agency…to be an appropriate aspect of the overall remedial program for the particular site.";
  - The same obviously holds true for licensed non-tailings ponds/impoundments necessary for active recovery operations

CLEAN AIR ACT: STATUTORY AND REGULATORY SUMMARY

- **EPA's Response to Comments and Method 115 Guidance Provides Additional Support:**
  - Response to Comments: "Recent technical assessments of radon emission rates from tailings indicate that radon emissions from tailings covered with *less than one meter of water, or merely saturated with water, are about 2% of emissions from dry tailings. Tailings covered with more than one meter of water are estimated to have a zero emissions rate. The Agency believes this calculated difference between 0% and 2% is negligible. The Agency used an emission rate of zero for all tailings covered with water or saturated with water in estimating radon emissions.*";
  - Method 115: "[R]adon flux measurements shall be made within each region on the pile, *except for those areas covered with water.*" *Water covered area*--no measurements required as radon flux assumed to be *zero*."

CLEAN AIR ACT: CONCLUSIONS

- **The Administrative Rulemaking Record States Unequivocally in Subparts T and W Proceedings and in Method 115 That a Water-Covered Mill Tailings Impoundment, Much Less a Water-Covered Non-Tailings Impoundment, is a "Zero Radon Flux Source Term:**
  - **Evaporation and Other Non-Tailings Ponds Contain Water During Operations;**
  - **Lined Ponds Must Be Disposed of In Place if They Do Not Contain 11e.(2) Byproduct Material Unless on Top of a Tailings Pile/Impoundment or They Must Be Removed and Placed in a Tailings Pile/Impoundment When No Longer Active;**
  - **Anything that is Not Active, Including Tailings Piles, are Not Subject to Subpart W**

CLEAN AIR ACT: CONCLUSIONS

- With Respect to Method 115 Testing Procedures and Guidance:
  - Both Subpart T and W Rulemakings Expressly State that the Requirements Do Not Apply to Evaporation Ponds--Even Those on Top of Tailings Piles/Impoundments;
- No Regulations for ISL As Such Facilities Are Never Mentioned in Subpart W or Its Administrative Rulemaking Record;
- Only in Subpart B Rulemaking for Underground Uranium Mines are ISLs Mentioned:
  - EPA States Not Enough Radon Released to Require Regulation

INDUSTRY CONCERNS: OVERSIGHT

- **Another Layer of Regulatory Oversight Will Result in Cost Increases and Inefficiency of Facility Processes:**
  - **Potential EPA Requirements for Concurrent Approval of Construction of New Evaporation or Other Non-Tailings Impoundments;**
  - **Potential Enforcement Action by EPA regarding Changes in Aspects of Ponds (i.e., Water Levels)**

INDUSTRY CONCERNS: STANDARDS

- **EPA May Re-Evaluate the 20 pCi/m2-sec Standard:**
  - All Title I Sites to Be Closed Pursuant to This Standard;
  - All Title II Uranium Mill Tailings Facilities Closed and Licenses Terminated Pursuant to This Standard;
  - Re-Evaluation of This Standard Could Result in Hundreds of Millions of Dollars in Changes to Already-Closed Sites That Have Been Transferred to the Department of Energy (DOE) as Perpetual Custodian

INDUSTRY CONCERNS: JURISDICTION

- **EPA's NESHAPs are "Outside the Fenceline" Standards:**
  - **Occupational Exposures are not Within EPA's Jurisdiction;**
  - **NRC Fence-Line Limits for Members of the Public of 100 Mrem/Year Provide a Safe and Effective Public Dose Standard:**
    - **Conventional Uranium Mills Satisfying the 20 pCi/m2-sec Standard Are Adequately protective of Public Health and Safety and Produce Less than 100 Mrem/Year to Nearest Resident;**
    - **ISL Facilities Produce Only a Tiny Fraction of the 100 Mrem/Year Dose to Members of the Public "At the Fence-Line"**

CONCLUSIONS

- EPA's Apparent Assumptions that Subpart W Applies to Non-Tailings Ponds/Impoundments at Conventional and ISL Facilities:
  - Is in Direct Conflict with the Rulemaking Record:
    - Subparts T and W Do Not Apply to Evaporation Ponds, Even Those on Tailings Piles/Impoundments;
    - Even Water-Covered Tailings Are a Zero Radon Flux Source Term;
    - ISL Sites Are Never Mentioned Except in Subpart B
  - Is Faulty if Based on Concept That Wastewater at Uranium Recovery Facilities is 11e.(2) Byproduct Material:
    - The Water Evaporates and Then Liner is Disposed of as 11e.(2) Byproduct Material ;
    - Materials Other Than Wastewater and Tailings are 11e.(2) Byproduct Material
- Re-Evaluating the 20 pCi/m2-sec Standard Per Public Lawsuit is Understandable But Changing the Standard Could Only Be Based on Speculation and Not on Identified Adverse Impacts