



GEOHERMAL 101

Operations

Geothermal Leasing & Implementation Workshops
April, May and June 2009

Geothermal Development Process

- Lease acquisition
 - Nomination
 - Competitive oral auction
- Exploration activities
- Drilling production & injection wells
- Utilization
 - Power plants
 - Direct use facilities
- Abandonment of wells & facilities
- Reclamation of surface



Geothermal Exploration

Types of exploration

- Satellite & Air Photo Mapping
- Geologic & Structural Mapping
- Volcanological Studies
- Gravity
- Magnetics
- Geochemical Sampling
- Seismic Exploration
- Temperature Gradient Well





Exploration Operations

General

- Regulations apply:
 - On BLM lands, leased or not
 - On other Federal surface where BLM has leased
- Regulations do not apply:
 - Unleased lands managed by another Federal Agency
 - Unleased geothermal managed by another Agency
- Can propose operations on any BLM lands open to leasing, even if leased by another party
- If already leased, cannot unreasonably interfere with or endanger those other lessee's operations

Exploration Operations

Notice of Intent

- Form 3200-9, Complete & Signed
- Other than TGW:
 - Include accurate description
 - Include starting & ending dates
- For TGW:
 - 12 items required [43 CFR 3251.11(c)]
- Evidence of Bond Coverage
- Estimate of surface disturbance
- Measures to protect the environment
- Reclamation methods
- Other information BLM may require



Exploration Operations

Exploration Bonding

- Necessary prior to surface disturbance
- Amounts:
 - \$5,000 single operation
 - \$25,000 for all operations in a single state
 - \$50,000 for all operations nationwide
- Released:
 - After request (not automatic)
 - All wells P&A'd
 - Surface reclaimed

Exploration Drilling



Core Hole : Valles Caldera, NM

Core Hole Examination and Analysis



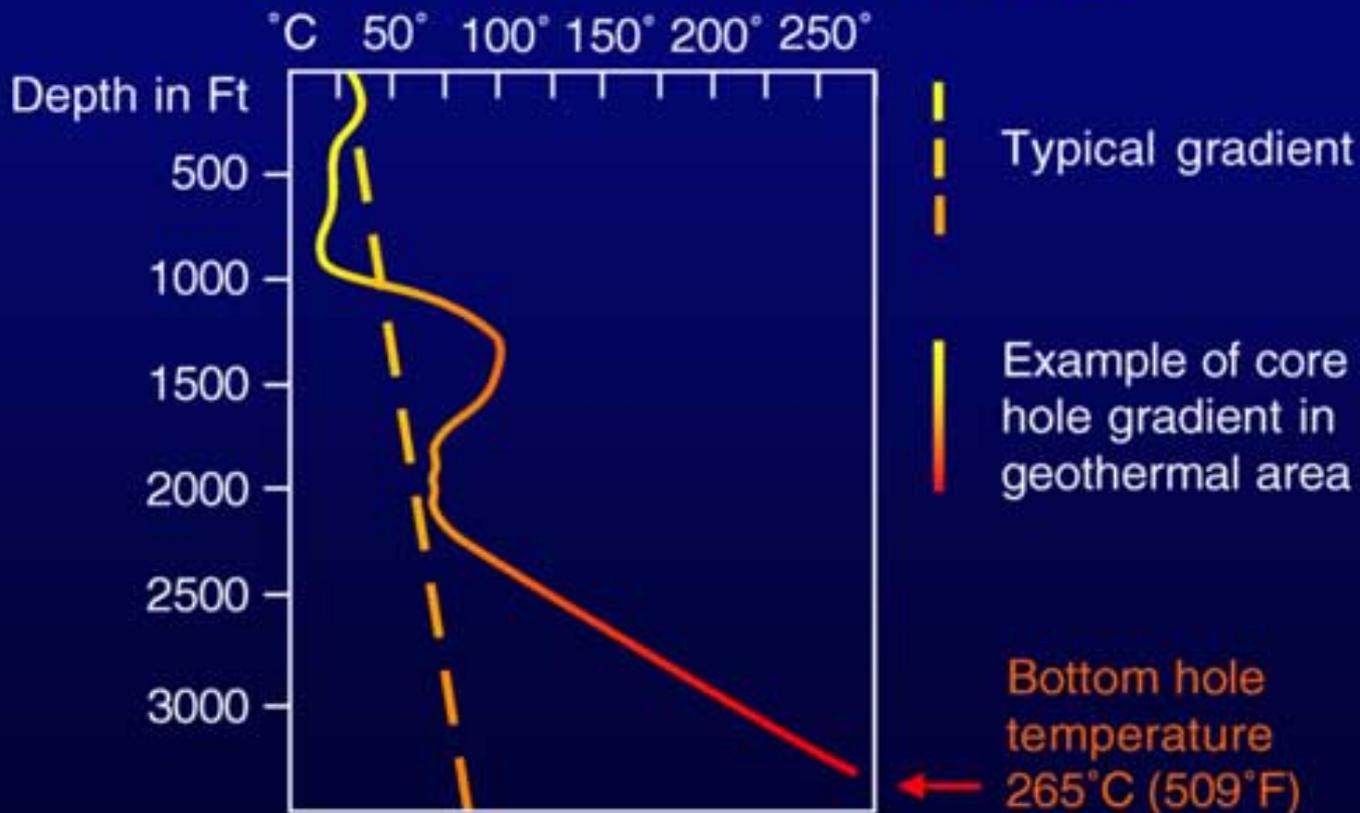
New Assessment Methods

Proof of concept –
Shallow Temperature
Surveys



Shevenell, L., Coolbaugh, M.F., Sladek, C., Zehner, R., and Kratt, C., *Our Evolving Knowledge of Nevada's Geothermal Resource Potential*, Geothermal Energy Development and Finance Workshop, January 2008, Las Vegas, NV.

Temperature Gradient Data



Seismic – Buggy Drill



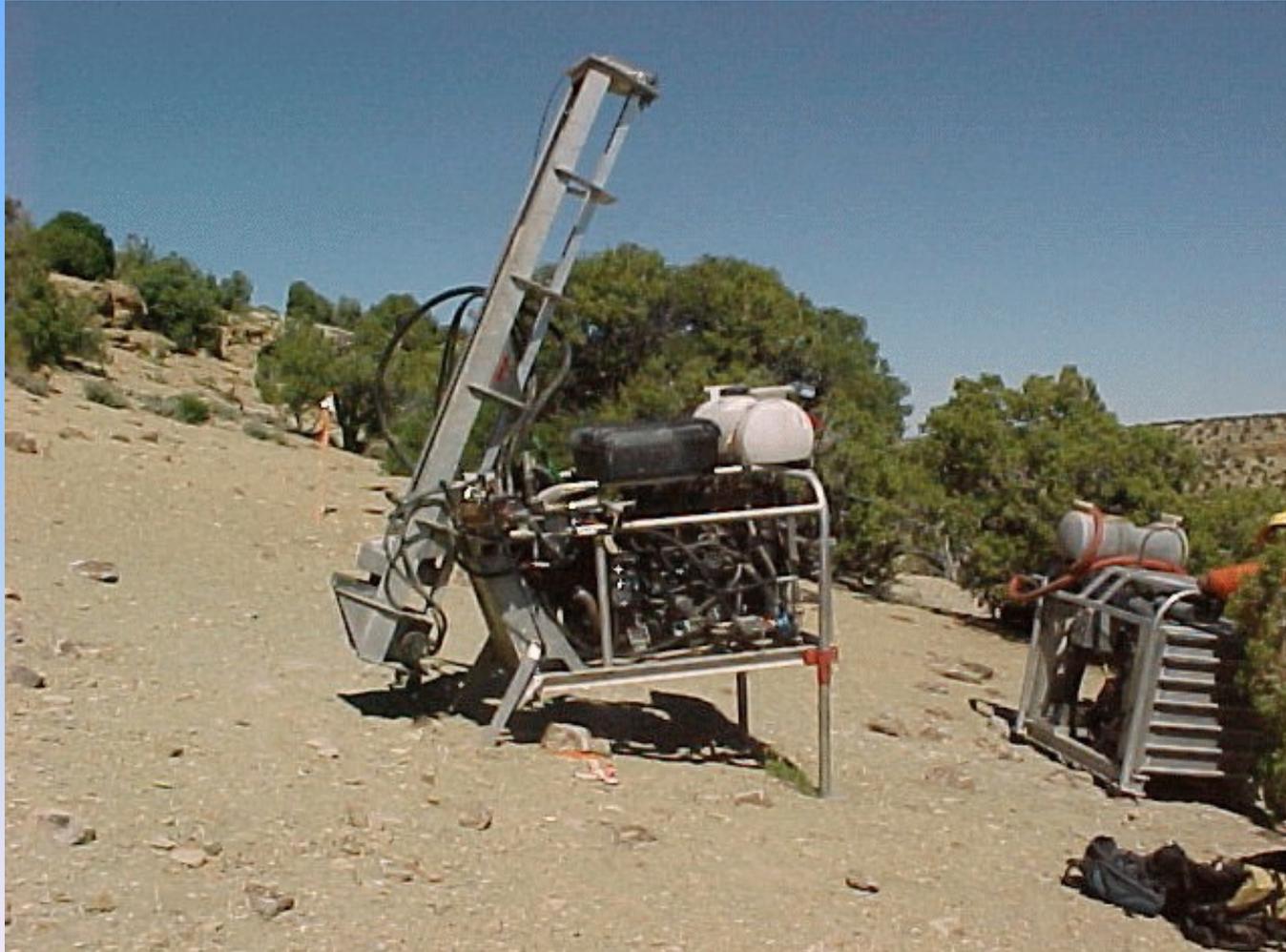
Seismic - Vibroseis



Vibroseis track



Seismic - Heliportable



Exploration Operations

Abandonment

- When no longer necessary
- When BLM requires it
- File NOI on Sundry Notice
- Do not start work until approved

Reports

- Your lease, submit all data
- Unleased acreage or other parties lease, not required to submit unless for DEE
- Signed NOC 30 days after operations conducted

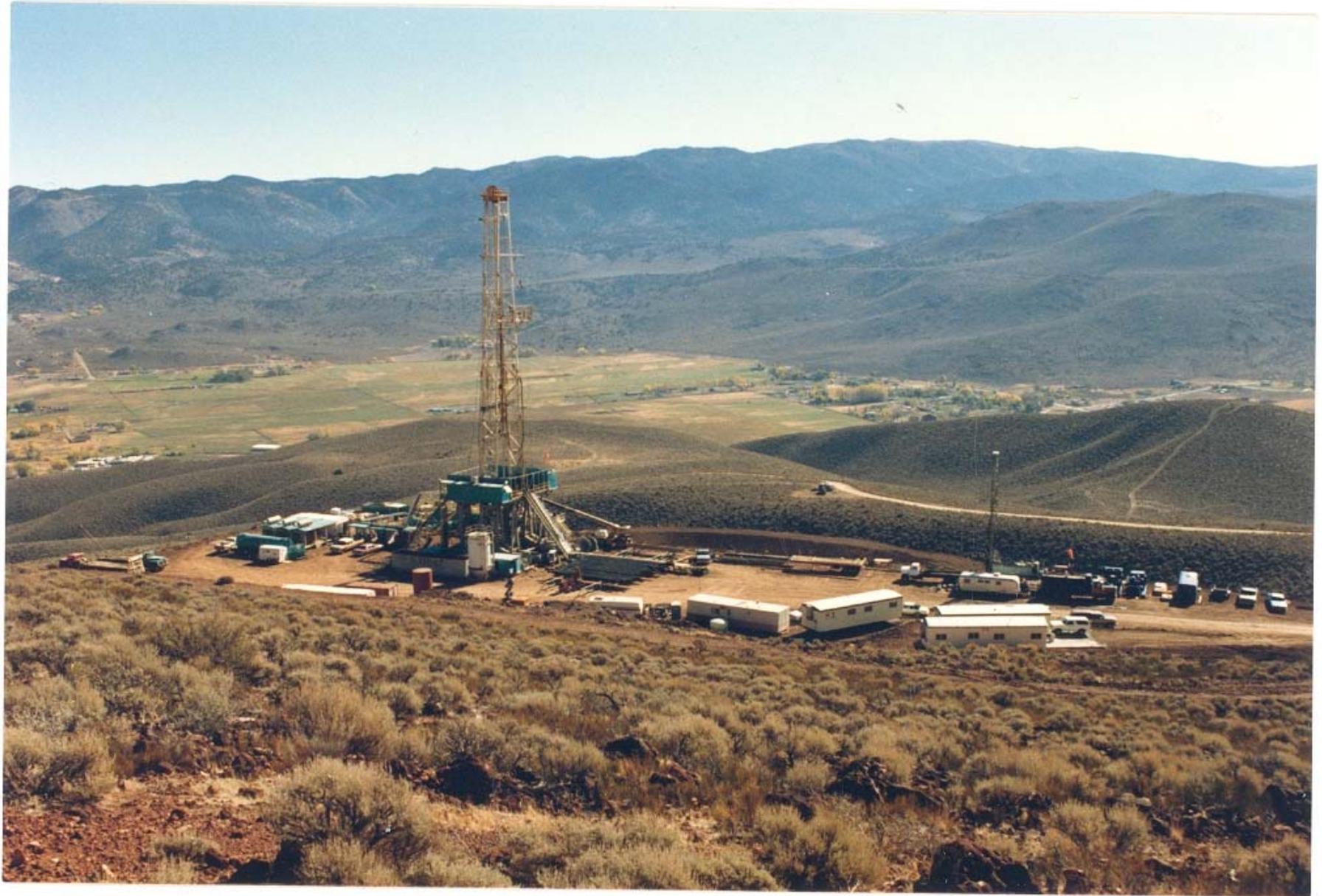
Confidential Information

- Held confidential per FOIA provisions
- Details at 43 CFR Part 2

GDPs – Overview

Four regulatory items -

- Geothermal Drilling Permit (GDP)
 - Form 3260-2
 - Complete & Signed
- Operations Plan
 - Describes the drilling pad, access roads and facilities related to drilling and testing
 - Includes measures for environmental protection and mitigation
- Drilling Program
 - Describes the technical and operational aspects of drilling, completing and testing
- Acceptable Bond
- No operations may commence until after BLM approves permit

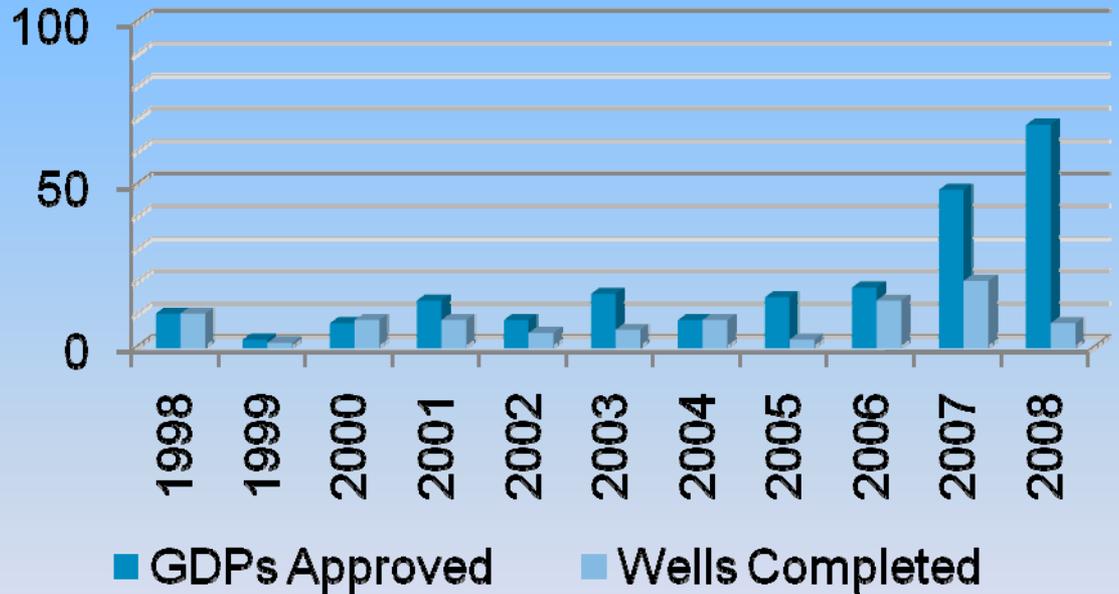


GDP - Permit Review Process

- Administrative review
 - Lease – Status & Constraints
 - Bonding
- Surface management review
- Geological/engineering review
- NEPA review (usually an EA)
- Conditions of Approval (COAs)
- Decision
 - Full Force in Effect
 - No State Director Review for Geothermal



GDPs Approved & Wells Completed



GDP – Operations Plan

Operations Plan

- Nine specific items
- Describes how the operator will drill & test geothermal resources on their lease
- Provide the information to initiate NEPA
- Well pad layout
- Existing & planned access roads
- Ancillary facilities
- Source of building material
- Water source
- Surface ownership
- Procedures to protect the environment
- Plans for reclamation
- Any other information BLM requires





GDPs – Drilling Program

Drilling program

- Describes the operational aspects
- Description of equipment, materials & procedures
- Proposed depth
- Directional specifics, including plan & vertical section
- Casing & Cementing program
- Circulation media (drilling fluids)
- Log description



GDPs – Drilling Program

Drilling program – (cont.)

- Blow Out Prevention Equipment (BOP)
- Fresh Water Zones
- Anticipated Reservoir Temperature & Pressure
- Anticipated Temperature Gradient
- Survey Plat by Licensed Surveyor
- Procedures and durations of well testing
- Any other information the BLM requires

Well Testing



GDPs – Miscellaneous

Miscellaneous -

- The drilling permit, drilling program and operations program can be submitted together
- If Operations Plan submitted separately
 - Submit prior to drilling permit & program
 - Sundry notice for well pad construction
- Operations plan and drilling program can cover several wells, but each drilling permit is well specific
- Subsequent changes to drilling plan via sundry notice
 - Oral approval option

GDPs – Bonding

Drilling Operations Bonding

- Necessary prior to surface disturbance
 - No Cash Bonds
 - Only LOC or Surety
- Amounts:
 - \$10,000 for individual lease
 - \$50,000 for statewide
 - \$150,000 for nationwide
- Released:
 - After request (not automatic)
 - All wells P&A'd
 - Surface reclaimed



GDPs - Operations Plan Checklist

- Based on regulatory requirements
- Encourage Use
 - BLM deficiency list
 - Industry quality control

<p>§ 3261.12 What is an operations plan? An operations plan describes how you will drill for and test the geothermal resources covered by your lease. Your plan must tell BLM enough about your proposal to allow us to assess the environmental impacts of your operations. This information should generally include:</p>	<p>Date Rec'd</p>	<p>Complete</p>	<p>Date Complete</p>	<p>Okay to Approve</p>
(a) Well pad layout and design;				
(b) A description of existing and planned access roads;				
(c) A description of any ancillary facilities;				
(d) The source of drill pad and road building material;				
(e) The water source;				
(f) A statement describing surface ownership;				
(g) Plans for surface reclamation;				
(h) A description of procedures to protect the environment and other resources; and				
(i) Any other information we may require.				

GDPs – Drilling Plan Checklist

§ 3261.13 What is a drilling program? A drilling program describes all the operational aspects of your proposal to drill, complete and test a well. Send us:	Date Rec'd	Complete	Date Complete	Okay to Approve
(a) A detailed description of the equipment, materials, and procedures you will use;				
(b) The proposed/anticipated depth of the well;				
(c) If you plan to directionally drill your well, also send us: (1) The proposed bottom hole location and distances from the nearest section or tract lines;				
(2) The kick-off point;				
(3) The direction of deviation;				
(4) The angle of build-up and maximum angle; and				
(5) Plan and cross section maps indicating the surface and bottom hole locations;				
(d) The casing and cementing program;				
(e) The circulation media (mud, air, foam, etc.);				
(f) A description of the logs that you will run;				
(g) A description and diagram of the blowout prevention equipment you will use during each phase of drilling;				
(h) The expected depth and thickness of fresh water zones;				
(i) Anticipated lost circulation zones;				
(j) Anticipated reservoir temperature and pressure;				
(k) Anticipated temperature gradient in the area;				
(l) A plat certified by a licensed surveyor showing the surveyed surface location and distances from the nearest section or tract lines;				
(m) Procedures and durations of well testing; and				
(n) Any other information we may require.				

GDPs – Abandonment

Plugging and Abandonment

- Do not start work until approved
- Operator must notify local BLM prior to initiating work
- File NOI on Sundry Notice
 - If not previously submitted, include all well completion data
 - Address all 6 items required (43 CFR 3263.11)
- BLM may grant oral approval -
 But operator must submit required info within 48 hrs.
- Restore the surface
- BLM may require abandonment
 - No longer needed
 - Not mechanically sound

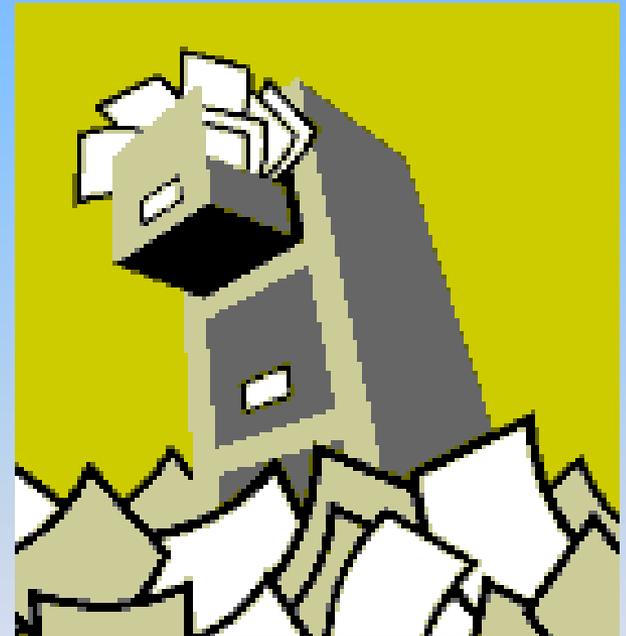
GDPs – Reports

Reports (43 CFR 3264)

- Newly completed wells
 - Completion Report (Form 3260-4)
 - 30 days after completion
 - 4 specific data items
- Subsequent Workovers
 - Subsequent Report
 - 30 Days following activity
 - 5 specific data items
 - BLM may waive this for routine operations

Confidential Information (43 CFR 3266)

- Held confidential per FOIA provisions
- Details at 43 CFR Part 2
- Items not held confidential:
 - Surface location
 - Surface elevation
 - Well status



Right of Appeal

- Authority at 43 CFR §3279.11
 - Refers back to §3200.5
- Adversely Affected Party May Appeal
- Decisions are full force in effect
- The IBLA Decision is Considered the Final DOI Decision
- Aggrieved Party May Seek Review in the *United States District Court*

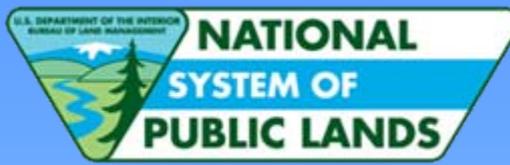
Documentation

- Administrative Record - Well & Plan Files
- GRASS – Geothermal Resource Automated Support System

If it's not documented – it hasn't happened!!

Inspection & Enforcement

- Responsibility for ensuring compliance with:
 - All lease stipulations
 - COAs in the drilling permit
 - All other applicable laws and regulations
- Production accountability to ensure all production is accurately measured
- Protect surface and subsurface environment
- Public health and safety
- Coordinated effort by NRS / PETs
- Certification process
- Specific enforcement tools



Acknowledgements

Thanks to the BLM staff
for their assistance in
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presentation

Any questions?

