CASE NO. 14015
OCD EXHIBIT 29

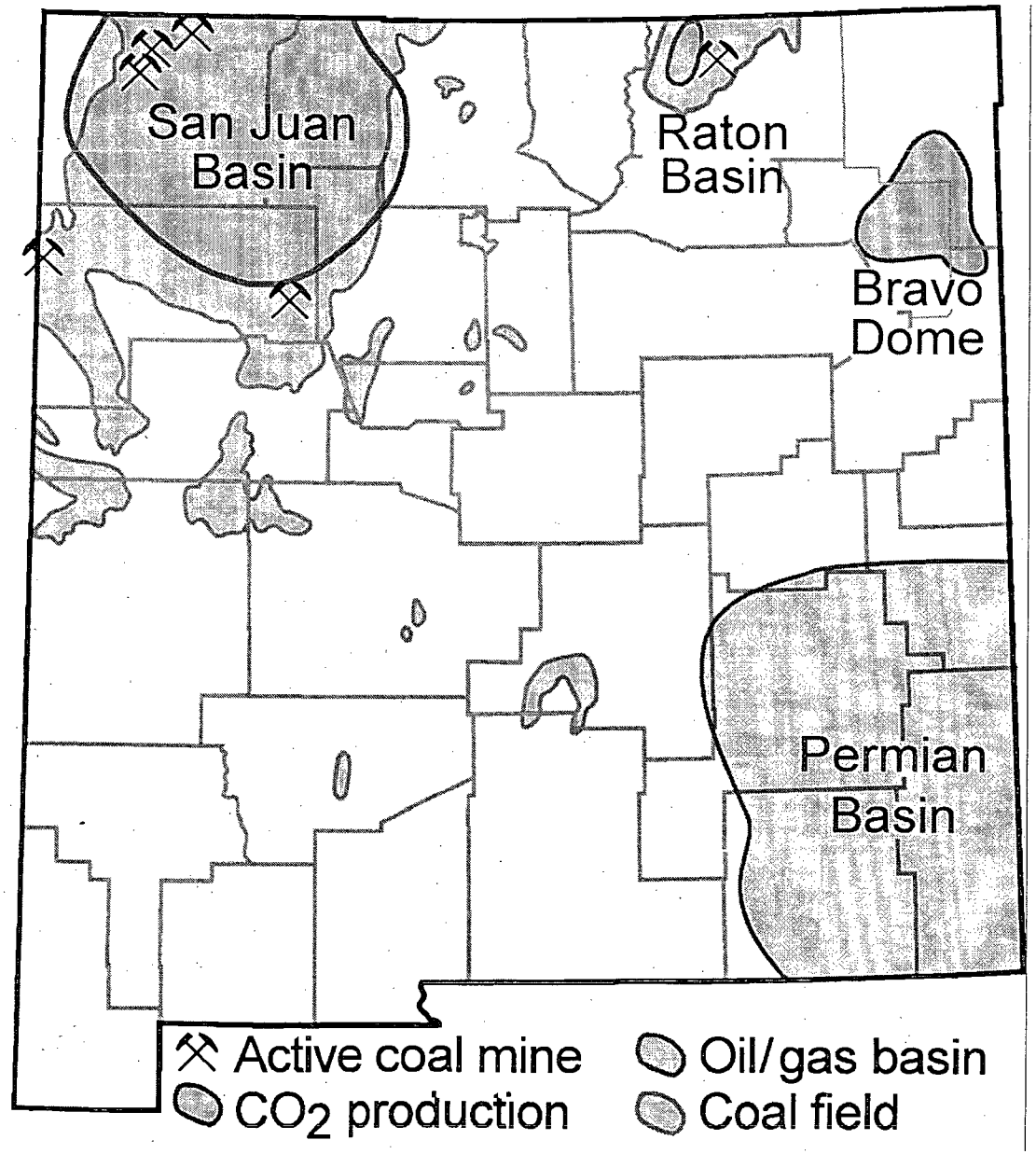
POLLUTION PREVENTION (P2)

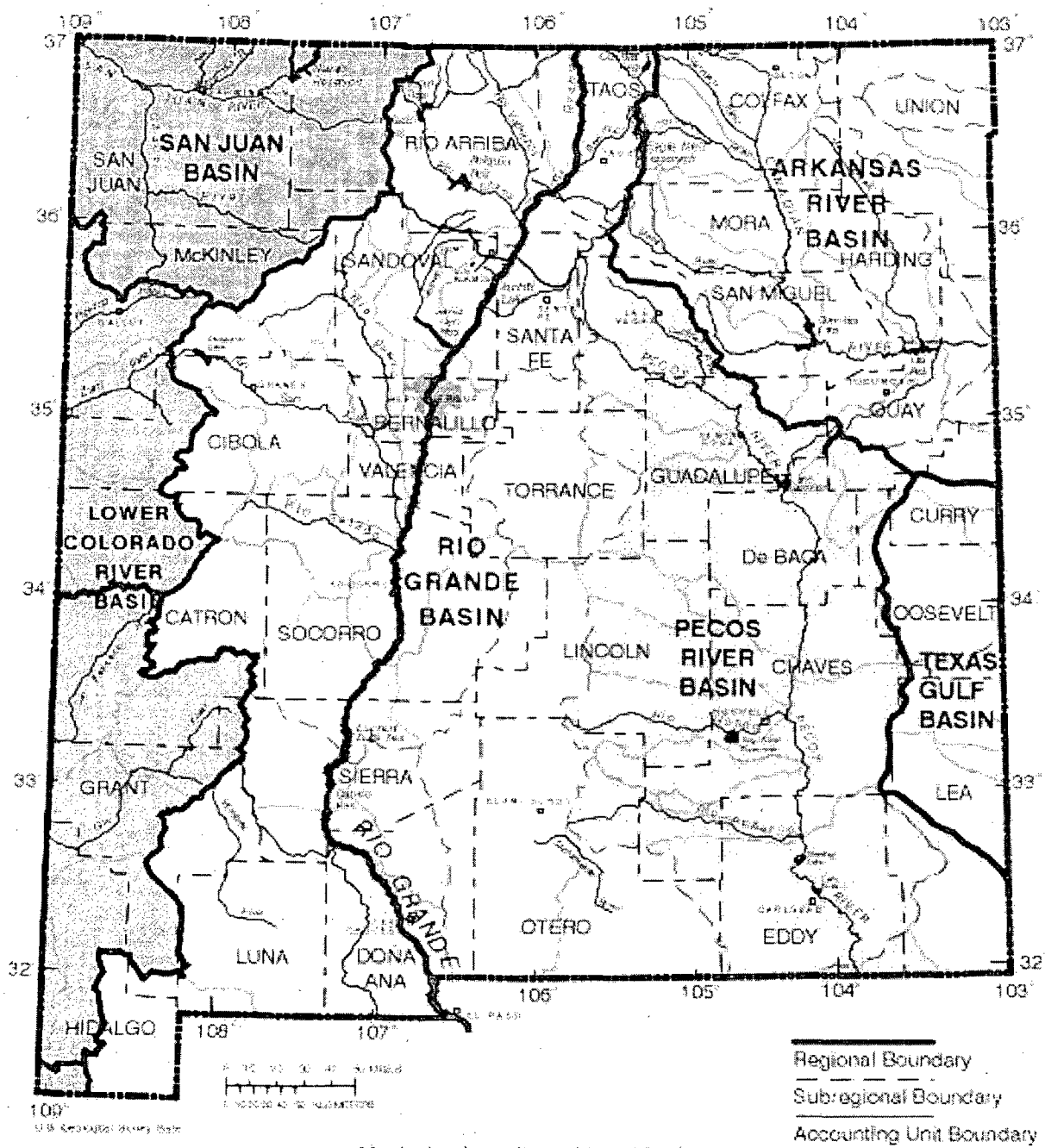
New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division

OCD POLLUTION PREVENTION (P2) INITIATIVE

"To protect human health and the environment from the effects of development of the state's oil, gas and geothermal resources." (Source: OCD Strategic Plan- June 28, 2007)

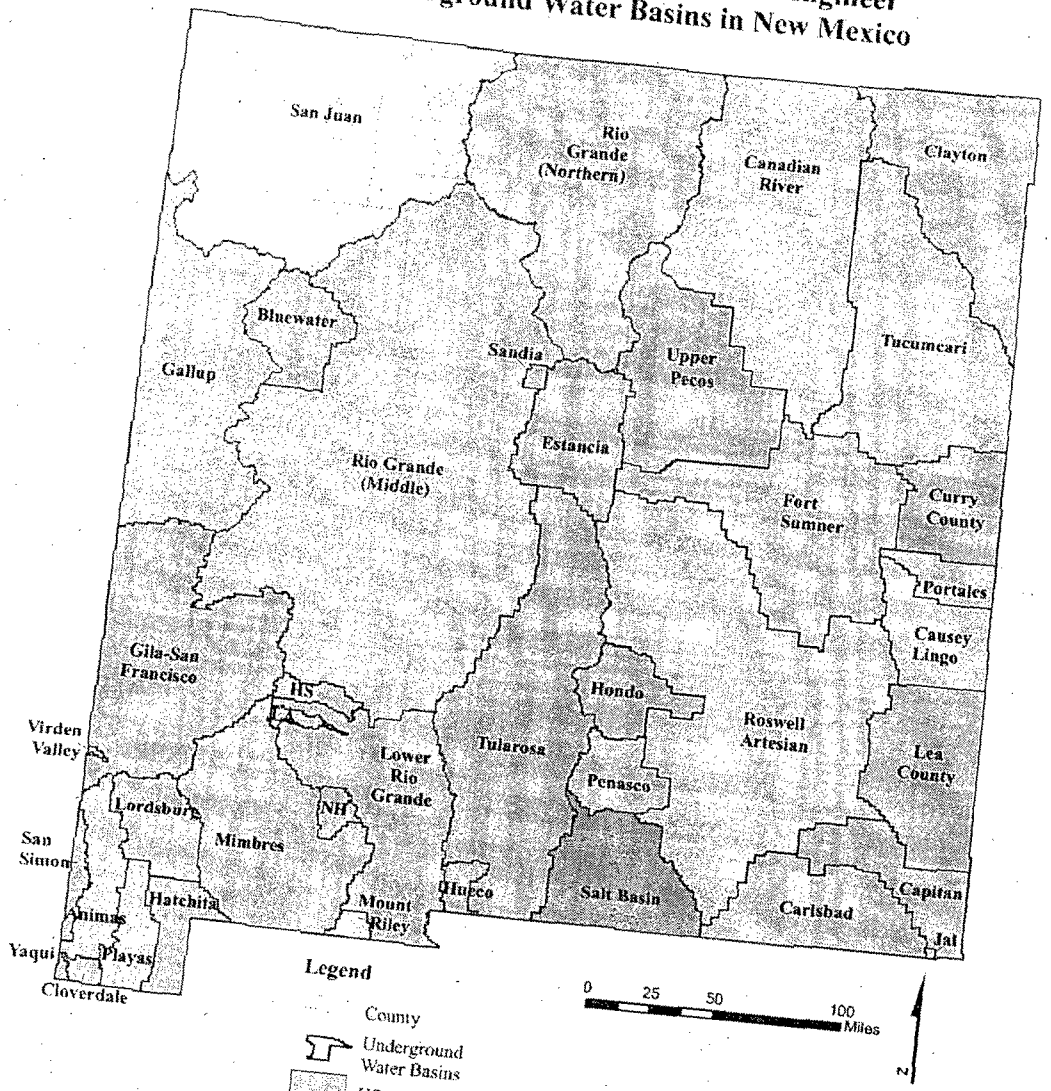
O&G PRODUCTION AREAS





Hydrologic units in New Mexico.

New Mexico Office of the State Engineer
Underground Water Basins in New Mexico



Underground Water Basins Map is based on the Bureau of Land Management Geographic Coordinate Data Base (GCDB) coordinate data (www.blm.gov/gcdb/)

Map is created in UTM, NAD27, Zone 13, Meters.

Created on October 24, 2005 by Christina Noftsker
OSE Water Resource Allocation Program

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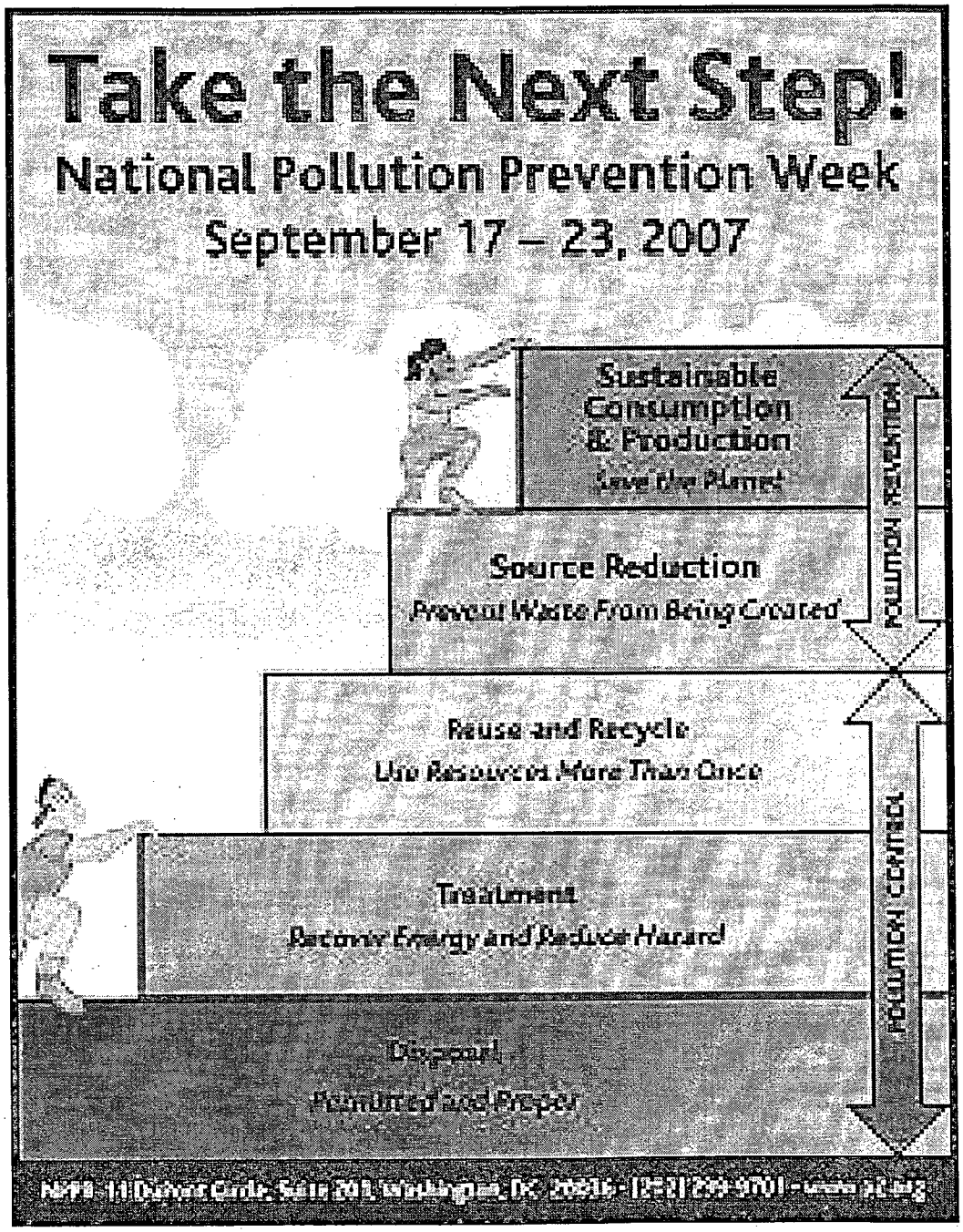
REGULATORY HISTORY

RCRA was created in 1976 under President Ford's Administration with other Environmental Acts that followed to compliment RCRA by seeking to protect public health.

- Prevent pollution in the first place by using better waste handling: treatment, storage and disposal practices.
- Pollution control - If pollution occurs, Reduce-Reuse-Recycle wherever possible to control pollution.
- National initiative - New Mexico is participating.

OCD REGULATORY HISTORY

- **1958** - First OCD Order restricting unlined pits
- **1965** - O&G Act amended to authorize OCD to regulate disposition of produced water
- **1989** - O&G Act amended to authorize OCD to regulate nondomestic waster
- **2003** - OCD adopts first comprehensive pit rule establishing general performance standards


Take the Next Step!
National Pollution Prevention Week
September 17 – 23, 2007
Sustainable Consumption & Production
Save the Planet
Source Reduction
Prevent Waste From Being Created
Reuse and Recycle
Use Resources More Than Once
Treatment
Recover Energy and Reduce Hazard
Disposal
Release Safe and Proper
POLLUTION PREVENTION
POLLUTION CONTROL

P2 - POLLUTION PREVENTION

- **SUSTAINABLE CONSUMPTION & PRODUCTION** (preferred to pollution control): Save the planet- find more efficient ways to extract mineral resources, protect the environment and save $ in the process (e.g., closed-loop drilling systems). O&G Industry can co-exist with the environment.
- **SOURCE REDUCTION** (preferred to pollution control): Use environmentally preferred chemicals- prevent wastes from being created (e.g., reduce toxicity and waste volumes by using less toxic products, better waste mgt., handling, treatment, storage and disposal processes)

P2 POLLUTION CONTROL

- **REUSE & RECYCLE** (preferred over treatment or disposal): Use resources more than once (*e.g.*, polymer or oil-based drill cuttings used at other drilling sites)

- **TREATMENT** (preferred over disposal): Use better waste treatment practices- recover energy and reduce hazard (e.g., reclaim oil and reprocess through treatment system- tank bottoms, skimming oil on pits/ponds, etc.)

- **DISPOSAL** (least preferred): Use better disposal practices- permitted and proper (*e.g.*, OCD permitted landfill facility)

IOGCC/EPA STATE REVIEW

Recommendation VI.4

"OCD should develop requirements for the siting, construction, operation, and closure of reserve pits."

Source: New Mexico State Review (June 1994)

IOGCC

"Facilities and sites used for the storage or disposal of wastes derived from the exploration and production of oil and natural gas should be operated and managed at all times to prevent contamination of ground water, surface water, soil and air, protect public health, safety and the environment, prevent property damage."

Source: State Review of Oil and Natural Gas Environmental Regulations, Inc. Adopted by IOGCC (June 2000)

IOGCC/EPA STATE REVIEW

Recommendation VI.4:

"OCD should develop requirements for the siting, construction, operation, and closure of reserve pits."

OCD Response:

"Approval of siting, construction and operation of lined pits and below grade tanks is already covered in Rule 18. All other on-site pits should be proposed and approved through the APD process."

Follow-up Review Comments:

"This recommendation has not been specifically met with regard to reserve pits. However, OCD has initiated rulemaking to clearly address reserve pits."

Source: STRONGER (August 2001)

PIT WASTES

3.3.1 Reserve Pits

Drilling muds are primarily water based mixtures of clays and inert weighting materials with special additives mixed in low concentrations. Wastes generated include various types of residual drilling fluids and solids, cement returns, freshwater, saltwater, oil and formation cuttings (shale, lime, salt, dolomite, etc.).

3.3.2 Drilling Rig Operations

Wastes generated from a drilling rig are primarily associated with mechanical equipments that include hydraulic fluids, used oils and rigwash fluids used to wash down the rig to provide a safe working environment.

3.4 Completions and Workovers

Workover operations include installing tubing and packer, acidizing or fracturing stimulations, replacing tubing or pumping equip., recompleting to new reservoirs, deepening, cementing or the PA of wellbores. Wastes generated may include hydraulic fluids, used oils and filters. Spent fluids include weighting agents, surfactants, muds, produced water, acids, inhibitors, gels, solvents and other materials.

Source: API Environmental Guidance Document, First Edition, January 15, 1989

OCD PIT WASTES

"Since the early days of drilling, so-called double horseshoe reserve pits have peppered the landscape throughout much of the Western US and elsewhere in the world. The earthen pits primarily are used to collect and retain drill cuttings for eventual disposal, but also hold base fluids, such as brines, cut brine or fresh water. To a limited extent, they also act as solids-control devices by settling solids in the outside ring of the horseshoe.

In the past, pits have been incorporated extensively in the solids-control system used to process drilling fluid. The inside portion of the pit generally holds fresh water for drilling surface hole and, later, brine for dilution of drilled solids in the active mud system. The outside portion of the pit is used to hold and settle solids while recovering fluid from the other end."

Dorsey Rogers and Dee Smith, Cimarex Energy Co.; and Gary Fout and Will Marchbanks, M-I SWACO in World Oil Magazine, Closed-loop drilling system: A viable alternative to reserve waste pits, Vol. 227 No. 12.

OCD PIT WASTES

"The double horseshoe design allows solids discarded from the solids control system to settle in the first part of the pit. Fluid continues to flow to the "deep" end where it can be recovered and re-used. In fact, this system became so effective that very large pits were developed with practically no solids control. This system was called circulating the pit, where the only practical solids control was gravity-induced settling."

Dorsey Rogers and Dee Smith, Cimarex Energy Co.; and Gary Fout and Will Marchbanks, M-I SWACO in World Oil Magazine, Closed-loop drilling system: A viable alternative to reserve waste pits, Vol. 227 No. 12.

OCD CONCERNS ABOUT PIT WASTES

- Wastes associated with O&G operations can poison living organisms (*e.g.*, cancer-causing substances like benzene and other hydrocarbons; radioactive materials and heavy metals)
- Wastes discharged into unlined pits, toxic substances can leach directly into the soil or sediment and may contaminate groundwater
- Lined pits with oil field wastes can cause pollution of soil, sediment and water via torn liners or overflow of fluids from pits, which can adversely affect human and ecosystem health

PITS CAN CAUSE POLLUTION

Liquid wastes may contain toxic substances that can:

- Leach directly into the ground if stored in unlined or inadequately lined pits and contaminate soil and water
- Overflow the sides of the pit (*e.g.,* precipitation event and/or lack of storage volume) and impact soil and water
- Seep into the ground via cracks, tears, *etc.* through liners and leach directly into soil and water. This happens because liners either have defects and/or are often improperly installed or are torn during installation.

Solid wastes, if left on site, may contain toxic substances that can:

- Readily leach from solids and impact soil and water
- Contaminate soil and vegetation
- Sterilize soil - preventing vegetative growth

O&G DRILLING SYSTEM

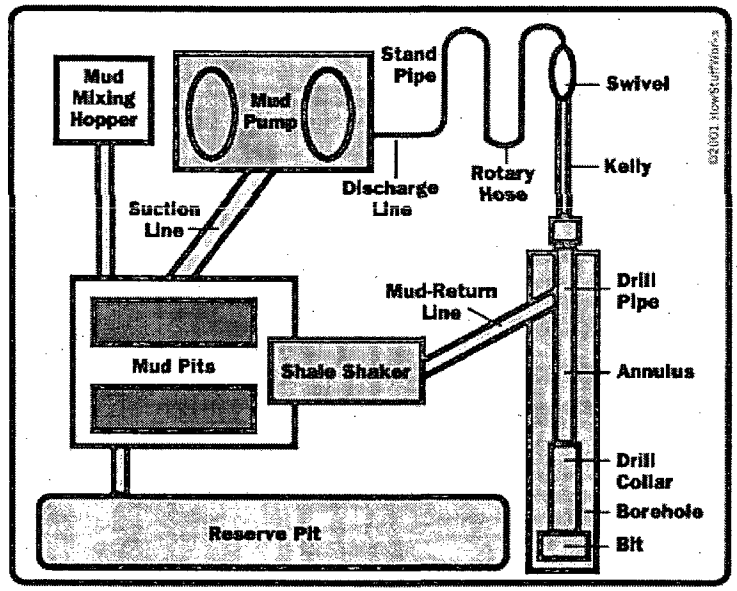


Photo courtesy of Institute of Petroleum
Mud circulation in the hole

Circulation system - pumps **drilling mud** (mixture of water, clay, weighting material and chemicals, used to lift rock cuttings from the drill bit to the surface) under pressure through the kelly, rotary table, drill pipes and drill collars
pump - sucks mud from the mud pits and pumps it to the drilling apparatus
pipes and hoses - connects pump to drilling apparatus
mud-return line - returns mud from hole
shale shaker - shaker/sieve that separates rock cuttings from the mud
shale slide - conveys cuttings to the reserve pit
reserve pit - collects rock cuttings separated from the mud pits
mud pits - where drilling mud is mixed and recycled
mud-mixing hopper - where new mud is mixed and then sent to the mud pits

CLOSED-LOOP SPECIFICATIONS AND REQUIREMENTS

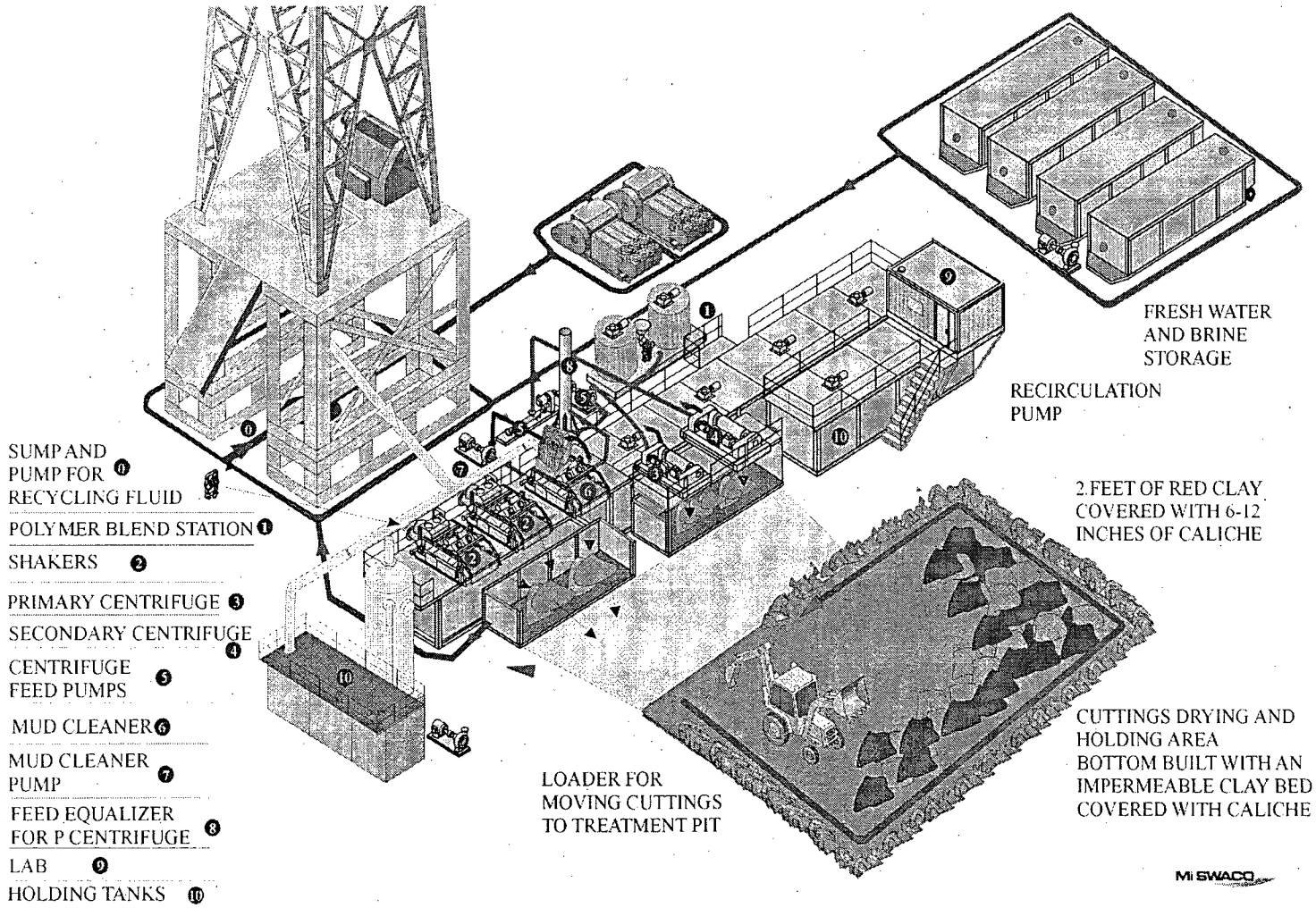
19.15.17.7 DEFINITIONS:

B. "**Closed-loop system**" means a system that uses above ground steel tanks for the management of drilling or workover fluids without using below-grade tanks or pits.

OCD POLLUTION PREVENTION

- Closed-Loop Drilling Systems minimize the need for pit construction and reduces associated liability for contamination
- Note: Cimarex Energy Co. was awarded the OCD 2007 Environmental Merit Award for "Pitless Drilling System")
- Protection of natural resources: soil, local and regional fresh water aquifer systems (*i.e.*, Surficial Aquifers, San Juan Basin Aquifers (NW) and High Plains Aquifer (SE)

Cimarex Co.
PITLESS DRILLING SYSTEM



CLOSED-LOOP DRILL SYSTEM

Railroad Commission of Texas
Waste Minimization Case Histories
- Drilling Operations

Closed Loop Drilling Fluid System

- **Problem:** A small independent operator was concerned about the volume of drilling waste in conventional reserve pits at his drilling locations. Waste management costs were a concern, as well as the costs associated with impact on adjacent land due to pit failures. The operator was concerned about the potential for surface water or ground water contamination and the associated potential liabilities.

CLOSED-LOOP DRILL SYSTEM

Railroad Commission of Texas
Waste Minimization Case Histories
- Drilling Operations

Closed Loop Drilling Fluid System

- **Solution:** The operator was drilling relatively shallow wells in normally pressured strata. Because the drilling plan was relatively simple, the operator investigated the feasibility of using a closed-loop drilling fluid system for these wells. The use of a closed-loop system eliminated the need for a conventional reserve pit. The operator negotiated with drilling contractors to obtain a turn-key contract that required the drilling company to use a closed-loop system and take responsibility for recycling the waste drilling fluid.

CLOSED-LOOP DRILL SYSTEM
Railroad Commission of Texas
Waste Minimization Case Histories
- Drilling Operations

Closed Loop Drilling Fluid System

- **Benefits:** The turn-key contract was incrementally more expensive. However, because of reduced drill site construction and closure costs; reduced waste management costs; and reduced surface damage payments, the operator realized a savings of about $10,000 per well. Also, the operator reduced the potential for environmental impact and associated potential liability concerns.

Swaco closed-loop systems: A Tale of two wells

The Swaco closed-loop system is probably the surest way to ensure the best solids-control value for your dollar. Basically, it is a suite of solids-control equipment custom-matched to your well and drilling objectives in order to minimize drilling fluid dilution and provide the most economic handling of the drilling waste. The result is that no mud is discarded from the rig, reserve pits are eliminated and used fluids are recycled. Two wells, drilled only 200 ft apart in Matagorda County, Texas, provided a unique opportunity to compare the cost savings difference between conventional solids-control equipment and a Swaco closed-loop system. Both wells drilled through the same formations, using the same rig, crew, mud company and bit program. Improved solids control resulted in some significant savings:

- **43% savings in drilling fluid costs**
- **23% fewer rotating hours**
- **33% fewer days to drill to a comparable depth**
- **37% reduction in the number of bits used**

Swaco closed-loop systems: A Tale of two wells

- **Up to 39% improvement in the rate of penetration**
- **Uses 80% less water**

Typically, the system includes a series of linear-motion shakers, mud cleaners and centrifuges followed by an optional dewatering system. The dewatering system adds flocculants to the feed of a high-speed centrifuge to coagulate ultra-fine particles that can then be discarded. This combination of equipment typically results in a "dry" location where a reserve pit is not required, and solid waste can be landfarmed, hauled off or injected downhole.

Source: Swaco www.miswaco.com/More_Info/About_Us/98131.pdf

BENEFITS OF CLOSED-LOOP SYSTEMS:

- Eliminates unsightly and hazardous pits
- Reduces the time, energy and expense of building, fencing and reclaiming reserve pits
- Decreases the need for cuts in sensitive and hilly areas
- Total surface disturbance associated with a well pad is reduced

BENEFITS OF CLOSED-LOOP SYSTEMS:

- Eliminates risk of waterfowl and wildlife mortality related to pits
- Eliminates risk of damaging underground pipelines and utilities
- Allows drilling in areas with a shallow ground water table

Source: Earthworks (http://www.earthworksaction.org/alternativestopits.cfm#CLOSEDLOOP)

BENEFITS OF CLOSED-LOOP SYSTEMS:

- Virtually eliminates drilling waste
- Uses less water per well - it can reduce water consumption by as much as 80%

BENEFITS OF CLOSED-LOOP SYSTEMS:

- EPA estimates that "closed loop systems" can reduce the volume of drilling fluids by as much as 90%
- Eliminates soil segregation, which reduces wind erosion problems

Source: Earthworks (http://www.earthworksaction.org/alternativestopits.cfm#CLOSEDLOOP)

BENEFITS OF CLOSED-LOOP SYSTEMS:

- May improve relationship with surface owners
- Greatly reduced waste tracking and need for landfarming operations
- Drill cuttings may be put to beneficial use (*e.g.*, if not contaminated they may provide a source of finely-ground clay for berm construction around tank batteries *etc.*)
- Tanks can be re-used

Source: Earthworks (http://www.earthworksaction.org/alternativestopits.cfm#CLOSEDLOOP)

P2 AND THE PIT RULE

- Use of unlined or improperly designed and constructed pits and deep trench burial for waste storage and disposal anywhere today is inconsistent with P2 practices
- IOGCC Mandate: *"Facilities and sites used for the storage or disposal of wastes derived from the exploration and production of oil and natural gas should be operated and managed at all times to prevent contamination of ground water surface water, soil and air, protect public health, safety and the environment, prevent property damage."* (*Source: Guidelines for the Review of State Oil and Natural Gas Environmental Programs*)

P2 AND THE PIT RULE

- Property devaluation issues
- Legacy Issues – Industry (or State taxpayers) will pay in the future to cleanup contamination that can be prevented now.

SUGGESTED E&P WASTE MANAGEMENT PRACTICES CONSISTENT WITH P2

- Use closed loop mud systems when practical, particularly with oil-based muds.
- Size reserve pits properly to avoid overflows.
- Review material safety data sheets (MSDSs) of materials used, and select less toxic alternatives when possible

Source: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)

SUGGESTED E&P WASTE MANAGEMENT PRACTICES CONSISTENT WITH P2

- Minimize waste generation, such as by designing systems with the smallest volumes possible (e.g., drilling mud systems).
- Reduce the amount of excess fluids entering reserve and production pits.
- Keep non-exempt wastes out of reserve or production pits.

Source: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)

SUGGESTED E&P WASTE MANAGEMENT PRACTICES CONSISTENT WITH P2

- Design the drilling pad to contain storm water and rigwash.
- Recycle and reuse oil-based muds and high density brines when practical.
- Perform routine equipment inspections and maintenance to prevent leaks or emissions.

Source: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)

SUGGESTED E&P WASTE MANAGEMENT PRACTICES CONSISTENT WITH P2

- Reclaim oily debris and tank bottoms when practical.
- Minimize the volume of materials stored at facilities.

Source: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)

SUGGESTED E&P WASTE MANAGEMENT PRACTICES CONSISTENT WITH P2

- Construct adequate berms around materials and waste storage areas to contain spills.
- Perform routine inspections of materials and waste storage areas to locate damaged or leaking containers.
- Train personnel to use sensible waste management practices.

Source: Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)

P2 CONCLUSIONS

Performance Based Standards clearly have not met P2 goals. For example:

- **Sustainable Consumption and Production** - current O&G practices do not appear to be addressing P2 during natural resource extraction (What about closed-loop systems?)
- **Reduce** - current practices may actually increase wastes as fluids are not drawn off and wastes are "bulked" with clean soils

P2 CONCLUSIONS

- **Recycle** - current pit and deep trench disposal discourage recycling
- **Reuse** - current pit and deep trench disposal discourage resuse of pit contens
- **Treatment** - current practices may not reduce toxicity of some parameters (e.g., TPH, Naphthalenes, Trimethyl Benzenes, and heavy metals)
- **Disposal** - pits and deep trench disposal may result in multiple disposal sites contrary to best disposal options.

P2 CONCLUSIONS

- The O&G Industry is not applying P2 practices during everyday drilling activities.
- The O&G Industry prefers to bury wastes and dispose of them on-site.
- Pits all too often can become open dumps.
- OCD's proposed Pit Rule by allowing the O&G Industry to continue drilling with pits and dispose of oil field waste using deep trench burial will ensure that Industry applies more efficient designs, construction, and emplacement techniques to minimize or defer impacts.

P2 CONCLUSIONS

- OCD should require the O&G Industry to follow BMPs for closed-loop drilling, pit, evaporation pond, and deep trench disposal guidance to prevent pollution.
- Better waste treatment, storage and disposal practices coupled with pollution prevention (reduce-reuse-recycle and sustainable consumption and production) is the right direction at the right time for the O&G Industry - RCRA 1976 - Present (OCD working on since 1965)

P2 CONCLUSIONS

- **There's no excuse**. Closed-loop field drilling systems are not new and are in widespread full-scale field application in the U.S. today.
- **It makes sense**. Closed-loop drilling systems will minimize land disturbance, reduce the cost of drilling, minimize, reuse or recycle drill cutting waste at other drilling sites while protecting the environment.
- **It's like a bad habit**. The obstacle impeding the O&G Industry from applying closed-loop drilling systems to prevent pollution today is its reliance on pits ("*This is the way we've always done it*").

P2 CONCLUSIONS

- **It's common sense.** The O&G Industry should seek out the most efficient and cost effective ways of exploring for and producing oil or gas while protecting the environment.
- **Habitat and wildlife will benefit.** Landscape beauty and surface waters of the state will also be better protected by OCD's proposed Pit Rule and P2 initiatives.
- **Fresh GW aquifers will benefit.** The surficial aquifers, San Juan Basin Aquifers and Great Plains Aquifer will be better protected by the new OCD regulations.

P2 CONCLUSIONS

- To correct the present crisis, the OCD should consider a massive enforcement campaign on drilling, workover, disposal and production pits across the state to enforce the problem of inadequate design and construction of pits.
- This would significantly increase the number of abatement plans and sites of environmental contamination under OCD Rule 19 where contamination impacts ground water.

KEY RECOMMENDATIONS

- The O&G Industry should switch to the more efficient "Closed-Loop Drilling System" in most of its drilling operations - especially in sensitive environmental areas

KEY RECOMMENDATIONS

- The O&G Industry should develop closed-loop drilling system, deep trench disposal, drilling pit and evaporation pond design and construction guidance or best management practices for the industry.

KEY RECOMMENDATIONS

- The O&G Industry should make a commitment to implement pollution prevention (P2) practices along with the rest of the nation, since it is most efficient, protective of the environment and industry is saving $ millions by incorporating P2 into its everyday work activities.

REFERENCES

(1) Pollution Prevention Publications, U.S. EPA
(2) Crude Oil and Natural Gas Exploration and Production Wastes: Exemption from RCRA Subtitle C Regulation, U.S. EPA (May 1995)
(3) IOGCC/EPA State Review of Oil and Gas Exploration and Production Waste Management Regulatory Programs, New Mexico State Review (June 1994)
(4) Guidelines for the Review of State Oil and Natural Gas Environmental Regulatory Programs, State Review of Oil and Natural Gas Environmental Regulations, Inc. Adopted by IOGCC (June 2000)
(5) New Mexico Follow-up and Supplemental Review, State Review, State Review of Oil and Natural Gas Environmental Regulations, Inc. (Stronger-August 2001)
(6) API Environmental Guidance Document, Onshore Solid Waste Management in Exploration and Production Operations, First Edition, January 15, 1989
(7) Earthworks™
http://www.earthworksaction.org/alternativestopits.cfm#CLOSEDLOOP
(8) World Oil Magazine, Closed-loop drilling system: A viable alternative to reserve waste pits, Vol. 227 No. 12.