DOE's Oil & Gas Environmental Research Program
Winter 1998, Vol. 3, No. 1

EYE On Environment

U.S. Department of Energy • National Petroleum Technology Office • P.O. Box 3628 • Tulsa, OK • 74101

Environmental Compliance Assistance System Is Online and On-time

by Rhonda Lindsey, U.S. DOE, NPTO, and
Deanna M. Rector, University of Central Oklahoma

For help in understanding and meeting Federal regulations for the oil and gas industry, consult the Environmental Compliance Assistance Systems (ECAS), a new Internet Web site sponsored by the U.S. Department of Energy at **http://www.npto.doe.gov/ECAS/main.html**. The goal of ECAS is to help operators avoid fines, obtain training tools, and reduce the hours spent on compliance.

If you have a computer set up for Internet searching, you will find using ECAS to be easier than wading through the Code of Federal Regulations, and faster than locating addresses in state, federal, and industry directories. The site offers plenty of efficient, free information to help lighten the burden of environmental compliance.

The Cost Burden

How heavy is this burden? A 1990 study by the First International Symposium on Oil and Gas Exploration and Production Waste Management Practices estimated costs at $15 to $79 billion cost for initial industry-wide compliance with new environmental regulations. Annual costs for compliance would range from $2 to $7 billion as environmental regulations increased.

Status of Oil & Gas Wells

A large number of the existing

Continued on page 2

This newsletter features oil-and gas-related projects implemented through the U.S. Department of Energy's (DOE's) oil and gas environmental research program. BDM-Oklahoma, Inc., as management and operating contractor of the National Oil Program, assists DOE in achieving its objectives.

DOE contacts for the program are Herb Tiedemann (918-699-2017) and David Alleman (918-699-2057) in the National Petroleum Technology Office. Contact Steve Jones (918-338-4486), BDM Petroleum Technologies, for information on the Environmental Research Program. Contact Viola Schatzinger (918-337-4341) for questions about the newsletter.

Acknowledgments

Editor Viola Rawn-Schatzinger
Copy Editor Irene Chang
Graphic Designers John Draper
Susan Hayden

CONTENTS

Continued from page 1

wells in the U.S. are either marginal producers or idle. These wells all need to meet varying environmental regulations. Figure 1 shows the percentages of endangered wells. Because the operators of these wells can little afford to spend time and money on compliance, ECAS has been designed especially to meet their needs. In fact, the top priority of DOE's Oil and Gas Environmental Research Program is simplifying environmental regulation without compromising protection.

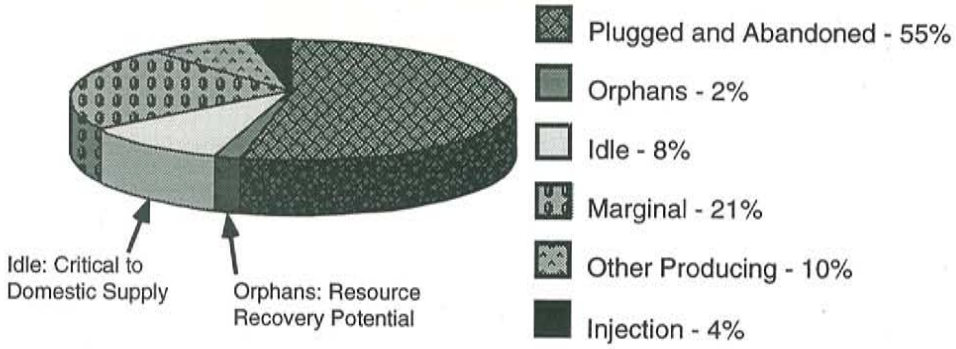


Figure 1 Data on U.S. oil and gas wells indicate that many existing wells are marginal producers or idle

Answering Questions

ECAS can help operators by answering these questions:

- What federal regulations do I need to comply with?
- How do I set up a waste management plan?
- What are some guidelines for responding to emergencies?
- What are some applicable cleanup methods?
- Where do I apply for exploration and production permits?
- What are the oil and gas associations in my state or region?

Keeping Industry Updated

Also, ECAS posts changes to Federal rules and regulations to offer timely notice. Regarding available environmental technologies, ECAS tries to respond to industry's needs to know "What's the best and cheapest...?" For example, ECAS lists applicable cleanup methods in these areas (along with links to other possible resources):

Groundwater Treatment

- Activated carbon adsorption
- Air stripping
- Biological aqueous treatment

Soil and Groundwater Treatment

- Activated carbon adsorption
- Air stripping
- Biological aqueous treatment

Soil Treatment

- In-situ bioventing
- Unsaturated zone in-situ bioreclamation
- Bioslurry reactors
- Surface pile bioremediation

Links to DOE Projects

The DOE has sponsored handbooks or simplified manuals which cover the guidelines in each state or area. Several states have manuals which are completed or in the pipeline. Kentucky's manual will be available on the Internet soon (see ECAS for details). Texas has also completed a draft manual. Colorado, Wyoming, and New Mexico have environment, safety, and health (ES&H) manuals created by the IPAMS (Independent Producers Association of Mountain States) staff. North Dakota, South Dakota and Montana will have ES&H handbooks completed soon. PTTC branches have manuals available on air compliance for several states and regions. Already, there are Web links to the Environmental Protection Agency (EPA), Code of Federal Regulations (CFR), American Petroleum Institute (API), and various state advisories.

Future Plans and Electronic Filing

A plan for guidance by the Environmental Protection Agency (EPA) and the Minerals Management Service (MMS) will be included when completed. Updates on all new cleanup methods will be added as they become available. Links to other states' environmental postings will be added as they are developed. Provisions for electronic filing also are in the plans.

With all these features and plans, ECAS (at **http://www.npto.doe.gov/ECAS/main.html**) is worth checking out now and adding a bookmark for the future.

Emissions Standards for Heavy Oil Tanks: Coming Soon?*

by Viola Rawn-Schatzinger, BDM-Oklahoma, Inc.

Regulatory agencies have plans to tighten allowed emissions of volatile organic compounds (VOCs) and reactive organic compounds (ROCs) to meet ozone requirements, and heavy oil tanks are targeted. Fortunately, preliminary tests sponsored by a voluntary government-industry group show that emissions from heavy oil tanks can be monitored at reasonable costs, and that emission rates tend to be within current emission standards.

Although most heavy oil tanks are in California, any regulations adopted may soon apply to other states as well. To ensure that any regulations enacted are both workable and effective, a voluntary government-industry group has been organized to work on the Heavy Oil Storage Tank (HOST) Project.[1] The group's aim is to develop and test new methods to measure hydrocarbon emissions from heavy oil (less than 20° API) storage tanks in central and southern California and determine if the emissions need pollution controls. Primary funding for HOST comes from the U.S DOE and the Western States Petroleum Association, and members are listed in Table 1.

Table 1 HOST Members

California Air Resources Board
Lawrence Berkeley National Laboratory (LBNL)
Monterey Unified Air Pollution Control District
San Joaquin Valley Unified Air Pollution Control District
Santa Barbara Unified Air Pollution Control District
U.S. DOE
U.S. Environmental Protection Agency
Western States Petroleum Association

Heavy Oil Problem

Thousands of oil storage and production tanks in California have no significant emissions controls, such as vapor recovery systems. Existing emission control requirements are inappropriate for heavy oils, because they had been devised for gasoline and based on vapor pressure measurements. Regulations for allowable emissions are defined by Reid vapor pressure (RVP) units; 1.5 psi is the current standard. The RVP method includes pressures from water, carbon dioxide, methane, and ethane; none of which are considered ROCs. Two problems were apparent:

1. Heavy oil vapor pressure is difficult to measure. Heavy crude oil cannot be poured into the Reid measuring apparatus, and the open air method allows some volatile gases to escape.
2. Little data are available from the thousands of tanks in California which do not have vapor recovery. Figure 1 shows the composition of gasoline, light crude, and heavy crude relating to the ROCs and vapors.

The problem of measuring vapor pressure from heavy oil and providing solutions required laboratory study.

Who Does the Work?

Lawrence Berkeley National Laboratory (LBNL) was chosen to study existing vapor pressure methods and develop new, scientifically valid procedures for heavy crudes. The National Laboratory

Continued on page 4

* This article is based on presentations by Rhonda P. Lindsey, U.S. DOE: SPE/EPA Exploration and Production Environmental Conference in Dallas, TX, March 3–5, 1997; and SPE Western Regional in Long Beach, CA, June 23–27, 1997.

1. Lucas, D., D. Littlejohn, and R. P. Lindsey. 1997. The Heavy Oil Storage Tank Project. Paper SPE 37886 presented at the SPE/EPA Exploration and Production Environmental Conference, Dallas, TX, March 3–5.

Continued from page 3

had the scientific background and laboratory facilities, and was considered suitably impartial for mediating between industry's needs and government regulatory agencies' desires. Funding for 1996 was $75K from DOE, $50K from WSPA, and in 1997 $30K from each. Other HOST members supplied guidance, personnel, and field equipment.

New Methods Developed

The LBNL liquid sampler consists of a copper tube equipped with two ball valves and different pipe fittings for connecting to the tank's sampling ports. The collection device is inexpensive ($20), rugged, and made from tubing and valves available off-the-shelf. Collection can be made at ambient temperature without exposure to the atmosphere. The sample tube is held vertically to ensure complete filling of the liquid chamber. In the laboratory, the liquid collector is attached to a vapor space chamber, and vapor composition is analyzed by gas chromatography.

As a test of this method, 20 tanks in southern California were successfully sampled and analyzed. A separate apparatus is used to sample the vapors in the tank headspace. Six additional tanks have been more extensively tested using tests for tank vapor tightness.

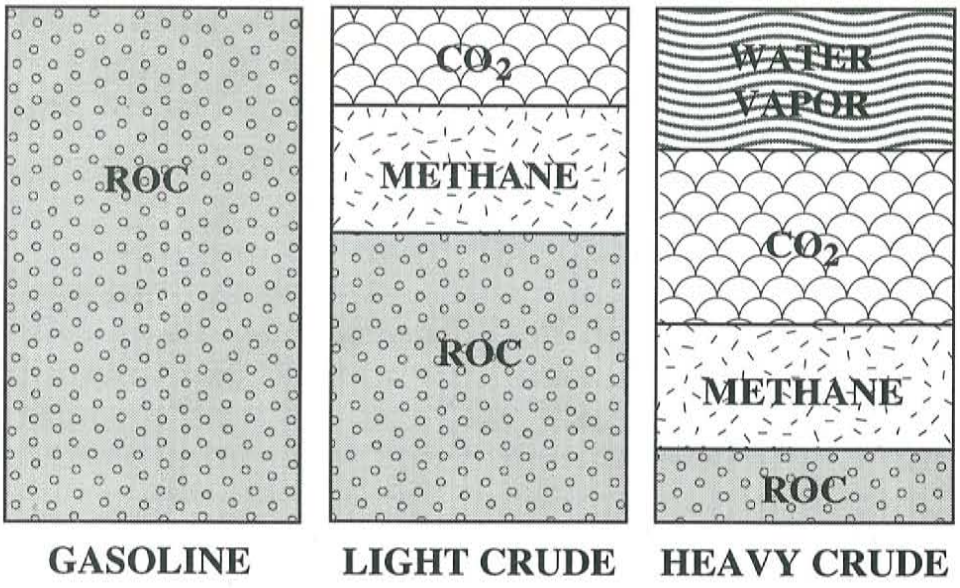


Figure 2 Vapor composition of various organic liquids

Also, the California Air Resource Board (CARB) has developed a CARB 150 measurement for determining hydrocarbon emissions from crude oil tanks. This process measures the gas flow in and out of the tank over a 24-hour period with continuous monitoring of the tank headspace temperature, oil temperature, hydrocarbon concentration, and tank pressure. Periodic measurements also were made of methane, air, and carbon dioxide levels, along with taking liquid and gas samples for hydrocarbon speciation.

Test Results

A summary of test results appears in Table 2. Note that the values in the final column, which lists the total pounds of reactive organics emitted from each tank during a 24-hour period, are all quite low. In the six tanks fully tested, less than 1 pound of organic compounds was emitted daily. This amount falls *well below the levels requiring regulatory control.*

These emissions are produced by different mechanisms–termed working, breathing, and flashing losses. Working losses are associated with changes in liquid level. Breathing losses stem from the flow of vapors in and out of the storage tank because of daily heating and cooling of gases in the tank. Flashing losses arise when dissolved gases in the liquids attempt to equilibrate with the gas phase. Each kind of loss may require different

mechanisms to measure and to control.

Future Plans

Future plans are to measure and test 20 to 50 additional tanks in California using both liquid and vapor methods. The aim is to collect representative samples from different fields and locations, and attempt to validate relationships among various methods and actual emissions. Continued development of a scientifically sound protocol acceptable to regulatory agencies and industry is the goal of the HOST project.

Conclusions

Preliminary tests show that emissions from heavy oil tanks can be monitored at reasonable costs, and at present are within air emission standards. Efforts to collect scientific data and recommend improvements *before government regulations are mandated* will reduce both the costs to industry and difficulties of compliance.

The HOST project shows how industry and government agencies can work cooperatively to attack problems having both scientific complexities and political involvement. All members of the group oversaw the scientific research, field testing, and measurements to improve air quality, increasing everyone's confidence in the methods.

Table 2 Results of Sample Tank Emissions Tests

Based on Society of Petroleum Engineers Paper 37886

Tank	Size, bbl	API Gravity	T liquid, °F	T vapor, atm	CH_2, °F	CH_4, °F	ROC, atm	LBL v.p. psi	lb ROC per day
1	4,000	13.0	120	105	0.004	0.05	6×10^{-6}	–	–
2	10,000	–	140	127	0.280	0.500	3.3×10^{-3}	0.5	–
3	10,000	–	148	135	0.100	0.095	1.5×10^{-3}	0.45	–
4	43,000	–	176	156	0.012	0.005	1.2×10^{-4}	2.4	–
5	2,000	13.0	148	79–129	0.09–0.18	0.30–0.62	$0.8–1.7 \times 10^{-4}$	0.5	0.13
6	2,000	13.0	145	79–138	0.004–0.0125	0.0042–0.025	$0.6–3.5 \times 10^{-5}$	–	0.035
7	2,000	13.0	145	82–118	0.0087-0.022	0.016–0.039	$2.3–5.4 \times 10^{-5}$	0.7	0.048
8	10,000	13.9	154	100–133	0.036–0.43	0.31–0.45	$0.8–1.4 \times 10^{-3}$	1.5	0.79
9	2,000	12.8	57	44–72	0.0046–0.004	0.0046–0.0054	1×10^{-5}	0	0.0
10	2,000	12.8	80	46–88	0.05–0.11	0.10–0.24	$3–7 \times 10^{-5}$	–	0.005

Alaska: Juggling Energy & Environmental Needs

by Viola Rawn-Schatzinger, BDM-Oklahoma, Inc.

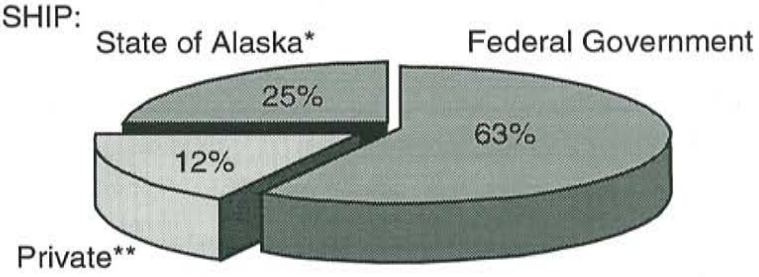
Because most Americans see Alaska as the last *pristine* area in the United States, federal and state agencies and environmental protection groups are making concerted efforts to monitor and regulate Alaska's enormous energy potential. In Anchorage last October 28–29, 1997, the U.S. Department of Energy held the Alaska Fossil Energy workshop: One Decade Later–What's Alaska's Future.[1] The workshop brought government and industry together to reassess the goals of developing Alaska's energy resources in a timely manner and with attention to environmental issues, and resulted in positive discussions of strategies toward achieving this common goal.

Importance of Alaskan Fossil Fuels

Fossil fuels are the major economic resource in Alaska. Petroleum accounted for more than 80% of revenue for Alaska in 1996 according to the Alaska Division of Oil and Gas. In 1997, Alaska produced 1.3 million barrels of oil per day, 20% of U.S. production. Alaska has 24% of total U.S. proven oil reserves, and 20–26% of the natural gas reserves. Coal also has potential as an emerging source of energy with a ready market in southeast Asia. Currently, natural gas production is insignificant because facilities for transportation and marketing are lacking. The State of Alaska and federal government are both the major landowners (see Fig. 1) and the bodies charged with regulating development and protecting the environment.

ALASKA 570,000 square miles
1.48 million square kilometers
365 million acres

OWNERSHIP:



*Majority of known petroleum reserves are on state-owned lands.
**Most of the private lands are owned by tribal groups.

Figure 1 Major landowners in Alaska based on data from the Alaska Division of Oil and Gas

Fossil Fuels for the Future

Development versus environment has been the past theme in Alaska. Today's goal is to maximize the development of Alaskan fossil resources in an environmentally acceptable manner for the benefit of Alaska residents and the American public. The DOE promotes the goal of all interested parties in Alaska working together. In 1995, Congress lifted the ban on oil exports from Alaska's North Slope. The plan is to develop technologies to extract and use the fossil resources efficiently, cost-effectively, and in a manner that will protect the environment for future generations. Principal Deputy Assistant Secretary of Energy Bob Kripowicz says, "fossil fuels are future fuel."

The first joint State of Alaska–DOE workshop was held in 1987. As a result of that effort, Fossil Energy R&D is sponsoring 11 oil and gas projects ($9.2 million total), 3 coal R&D projects ($3.04 million total), and 2 clean coal demonstrations ($1.4 billion total) in Alaska. Project highlights include:

1. A 4-year study to determine the risks associated with discharging produced water into open bays
2. Development of phosphoric acid

1. Based on the Program and Proceedings of the Alaska Fossil Energy Workshop, held in Anchorage, AK, October 28–29, 1997, sponsored by the U.S. DOE Office of Fossil Energy.

fuel cells as environmentally clean, high-efficiency sources of reliable electric power and heat (fuel cells operate with extremely low greenhouse gases and pollutant emissions)

3. A study to access gas-to-liquid conversion technology as an environmentally safe, econo-mic method to develop North Slope natural gas resources

Goals Set by the Alaska Oil and Gas Association

David Perkins, president of the Alaska Oil and Gas Association, reviewed Alaska's changes since 1987 and emphasized the state's commitment to preserving and monitoring air, water, fish, and wildlife environment. He also named the continuing needs of the next 10 years:

1. Continued research and development
2. Access to land
3. Continued pursuit of environmental excellence

Technologies & Strategies

New technologies and strategies aim to decrease the developmental footprint to minimize environmental impact. This means using these techniques for extracting petroleum products with less damage to the land surface:

- 3-D exploration
- Directional drilling
- Greater distances between well pads
- Converting gas to liquid to transport natural gas in existing pipelines
- Smaller drilling pad size
- Arctic offshore buried pipeline
- Improved land leasing

Similar concepts were addressed by a preliminary environmental impact statement for the National Petroleum Reserve Alaska (NPRA) released by the Bureau of Land Management in November 1997.

Alaska Energy Infobank

Alaskan industry and state officials are responding to energy and environmental needs by organizing a unique Infobank for all kinds of nonproprietary data. This database is designed to be a trusted third party where high quality geological, geophysical, environmental, and all scientific data can be stored and quickly accessed without dealing with issues of data ownership or competitive advantage. Infobank information would be input by all companies and government agencies, and data could be withdrawn as needed. A technical committee would be responsible for maintaining a Web site, sending e-mail, setting standards, planning strategy, and informing all members of new developments and technologies.

Stop Raising the Regulatory Bar

The problems with oil and gas resource development and access in Alaska most often cited are linked to *regulatory creep*, where stipulations and regulations on lease sales continue to change, often without scientific basis. Unnecessary stipulations added on late in the process and excessive lawsuits delay lease sales, yet do not necessarily protect people or the environment.

All parties need to coordinate efforts to meet the goal of predictable, reliable, timely lease sales with stipulations based on sound science and risk assessment data. Environmental reviews need to have a scientific basis, and consensus should be reached before leases are advertised. Knowledge and acceptance by all groups that some environmental restrictions apply to one site but not another should help reduce arbitrary regulations. The Bureau of Land Management's NPRA environmental impact statement may set a standard procedure in meeting environmental regulations while helping lease sales operate more smoothly.

Conclusions

Alaska is seen by Americans as both a pristine wilderness and the largest U.S. petroleum reserve. Meeting the goals of both interests requires the cooperation of all individuals, companies, and state and federal agencies. The Alaska Fossil Energy Workshop is serving as a forum for all parties to meet and discuss strategies to reach the combined goals. The Alaska Energy Infobank is an excellent example of how industry, and state and federal agencies can work together to achieve the combined goals.

Because of the positive response to the 1997 Alaska Fossil Energy workshop, the DOE is committed to hosting a follow-up workshop in the summer of 1998.

CALENDAR

JAN. 27, FEB. 10, AND FEB. 19, 1998

Environmental Issues Related to Oil and Gas Production, PTTC Workshop, North Midcontinent Resource Center, Jan. 27, Wichita, KS; Feb. 10, Iola, KS; Feb. 19, Hays, KS. Sponsored by U.S. DOE, Kansas Geological Survey, University of Kansas Tertiary Oil Recovery Project, and PTTC. Contact Lisa Love, Energy Research Center, Lawrence, KS, 785-864-7398; fax 785-864-7399.

HERB TIEDEMANN
DEPARTMENT OF ENERGY
NATIONAL PETROLEUM TECHNOLOGY OFFICE
P.O. BOX 3628
TULSA, OK 74101
PHONE: 918-699-2017
FAX: 918-699-2005
E-MAIL: htiedema@npto.doe.gov

http://www.npto.doe.gov

READ **EYE on Environment** ON NPTO'S WEB SITE