

The NORM Report

Naturally Occurring Radioactive Material Contamination
SUMMER 1999

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Regulations for the Control of Naturally Occurring Radioactive Materials - An Update

The status of regulations for the control of NORM contamination is summarized below for all 50 states, the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC), Canada, and the Conference of Radiation Control Program Directors (CRCPD). NORM contamination is not limited to the petroleum industry and several non-petroleum states are drafting rules for the control of NORM in other industries in their states. Each regulatory agency was contacted during late September and early October, 1999.

The last state to enact NORM regulations was Ohio. Ohio's regulations became effective June 9, 1997, and were summarized in the Spring 97 issue of *The NORM Report*. The New Mexico and South Carolina regulations were summarized in the Summer 1995 issue of *The NORM Report*. Louisiana, Mississippi, Arkansas, Texas and Georgia have previously enacted regulations for the control of NORM. Oregon enacted regulations in January 1990. Although the Oregon regulations were specifically written for control of NORM in zircon sands, the Oregon regulations do apply to all NORM contamination in the state. The Oregon regulations were summarized in the Winter 1996 issue of *The NORM Report*.

There currently are no federal regulations specifically for the control of NORM, although the Environmental Protection Agency appears to be moving in that direction.

Enactment of regulations specifically for the control of NORM requires compliance by all industries and companies with NORM contamination and NORM waste materials. Companies should also be in compliance with state general regulations for the control of radiation and the OSHA radiation regulations.

The status of NORM regulations in all 50 states, the EPA and NRC, Canada and the CRCPD begins on page 2.

Its just a question of doing what is right and what is best —
scientifically, technically, and environmentally.

— Anonymous

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Summaries of State and Federal Regulations for the Control of NORM

ALABAMA

Alabama is waiting for the CRCPD recommendations for the control of NORM before finalizing their redraft of the state's proposed NORM regulations. There is no time table for the regulations to be adopted. There has been some interest in plugging and abandoning wells, but there have been no requests from industry for NORM regulations.

ALASKA

There is no NORM regulatory activity in Alaska at the present time. Although the price of oil has risen significantly, the budget is still very tight.

The Arctic Monitoring Assessment Program which is a consortium of all the Arctic countries, is starting to take an interest in NORM-type material. It is not known how this will translate into the U.S. Committee's action on the issue.

Alaska is fielding many questions from its residents regarding the Japanese nuclear incident.

ARIZONA

Although some consideration has been given to the need for specific NORM regulations in Arizona, there is no regulatory activity at present. All radioactive materials, including NORM, are addressed in Arizona's general radiation regulations.

ARKANSAS

The Arkansas NORM regulations constitute Section 7 of the *Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation*. The revised regulations were summarized in the Fall 96 issue of this newsletter. There are no plans at present to further revise the NORM regulations.

CALIFORNIA

In 1993, California underwent a peer review of its oil and gas exploration and production waste management regulatory programs. The review was conducted by the Interstate Oil and Gas Compact Commission (IOGCC), in cooperation with the U.S. Environmental Protection Agency and other interested groups. One recommendation of the review team was for a thorough evaluation of the industry NORM survey data by the appropriate state agencies to verify the extent of oil and gas field NORM in California.

Subsequent to the IOGCC peer review, and following increased public and governmental interest in NORM issues, the Department of Conservation, Division of Oil, Gas and Geothermal Resources and the Department of Health Services, Radiological Health Branch conducted a more comprehensive survey of selected sites. This effort was in cooperation with the oil and gas industry. The sites chosen for the study were selected because they were points where NORM was expected to occur; the sites were not selected randomly.

All six oil and gas districts in the state were sampled in this study. Four hundred seventy-five radiation measurements were taken in 70 oil and gas fields. In addition to gamma radiation meter readings, 124 samples of pipe scale, produced water, tank bottoms and soil were collected and analyzed by the Sanitation and Radiation Laboratory of the Department of Health Services to assess the actual concentrations and radionuclides present.

The results of the study indicate that NORM is not a serious prob-

lem in California oil and gas production facilities - confirming the findings found in an earlier survey (1987). In the 1987 survey, seventy-eight percent of the measurements were at background levels. A few sites had elevated levels of NORM. Further studies of those sites should be considered. Routine protective measures may be all that is necessary to minimize exposure to radiation in these particular areas. Survey results and laboratory analyses are reported in: *A Study of NORM Associated with Oil and Gas Production Operations in California*. The report was issued by:

Department of Health Services
Radiological Health Branch
and
Department of Conservation
Division of Oil, Gas and
Geothermal Resources

Elevated levels of NORM were found in material from some of the production facilities. The NORM was found in water filters and softeners, gas processing equipment, pipe scale, and tank bottoms. However, these elevated levels were not high enough to be of immediate health concern.

Copies of the report are available from:

Stephen Hsu
Department of Health Services
Radiological Health Branch
601 N 7th Street
P.O. Box 942732, MS 178
Sacramento, CA 94234-7320
E-mail: shsu@hwl.cahwnel.gov
Telephone: (916) 322-4797

A summary of the report recommendations was included in the Fall 96 issue of The NORM Report.

(Continued on page 3)

CALIFORNIA (continued)

Promulgation of NORM regulations in California is low priority at present. However, it is expected that California will enact NORM regulations sometime in the future.

COLORADO

Senate Bill 97-154, **Controlling Regulation of Radioactive Material**, did not get out of the Appropriations Committee and the Legislature adjourned without further action. (See the Winter 97 issue of *The NORM Report* for a summary of Bill 97-154.)

There is no NORM regulatory activity in Colorado at this time.

CONNECTICUT

Using "Guidelines for Disposal of Drinking Water Wastes Containing Radioactivity" (U.S. Environmental Protection Agency draft, June 1994) and Nuclear Regulatory Commission limits for release of licensed material, the Connecticut Department of Environmental Protection put together its first guidelines for an actual water treatment facility. It will (for the present) continue developing guidelines for other facilities, giving case-by-case guidance. Simply put, the guidance will be to apply NRC discharge limits above background radioactivity. EPA Region I has given preliminary concurrence on this interpretation of EPA's Draft guidance. The thinking on this — If it came from the ground and nothing was done to enhance it, it can go back into the ground.

DELAWARE

There are no specific regulations for NORM in Delaware. NORM, NARM and other radioactive materials are considered to be covered in the general regulations for the control of radiation enacted in 1993. A revision of the general reg-

ulations became effective September 1, 1995. The revision tightened the compliance aspect of the regulations. NORM is considered to be covered in Sections C and D, Radioactive Materials, in the regulations.

The Radiation Control Regulations are being considered for further revision, particularly Parts H and K. The revisions are at least six months to a year away.

NORM contamination appears to be minimal in the state. Occasionally a call is received from a salvage yard or steel mill reporting that their gate radiation monitors had detected gamma radiation above background on a load of scrap metal.

FLORIDA

Recommendations of the Florida NORM Advisory Committee (FNAC) Regarding the Adoption of NORM Regulations in Florida was submitted October 14, 1997 to the Advisory Council on Radiation Protection. Since the recommendations of the Committee are indicative of many of the issues confronted by regulators when considering regulations for the control of NORM, a summary of the recommendations was reported in the Winter 98 newsletter and repeated in the Fall 98 issue.

In its continuing effort to characterize TENORM within the state, site visits to oil fields located in southern Florida are continuing. The inspections verified that TENORM concentrations at the sites are minimal. The highest recorded gamma reading was 80 $\mu\text{R/hr}$, taken at the base of a saltwater storage tank that had been accumulating particulates for at least ten years. No other readings exceeded one-half that total. Analytical sample results are expected to confirm the low radium

content of oilfield pipe scales in the South Florida fields. No conclusions have been reached and no report has been issued. The State's intent is to write a comprehensive report on TENORM in Florida.

The report on the program sponsored by the Florida Institute of Phosphate Research to characterize NORM in the phosphate industry is complete and is awaiting printing and should be available soon.

GEORGIA

Georgia's regulations for the control of NORM became effective in October 1994. There have been no changes in the rules since. Revisions to the general rules and regulations for the control of radiation have been drafted and were adopted by the Board. The revisions became effective May 6, 1997. However, there are no changes in the NORM rules in this revision.

HAWAII

Hawaii is revising their general regulations for the control of radiation. It is planned to incorporate the CRCPD Part N in the revised rules. It is expected that the new regulations will be ready in 2000.

Hawaii does not have any particular problems with NORM at this time. Although Hawaii does not have petroleum production, it does have geothermal wells on the big island. Possible NORM contamination in these geothermal wells has not been addressed.

There is also some concern about radioactivity and radiation contamination in the state's military posts and bases, including old radium gauges and instruments. Additionally, there may be some NORM associated with the dry dock activities in the state.

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IDAHO

Idaho has no regulations for the control of NORM and none are planned for the near future. There has been no indication from the state legislature or anybody else concerning interest in NORM regulations. There are provisions in the general regulations for the control of radiation that can be used for NORM problems if the need arises.

Idaho does have a problem with cleaning up old uranium tailing piles. Some of this material predates 1978 and the NRC says it does not have jurisdiction to regulate it. The Army Corps of Engineers has been assigned to clean it up and are considering disposing of the material in a RCRA facility.

ILLINOIS

Illinois has drafted regulations for the control of TENORM based on the November 97 draft of CRCPD Part N. The draft has been circulated in-house. It is planned to have stakeholder meetings during the winter to get their input before publishing it in the Illinois Register.

Some of the delay was caused by the rewrite of licensing requirements in the general radiation regulations. Since the NORM draft rules refers to these licensing regulations, the NORM rules had to be revised as well.

The TENORM regulations will be summarized in **The NORM Report** when available.

INDIANA

No new regulations for the control of NORM have been enacted or proposed at this time in Indiana. There have been incidents involving NORM — contaminated materials in scrap yards, etc. It is expected there may be a need for NORM regulations sometime in the future.

IOWA

Iowa does not have specific regulations for the control of NORM. The Iowa general regulations for radiation control are assumed to cover NORM and are used when NORM problems arise. Most of the NORM problems in Iowa involve NORM contaminated metal sent to scrap recyclers. Most of this contaminated metal comes from out-of-state sources.

KANSAS

Regulations for the separate and specific control of NORM have not been proposed. Regulations for the control of all radioactive materials in Kansas implicitly include NORM. NORM problems that do arise are handled on a case-by-case basis, taking into consideration radiation exposures to the public and workers.

Kansas regulators have been working closely with the scrap industry, but there is no indication of probable legislation concerning NORM issues.

KENTUCKY

The Kentucky Department of Environmental Protection continues to work on a satisfactory long term disposal site for NORM. In the meantime, remediation activities in the Martha Oilfield are proceeding gradually and continually towards the final phases of the cleanup of the field. Remediated materials are being stored in a temporary site pending the resolution of discussions on long term storage.

Tracts of land are being certified that they meet the remediation requirements worked out with Ashland Oil. In the last month several owners of some of the tracts have been identified and letters sent to them verifying that their land had been satisfactorily reme-

diated.

When the public clamor over the contamination of the Martha Oilfield dies down, consideration will be given to promulgating NORM regulations.

LOUISIANA

There have been no changes or revisions in the Louisiana NORM regulations and none are planned at the present time.

Chem Waste has received approval for the disposal of NORM wastes containing up to 150 pCi/gm. Chem Waste was hoping for a permit to dispose of mixed wastes, but the permit by the Department of Natural Resources was to create a NOW disposal facility within, but separate from, the RCRA facility. There is a cell specifically for NOW material.

US Liquid sites in Louisiana can receive wastes containing less than 30 pCi/gm.

There is nothing new on the pending application for a new NORM disposal well. The DEQ is waiting approval from the Office of Conservation who must approve as a disposal well.

The number of P&A disposal wells has increased probably due to the high costs of NORM waste disposal.

There is one facility operated by Phillips Services. It is allowed to operate as a commercial facility because during the incineration process used the NORM is diluted. It is required that the incinerator wastes be disposed as incinerator RCRA waste. As long as the NORM wastes contain less than 5 pCi/gm the Department is not concerned about it from a regulatory

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LOUISIANA (continued)
point.

Chevron has a NORM injection well for their own wastes from a specific cleaning area (that is, a non-commercial facility.) Chevron was refused permission to bring NORM wastes from Chevron facilities in Mississippi for disposal in their Louisiana injection well.

Meetings have been held with the Hazardous Waste Division to discuss the disposal of NORM contaminated mixed wastes in a hazardous waste landfill. One problem is that the hazardous waste disposal regulations in Louisiana prohibit the disposal of RCRA hazardous wastes containing NORM in a hazardous waste landfill.

The Louisiana regulations are based upon federal regulations. There has been some contact with the EPA in an attempt to determine the intent of the federal regulations. Knowing the intent of the federal regulations may suggest some options which can be used for the disposal of the hazardous wastes containing small concentrations of NORM. The federal regulations do allow some radioactivity, e.g. cesium-137, in the wastes to be disposed of in a hazardous waste landfill. Up to 100 picocuries cesium per gram can be disposed of this way.

MAINE

Maine has general regulations for the control of radiation, but does not currently have specific regulations for NORM. The CRCPD Draft Part N (TENORM) is being reviewed for possible adoption early to mid 2000.

Maine does have NORM - contaminated water treatment wastes. Many water supplies in Maine contain significant concentrations of

radium, radon and uranium. Ion exchange resins used in water treatment can become "hot" with radium and uranium. Carbon filters used to remove radon from water become contaminated with the radon decay products, i.e. radioactive lead, bismuth and polonium.

The recent National Academy of Science report (**Risk Assessment of Exposure of Radon in Drinking Water, 1998**) and EPA's imminent adoption of radon in water MCL will mandate the state adopt water treatment wastes regulations.

MARYLAND

Maryland has no specific regulations for the control of NORM. NORM is handled under the general radiation regulations. These general regulations were recently revised to bring the rules into line with 10 CFR 20 as well as making other changes deemed advisable. The revisions became effective October 9, 1995.

MASSACHUSETTS

Massachusetts does not have specific regulations for the control of NORM. NORM is considered to be a subset of NARM and NARM is considered to be regulated by the Massachusetts general radiation regulations.

These general radiation regulations were amended earlier this year and became effective July 9, 1999.

MICHIGAN

There have been no changes in the Michigan guidance documents for the control of NORM and although none are planned for the immediate future, the CRCPD's Part N is being closely followed to determine if it should be the basis for future NORM regulations in Michigan.

The Michigan guidelines for disposal in a type 2 municipal solid waste landfill allow up to 50 pCi/gm radium-226 to be disposed. This can be a large cost saving. Analysis has shown that this level shows insignificant risk to the public.

Michigan is resurveying many sites for NORM contamination. The original surveys had been made in the early 90's. The resurveys show that, in general, oil and gas sites which showed NORM contamination in the earlier surveys showed even greater contamination in the present study. For example, radiation readings of 1,800 μ R/hour were seen at a gas separator and radioactivity levels of radium-226 as high as 150,000 to 200,000 pCi/g are seen in oil and gas facilities.

NORM contamination in paper mills has been reported. It is expected that Michigan paper mills will be surveyed for NORM

MINNESOTA

Minnesota has no regulations for the specific control of NORM; it has regulations for devices that use discrete NARM (e.g. radium-226) as a source of radiation.

Within the next year Minnesota will have permitted four landfills to take low-level NORM wastes. One of the landfills should be permitted by November 1, 1999 and the other three before the end of 2000. The level of NORM which will be accepted at the landfills is not determined yet.

The level of concern about NORM contamination is increasing as more people learn about NORM

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MINNESOTA (continued) contamination. One problem that has arisen is the zircon sands left when foundries go out of business. Allowing these NORM wastes to be disposed in a landfill will make the disposal easier.

In 1998, the Minnesota Department of Health began the process to become an Agreement State with the U.S. Nuclear Regulatory Commission.

MISSISSIPPI

Responsibility for NORM in Mississippi is currently divided between the Department of Health and the Oil and Gas Board. The Oil and Gas Board has authority for NORM at the wellsite (effective July 1, 1995). After the petroleum leaves the wellsite the Department of Health has jurisdiction for any NORM contamination.

However, the Mississippi legislature has enacted legislation that gives the Oil and Gas Board jurisdiction over all oil and gas wastes. The Oil and Gas Board's NORM rules which became effective July 1, 1995 assumes jurisdiction only over NORM at the well. The Mississippi State Board of Health Regulations for Control of Radiation, Section 801.N is still in effect. The Division of Radiological Health continues to process licenses from contractors for NORM decontamination at industrial facilities. The attorney for the Department of Health believes that any commercial remediation, etc. will still have to be licensed by the Department.

Although the jurisdictional conflict has not been completely resolved, it has been smoothed out to a degree. If the NORM wastes are generated by E & P activities it is assumed to be under the jurisdiction of the Oil and Gas Board. If

the dosage from the NORM reaches a certain level, the Department of Health assumes jurisdiction. The Department of Health does not appear to be disputing this. The Oil and Gas Board has assumed jurisdiction for about 99% of NORM associated with oil and gas.

On August 11, 1995, the Oil and Gas Board issued a proposed **Rule 69: Control of Oil Field NORM**. The rule provides the regulations for the control of oil field NORM to ensure that radiation exposures of workers and members of the general public are negligible. The rule applies to NORM that has been derived from the exploration and production activities of oil and gas operations within Mississippi.

Revisions made to Rule 69 at the public hearing August 1995 were summarized in the Winter 96 issue of **The NORM Report**.

Rule 69 is being implemented. Oil and gas operators are conducting NORM surveys on all their properties. Over 1,500 survey data have been entered in a computer. Once all the surveys submitted have been put in the data base, it will be determined which oil and gas sites have not submitted survey data.

The data will be analyzed to determine how many sites are over a selected concentration level of NORM contamination. In the absence of a resolution of the jurisdictional dispute between the Department of Health and the Oil and Gas Board, the latter is assuming responsibility for every oil and gas site in the state.

The Oil and Gas Board has proposed **Rule 68, Disposal of Naturally Occurring Radioactive Materials (NORM) Associated with the Exploration and Production of Oil and Gas**. Rule

68 was proposed by an oil and gas association. At a hearing held September 15, 1999 arguments and closing statements were heard. The Mississippi Department of Health raised some concerns (particularly about the landspreading option) as did the state DEQ and the EPA (by letter). It has not been announced when the Oil and Gas Board will make its decision. It is the Board and not the Legislature who will decide if the proposed Rule 68 becomes Rule 68. The decision is expected in the near future. When Rule 68 is adopted I will summarize it in **The NORM Report**.

MISSOURI

There are no specific NORM regulations in Missouri and none are planned at present. Occurrences of NORM problems are handled under the state's general regulations for the control of radiation.

MONTANA

There have been no new developments applicable to NORM regulations in Montana. The regulations for the control of radiation have not been revised since 1980 and NORM is not considered to be included in these general radiation regulations. The Montana Department of Health and Environmental Sciences does have the statutory authority for NORM regulations, but there is no funded program for their development.

NEBRASKA

There has been no change in the status of NORM regulations in Nebraska. The state believes NORM is included in their general rules for the control of radiation. There are no plans for specific NORM rules at the present time.

Like many other states, Nebraska receives comments and questions from recyclers. Some of these recy-

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NEBRASKA (continued)

clers have "requested" NORM rules so they can use NORM limits, e.g., 50 microrem/hr, to know when they can refuse or accept contaminated scrap.

NEVADA

Nevada has no specific NORM regulations and none have been proposed. Comprehensive statutes for the control of radiation address NORM and NARM similarly.

NEW HAMPSHIRE

New Hampshire considers NORM to be a subset of NARM and the state has always regulated NARM in the same manner as by-product, source, and special nuclear materials are regulated as an Agreement State.

One area presently not regulated and may have to be is water treatment systems. There are significant quantities of radon in New Hampshire water supplies. Some water treatment facilities actually become quite "hot". Another potential NORM problem area is the inadvertent exposure to the radiation hazards associated with construction involving granite containing uranium and thorium and their radioactive decay products.

Future regulatory activities may consider the need to adopt regulations similar to Part N of the Conference of Radiation Control Program Directors, Inc. (CRCPD), and the specific NORM regulations which have been adopted by several states.

NEW JERSEY

The Bureau of Environmental Radiation has completed updating the interested party draft of N.J.A.C. 7:28-12, *Soil Remediation Standards for Radioactive Materials*. Updates included incorporation of com-

ments received and changing some language to be consistent with the new Brownfield and Contaminated Site Remediation Act. At its January 20, 1999 meeting, the Commission on Radiation Protection approved the release of the rule as a proposal.

On July 6, 1999, N.J.A.C.7:28-12, *Soil Remediation Standards for Radioactive Materials*, was proposed in the New Jersey Register with a comment period of 30 days. The comment period was subsequently extended to September 15, 1999. The proposal, the technical basis document, the spreadsheet that implements the standards, and guidance on conducting characterization and final surveys, are all available on the Radiation Protection Program's web site: <http://www.state.nj.us/dep/rop/index>.

NEW MEXICO

The New Mexico NORM regulations, *Subpart 14: Naturally Occurring Radioactive Materials (NORM) in the Oil and Gas Industry* became effective August 3, 1995.

Rule 714, Disposal and Transfer of Regulated NORM for Disposal provides the regulatory framework for the disposal options addressed in the Part 14 NORM regulations. Rule 714 became effective July 15, 1996. Rule 714 was summarized in the Summer 96 issue of *The NORM Report*.

The New Mexico NORM regulations allow for down-hole injection of NORM waste in a company's own wells. However, the Rocky Mountain Board, one of the Low-Level Radioactive Waste regional compacts, considered NORM to be a low-level radioactive waste and subject to their regulations and the Compact refused to give approval for the injection of NORM wastes

in private wells in New Mexico.

On June 1, 1998, the Rocky Mountain Low-Level Radioactive Waste Board adopted an amendment to the Board's rules. The change clarifies that NORM waste from oil and gas production within the Rocky Mountain Compact region may be placed in oil and gas wells without the Board's designating such wells as regional facilities. The Board's action followed a public hearing on the matter.

No one has actually requested permission to dispose of NORM down-hole. A few companies in the state who have accumulated NORM wastes under a general license have requested a one year extension for storing the wastes. Most of these NORM wastes will probably eventually be disposed of down-hole.

The guideline document draft for use with the NORM regulations (Appendix A of the regulations) is now available. The guide is entitled *Appendix A: Regulation Guidelines for the Management of NORM in the Oil and Gas Industry in New Mexico*.

The purpose of the document is to provide guidance to persons involved with facilities or equipment associated with the production of oil and gas and how to conduct screening surveys with portable radiation detectors to identify NORM and to initiate determination of the extent of needed radiation protection controls. The guide is intended for individuals licensed by the New Mexico Environment Department and permitted by the New Mexico Oil Conservation Division. The document is intended to assist general and specific licensees in the proper use, transfer, transport, storage and disposal of

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NEW MEXICO (continued)
regulated NORM.

The guide describes the type and extent of information needed by the New Mexico Radiation Licensing and Registration Section staff to evaluate an application for a specific license for authorization to perform the following commercial services involving NORM contamination:

- A. Commercial decontamination of equipment, facilities and land.
- B. To perform maintenance on NORM contaminated equipment.
- C. To promote mixing, grinding, or volume reduction of NORM contaminated material in preparation for disposal.
- D. To package or encapsulate NORM contaminated materials in preparation for disposal.
- E. To provide health physics support for disposal in plugged abandoned wells.
- F. Other services as described in the application.

The following regulations apply and should be used in conjunction with the guide:

- A. Subpart 1. General Provisions
- B. Subpart 3. Licensing of Radioactive Materials
- C. Subpart 4. Standards for Protection Against Radiation
- D. Subpart 10. Notices, Instructions and Reports to Workers; Inspections
- E. Subpart 14. Naturally Occurring Radioactive Material (NORM) in the Oil and Gas Industry

The guide is for general guidance in preparation of the license application and should not be considered as all the information that may be required for a particular application. Nor is it a substitute for the applicant's safety evaluation of the proposed activity. The applicant must ensure that the application correctly and adequately describes the commercial services offered, and the radiation safety measures and procedures to be followed in order to provide adequate protection. For the purposes of this guide, decontamination means deliberate operations to reduce or remove residual NORM contamination from equipment, facilities or land.

On September 28, 1999 a meeting was held with a Texaco (Midland, Texas) employee (and other interested parties) who wanted to discuss some of the requirements of the Guidance Document. The Guidance Document has been out for about 18 months and before it was available the state asked for comments, etc. and received no response. Now Texaco has prepared a forty-page critique (for a 14 page document). Apparently one of Texaco's problems is the requirement to make baseline radiation surveys of contaminated equipment. Texaco does not think surveys should have to be made of equipment while it is being used. Bill Floyd's answer to that is that the surveys are necessary, for example, to verify that posting is, or is not, required for the protection of workers, etc. Depending on the results of the September 28 meeting, the guidance document may be revised.

Copies of the New Mexico NORM guide are available from:

William M. Floyd
Program Manager
Radiation Licensing &

Registration Program
2044 Galisteo
P.O. Box 28110
Santa Fe, NM 87502
Telephone: (505) 827-1862
FAX: (505) 827-1544

Copies of the State of New Mexico Radiation Protection Regulations (including the NORM rules), are available for \$37.50 from:

Santa Fe Printing
1424 Second Street
Santa Fe, New Mexico 87505
505-982-8111

NEW YORK

The New York State Department of Environmental Conservation, Bureau of Radiation and Hazardous Site Management, recently published a report entitled *An Investigation of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Wells in New York State*. (April 1999). The report documents the findings that oil and gas production is not adversely affected by NORM contamination and does not appear to be a public health or environmental problem in New York State. Copies of the report are available from:

Rudyard Edick or John Zeh
New York State Department of
Environmental Conservation
Division of Solid and Hazardous
Materials
Bureau of Radiation and
Hazardous Site Management,
Room 460
50 Wolf Road
Albany, New York 12233-7255
Phone: (518) 457-2225
FAX: (518) 457-9240

The report is also available on the website:

www.dec.state.ny.us/website/dshmhazrad/norm.htm

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NEW YORK (continued)

The introduction and conclusions of the Executive Summary for the report is reproduced below.

1. EXECUTIVE SUMMARY**Introduction**

This report presents the findings of the New York State Department of Environmental Conservation (NY SDEC) that New York State oil and gas production equipment and wastes are not significantly contaminated by naturally occurring radioactive materials (NORM). The concentrations of NORM found on oil and gas production equipment and wastes pose no threat to the public health and the environment. The research and analysis supporting this conclusion were performed in 1996. Direct measurements of the radioactivity at well sites were performed. Samples of scales, sludges, sediments, soils, water, rock, brines, waxes, and oils were taken and analyzed by gamma spectrometry.

Conclusions

While NORM-contaminated equipment has been a concern in North Sea oil well drilling, the results of this investigation show that NORM contamination of New York State equipment is insignificant. New York State well drilling equipment and wastes do not constitute a health risk for the State's residents nor present a potential degradation of the State's environment.

NORTH CAROLINA

Nothing presently is being proposed on NORM regulations for North Carolina. The state recognizes that NORM is an issue that may need further attention, particularly in scrap metal yards. The state is also aware that there are North Carolina industries that generate NORM wastes, such as the phos-

phate industry, waste water treatment sludge, and metal mining and processing wastes. For the present, North Carolina remains committed to interacting with industry, Federal and state agencies and providing assistance in resolving disposition of NORM wastes.

NORTH DAKOTA

North Dakota does not have specific regulations for the control of NORM. The state is currently revising their Radiation Control Regulations. No changes are expected with respect to NORM.

OHIO

The revised Ohio regulations for the control of radiation, including NORM and NARM, were summarized in the Spring 97 issue of *The NORM Report*. The regulations were revised to agree with the federal regulations as an initial step in Ohio's application to become an Agreement State. The Agreement State status became effective August 31, 1999.

The Ohio Department of Health and Radiation Control has proposed action to the following:

- * 3701:1-38, General Radiation Protection Standards; and
- * 3701-77 Low-level Radioactive Waste.

OKLAHOMA

Oklahoma has no specific regulations for the control of NORM contamination. The draft of NORM regulations being prepared by the Department of Environmental Quality's Radiation Management Advisory Council was tabled indefinitely at the request of the state legislature.

OREGON

There are no new developments regarding NORM regulations in

Oregon. Ray Paris, Manager of Radiation Protection Services in the Oregon Department of Human Resources was also the Chairman of CRCPD's NORM Commission that was responsible for writing the final draft of Part N. Oregon is "waiting" for Part N to be completed before revising or writing new NORM rules for the state.

Oregon has NORM regulations entitled *Regulation and Licensing of Naturally Occurring Radioactive Materials (NORM)*. The rules which became effective in January 1990 are found in the Oregon Administration Rules, Chapter 333, Division 117 - Health Division. The Oregon NORM rules were summarized in the Winter 96 issue of *The NORM Report*.

PENNSYLVANIA

All radioactive materials including NORM are addressed in Pennsylvania's general radiation regulations. At present there are no specific NORM regulations.

In the past few years some of the Pennsylvania brine wells were checked for NORM contamination as were roads where brine was used. Nothing of consequence was found.

Pennsylvania is in the process of becoming an Agreement State.

RHODE ISLAND

Rhode Island has no specific regulations for the control of NORM and none are in the planning stage. NORM is considered to be covered under the state's general radiation control regulations.

SOUTH CAROLINA

Part IX -- Licensing of Naturally Occurring Radioactive Material (NORM) became effective June

(Continued on page 10)

SOUTH CAROLINA (continued) 30, 1995 in South Carolina. There have been no changes in the regulations and none are proposed at the present time. Part IX was summarized in the Summer 95 issue of *The NORM Report*.

SOUTH DAKOTA

South Dakota has regulations for the control of radiation, but nothing specific to NORM. No legislation has been proposed to regulate NORM at this time.

TENNESSEE

NORM contamination in Tennessee is handled basically like any other radioactive material. If it is enhanced above background levels, an assessment is made to determine if it constitutes a problem. If it does, it is dealt with similarly to any other radioactive material, i.e., by using the general radiation regulations. There are no specific regulations for the control of NORM and none are planned. It appears that as more people learn about NORM, more instances of NORM contamination are being reported.

Recently, some NORM contamination has been reported in area paper plants. The radium contamination is thought to come from the large amounts of water used. Another possibility for the contamination is from the clays used in the process. The response by the plants to the investigations has been very good and cooperative.

TEXAS

The Texas Department of Health has jurisdiction for NORM except for the disposal of NORM contaminated wastes. The Railroad Commission has jurisdiction for the disposal of oil and gas industry NORM wastes, while the Texas Natural Resource Conservation Commission has responsibility for the disposal of NORM wastes not

associated with oil and gas exploration and production.

In April, 1999, the Texas Department of Health (TDH) finalized revisions to 25 Texas Administrative Code, §289.259, **Licensing of Naturally Occurring Radioactive Material (NORM)**. The revisions include new definitions that support the changes in the rule. Exemptions for oil and gas NORM waste are redefined and exemptions for pipe (tubulars) and other downhole or surface equipment contaminated with NORM are clarified. Specific licensing requirements for spinning pipe gauge operations that perform NORM decontamination and for persons receiving NORM waste from other persons for processing or storage are added. Other minor grammatical changes are made to the section for clarification.

Over the last several years, industry has indicated that they consider "routine maintenance" to be the repair and maintenance of equipment for the purpose of restoring it to its intended use or efficiency, regardless of the presence of oil and gas NORM. Decontamination of equipment contaminated with NORM above the exempt limits may occur incidental to the routine maintenance. The TDH acknowledges that not all routine maintenance activities result in a significant increase in radiation exposure risk. Simple routine maintenance tasks such as replacing or repairing a valve, changing filters, or "pigging" a pipe are such activities.

The wording in the revised rule, "Maintenance that provides a different pathway for exposure than is found in daily operations and that increases the potential for additional exposure is not considered routine," was proposed in order to further define the risk the department

is concerned about. In discussions with the industry, the TDH determined that the activity that presents the most concern is vessel entry. The industry considers this to be routine maintenance. However, this is the type of operation that the TDH believes presents a significantly increased risk from an enclosed environment where an inhalation risk (a different pathway for exposure than is found in daily operations) from NORM can be present.

The TDH acknowledges that unlike the employees of a company specifically licensed to perform decontamination, the employees or contractors of a general license would be performing vessel entry on an infrequent basis and thus, the radiation exposure risk is lowered due to a time factor.

The TDH drafted language that will outline radiation safety precautions that must be followed when vessel entry is conducted during the course of routine maintenance, but wishes to seek further input from the industry on that draft language. However, in order for several of the other revisions of this section supported by commenters to become effective and for the section to be reformatted in Texas Register format, no change to the wording about routine maintenance was made prior to the rule revisions being finalized.

In July, 1999, the TDH held a workshop to explain the revisions to the rule and to get stakeholder input on the draft language about routine maintenance. Over 75 people attended the workshop and the TDH received a good amount of input on the draft language. Staff will be reviewing the input received during the workshop and will develop new draft revisions to

(Continued on page 11)

TEXAS (continued)

25 TAC §289.259 in the near future.

The Texas Railroad Commission's Statewide **Rule 94: Disposal of Oil and Gas NORM Wastes** took effect February 11, 1995. This rule sets forth requirements for the safe disposal of NORM that constitutes, is contained in, or has contaminated oil and gas wastes. Rule 94 was summarized in the Winter 95 issue of *The NORM Report*. There are no plans to revise Rule 94.

The Texas Natural Resource Conservation Commission has deferred the development of rules for non-oil and gas NORM waste disposal, pending the results of a second needs survey. An initial survey, conducted in the summer of 1999, failed to gather sufficient data. Staff will continue to gather data regarding the generation of non-oil and gas NORM waste and need for disposal options in Texas. Disposal of non-oil and gas NORM waste in Texas that does not meet exemption criteria is currently prohibited by state rules.

UTAH

NORM is considered to be included in Utah's comprehensive radiation control regulations. No specific NORM regulations have been proposed at the present time in Utah.

There is a proposal for a new NORM and low-level waste disposal facility. Safety-Kleen currently has a hazardous waste facility ten miles north of Envirocare's NORM site and wants to convert one of their industrial waste cells to a low-level NORM cell. Safety-Kleen must submit a siting criteria document, get local approval, go through the licensing process and get the governor's and legislative approvals.

A preliminary decision was made that Safety-Kleen meets the siting criteria which is step one in their application process. Safety-Kleen underwent a "needs analysis" with the county. The County Planning Commission denied Safety-Kleen's request to amend the current conditional use permit. The decision is currently on appeal to the Tooele County Commission.

Envirocare's radioactive material license was renewed on October 22, 1998 for a five-year period.

VERMONT

Vermont has no regulations for the specific control of NORM and none are planned at the present time. Concern has been expressed as to the radiation received by some workers in granite plants due to radioactive materials (NORM) in dust and the air. An excess of lung cancers has been reported in employees who have worked for a long time in the stone industry. Silicosis used to be the primary result of working with stone, but now lung cancer is reported to be a serious hazard as well. Some persons have expressed a desire to investigate this in more detail, but limited time and testing capability permit only so much activity. The bottom line is that the regulators are being watched to see what they decide appropriate concentrations of NORM (radium) should be.

Another interesting situation involves the monitoring wells from waste treatment facilities. Some facilities are not prepared to take into account the natural radioactivity in the water. Some facilities are inappropriately applying the U.S. EPA standards for drinking water, neglecting the natural radioactivity in the water. Without allowing for the natural activity in the water, some of the monitoring wells exceed the EPA standard, leading to the conclusion that the treatment

facility is contaminating the ground water.

Another situation in Vermont involves medical radioactive waste shipped from Canada to Vermont for treatment. The regulations in Canada and Vermont are different creating a snag which the state is presently trying to resolve.

Vermont is becoming concerned as to what effect small concentrations of radium-224 (see page 28 in this issue), lead-210 and polonium-210 (all of which have been detected in Vermont waters) will have on regulations to safeguard the health of residents of the state.

VIRGINIA

Virginia has no specific regulations for the control of NORM. NORM is considered to be covered in the general regulations for the control of radiation. These general regulations are in the process of being revised.

WASHINGTON

The Departments of Health and Ecology have reviewed the environmental checklists and supporting information for three upcoming actions related to US Ecology's commercial low-level radioactive waste disposal facility located near Richland, Washington.

The three actions are: renewal of the facility operating license, approval of a closure plan, and a rule making establishing an annual disposal limit for naturally occurring and accelerator produced radioactive materials (NARM). In making the determination of significance, the two agencies have found that among the proposed actions, there are several probable direct or indirect impacts to elements of the environment such as air quality, soils, groundwater, and

(Continued on page 12)

WASHINGTON (continued) habitat. When considered together, these impacts may be significant. Therefore, an Environmental Impact Statement (EIS) must be prepared before any of the actions may be taken.

The scoping process for the EIS was scheduled to begin February 26, 1997. Following that, a draft and final EIS will be prepared; a process expected to take one to two years to complete. While the EIS is in preparation, US Ecology may continue to operate under the timely renewal provisions of its license.

US Ecology has always met state regulations. The Environmental Impact Statement will evaluate the effects of the three actions to show that the site will be safe for at least 1,000 years.

WEST VIRGINIA

There are no specific regulations for the control of NORM in West Virginia. The general regulations for the control of radiation are in the process of being revised. NORM will be included in these revised regulations. It will probably be a year before the revised regulations get to the legislature. All revisions to regulations in West Virginia must go to the legislature for approval.

WISCONSIN

Wisconsin has no specific regulations for the control of NORM, except those imposed by the Department of Natural Resources for the disposal of materials containing radium-226. The state does have general regulations for the control of radiation.

Wisconsin has been drafting an enforcement standard for radioactive contaminants in ground water with the primary isotope being radium-226. The main purpose was

to establish a ground water enforcement standard for use in monitoring, controlling, and if necessary, limiting human exposure to radioactive materials introduced into ground water by regulated human activities.

Activities on this enforcement standard have ended and it is not going to be implemented at this time.

Wisconsin's general radiation regulations are being revised as part of the process of becoming an Agreement State.

WYOMING

Wyoming has no regulations for the control of NORM and none have been proposed at this time. Wyoming relies on voluntary cooperation for the control of NORM. For example, scrap yards and other recyclers have installed gate radiation monitors, etc. Considerable scale is found in the Wyoming oil and gas industry but there appears to be no support for NORM regulations at the present time. There is a restriction on produced water. Produced water cannot be discharged if it contains more than 60 picocuries radium per liter.

Wyoming no longer has regulations that require the registration of radioactive materials.

FEDERAL ACTIONS

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Since completion of the National Academy of Sciences report on TENORM (see The NORM Report Winter/Spring 1999 issue), EPA has been preparing a separate report to Congress that states the agency's views on the need to revise its guidelines for radon and TENORM in light of the NAS evaluation. EPA must also explain the

technical and policy basis for its views and submit the NAS report along with the EPA report. The EPA report is expected to be sent to Congress in early calendar year 2000.

In that report, EPA will describe its approach to TENORM and how it addresses the recommendations of the Academy. The agency's approach is to:

Study and issue individual technical reports on TENORM producing industries to determine what is in the wastes from each industry and how much risk they pose. Rather than issue a single scoping report covering all industries, the agency will focus on TENORM materials from specific sources in a series of separate reports.

Identify and study existing TENORM sites to assemble a nation-wide view of the problem—where the wastes are, what is in them and the risks they present. This consists of a variety of field projects that will give EPA more information on the sources, characteristics and risks of TENORM.

Develop and provide education and guidance for safely and economically decontaminating and disposing of TENORM wastes.

Accordingly, EPA will not be issuing a revision of the draft report **Diffuse NORM Wastes — Waste Characterization and Preliminary Risk Assessment** originally issued in April 1993. Instead, it plans to use some materials in that report plus new information and revised risk analyses developed since that time in each of its technical reports. The first of those reports will be on TENORM

(Continued on page 13)

EPA (continued)
from uranium mining and is expected to be issued in draft next year (2000).

The agency is currently conducting a number of field projects focusing primarily on abandoned mines:

EPA and the National Park Service have developed a computerized database that will describe existing sources of information about abandoned mine lands in nine western states (EPA's Regions 8 and 9, including Indian reservations). This "database of databases" will be put on the Internet to make it easier to locate information about abandoned mining lands that may present TENORM radiation hazards.

EPA and the Navajo Abandoned Mine Lands Reclamation Department are conducting a project in which they will investigate the radiation hazards from abandoned uranium mining lands on the Navajo Reservation. They will test the soil, water, and other aspects of the environment around and under the abandoned mines to identify the types and levels of contamination. The project team then will recommend ways to clean up the sites.

EPA is working with the multi-agency Colorado Plateau Data Coordination Group Steering Committee to develop a pilot geographic information database on uranium mines and mills. The database will identify and show the location of active and inactive uranium mines and mills in Colorado and Utah. It also will contain other information about the sites. This is the first step in developing an ecological atlas about the Colorado

Plateau for use by the public and federal, state, tribal, academic, and industrial organizations.

EPA is providing assistance to the Spokane Indian Tribe to evaluate and clean up the radiological hazards in water and soils from the Midnite uranium mine proposed Superfund site in Washington State.

Using data obtained primarily from state agencies in Arizona, a report on the occurrence of TENORM from copper mines of Arizona is expected to be released in late 1999. That report will provide radionuclide sampling data, but not include risk assessments for the Arizona sites.

In conducting its review of the CRCPD's proposed Part N regulation for TENORM, EPA determined it could not concur with issuance of that suggested regulation as a model for states to use for oversight of TENORM. In its letter to the CRCPD in March 1999, EPA stated that "... the wide variety of industries that might be covered by this rule, and the many different forms and types of TENORM wastes these industries generate, require a different approach than the current proposal." It continued, "We suggest for purposes of clarification that this rule be divided into two main parts, an administrative licensing rule, and a substantive requirements rule (e.g., radiation protection standards, waste disposal, recycling, clean-up)." Additionally, EPA said, "Unfortunately, nearly all of the principal concerns our respective offices voiced in previous letters to you were not corrected." These concerns included, but were not limited to the failure to recommend a standard that is protective of human health and the environ-

ment, failure to include a separate standard or requirement for ground water protection, and lack of a preference for permanent remedies and treatment." Lastly, EPA said, "Should such a regulation be adopted, the latitude given in choosing appropriate radiation standards up to 100 millirem exposure annually from a single source of TENORM could create unacceptable health risks to the public, result in inconsistent standards among the States, and potentially result in the creation of new Superfund sites."

As part of efforts being conducted by the multi-agency Interagency Steering Committee On Radiation Standards (ISCORS), Sewage Sludge and Incinerator Ash Subcommittee, a survey is currently being conducted by the EPA, NRC, DOE, DOD, and State agencies in looking at TENORM and other radionuclides in sewage sludge and ash from publicly owned sewage treatment facilities. A pilot study of samples from 9 treatment plants' sludge and ash was conducted in 1997 to calibrate laboratory procedures and analyses, and a report on the survey has been made available on the Internet by EPA and NRC. The survey consists of two parts, a questionnaire and a request for samples of sludge and ash. The questionnaire portion of the survey was sent out to sewage treatment facilities nationally in the summer of 1999. Based on the responses from the questionnaire, information on TENORM concentrations and occurrence, as well as NRC licensee distributions, state and federal agency recommendations, and other statistical information on the size and geographic distribution of the sewage treatment facilities, approximately 300 facilities will be asked to provide samples of sludge and ash for laboratory analysis. It is expected

(Continued on page 14)

EPA (continued)

that this study, to be completed in the year 2000, will provide information to the agencies on whether there is a need for revising existing procedures for discharge of radionuclides into sewers, or conducting additional sampling to support revisions to regulations on the use and disposition of biosolids (sludge and ash).

At a meeting of the ISCOR-NORM Subcommittee on September 15, discussions were held on an upcoming review of DOT transport regulatory limits for radioactive materials, the Energy Information Agency's contract study to compile reclamation costs for uranium facilities nationwide, and the NRC's staff proposed regulatory and legislative changes for oversight of uranium in-situ leaching production facilities and uranium mill tailings impoundments.

NUCLEAR REGULATORY COMMISSION (NRC)

The Commission approved the decision to proceed independently of the EPA to promulgate a dose-based regulation for clearance of materials and equipment having residual radioactivity.

The NRC staff pursued an enhanced participatory rulemaking process. The proposed standard for clearance is not a detectability standard, but draws from the IAEA's interim report and the SAIC analysis. It also draws from ongoing practice with regard to NORM and NARM (such as the encouragement for coal ash to be recycled in building materials). The rulemaking will focus on the codified clearance levels above background for unrestricted use that adequately protect the public health and safety. This level is based on realistic scenarios of health effects from low doses that still allow quantities of

materials to be released. The rule will be comprehensive and apply to all metals, equipment and materials, including soil. If problems that would delay completing the rulemaking arise in certain categories of solid materials, then a decision can be made to narrow the scope of the rule.

The issues paper was approved by the Commission at the end of June, 1999 and published in the June 30, 1999 Federal Register. The first of the public workshops on the issues paper was held in San Francisco September 15/16. The next workshop is scheduled for Atlanta October 5/6 with a third workshop near Washington, DC on November 2/3.

The Commission has directed that the results and recommendations resulting from the public workshops be available to the Commission by March, 2000.

Although the proposed rulemaking will apply only to NRC-licensed facilities (the NRC does not have the authority to regulate NORM), this rulemaking is important to NORM because it will set a reference point for future NORM regulations at the state and federal levels.

The paper, *Release of Solid Materials at Licensed Facilities: Issues Paper, Scoping Process for Environmental Issues, and Notice of Public Meetings* can be seen in the June 30, 1999 Federal Register, Volume 64: 35090.

MINERALS MANAGEMENT SERVICE (MMS)

The Minerals Management Service Gulf of Mexico OCS Region has released a **NOTICE TO LESSEES AND OPERATORS OF FEDERAL OIL, GAS, AND SULFUR LEASES AND PIPELINE RIGHT-OF-WAY**

HOLDERS IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO OCS REGION: Guidelines for the Sub-Seabed Disposal and Offshore Disposal Storage of Solid Wastes. This Notice to Lessees and Operators (NTL) supercedes NTL No. 96-03, dated May 8, 1996, on this subject.

It updates regulatory citations, makes minor technical amendments, and includes a statement on the Paperwork Reduction Act of 1995. The Guidelines became effective September 24, 1999. The background section of the Guidelines are reproduced below.

NTL No. 99-G22 BACKGROUND

This Notice to Lessees (NTL) provides standardized guidelines and instructions for the sub-seabed disposal and offshore storage of solid wastes generated from oil and gas development on the Outer Continental Shelf (OCS) in the Gulf of Mexico OCS Region (GOMR). This NTL applies only to such solid wastes that are classified as exempt exploration and production (E&P) wastes under the Resource and Conservation and Recovery Act (RCRA) (see 40 CFR 261.4(b)(5)). These exempt E&P wastes include drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of oil, gas, or sulfur on the OCS.

According to 30 CFR 250.300(b)(2), you must obtain approval from the Minerals Management Service (MMS) of the methods you will use to dispose of drill cuttings, sand, and other well solids. Under this authority, the MMS GOMR requires that you must obtain approval for the sub-seabed disposal of all wastes, and for the offshore storage of E&P

(Continued on page 15)

MMS (continued)

wastes that contain naturally occurring radioactive materials (NORM) above background levels. You must obtain these approvals before you may proceed with such disposal or storage operations.

This NTL provides guidance and instructions on the disposal of these E&P wastes, worker safety when handling these wastes, and the contents of application to dispose of or store these wastes. The procedures regarding waste disposal outlined in this NTL do not supercede, but are supplemental to, those procedures for abandonment of wells as specified in Subpart G of 30 CFR 250.

This Notice to Lessees (NTL No. 99-G22 is available on the Internet at the following URL:

http://www.gomr.mms.gov/homepg/regulate/regs/ntls/ntl_1st.html

CANADA

**CANADIAN GUIDELINES
FOR THE MANAGEMENT
OF NATURALLY OCCUR-
RING RADIOACTIVE
MATERIALS (NORM)**

(February, 1999 Draft)

Prepared by the Canadian
NORM Working Group of the
Federal Provincial Territorial
Radiation Protection
Committee

The July/August 1998 draft was circulated to a number of outside reviewers for comment. Many welcome suggestions for improvement were received and have been incorporated into this version.

A major change to this draft is the

reorganization of the chapters. The grouping of the topics should lead to a natural progression from NORM as a concern through basis and criteria for standards, to a management philosophy with derived working limits for waste disposal. The appendices have remained the same as in the previous draft.

PREFACE

The NORM Working Group, a working group of the Federal Provincial Territorial Radiation Protection Committee, represents the interests of provincial and territorial regulators and includes affected industries, such as petroleum production, fertilizer manufacturing and metal recycling. With the support and encouragement of Health Canada and the Canadian Nuclear Safety Commission, these Guidelines are the result of their efforts.

Comments or suggestions concerning the Guidelines should be sent to:

Secretariat, Federal Provincial
Territorial Radiation Protection
Committee
Radiation Protection Bureau
Health Canada, PL 6302D
775 Brookfield Road
Ottawa, Ontario, K1A 1C1

INTRODUCTION

The Canadian Nuclear Safety Commission (CNSC), formerly the Atomic Energy Control Board (AECB), has legislative control of nuclear fuel cycle materials and man-made radionuclides. However, naturally occurring radioactive material (NORM) is exempt from CNSC jurisdiction except for the import, export and transport of the material. Therefore, jurisdiction over use and radiation exposure to NORM rests with each Canadian province and territory.

It has been the practice for companies that encounter challenges associated with naturally occurring radioactive material (NORM) to seek advice on safety procedures from provincial and territorial regulatory agencies. Such advice has been given on an ad hoc basis, leading to inconsistencies in the interpretation and application of radiation safety standards across Canada.

The Federal Provincial Territorial Radiation Protection Committee recognizes that the potential radiation hazards from NORM are the same as those from radioactive materials controlled by the CNSC, and believes that similar levels of protection should be applied to both CNSC-regulated workers and those workers and public exposed to NORM.

To that end, the Canadian NORM Working Group has, on behalf of the Federal Provincial Territorial Radiation Protection Committee, produced the Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM). The Guidelines are an extension of the work done by the Western Canadian Committee on NORM published in August 1995 as the **Guidelines for the Handling of NORM**.

The Canadian Guidelines set out principles and procedures for the detection, classification, handling and material management of NORM in Canada, and also include guidance for compliance with federal transportation regulations. A separate section outlines the basic science of radioactivity and explains the technical terms and concepts that are used throughout the Guidelines. There is also a glossary at the end of the document for quick reference and definitions.

(Continued on page 16)

CANADA (continued)

The Guidelines were developed to:

- * ensure adequate control of NORM encountered by affected industries;
- * harmonize standards;
- * reduce jurisdictional gap or overgap.

The basic principle of the Guidelines is that persons exposed to NORM should be subject to the same radiation exposure standards that apply to persons exposed to CNSC-regulated radioactive materials. No distinction is made regarding the origin of the radiation, whether it is NORM in its natural state or NORM whose concentrated radioactive material has been increased by processing (Technologically Enhanced NORM or TENORM).

A major principle in radiation dose control is that if doses can be reduced by some actions, those actions should be taken. Since even low doses of radiation exposure produce harmful effects, reducing low doses of radiation may be beneficial. The principle that doses should be As Low As Reasonably Achievable, economic and social factors being taken into consideration is recommended. This principle is usually referred to by the acronym ALARA.

THE NORM STANDARDS BASIS AND CRITERIA

Uniformity of Protection

The basic principle of these guidelines is that where workers or the public are exposed to new sources or modes of radiation exposure because of activities involving NORM, the same radiation exposure criteria should be applied as for CNSC activities. That applies where NORM is in its natural state and to cases in which the concentration of NORM material has been

increased by processing.

Guideline Basis

The Guidelines are based on the most recent international consensus standards recommended by the International Commission on Radiological Protection (ICRP) and CNSC regulations. The recommendations of the ICRP represent a consensus on international radiation protection standards and provide the basis for regulatory control of radioactive materials in virtually all countries of the world. As these regulations and standards are subject to periodic amendment, the Guidelines may also be updated to reflect amendments to accepted national and international radiation protection practices. The ICRP radiation protection philosophy and recommendations of significance for NORM in Canada are contained in ICRP reports 60, 65, 68, 72 and 77.

(Editor's Note: The Canadian Guidelines are excellent and are recommended as a treatise on NORM. There is insufficient room here to adequately summarize the total document.)

The February 1999 draft of the Canadian Guidelines was summarized in the Winter/Spring 99 issue of **The NORM Report**.

Finalization of the Guidelines is getting close. It is hoped to have it complete by the end of the year. A recent meeting was held with representatives of the oil and gas and potash industries for final comments and recommendations. After making recommended changes, the draft will be ready for public comment. It is expected that some parts of the Guidelines will be extensively revised.

When available, copies of the Guidelines can be obtained from:

Wayne Tiefenbach
Manager, Radiation Safety Unit
Sask Labour
1870 Albert Street
Regina, Saskatchewan S4P 3V7
Canada

CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS (CRCPD)

The final draft of Part N has been approved by the CRCPD Board of Directors. Part N has been sent to several agencies in the federal government for their concurrence to release Part N. The FDA has concurred; EPA has not concurred (See the EPA summary on page 13). The CRCPD Board may opt to send it to the states with a cover letter indicating that not all applicable agencies in the federal government have given their concurrence for release of Part N.

The NORM Commission considered all the comments from the public (either submitted in writing or as a result of the two stakeholder meetings). Part N has been peer reviewed.

Tommy Cardwell of the Texas Bureau of Radiation Control is heading up a committee to prepare an implementation guidance document for Part N.

The TENORM ad-hoc committee met at the Annual CRCPD Conference on May 7 - 8, 1999. The Committee reviewed Part N and identified areas where guidance was needed. The members of the Committee were assigned sections to write.

The Committee met again on August 13 - 14, 1999. The separate sections were incorporated into one document, reviewed and edited.

(Continued on page 17)

CRCPD (continued)

A stakeholders meeting was held on September 10 and 11, 1999. The meeting was held in conjunction with the Office of Agreement States meeting in Austin, Texas. Twenty-five persons were in attendance. The document was reviewed and comments documented. The

Committee met on September 11 and 12 and considered the comments received. The document was edited and changes made as necessary. A final draft will be completed by September 30, 1999, and will be submitted to the CRCPD to enter the publication process.

The Table of Contents for the

guidance document is reproduced below and on pages 18.

Questions and comments can be directed to:

Tommy Cardwell
Texas Department of Health
Bureau of Radiation Control
512-834-6688

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The Future of Radiation Protection - 2025

by Renelle Rae, U.S. Environmental Protection Agency

With the support of the EPA, the Institute for Alternative Futures (IAF) is undertaking a project on the Future of Radiation Protection. The project's purpose is to identify the most important radiation-related challenges and opportunities for organizations, at local, state, and national levels, that may emerge between now and 2025.

Four questions are being asked:

- What are the most significant radiation-related issues between now and 2025?
- What are the least appreciated, neglected challenges?
- What are the important prevention issues?

- What wild cards—low probability but high impact developments—could create new challenges and opportunities?

Since the CRCPD meeting, IAF has conducted focus groups and interviews with a variety of audiences. In August 1999, IAF held a session with the Association of State and Territorial Solid Waste Management Officials Radiation Task Force. IAF is currently assembling the information obtained from more than 100 participants. The significant challenges identified include risks from lasers and other forms of nonionizing radiation, low-grade proliferation of radiation sources, risk questions, public right-to-know, and technically enhanced naturally occurring radioactive materials.

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More NORM Training Courses

In addition to the OGCi-sponsored NORM courses (See page 36) I also teach NORM training courses on my own. The course, *NORM - An Emerging Environmental Problem*, covers most of the material contained in the OGCi course as well as material pertinent to industries other than petroleum.

The course length can be either one day or two days. The courses are essentially the same in content with the exception that the two-day course contains more detail.

One advantage of presenting the courses on my own, I can present the course to as few as one or two persons. The courses can be given at your facility or in Fort Smith, Arkansas.

The cost of the courses is \$650 per attendee for the 2-

day course and \$450 per attendee for the 1-day course. There is a 10% discount for two or three attendees from the same company and a 20% discount for more than three attendees from the same company. For larger classes, please call for prices. Travel expenses are in addition to the course fees.

Each attendee receives a copy of the NORM manual containing copies of all the slides used in the course (See "Manuals Available" page 20). I should be available to give these NORM courses at your convenience.

Peter Gray
The NORM Report
P.O. Box 11541
Fort Smith, AR 72917
Phone: 501-646-5142
Fax: 501-646-5359

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Dan Snow - General Manager
Jerry Kelly - Regulatory Affairs Mgr.

www.lotusllc.com

State of Texas Radioactive Material License No. L05147

NORM Manuals Available

The manual which I use in teaching my 2-day course *NORM Contamination - An Emerging Environmental Problem* is available. The manual contains over 650 copies of the slides used in the course. Although designed originally for the oil and gas industry, the manual also contains material about NORM contamination in other industries.

In addition to being an inclusive text on NORM, the manual can be easily used to structure in-house information or training courses on NORM.

The Table of Contents shown below indicates the range of topics in the manual.

1. Fundamentals of Radiation Protection
2. Radiation / Radioactivity Units
3. Biological Effects of Radiation
4. Radiological Protection
5. Introduction to NORM Contamination
6. NORM Contamination - Radium
7. NORM Contamination - Radon
8. NORM in Oil & Gas & Other Industries
9. Fundamentals of Radiation Detection
10. NORM Surveys
11. Disposal of NORM Wastes

12. Regulations - General
13. Federal Regulations
14. State Regulations
15. Regulations - Conclusions
16. Recommended Industrial Hygiene
17. Program Suggestions for NORM Control
18. Radiation Litigation & Minimization
19. Conclusions
20. Glossary

For further information contact:

Peter Gray
P.O. Box 11451
Fort Smith, AR 72917
TEL (501)646-5142
FAX (501)646-5359
E-mail: pgray@normreport.com

In addition to the manual for the 2-day NORM course the manual from my 1-day course is also available. The two manuals are similar in content—but the 2-day course manual is more detailed. The 1-day course manual contains about 400 slides.

The cost of the 2-day course manual is \$195 (US) and the cost of the 1-day course manual is \$125. ■

PHILIP SERVICES CORP.**TECHNOLOGY UPDATE
CHELATION TECHNIQUES
THERMAL FILTER ASHING**

Philip Services Corporation (PSC), the nation's leading provider of NORM decontamination services is pleased to announce the development of new high tech NORM decontamination and processing techniques.

In addition to the more traditional cleaning methods used at PSC's Amelia, Louisiana facility, such as:

- High Pressure Water Jetting with Filtered Recovery
- High Speed Reaming with Negative Air Waste Collection
- Mechanical Removal Techniques

PSC has developed both a chemical chelation and high temperature decontamination process to deal with difficult NORM processing problems.

The chemical chelation process developed by PSC utilizes custom blended chemicals, heat and circulation to remove Pb²¹⁰ and Po²¹⁰ which accumulates as a monomolecular film on the surface of piping and vessels. This occurs primarily in piping and vessels used in the light-end service in Exploration and Production, Refinery, and Chemical Manufacturing applications.

This film, which cannot be removed by traditional cleaning techniques, can be removed from the microscopic surface structure of the process metals by high temperature, directional circulation of chelant chemicals. The NORM particles are sequestered within the matrix of the chelant chemicals. This solution can then be treated to floc the materials as residue. This residue (approximately 10% of the original volume) is suitable for injection at a 29-B facility or incarceration at a permitted landfill facility.

Additionally, PSC has developed unique technology to handle the difficult problem of NORM contaminated polypropylene filter materials. This process "FilterTherm" (patent applied for) utilizes a high temperature reactor in the absence of oxygen to break down the filter material into gaseous compounds. These spent gases are vented and absorbed into activated carbon filters leaving only ash and NORM contaminants for isolated disposal. This process allows once "non-injectable" filters to become easily injected into approved disposal wells. An 80 - 90% reduction in volume is achieved in this process.

For further information, please contact Charles Wimberley (504-467-1197) or Paul Zimmerman (225-664-6406). ■

Contacting the EPA About Their TENORM Program

If you have questions or comments about EPA's TENORM Program or TENORM in general, or if you'd like to request more information, please contact us by one of the following ways:

You can write to us by mail at the following address:

**TENORM Program
U.S. Environmental Protection Agency**

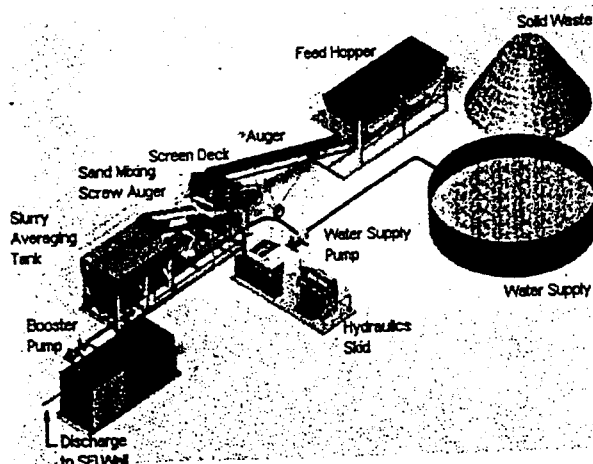
**Office of Radiation and Indoor Air
MS 6602J
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Washington, DC 20460**

You can Phone us at 202.564.9445

Or send a FA X to us at 202.565.2065 ■

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Visit our website: www.terralog.com

NCRP Report No. 129: Recommended Screening Limits for Contaminated Soil and Review of Factors Relevant to Site Specific Studies

The National Council on Radiation Protection and Measurements (NCRP) has published Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site Specific Studies*. Since 1987 (NCRP Report No. 91), the NCRP has recommended an exposure limit for the public of 100 mR per year under continuous exposure conditions and 500 mR per year for an infrequent exposure (see Report No. 116, *Limitation of Exposure to Ionizing Radiation* for the most current discussion of this subject.) Because the limit is intended to apply to ALL sources of radiation (excluding medical procedures and natural background), how can the public be protected at this level if conditions exist whereby individuals may be exposed to many

different human-made controlled sources? The NCRP recommended that whenever the potential exists for an individual to exceed 25 percent of the exposure limit from any single site, the site operator should be required to assure that the exposure of the exposed individual from ALL sources (excluding medical procedures and natural background) would not exceed 100 mR per year on a continuous basis. The NCRP viewed this to be acceptable because of the unlikelihood that any individual would be continuously exposed to more than four individual sites at a location that would permit the limit to be exceeded.

Report No. 129 provides screening limits for contaminated surface soil for over 200 nuclides that were derived based on the 25 mR per year described above. The reported screening limits are based on dose calculations to the highest exposed populations for each of eight different land-use scenarios. For example, in an agricultural setting it is assumed that there are no dwellings on the contaminated site and thus adults are assumed to be exposed via inhalation and/or external radiation, whereas children and infants may be exposed via ingestion of contaminated food produced on the site. In this case, separate calculations of the maximum dose are made for adults and for children and infants and the highest calculated dose is then used to determine the screening limit reported for that scenario. ■

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- NSG's Office: (409) 535-8043
- H Paul Estey (CEO&RSO): (409) 865-8599

Radon and Cancer - Professor Bernard Cohen

While my research indicates that radon in houses is not a serious danger, it is still indisputable that the average American gets more radiation from radon in his home than from all other sources of radiation combined, natural, medical, and all else. He gets about 1000 times as much radiation from radon in his home as he will get from nuclear power, including reactor accidents (treated probabilistically), radioactive wastes, and everything else. If my research is accepted, this means that all sources of low level radiation are inconsequential.

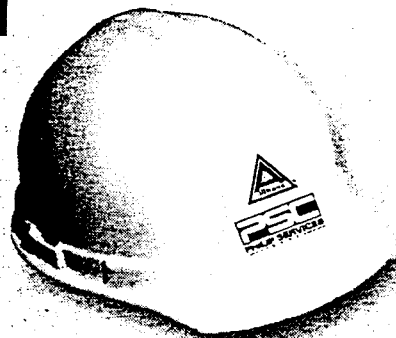
It is interesting to note that while radon gives us 1,000 times as much radiation dose as nuclear power, our society spends 1,000 times as much to reduce our dose from nuclear power. Thus the expenditure per life saved (if lives are indeed lost due to low level radiation) is 1,000,000 times

(1000 x 1000) larger for nuclear power radiation than for radiation from radon. Note that if a particle (alpha, beta, or gamma) strikes our body, there is no way for that cell to "know" whether it came from a material produced in a reactor or from a radon daughter; the health effects must therefore be the same. To me this means that society is behaving insanely. If someone disagrees, please try to enlighten me.

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e-mail: blc+@pitt.edu

Defining Oilfield Services

oil·field ser·vic·es – see “Allwaste”,
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Radioactive Wastes and the Environmental Protection Agency

There are some caveats regarding radioactive material and EPA. EPA considers radioactive material hazardous waste covered under CERCLA. Therefore, you retain liability for proper disposal of the material **FOREVER**. So if your waste broker illegally dumped your waste, you are liable for the clean up costs and will be followed by the EPA's cost recovery lawyers. There are also reporting requirements to the national response center if you have a spill or release. ■

LOTUS, L.L.C.

LOTUS, L.L.C. GRANTED TWO NEW
INJECTION WELL PERMITS

Lotus has announced that the Railroad Commission of Texas has granted injection permits for two wells at its Andrews County, Texas, NORM disposal facility. The proposed wells are part of a new NORM disposal technology for which Lotus has a patent pending.

The new disposal process will allow for the emplacement of slurried solid NORM waste into a geometrically controlled horizontal section within the Salado formation (a massive bedded salt formation in Western Texas). Lotus has proven the exceptional environmental protection afforded from this process and Lotus believes that this technology will allow them to control the cost of disposal to NORM generators for the next several years.

Lotus operates a state-of-the-art NORM processing, decontamination, and disposal facility in Andrews, TX. The services provided by Lotus include: NORM disposal, decontamination of tubulars, pipe and vessels, NORM surveys, site assessment, project management, NORM and hazardous waste transportation, roll-off container rental, and management of hazardous and mixed wastes. Lotus accepts E&P generated NORM wastes from anywhere within the United States and Canada.

For more information on LOTUS, L.L.C., visit their web site at www.lotusllc.com, or contact their offices at 915-523-3320. ■

Excerpts from the Federal Register

● 64 FR 10064, 1 March 1999, Advance notice of proposed rulemaking; comments were due by 15 April 1999. The U.S. Environmental Protection Agency (EPA) is considering options to make regulations more flexible for generators of mixed low-level radioactive waste who are storing wastes regulated by both the EPA and the U. S. Nuclear Regulatory Commission (NRC). The EPA requested comments on options for storing mixed waste; suggestions on providing regulatory flexibility to manage mixed wastes; and information about generating mixed wastes, operating procedures, and costs for storing, treating, and disposing of these wastes.

● 64 FR 194, 7 October 1999, final rule on amendments to 10 CFR 20 on **Respiratory Protection and Controls to Restrict Internal Exposures**.

SUMMARY: The Nuclear Regulatory Commission (NRC) is amending its regulations regarding the use of respiratory protection and other controls to restrict intake of radioactive material, 10 CFR 20. The amendments make these regulations more consistent with the philosophy of controlling the sum of internal and external radiation exposure, reflect current guidance

on respiratory protection from the American National Standards Institute (ANSI), are consistent with recently effective revisions to Occupational Safety and Health Administration (OSHA's) respiratory protection rule, and make NRC requirements for radiological protection less prescriptive while reducing unnecessary regulatory burden without reducing worker protection. The amendments provide greater assurance that worker dose will be maintained as low as is reasonably achievable (ALARA) and that recent technological advances in respiratory protection equipment and procedures are reflected in NRC regulations and clearly approved for use by licensees.

● 64 FR 197, 13 October 99: Corrections to Respiratory Protection and Controls to Restrict Internal Exposures (see above). In Appendix A to 10 CFR 20, on page , 54558, in the table, in the first column , in the second line entry, should read disposable^d. On the same page, in the same table, in the third column in the fifth line from the bottom of the table, and also in the third line from the bottom of the table, "i100" should read "h100". ■

Radon, Smoking and Lung Cancer

The health effects due to radon progeny are derived mainly from studies of lung cancer in underground miners in the U.S., Canada, Sweden and Czechoslovakia. Studies of the human health effects of radon have several limitations. The main limitations of which concern weak estimations of exposure and the complicating role of smoking in the causation of the lung cancers observed in miners. Only the U.S. uranium miner study contains relatively complete smoking histories. In that study 3/4 of the miners were smokers. Of the 383 cases of lung cancer observed in the U.S. study, 356 (93%) occurred in smokers and 25 occurred in non-smokers (the smoking histories of two cases were unknown). Also, apparently there are no studies of high radon areas in the U.S. which have demonstrated a statistically significant association between radon exposure and lung cancer. It is still an unsettled question (whether the press and the EPA like to admit it or not) as to whether or not radon causes lung cancer in humans in the absence of smoking. Another possible confounding factor raises interesting questions about the etiology of lung cancer in underground miners. A study by Scram, et. al. (1993) reported mutagenic mycotoxins from the throat swabs of Czechoslovakian miners. They hypothesize that the inhalation of dust contaminated with the molds of *Aspergillus* and *Penicillium* may be another risk factor responsible for the continued high cancer rate of the miner population.

Also, when Rn-222 decays, the resulting decay products (RnDP) rapidly diffuse and most become attached to airborne particles or surfaces. These attached RnDP deposit throughout the respiratory tract as a function of the particle size and distribution of the carrier aerosol. Unattached RnDP are assumed to be significantly more hazardous than aerosol-attached RnDP. The type of breathing (nose and/or mouth) influences the site of deposition of unattached RnDP also. A large fraction of unattached RnDP deposits in the nose with nasal breathing. However, oral breathing causes unattached RnDP to deposit on the bronchial epithelium where the

lung cancer target cells seem to be located.

The fraction of RnDP attached to airborne particles is highly dependent on particle concentration. Deposition of RnDP on surfaces is rapid for clean indoor air. However, as indoor particle concentration increases (e.g., from cigarette smoking), the fraction of RnDP attached to airborne particles increases and the concentration of airborne RnDP increases (this is interesting in the light of exposure due to second-hand cigarette smoke).

Remember that tobacco and tobacco smoke are a significant source of RnDP exposure to the smoker! (See NCRP Report No. 95 (1987) concerning tobacco products.) The RnDP's which seem to cause the detrimental effects are Pb-210 and Po-210. The presence of these daughters appear to result from the deposition of airborne radon decay products on the leaves of the tobacco plant during its growth. This report indicated that the maximum average dose-equivalent rate due to smoking 30 cigarettes per day to small areas of the bronchial epithelium at segmental bifurcations of each of the approximately 50-55 million adult smokers in the U.S. would be 800 to 1000 rad/year. Applying a quality factor of 20, this would yield an annual dose equivalent of about 16 rem. This report goes on to attempt to convert this to an effective dose equivalent of 1,300 mrem per year. Compare this with the EPA limit of radiation exposure to the general public of 100 mrem per year!

One might wonder if the EPA or any one else engaged in radon/lung cancer studies has ever bothered to figure out just how many of the radon detectors the EPA sent out were set to homes of smokers and just how skewed radon estimates for the U. S. might really be??? Could it be possible that our current lung cancer dilemma might really be due to smoking and the breathing of primary and secondary tobacco smoke? Remember lung cancer was not a common disease before smoking caught on as an enjoyable vice. ■

"Look for strength in people, not weakness; good, not evil. Most of us find what we search for." —Anonymous

A New NORM-TENORM Listserv

During the past year Phil Egidi has received requests to his TENORM web site asking him to set up a dedicated listserv (mailing list like RADSAFE) for NORM-TENORM issues. Although somewhat reluctant at first, Phil decided that it is time for NORM-TENORM to have its own forum. This is because many of the questions he was receiving are not directly related to health physics/radiation safety, but are more generic (not to be confused with stupid), and may be considered off-topic for RADSAFE.

Please consider joining this new listserv, all input is welcome, expertise and experience will certainly help people who are impacted in this growing field of operational safety, regulation, and environmental restoration.

To join the NORM-TENORM listserv, send an e-mail to the following address:

majordomo@mailhub.ornl.gov

In the body of the message type:

subscribe to norm-tenorm and (your e-mail address)

Editor's note:

Phil Egidi's web site is an excellent resource for NORM and TENORM. If you haven't visited the site it is highly recommended. The URL is:

www.normis.com/nindex.htm ■

Statistical Trivia

(The following was sent to me by Fred Scheuritzel, Radiation Control Physicist in the Connecticut Department of Environmental Protection.)

Cancers Caused by Exposure to Radiation

(Basis: Per 1,000,000 People with 70 Year Life Expectancy)

- 250,000 Cancer (unspecified sources)
- 250 Radon (all exposures)
- 75 Radon (4 pCi/liter air)
- 2.5 Radon (water)
- 600 Food (natural - potassium, polonium, tritium, carbon-14, calcium, etc.)
- 100 Co-Sleep (RAM in body tissue)

Conclusion: The Environmental Protection Agency would save more lives from radiation-induced cancer by promoting sleeping in single/twin beds.

Sources: EPA documents, BEIR IV, Health Physics Handbook. Numbers based on the linear non-threshold model. ■

RAC Consultation with EPA on TENORM

The Radiation Advisory Committee (RAC) of the Science Advisory Board (SAB), met on March 26, 1999 to conduct a consultation with staff from the Office of Radiation and Indoor Air (ORIA) on data collection efforts to respond to the National Academy of Sciences (NAS), National Research Council (NRC) recommendations on Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM), and to comment on ORIA's approach to respond to the SAB/RAC's 1994 review of ORIA's draft scoping report on NORM (EPA-SAB-RAC-94-013). This activity is a logical follow-up by the ORIA staff to the on-going work of the National Research Council's report entitled **Evaluation Guidelines for Exposures to Technologically Enhanced Naturally Occurring Radioactive Materials**, which addresses the potential hazards of human exposure to TENORM. ■

The SAB has developed the consultation as a mechanism to advise the Agency on technical issues that should be considered in the development of regulations, guidelines, or technical guidance before the Agency has taken a position. ■

Radium-224 — An Overlooked Environmental Problem?

A paper presented at the Annual Meeting of the Conference of Radiation Control Program Directors in May of this year pointed out a potentially new environmental problem. The paper **Radium-224 in New Jersey, a Federal Perspective** was presented by Eric Simpson of the Environmental Protection Agency.

When New Jersey opted for rapid sampling to analysis times in their activities in Toms River (a municipality of southern New Jersey), they unwittingly made the circumstances ideal for a wholly unexpected discovery — significant quantities of naturally occurring radioactive radium-224 in groundwater unsupported by other radionuclides in the thorium decay series.

Emphasis has historically been placed on the presence of radium-226 and radium-228 in drinking water supplies. Little attention has been on the presence of radium-224, the first decay product of thorium-228. Underground water, in contact with rocks, etc., can extract or leach radium from these rocks putting the radium in solution in the water. This includes radium-224, radium-226 and radium-228. Radium-224 is relatively short-lived, with a half-life of 3.66 days compared to the 1620 year half-life of radium-226 and 1.9 years for radium-228. This much shorter half-life of radium-224 means that if analyses for radium-224 or gross alpha is delayed for several weeks, the analyses will show only radium-226 and radium-228, the radium-224 having decayed. If the water is used for drink-

ing and cooking soon after being produced at the well, etc., there is a distinct probability that the water can contain significant concentrations of radium-224, an alpha emitter.

This is an issue for the northeast in particular where the geology is enriched in thorium which causes higher than average concentrations of thorium-228 in the rocks and soils and subsequently higher concentrations of radium-224 in water.

The possibility that radium-224 may be more important than previously thought was first noted in New Jersey in 1996 when gross alpha determinations on the same aquifer by different laboratories gave quite different results. It was subsequently found that the longer the delay between sampling and analysis, the less gross alpha counts resulted. It was subsequently found that the fresher water contained significant concentrations of radium-224 which decayed with its 3.66-day half-life. Since radium-224 is the first decay product of thorium-228 the radium-224 is not being formed in the water because the thorium is not extracted, or very slightly, from the rocks of the aquifer.

The discovery of unsupported radium-224 in southern New Jersey has affected how the Office of Radiation and Indoor Air and especially EPA's Office of Water look at gross alpha radioactivity and radium in drinking water.

EPA relies heavily on the states when it comes to setting policy for the environment. Radium-224 has radically changed the way that New Jersey handles drinking water compliance. Many of the policy changes and adjustments that have been implemented in New Jersey are being considered as a basis for national policy. The states provide an excellent opportunity for the federal government to adopt what works well. Thanks to New Jersey, EPA is working to address the weaknesses in the Safe Drinking Water Act that were illuminated by radium-224. ■

The NORM REPORT A NORM Contamination Newsletter

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Published Quarterly
Editor: Peter Gray, Ph.D.

The road to success is dotted with many tempting parking places." Anonymous

Meetings Calendar

Issues and Solutions in Exploration, Production and Refining

This Sixth Annual International Petroleum Environmental Conference brings together professionals from industry and academia who seek solutions to environmental problems of a technical, legal, and regulatory nature. The conference will be held November 16-19, 1999 in Houston, Texas. For up-to-date conference information see <http://ipec.ens.utulsa.edu/>

The Second International Symposium on TENORM

A very successful Second International Symposium on Technological Enhancement of Natural Radioactivity was held in Rio de Janeiro between 12 and 17 September 1999. There were many interesting presentations. The following topics were discussed:

1. TENORM in mining and Non-Nuclear Industry
2. Radon Indoor and Outdoor
3. Mobility and Transfer of Natural Radionuclides
4. Natural Radiation and Health Effects
5. Remediation and Contaminated Sites
6. Analytical Techniques and Methodologies
7. Regulatory and Legal Aspects

The scientific program is available from the Symposium web site:

<http://www.tenr.com.br/>

It is expected that TENR-111 Symposium will be held in Europe in 2002.

5th International Conference on High Levels of Natural Radiation and Radon Areas: Radiation Dose and Health Effects

This International Conference will be held in Munich, Germany in September 2000. The contact address is A. Bayer, Bfs - Institute for Radiation Hygiene, P.O. Box 1108, D-85758, Oberschleissheim, Germany, Phone: +49-89-31603-230, fax: +49-89-31603-270, e-mail: abayer@bfs.de.

THE FIFTH INTERNATIONAL CONFER- ENCE ON HEALTH, SAFETY & ENVI- RONMENT IN OIL AND GAS EXPLOR- ATION AND PRODUCTION

26-28 June 2000 Stavanger, Norway

The SPE Programme Committee, and the endorsing organizations, invite you and your colleagues to submit proposals for papers for the **Fifth International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production** to be held 26-28 June in Stavanger, Norway. The chosen theme for the conference is "Progress through Sharing Values".

This reflects the goal of the conference, which is to promote world wide progress in health, safety and environmental management with all the stakeholders in an open forum. Sharing the variety of stakeholder values with the aim of full understanding and, wherever possible, of agreement, is the key to maintaining the license to operate. Sharing values is also essential in order to be able to continue to improve HSE performance under the very challenging internal and external conditions that the oil and gas industry experiences.

For further information or to submit your abstract online please visit the SPE website at:

<http://www.spe.org/events>

or contact the SPE Office in London:

Tel: +44 171 408 4466

Fax: +44 171 408 2299

(Continued on page 30)

Meetings Calendar (continued)

INTERNATIONAL SYMPOSIUM ON RESTORATION OF ENVIRONMENTS WITH RADIOACTIVE RESIDUES

ARLINGTON, VIRGINIA, USA
NOVEMBER 29 - DECEMBER 3, 1999

Sponsored by the International Atomic Energy Agency, the objective of the Symposium is to foster information exchange on the restoration of environments with radioactive residues, including principles and criteria for guiding decision making and the methodologies for assessing the radiological situation and for remediating the sites, with the overall aim of promoting international consensus on the relevant issues in these areas.

The following main topics will be covered in the Symposium:

- national and international policies and criteria for the remediation of sites with radioactive residues;
- radiological assessment of sites with radioactive residues;
- remediation of sites with radioactive residues: strategies, remediation techniques and technologies, and safe waste management; and
- decision making and involvement of interested parties in policy implementation.

Information: Conference Service Section, IAEA,
P.O. Box 100, A-1400 Vienna, Austria. Fax: 43 1
26007. Telephone: 43 1 2600 21310.
Email: Official.Mail@iaea.org
Web Site: www.iaea.org/worldatom/

Instrumentation, Measurements and Electronic Dosimetry

Where are We Going in the New Millennium?

33rd Midyear Topical Meeting

The Health Physics Society
January 30 - February 2, 2000

We intend for the technical sessions to deal with the myriad issues of instrumentation, measurements and electronic dosimetry. The following technical sessions are currently planned:

1. Instrumentation for Field Use
2. Instrumentation for Laboratory Use
3. instrumentation for Medical Use
4. Portable Instrument Calibration Programs and Problems
5. Records Management - Format, Legal Requirements, etc.
6. Site Characterization and Design of Survey Protocols for Evaluating/Releasing a Controlled Area - MARSSIM or NUREG 1444, Supp. #1 or 10 CFR 835 or others
7. Instrumentation Quality Assurance and Quality Control Issues
8. Electronic Dosimetry - Uses, Records and Experience
9. Electronic Dosimetry - Quality Assurance and Quality Control Issues and Certifications, similar to the NAVLAP/DOELAP Programs

Other topics or sessions will be added as we receive abstracts and more fully develop the technical program for this wide-ranging topic.

Questions may be addressed to a member of the Local Arrangements Committee: Carlyle Gravely at:
gravely_hc@nns.com.

Evaluation of Guidelines for Exposures to TENORM (1999)

This publication from the Commission on Life Sciences and published by the National Academy Press will be available online. Part of the publication, including its Table of Contents, should be available online at the National Academy of Sciences web site.

NORM in the Literature

Risk Assessment of Radon in Drinking Water

At the request of the Environmental Protection Agency (EPA) pursuant to a congressional mandate (amendment to bill S. 1316 to amend title XIV of the Public Health Service Act commonly known as the Safe Drinking Water Act), the National Research Council has appointed a multidisciplinary committee to conduct a study and report on the health risks associated with exposure to radon in drinking water. The committee was also asked to prepare an assessment of the health-risk reduction associated with various mitigation measures to reduce radon in indoor air; to accomplish this task, the committee used the results of the latest scientific studies of risk assessment and relevant peer-reviewed research carried out by organizations and individual investigators. Finally, the committee was asked to summarize the agreements and differences between the various advisory organizations on the issues relevant to the health risks posed by radon in drinking water and radon-mitigation measures and to evaluate the technical and scientific bases of any differences that exist.

Copies of the report are available from
 National Research Council
 Board on Radiation Effects Research
 Room 342
 2101 Constitution Avenue, NW
 Washington, DC 20418
 (202) 334-2232

MEASUREMENT OF Rn^{222} FLUX, Rn^{222} EMANATION, AND $Ra^{226,228}$ CONCENTRATION FROM INJECTION WELL PIPE SCALE

by

Arthur S. Rood, Gregory J. White, and
 D. Thomas Kendrick
 Health Phys. 75(2):187-192; 1998

Abstract -- Rn^{222} flux was measured from the ends of

twenty sections of produced water injection tubing (pipe) containing barite scale contaminated with naturally occurring radioactive material (NORM). Exposure measurements near the pipes were as high as 300 $\mu R/hr$. Flux measurements were accomplished by first purging the pipes with dry nitrogen and then collecting the outflow (nitrogen and radon) on charcoal columns affixed to the end of the pipe for 66 hours. As determined in this manner, Rn^{222} flux from the ends of the pipe ranged from 0.46 to 2.7 pCi/second. Following the radon flux measurements, pipe scale was removed and a representative sample was taken for Ra^{226} and Ra^{228} concentration measurements and determination of Rn^{222} emanation fractions (the fraction of the total radon contained in a material that is released from the material and free to migrate). The samples were also analyzed for gross mineral content. Emanation fraction measurements for Rn^{222} ranged from 0.020 to 0.063, while Ra^{226} concentrations ranged from 424 to 2,760 pCi/g. Barite was the predominant mineral in 17 of the 20 scale samples collected. Much of the previous work dealing with radon emanation fraction measurements has involved uranium mill tailings. Compared to mill tailings and natural soils which have emanation fractions that typically range from 0.1 to 0.3, the emanation fractions measured for these NORM scales are substantially lower.

MODEL FOR ESTIMATING POPULATION IMPACTS AVERTED THROUGH THE REMEDIATION OF CONTAMINATED SOIL

by

A. B. Wolbarst, J. Mauro, R. Anigstein, D. Beres,
 M. Doehnert, H. B. Hull, and S. Marschke
 Health Phys. 75(1):67-76; 1998

Abstract -- This is the second in a series of papers that discuss methodologies being developed and employed by the U.S. Environmental Protection Agency in support of its decisions on cleanup levels for radioactive-

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NORM in the Literature (continued)

ly contaminated sites that are to be remediated and released for public use. It describes a model, CU-POP, designed by the U.S. Environmental Protection Agency to obtain estimates of the potential collective radiological health impacts over specific periods of time (100, 1,000 and 10,000 years following cleanup), both on and off site, due to residual radioactive materials in on-site soil. Collective doses and risks are linear in population density, for the direct exposure, dust and indoor radon inhalation, and soil ingestion pathways. It is assumed that specific fractions of all food grown and all groundwater pumped at a site are consumed by on- and off-site populations. The model was developed for application to a set of hypothetical "reference" sites. Its testing on a simple generic site is discussed briefly here.

TENORM Legislation - Theory and Practice

by
Nick Tsurikov

PREFACE

Activities and work practices in which radiation exposure of workers and members of the public is increased due to the presence of Naturally Occurring Radioactive Material (NORM) are receiving increased attention from regulatory agencies and, to a lesser extent, from the general public. Proposed national and international radiation protection standards are likely to bring many industries into the realm of regulatory concern. Attention focused on industries where enhancement of natural radioactivity takes place and radiation exposure of workers and members of the public may be comparable to that for already 'controlled' activities. However, industries, where technological enhancement of NORM results in only small increases of radiation exposure, could also become 'regulated' in accordance with the provisions of the 'new' radiation protection legislation. One of such industries is mining and minerals processing in general. Verbatim adoption of Basic Safety Standards (BSS) of the International Atomic Energy Agency into a national legislation without a full assessment of health,

economic and legal consequences could present enormous practical problems. Therefore, it is appropriate to discuss if these Standards prescribe appropriate control measures for the Technological Enhancement of Natural Radioactivity, especially in mining and minerals processing.

The full text of "TENORM Legislation - Theory and Practice" is available from nicktsurikov@ihuka.com. The paper was presented at TENR-11, Rio de Janeiro, 12 - 17 September 1999.

 μ R Standards Workshop white paper available

CRCPD, USDOE, CIRMS, and NIST held this workshop on May 13, 1999, to document the need for μ R standards and develop an action plan to establish NIST traceability. CRCPD requirements for μ R measurements are given in Part N. The technically enhanced naturally occurring radioactive material (TENORM) rule has been approved by the CRCPD Board of Directors and distributed to the states for use. The public release dose-rate criteria in the TENORM rule is below 0.05 mR/h (50 μ R/h). Measurement traceability currently ends at 0.5 mR/h (500 μ R/h).

μ R instruments are used to find areas for further investigation, to release materials into recycling operations, to determine compliance with TENORM release criteria (e.g., pipe scale), and to verify decommissioning activities in the field (i.e., is it clean enough?). For a particular site, a state may be willing to do comparisons between radiochemistry lab results and the survey instrument results under actual field conditions, and then use the survey instruments for most decisions in the field. This results in great savings in time and dollars by allowing decontamination to continue without long delays waiting for radiochemical analysis.

The five-page white paper was published by CIRMS. It can be obtained by contacting Robert Lommler at rlommler@idns.state.il.us or by fax at 217/786-7223.

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NORM in the Literature (continued)**RADON EXHALATION RATES AND GAMMA DOSES FROM CERAMIC TILES**

by

R. S. O'Brien, H. Aral, and J. R. Peggi
Health Phys. 75(6):630-639; 1998

Abstract – This study was carried out to assess the possible radiological hazard resulting from the use of zircon glaze applied to tiles used in buildings. The Ra^{226} content of various stains and glazing compounds was measured using gamma spectroscopy and the Rn^{222} exhalation rates for these materials were measured using adsorption on activated charcoal. The radon exhalation rates were found to be close to or less than the minimum detectable values for the equipment used. This limit was much lower than the estimated exhalation rates, which were calculated assuming that the parameters controlling the emanation and diffusion of Rn^{222} in the materials studied were similar to those of soil. This implied that the Rn^{222} emanation coefficients and/or diffusion coefficients for most of the materials studied were very much lower than expected. Measurements on zircon powders showed that the Rn^{222} emanation coefficient for zircon was much lower than that for soil, indicating that only a small fraction of the Rn^{222} produced by the decay of Ra^{226} was able to escape from the zircon grains. The estimated increase in radon concentration in room air and the estimated external gamma radiation dose resulting from the use of zircon glaze are both much lower than the relevant action level and dose limit.

Regulation of Naturally Occurring Radioactive Material (NORM) - An International Perspective

by

Mitchell W. Davis

(Presented at the Air & Waste Management Association's 90th Annual Meeting & Exhibition, June 8-13, 1997, Toronto, Ontario, Canada.)

Naturally Occurring Radioactive Material (NORM)

was first recognized as a potential problem as long ago as 1904 in the oil fields of Canada. NORM later became an issue in the North Sea oil and gas production facilities in the early 1980's and became more widely recognized in the United States in 1986 during a routine well workover in the State of Mississippi. NORM contamination of oil and gas industry production equipment has since been identified world wide. The United States, including Alaska and the Gulf of Mexico region, the North Sea region, the United Kingdom, Canada, Australia and several middle eastern countries have all reported NORM contamination.

In the early 1990's, the three western provinces of Canada; Alberta, British Columbia and Saskatchewan, formed a committee of government and industry representatives to develop guidelines for the control of NORM. The committee released the document titled **Guidelines for the Handling of Naturally Occurring Radioactive Material (NORM) in Western Canada** in August of 1995. Also in 1995, the Egyptian Atomic Energy Authority (AEA) released, in draft form, guidelines for the control of NORM in Egypt. The Egyptian guidelines categorize NORM sites to three levels based on radiation levels at the site.

The purpose of this paper is to discuss some of the international regulations or guidelines that have been promulgated concerning NORM in the oil and gas industry. In addition to the Canadian and Egyptian guidelines, guidelines or regulations in the United Kingdom, the North Sea, China, and other middle eastern countries will be discussed. The impact of these regulations or guidelines on non-oil and gas industries will also be discussed. A comparison of these regulations or guidelines to those generally found in the United States shall be drawn. ■

Be Persistent – Like a Stonecutter

When nothing seems to help, I go and look at a stonecutter hammering away at his rock, perhaps a hundred times without as much as a crack showing in it. Yet at the hundred and first blow it will split in two, and I know it was not that last blow that did it, but all that had gone before. — — Jacob A. Riis ■

Regulatory References

Title 10 CFR Part 20 ---- Standards for Protection Against Radiation	U.S. AEC 1974 ----	Termination of Operating Licenses for Nuclear Reactors, NUREG 1.86 U.S. Atomic Energy Commission, Washington, D.C. June 1974
Title 10 CFR Part 61 ---- National Emission Standards for Radionuclide		
Title 29 CFR Part 1910.96 ---- Ionizing Radiation	ARKANSAS	Rules and Regulations for Control of Sources of Ionizing Radiation. Section 7 NORM
Title 33 U.S.C. 466, et seq. ---- Federal Water Pollution Control Act as amended		
Title 40 CFR Part 141 ---- National Primary Drinking Control Program; Criteria and Standards	GEORGIA	Rules and Regulations for Radioactive Materials, Chapter 391-3-17, Section 08-Regulation and Licensing of NORM
Title 40 CFR Part 190 ---- Environmental Radiation Protection Standards for Protection Power Operations	LOUISIANA	Title 33: Environmental Quality Part XV: Radiation. Chapter 14: Regulation and Licensing of NORM
Title 40 CFR Part 192 ---- Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings	MISSISSIPPI	Part 801 Section N Licensing of NORM Oil and Gas Board, Rule 69, Control of Oil field NORM
Title 40 CFR Part 440 ---- Ore Mining and Dressing Point Source Category	NEW MEXICO	Subject 14: NORM in the Oil and Gas Industry
Title 42 U.S.C. 300, et seq. ---- Safe Drinking Water Act, as amended	OREGON	Regulations and Licensing of NORM Oregon Administrative Rules, Chapter 333, Division 117 -- Health Division
Title 42 U.S.C 2011, et seq. ---- Atomic Energy Act of 1954, as amended		
Title 42 U.S.C 4321, et seq. ---- Toxic Substances Control Act (TSCA)	SOUTH CAROLINA	Part IX, Licensing of NORM
Title 42 U.S.C. 4341, et seq. ---- Conservation and Recovery Act of 1976 (RCRA)	TEXAS	Texas Department of Health-- Texas Regulations for Control of Radiation (TRCR) Part 46, Licensing of NORM Railroad Commission of Texas-- Rule 94, Disposal of Oil and Gas NORM Wastes
Title 42 U.S.C 7401, et seq. ---- Clean Air Act; as amended		
Title 42 U.S.C. 7901, et seq. ---- The Uranium Mill Tailings Radiation Control Act of 1978		

Comparison of NORM Rules by State

<u>Radium Exemption Concentration</u>		<u>Radium Cleanup Standard</u>	
AR	5 pCi/g	AR	5/15 pCi/g ⁽³⁾
CO (proposed)	5 pCi/g	CO (proposed)	5 pCi/g
GA	5 pCi/g with high radon factor ⁽¹⁾ 30 pCi/g with low radon factor ⁽²⁾	GA	5/15 pCi/g with high radon factor 30/15 pCi/g ⁽⁴⁾ with low radon factor
LA	5 pCi/g above background	LA	5/15 pCi/g, or 30 pCi/g if the effective dose equivalent to members of the public does not exceed 100 millirem per year
MI (proposed)	5 pCi/g	MI (proposed)	5/15 pCi/g
MS	5 pCi/g with high radon factor 30 pCi/g with low radon factor	MS	5/15 pCi/g with high radon factor 30 pCi/g with low radon factor
NM	30 pCi/g	NM	30/15 pCi/g
ND	5 pCi/g.	ND	5 pCi/g
NJ	Variable- depending on concentrations and volumes- annual dose less than 15 mrem/yr.	NJ	Variable- depending on concentrations and volumes- annual dose less than 15 mrem/yr.
OK (proposed)	30 pCi/g	OK (proposed)	30/15 pCi/g
OR	5/15 pCi/g	OR	5 pCi/g
SC	5 pCi/g with high radon factor 30 pCi/g with low radon factor	SC	5/15 pCi/g with high radon factor 30/15 pCi/g with low radon factor
TX	5 pCi/g with high radon factor 30 pCi/g with low radon factor	TX	5/15 pCi/g with high radon factor 30/15 pCi/g with low radon factor
CRCPD (proposed)	5 pCi/g	CRCPD (proposed)	5/15 pCi/g

NOTES

- (1) High radon factory is a radon emanation rate greater than 20 pCi per square meter per second
- (2) Low radon factory is a radon emanation rate less than 20 pCi per square meter per second.
- (3) 5/15 pCi/g of radium in soil, averaged over any 100 square meters and averaged over the first 15 centimeters of soil below the surface.

- (4) 30/15 pCi/g is 30 pCi/g of radium in soil, averaged over any 100 square meters and averaged over the first 15 centimeters of soil below the surface.

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NORM Training Course Offered by OGCI & Peter Gray

OGCI (Oil & Gas Consultants International, Inc.), a world leader in petroleum training, has scheduled 2-day training courses in NORM for 2000. The course *NORM Contamination in the Petroleum Industry* covers all aspects of NORM contamination and its control, including:

- Fundamentals of Radiation
- Fundamentals of NORM
- Radium Contamination
- Radon Contamination
- State & Federal Regulations
- NORM Surveys including Hands-on Training
- Maintenance Procedures
- Disposal of NORM Wastes
- Decontaminations
- Release of Facilities
- Recommended Programs
- Liability and Litigation

This course builds a rigorous and complete foundation for the control of NORM contamination.

This in-depth course is taught by Peter Gray who has a background in nuclear and radiochemistry and 25 years experience in the petroleum industry. Dr. Gray has a Ph.D. in Nuclear Chemistry from the University of California at Berkeley. He took early retirement from Phillips Petroleum Company in 1985 after 25 years with the company. Since 1985, Dr. Gray has been a consultant in NORM. During his tenure with Phillips, Dr. Gray was in charge of the company's NORM control program from the discovery of NORM contamination in natural gas and natural gas liquids in 1971 until his early retirement in 1985. This background uniquely qualifies Dr. Gray as the instructor for the course -- an instructor who understands the origin of NORM and why it contaminates nearly all petroleum facilities, where the contamination is, how to set up programs that protect employees, company facilities, the environment and the public, how to survey for NORM contamination, the available options for the disposal of NORM wastes, and the Federal and state regulations for the control of NORM.

Peter Gray is the editor/publisher of *The NORM Report*, a newsletter reporting on developments in NORM, including summaries of regulatory activities in all fifty states, the Federal level as well as in Canada.

The 2000 schedule for the course *NORM Contamination in the Petroleum Industry* is

April 25-26, Tulsa, OK
Nov. 7-8, Tulsa, OK

For further information about the course, contact Joseph Goetz, OGCI, 1-800-821-5933, or contact Peter Gray, 501-646-5142, for information about the course content.

Comparison of NORM Rules by State (Continued)

Exemption for Contaminated Equipment

AR	Concentration limit only (5 pCi/g)	OR	5 pCi/g
CO (Proposed)	Concentration limit only (5pCi/g)	SC	50 µR/hr including background
GA	50 µR/hr including background	TX	50 µR/hr including background
LA	50 µR/hr including background	CRCPD (Proposed)	Concentration in dpm
MS	25 µR/hr above background 100 cpm above background	NOTES Before release for unrestricted use, facilities or equipment contaminated with NORM should not exceed specified contamination limits in dpm/100 sq. centimeters.	
NM	50 µR/hr including background		
OK	50 µR/hr including background		