The *NORM* Report

Naturally Occurring Radioactive Material Contamination
Fall 96

Index

The NORM Report

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Regulations for the Control of NORM - Update

The status of regulations for the control of NORM is summarized below for 16 states and the federal government (EPA). Significant developments have occurred in Arkansas, California, Oklahoma and the CRCPD. Each regulatory agency was contacted during November 18-27.

The last states to enact NORM regulations were New Mexico and South Carolina. Their regulations were summarized in the Summer 1995 issue of **The NORM Report.** Arkansas, Georgia, Louisiana, Mississippi, Oregon and Texas have previously enacted specific regulations for the control of NORM.

Enactment of regulations specifically for the control of NORM will require compliance by industries and companies with NORM contamination and NORM waste materials. Such 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 federal government and Canada will be summarized in the Winter 97 issue of **The NORM Report.**

ARKANSAS

The revisions to the Arkansas NORM regulations have been completed and sent to the governor for his signature. After the Secretary of State's certification of the revised NORM regulations, they will be printed and become effective January 1, 1997 or shortly thereafter. The revisions codify many of the provisions in the Louisiana NORM regulations. Significant changes in the revised Arkansas NORM regulations are summarized below.

The Arkansas NORM regulations constitute Section 7 of the *Arkansas Rules and Regulations for Control of Sources of Ionizing Regulations.*

RH-6004. General Definitions
Several new definitions have been added. Specifically, definitions have been added for:

- Breathing zone
- Confirmatory survey
- Designated facility
- NORM facility identification number
- NORM field supervisor
- NORM general license number
- NORM Radiation Safety Officer
- NORM surveyor
- NORM waste management plan
- NORM worker
- Notifier
- Release survey

RH-6005. Exemptions
The exempt level for radium-226 and/or radium-228 remains at 5 picocuries per gram. The exempt levels for uranium and thorium and other NORM radionuclides also

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ARKANSAS (Continued)
remain the same as previously.

There are no changes in other exemptions in the revised regulations.

RH-6010. General License

a.1. Persons subject to the general license shall notify the Department by filing a *Notification of a NORM Facility Form.*

Note: The Department recommends a general licensee under RH-6010.a.1 conduct or arrange to have conducted a confirmatory survey to determine the extent and magnitude of the NORM contamination at the general licensee's facility .

2. Each general licensee performing on-site maintenance of contaminated facilities, sites, or equipment or the excavation of land shall establish and submit to the Department for approval written procedures as outlined in RH-6019 to ensure worker protection and survey (or screening) of sites and equipment as outlined in RH-6018.

3. On-site maintenance is authorized only if the maximum radiation level does not exceed 2 millirem per hour at any accessible point of the work area.

b. Facilities and equipment contaminated with NORM in excess of the levels set forth in Appendix A of this Section, or if the maximum radiation exposure level exceeds 50 microroentgen per hour including background at any accessible point shall not be released for unrestricted use. The decontamination of equipment and facilities shall be performed by persons specifically licensed by the Department or another Licensing State to conduct such work. Each general licensee shall establish for approval written procedures for the evaluation (or screening) of equipment, components, and facilities prior to release for unrestricted use to ensure that the levels in Appendix A of this Section are not exceeded.

d. Equipment contaminated with NORM is exempt from the requirements of these Regulations if the maximum radiation exposure level does not exceed 50 microroentgen per hour including background at any accessible point, and radioactive contamination levels do not exceed levels set forth in Appendix A of this Section.

g. Storage of NORM and NORM waste from remediation.

1. A general licensee is authorized to store NORM waste generated during remediation in a container for ninety (90) days from the date of generation. After such time, the NORM waste must be transferred to an authorized facility for the purposes of treatment, storage, or disposal unless otherwise exempted in writing by the Department.

2. To store NORM waste in an approved container for up to one (1) year from generation, a general licensee must first submit a written NORM waste management plan to the Department and receive authorization from the Department. The general licensee may store NORM waste in an approved container up to one (1) year (365 days) from generation under the written NORM waste management plan while waiting for Department determination unless otherwise exempted in writing by the Department.

RH-6014. Containers.
Section RH-6014 details specifications for containers for NORM waste.

RH-6015. Tanks Containing NORM.
This new Section details requirements for tanks containing NORM.

RH-6016. Transportation of NORM.
This new Section details the requirements for the transportation of NORM contaminated equipment and/or NORM waste.

RH-6017. Radiation Survey and Counting Instrumentation.
This new Section details the requirements for radiation surveying and counting instrumentation including subjects that individuals must demonstrate competence in

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ARKANSAS (continued)

prior to being approved as a NORM surveyor.

RH-6019. Worker Protection Plan.
This section details the material which must be included in the Worker Protection Plan. The Plan must include:

- Posting procedures
- Dosimeter procedures/program
- Contamination control procedures
- Training programs

RH-6032. Vacating Premises.
Each specific licensee shall, no less than thirty (30) days before vacating or relinquishing possession or control of premises which may have been contaminated with NORM as a result of the activities, notify the Department in writing of intent to vacate. When deemed necessary by the Department, the licensee shall decontaminate the premises in such a manner as the Department may specify.

RH-6033. Financial Assurance and Recordkeeping for Decommissioning.
Each specific licensee shall be subject to the financial assurance and recordkeeping for decommissioning under RH-409.h of these Regulations.

The sections in the revised Arkansas NORM regulations not summarized above are essentially the same as in the original NORM regulations.

CALIFORNIA

In 1987, the California oil and gas industry conducted a statewide survey of production facilities to determine the extent of elevated levels of Naturally Occurring Radioactive Material (NORM), if any. The industry survey consisted predominantly of external gamma radiation meter readings. Of the 10,000 measurements taken, about 93 percent were at background levels. The remaining readings were above background levels, but low enough that only routine safety measures were considered necessary to minimize employee exposure and protect human health and the environment.

In 1993, California underwent a peer review of its oil and gas exploration and production waste-management regulatory programs. The review was coordinated 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 (Division) and the Department of Health Services, Radiological Health Branch (RHB) 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 this study indicate that NORM is not a serious problem in California oil- and gas-producing operations -- confirming findings in the 1987 study. Seventy-eight percent of the measurements in this study were at background levels. A few sites had elevated levels of NORM. Further study of those sites or facilities should be considered. Routine protective measures may be all that is necessary to minimize exposure in these particular areas.

Survey results and laboratory analyses of samples 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

The study confirmed most of the findings of the 1987 survey. 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.

In gas processing facilities, high activities relative to background were discovered in the gas lines after the methane and ethane had

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California (continued)

been removed from the gas stream and where the propane was being distilled. Since propane and radon have similar boiling points, higher activities were expected from these lines.

Summary/Recommendations

1. Since this was a focused survey, conclusive assessment of the status of NORM for every California oil and gas operation cannot be made. However, since some levels of NORM were found, further study of those sites or facilities should be evaluated for potential problems.

2. Sites or facilities with levels less than 5pCi/g need no further study at this time. Sites/facilities with levels between 5pCi/g and 15 pCi/g may require further study to review possible pathways to humans and to determine the extent of control that may be needed. Sites/facilities with levels greater than 15 pCi/g should be evaluated to determine if protective safety measures are necessary to control the ingestion or inhalation of the stated materials by workers.

3. Simple protective measures should be taken, where necessary, to minimize exposures and keep exposures as low as reasonably achievable.

4. In gas processing facilities where separation of the more volatile fractions occur, personnel should not remain for long periods near the propanizer reflux pumps while those pumps are in operations.

5. American Petroleum Institute (API) Bulletin E2, ***Bulletin on Management of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Production***, should be adhered to by all operators, as necessary, and used as the primary guidance document. However, the appropriate State agency should be contacted before any disposal of NORM occurs.

6. The Division should develop a field/formation matrix, where possible, to assist oil and gas operators in identifying potential areas of concern.

7. The promulgation of NORM guidelines or basic regulations may lead to better control of this source of radiation exposure to workers and to the public in California. Levels of cleanliness can be specified for the decontamination of equipment and land, when considering the possible future use of both, and for the disposal of produced water (if NORM is an issue).

8. This study demonstrated the ability of the State of California and its oil and gas industry to work cooperatively to address an important issue and deal with it at the state level, in the absence of generic, national directives and regulations that may not be applicable nationwide.

Copies of the report are available from:

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FLORIDA

The 18 month study of phosphate NORM, funded by the Florida Institute of Phosphate Research at the state's request, began in July. The study's goal is to identify and evaluate the extent of occupational and public radiation exposure risks related to phosphate NORM. The Institute, located in Bartow and affiliated with the University of South Florida, selected the Polk County Public Health Unit and a private consulting firm to conduct the study as a joint project. Florida hopes the data provided by the study will provide guidance on the extent of regulatory intervention needed to address phosphate NORM in the state.

The Florida Advisory Council on Radiation Protection's NORM Committee, formed in response to the state's request for recommendations on regulatory approaches to NORM, met in October regarding its efforts to provide recommendations regarding potential NORM regulations.

The Advisory Council on Radiation Protection has the following future schedule:

Schedule for additional tasks

a. November 1996
   i. Draft proposed recommendations
   ii. Consider concentration guidelines
   iii. Discuss assessment guidelines
b. January 1997 - Meet with Department of Health
c. March 1997 - Finalize draft recommendations
d. Present final draft to Florida Advisory Council on Radiation Protection at subsequent meeting
   i. Report on status of CRCPD draft regulations
   ii. Report on status of Florida Institute of Phosphate Research
e. Summer 1997 - finalize recommendations

The following is a report submitted to the CRCPD by the Florida

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FLORIDA (continued)

NORM Advisory Committee on its efforts to provide recommendations to the Florida Advisory Council on Radiation Protection regarding potential NORM regulations in Florida.

Summary Submitted to the CRCPD Commission on NORM

The Florida NORM Advisory Committee (FNAC) does not support concentration-based regulations, but rather a dose-based standard. The consensus at this point is that the dose standard would probably be 500 mrem/year including the existing 100 mrem/year from licensed activities and operations. The FNAC believes this standard to be consistent with the recommendations of the ICRP and the NCRP. While concentration-based standards are not believed to be appropriate, concentration-based guidelines are believed to be appropriate as an alternative to demonstrating compliance with the dose-based standard.

The dose-based standard would apply to the total dose received by a member of the public from licensed activities and materials (already limited to 100 mrem/year) and the dose from "regulated NORM." Regulated NORM would be limited to NORM which has been chemically enhanced by man's activities. Thus NORM which has been enhanced by physical activities alone would not be regulated. The FNAC's rationale for this limitation is that the public already has access to physically-enhanced NORM. In addition, this limitation would eliminate the need to evaluate trivial activities such as earth-moving, building construction, etc.

As with most public doses, compliance is usually demonstrated by calculation. The FNAC is concerned about the use of ultra-conservative modeling for such demonstrations, citing differences of up to two orders of magnitude for results of the same evaluation using different levels of conservative assumptions. The FNAC is considering requiring the inclusion of the probability of occurrence of assumed parameters in such evaluations, in accordance with the recommendations of the ICRP. (See *Dose Assessments* on page 11.)

In an on-going effort to improve the characterization of NORM in Florida, state personnel have been conducting informal site surveys of NORM generators. Surveys of oilfields located in the Panhandle and southwest part of the state remain in the planning stage.

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 are expected to be adopted by the Board in early 1997. However, there are no changes in the NORM rules in this revision.

ILLINOIS

Illinois's approach to NORM regulations is being reviewed to decide if general NORM regulations should be proposed. Or as an alternative, should rules be written to address the NORM problems in selected industries where the potential exists for NORM contamination. No decision as to the approach to be proposed has been made yet. The Department of Nuclear Safety may go with the approach of identifying known NORM problems and writing specific rules for those problems. As new NORM problem areas are identified, new rules will be written to cover them. This approach may be preferable to generic rules which cover the whole world of NORM and results in too much unnecessary regulations without much benefit. This approach to NORM rule making is the result of reviewing the in-depth comments made on the latest (1994) CRCPD draft. There is no time schedule for NORM rule making in Illinois.

KENTUCKY

The Kentucky Department of Environmental Protection is in discussions with Ashland Exploration to find a satisfactory long term disposal site for the NORM that needs to be remediated from the Martha Oil Field.

While arrangements are being made for the long-term storage of the remediated material removed from the oil field, the Kentucky Department of Environmental Protection has given permission to Ashland to allow moving the contaminated soil to temporary storage.

More than 1,300 former well sites have been released for unrestricted use. Remediation is now being done on 200 contaminated well sites in the Martha Oil Field. Approximated 20,000 tons of contaminated dirt will be removed to allow the sites to be used for unrestricted activities.

An additional 20 sites tied up in state and federal litigation are not involved in the present cleanup.

LOUISIANA

The Louisiana DEQ has an application from an oil company for permission to dispose of their own NORM in an injection well. This is the first proposal for injection received by the new administration in Louisiana and it is not known what the Secretary of the DEQ will do. The issues have been outlined

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Louisiana (continued)

for him but there has been no decision yet whether legislative action will be required.

A statute enacted by the legislature many years ago prohibits any disposal of radioactive waste in salt domes or on land that is not owned by the state or federal government. The statute was enacted to prevent the DOE and/or DOD from disposing of their wastes in salt domes in Louisiana. The problem it created is that at the time it was enacted NORM wasn't regulated. The language used in the statute, however, clearly prevents the disposal of NORM also. It may require an amendment to the law to exempt NORM.

The oil company requesting approval to dispose of their own NORM wastes in an injection well has given the DEQ further information. After review, the request will be sent to the Secretary of the DEQ with recommendations.

Another proposal was received by the DEQ from a petrochemical company looking for a disposal site for non-oilfield NORM. They wanted a rules change which would allow this kind of waste to go to a Class D landfill. The DEQ is studying the proposal. The DEQ Legal Division has been asked to make a legal analysis of the request.

The petrochemical company wants to modify the regulations so that there will be provisions for the disposal of non-oilfield NORM in a landfill. The Legal Division leans towards arguing the acceptability of the present law. However, it has been pointed out to them that there are materials that are exempted in the regulations, but often contain as much radium as the non-oilfield NORM. For example, "Black Beauty", a metal abrasive cleaner, contains natural radium since it is mined from a slate or shale formation. After use it is usually disposed of in a landfill. The question has been asked --- what is the difference between this material which can be disposed of in a landfill and non-oilfield NORM which contains similar concentrations of radionuclides but cannot be put into a landfill? Also refractory bricks which often contain radioactive materials are disposed of in landfills. This situation remains at a standstill. Legal has not yet responded.

MICHIGAN

There have been further reorganizations within the Department of Environmental Quality. These include staffing changes and new responsibilities. Responsibilities for radioactive materials, etc. are in the newly created Radiological Protection Section. The telephone number for contacting the new section is (517) 335-8198 or 335-8190.

There have been no changes in the draft of the Michigan guidance documents for the control of NORM.

A new "high" in NORM contamination in pipe scale has been seen. A sample recently analyzed contained 200,000 picocuries per gram. Concentrations over 100,000 pCi/gm are commonly seen.

Most attention at present is still focused on radium luminous products of military origin and radium-contaminated warehouses. EPA superfund cleanup should begin in December 1996. EPA has allotted over 12 million dollars toward the cleanup of the warehouses and other contaminated buildings. It is expected that after the removal of the gauges the building contamination will be small and much of the remaining debris might be able to be disposed of in a landfill under the new landfill guidelines. 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. Analyses have shown that this level shows insignificant risk to the public.

MINNESOTA

There has been no legislative action with regard to the disposal of radium and other NORM-type materials. Minnesota has no regulations for the specific control of NORM. The general regulations for the control of radiation are currently being revised. Specifically the revisions cover the regulations dealing with x-ray and other devices in medical settings that may use NORM as a source of radiation. The revisions may be published for public comment by January 1997. They are currently under review by Legal.

MISSISSIPPI

Responsibility for NORM in Mississippi is 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). Currently, after the petroleum leaves the wellsite, the Department of Health has jurisdiction for any NORM contamination.

However, there is a controversy about this division of responsibility for NORM. Some time ago, the legislature enacted legislation giving the Oil and Gas Board jurisdiction over <u>all</u> oil and gas wastes. The Oil and Gas Board's NORM rules which became effective July 1, 1995 assumes jurisdiction only

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MISSISSIPPI (continued)
over NORM at the wellsite.

The Department of Health has asked the Attorney General for an opinion as to who will have jurisdiction for NORM in the future. This has been challenged in court by an attorney who has been very active in NORM litigation in the state. The Attorney General has stated he will not render his opinion until the court challenge is settled.

It is expected that the Attorney General's opinion will find that the Oil and Gas Board has jurisdiction over all NORM associated with oil and gas production. The Department of Health remains in limbo until the Attorney General acts. There has been no action on the appeal.

In the interim, the Department of Health continues to function as it has in regard to NORM. Licenses are still being processed for remediation contractors, etc. There have been no changes in the Department of Health NORM rules and none are expected unless the Attorney General "rules" that the Department of Health has no NORM jurisdiction. The Health Department's attorney believes that any commercial remediation, etc. will still have to be licensed by the Department of Health. Although the Department of Health appears to being doing less with NORM, complaints are still being received concerning health problems associated with NORM exposures.

Very little is being done about these complaints since the Department of Health has been told they may have no jurisdiction according to state law.

NEW JERSEY

The Bureau of Environmental Radiation continues to address the comments received on the interested party draft of N.J.A.C. 7:28-12, ***Remediation Standards for Radioactive Materials***. The Bureau continues to address the comments, and are proceeding to develop a formal rule proposal. There is no schedule set for publication of the rule proposal in the New Jersey Register.

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"** became effective July 15, 1996. Rule 714 was summarized in the Summer 96 issue of **The NORM Report**.

OHIO

Ohio is presently revising their general regulations for the control of radiation. The proposed rules are currently undergoing review by the Radiation Control Advisory Council. The rules have one more stage to go through before becoming effective. NORM is included in the revised regulations as part of Ohio's preparation for Agreement State status. It is hoped to have the rules finalized by Spring, 1997.

OKLAHOMA

The draft of the proposed NORM regulations is still under development by the Radiation Management Advisory Council. The rules will be included in DEQ's Chapter 400, **Radiation Management** as Subchapter 14. Although not finalized yet, some of the features being considered include:

- A 30 pCi/gm exemption for technologically enhanced NORM in substances.
- A 30 pCi/gm exemption for TE-NORM in soil.
- 30 pCi/gm exemption for TE-NORM in media other than soil.
- Substances and equipment containing TE-NORM are exempt if the radiation exposure level does not exceed 50 µR/hr including background at any accessible point.
- Impacted substances may be stored in open piles if notice is given. Otherwise, they must be stored in closed and labeled containers. Impacted pipe and equipment may be stored off a site of origination or a related site if the storage site is fenced and notice is given.
- Conducting TE-NORM surveys and site assessments or remediating impacted sites, facilities, substances or equipment for others requires a general permit authorization.
- Any site used for TE-NORM processing for which an individual TE-NORM permit is required must be described in the permit application and approved by the DEQ.
- Soil farming is being considered as an option for the disposal of TE-NORM if radium-226 or radium-228 is less than 30 pCi/gm. During a permit year, general permittees who soil farm must give the DEQ prior written notice of any new soil farming location.

When the draft of the proposed NORM rules are finalized, they will be summarized in **The NORM Report**.

TEXAS

The Texas Department of Health has jurisdiction for NORM except for the disposal of NORM. The Railroad Commission has jurisdic-

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TEXAS (continued)

tion 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.

The Department of Health is still considering revisions in their NORM regulations. The revisions have been delayed by other priority matters. The changes will primarily be in classifications of NORM and adding some requirements for processing of NORM from other persons. The revisions will be coordinated with the Railroad Commission, particularly where they concern jurisdictional issues. There is no timetable for making these changes.

The Railroad Commission's ***Statewide Rule 94: Disposal of Oil and Gas NORM Wastes*** took effect February 1, 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 at present to revise Rule 95.

The Texas Natural Resource Commission has not started drafting rules for the disposal of NORM wastes not associated with oil and gas exploration and production. Although there is no firm schedule, the drafting of specific NORM disposal rules could begin in the summer of 1997.

WASHINGTON

Rulemaking as to the quantity of NARM which will be allowed to be brought into Washington for disposal is continuing consistent with the requirements of Washington's Administrative Procedures Act. (See the Spring 96 issue of **The NORM Report**.)

While the rulemaking proceeds, the State is under court order to accept 100,000 cubic feet per year. At the present rate NARM is coming into the state, the 100,000 cubic feet limit may be sufficient, at least for this year.

FEDERAL ACTIONS

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

The EPA has begun finalizing the draft report ***Diffuse NORM Wastes - Waste Characterization and Preliminary Risk Assessment*** issued in April, 1993. The report has been reviewed by EPA's Radiation Advisory Committee (RAC). The RAC issued their report ***A SAB Report: Review of Diffuse NORM Draft Scoping Document. Review of the Office of Radiation and Indoor Air Draft Document on Diffuse Naturally Occurring Radioactive Material (NORM) : Waste Characterization and Preliminary Risk Assessment*** in May 1994. The final draft of the EPA Report will respond to the comments detailed in the RAC Report. The goal for the EPA is to complete the final report by October, 1997.

CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS (CRCPD)

The Conference of Radiation Control Program Directors, Inc. (CRCPD) was formed in 1968. The major purpose for its establishment was to serve as a common forum for state radiation control programs in the United States to communicate with each other. A secondary purpose was to serve as a forum for the state radiation control programs to communicate in a uniform manner with the many federal agencies having radiation protection responsibilities. As stated in its Bylaws, the first objective of the CRCPD is to promote radiological health in all aspects and phases.

The following is Ray Paris's report on the NORM Summit held in early September. Ray is Chairman of CRCPD's NORM Commission.

NORM Summit

Combined Meeting of the NORM Commission and the NORM Advisory Committee

By Ray D. Paris, Chairman, Commission on NORM, Oregon Radiation Protection Services

Commission members present: Ray Paris, Chairperson (OR), Tommy Cardwell (TX), Walter Cofer (FL), Sam Finklea (SC), Jim Hickey (Consultant), Bill Russo (EPA), and Ed Tupin (CDRH).

Advisory Committee members present: Kenneth Alkema (representing Al Rafiti who represents the NORM waste management industry), David Bernhardt, CHP (representing environmental interests), Lewis Cook (representing Bill Guerard, representing oil and gas industry), Gregory Crinion (representing legal aspects), William Geifer, RSO (representing phosphate industry), David Gooden, Ph.D., J.D., CHP (representing legal aspects), Michael Kletter, Ph.D. (representing rare earth/zircon sand industry), Charles Roessler, Ph.D., CHP (representing academia), Michael Ryan, Ph.D., CHP (representing the National Council on Radiation Protection and Measurements), Max Scott, Ph.D. (representing academia), and Anthony Thompson (representing uranium mining industry).

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CRCPD (continued)
Other attendees: Tom Amidon (NJ), David Fauver (NRC), Jon Richards (EPA Region 4), and Alexander Williams (DOE).

Advisory Committee members unable to attend: Jean-Claude Dehmel (representing rare earth industry and the Health Physics Society), Kevin Grice (representing oil and gas industry), Michael Mattia (representing NORM waste management industry), and John Richardson (representing rare earth industry).

Meeting Summary

Rather than the name of this meeting being ***The NORM Summit***, a more appropriate title would be ***The Storm & NORM***. Hurricane Fran played havoc with this meeting. The intent was for the NORM Commission and NORM Advisory Committee to have a joint meeting on Wednesday and Thursday (September 4 & 5) followed by a NORM Commission meeting the following two days to rewrite Part N commensurate with conclusions drawn on the 4th and 5th.

In spite of the intent, Hurricane Fran caused this joint meeting to be adjourned about 1:30 p.m. on Wednesday, September 4. Thus, we only had about 4-5 hours of discussions (lively at times) on the direction Part N should go. However, adequate information was obtained and consensus drawn for the NORM Commission to continue working the rest of the week. The Commission had to relocate to Columbia from Charleston, which was no small feat considering thousands of other people were heading to Columbia at the same time. Lodging and other logistics were settled and the Commission met Thursday afternoon through Saturday.

There were so many substantive changes being considered for the new Part N that the Advisory Committee agreed that the new draft should stand alone and not be compared by redlining and strike-outs with the existing June 1994 Part N version. The Commission took this into account and redrafted a whole new Part N during this two and a half day period. An outline of the Rationale was also developed, with the actual writing to be completed later.

The following is a summary of the substantive changes for the new Part N:

- More clearly defined what is being regulated and called it "TE-NORM."
- Went to a "dose based" instead of a "concentration based" standard.
- Refined the exemptions from regulation.
- Excluded radon from total effective dose equivalent (TEDE) calculations.
- Gave considerable flexibility to the states for implementation.
- Included prospective, remedial, and operational aspects for TE-NORM.
- Provided for institutional controls to be part of the equation for problem solving.
- Recognized the imminent need for Implementation Guidance and made plans to develop this guidance document.
- Recognized the need to look further at recycling options for TE-NORM.
- ALARA was excluded from the regulations to prevent it from being interpreted as a standard of care.
- Developed a time schedule for finalization of Part N, which appears at the conclusion of this article.

One of the objectives of this joint meeting of the Advisory Committee and the NORM Commission was to address previously identified *key issues to resolve*. Even though the actual meeting time was short, the discussion and opinions were coming out about as fast as Hurricane Fran was blowing (i.e., 115 m.p.h.). It is amazing how a hurricane warning can focus a group's attention in getting down to business. All but one of the key issues were resolved (at least for this first draft stage of the new Part N). The following is a list of the key issues and how each was addressed:

Is there a better definition of NORM?

Yes -- The material being regulated is technologically enhanced naturally occurring radioactive material (**TE-NORM**). **TE-NORM** means naturally occurring radioactive material not regulated under the Atomic Energy Act (AEA) whose radionuclide concentrations have been increased by or as a result of human practices. **TE-NORM** does not include the natural radioactivity of rock or soils, or background radiation, but instead refers to materials whose radioactivity is technologically enhanced by controllable practices (or by past human practices). For the purposes of Part C of the SSRCRs, **TE-NORM** is radioactive material.

What is the threshold for starting regulatory action?

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CRCPD (continued)
Persons who receive, own, possess, use, process, transfer, distribute, and dispose of **TE-NORM** are exempt from requirements of Part N if the materials contain or are contaminated at concentrations less than 5 picocuries per gram (185 Bq/kg) of any combination of Ra-226 and Ra-228. Note: States are also given the option of establishing screening levels based upon gamma survey instrument results for use in exempting various materials. However, these exemptions must be consistent with dose criteria limits in Sec. N.5 of Part N. More will be stated about these limits later.

Where does cost vs. benefit factor in?
States are given the opportunity to consider cost/benefit factors with site specific needs in their respective states in the development of applicable regulations. It was noted that there would likely be instances where simplistic measures such as institutional controls with minimal **out of pocket** expenditures would be the best controllable option.

What is background -- how is it determined?
Background is not defined in Part N, but will be defined in the Implementation Guidance. How to determine background in a particular area will also be established in this guidance. A key point about the anticipated definition of background in Part N is that background is everything which isn't the TE-NORM under discussion. For example, if the ambient radiation field over the native soil is 10 microR/hr, and the ambient field over a laydown yard is 15 microR/hr, the difference being due to crusher-run gravel, then background for purposes of determining action levels for dealing with oil scale is 15 microR/hr rather than 10.

Can release criteria be based on direct external measurements only?
This will be addressed in the Implementation Guidance document.

Will Part N be based upon dose or concentration limits?
The new Part N will be based upon dose. Sec. N. states that "no person shall conduct operations or use, transfer or dispose of **TE-NORM** in such a manner that the reasonably maximally exposed member of the public will receive an annual total effective dose equivalent (TEDE) in excess of [some fraction of 100 millirem/yr to be determined by the implementing state, taking principles of ALARA into account]. It was noted that there are too many variables and unique circumstances among states for Part N to specifically set one allowable fraction of 100 millirem/yr for **TE-NORM**.

Will flexibility be permitted in site remediation? Cost, remoteness, projected land use? Past practices vs. current use?
Yes to all the above--as long as Sec.N.5 (Standards for Radiation Protection for **TE-NORM**) are met, e.g., provided that some fraction of 100 millirem/yr to be determined by the implementing state is not exceeded.

What is appropriate clean-up standard? 10, 15, 25, 100, 500 mRem? 5,10, 15, 30 pCi/gm Ra-226?
Flexibility is given to implementing states to the degree that the standard meets the criteria in Sec.N.5 stated above, e.g., an acceptable fraction of 100 mRem/yr to the maximally exposed individual.

Should radon be included or excluded from calculations?
Unless specifically noted, doses from indoor radon and its progeny shall not be included in TEDE calculations.

Should all exposure pathways be used in calculations? (Can food pathways be excluded?)
This will be addressed in the Implementation Guidance. It was noted that there may be instances where all pathways will not need to be included.

Should NORM disposal criteria be kept separate from LLW criteria?
TE-NORM disposal will be kept separate from LLW criteria.

Is a person/organization culpable if they were unaware they had material that needed to be regulated?
This issue was not specifically addressed at this meeting.

Is there a universal exposure limit or concentration limit to capture all industries?
It was clearly noted that there is not one *concentration limit* that would capture all industries. The concept for selecting an acceptable *dose limit* of some fraction of 100 mRem for the maximally exposed member of the public is consistent with dose criteria established on other guidance documents and 10 CFR 20, which most states have adopted. The option for the states to select that appropriate fraction of 100 mRem for **TE-NORM** is unique to the new Part N.

A brief version of the discussion during the joint meeting is available upon request. The meeting was recorded and the tapes are also available upon request.

(Continued on page 11)

CRCPD (continued)
Note: There may be a charge for the tapes, sufficient to cover the cost of duplication. Ray Paris's address is:

Ray D. Paris, Manager
Radiation Protection Services
State Health Division
Department of Human Resources
800 N.E. Oregon Street
Portland, OR 97232
(503) 731-4014

A time schedule with projected completion dates for Part N follows.

Draft Schedule for Part N Approval

(Note: This is for the September 1996 Draft)

Oct.1, Commission to complete drafting the rationale for the September 1996 draft of Part N.

Oct.15, The September 1996 draft along with Rationale to be mailed to NORM Advisory Committee and CRCPD Board of Directors.

Nov. 6. The NORM Commission chairperson to have received approval/disapproval to start a working group for developing Implementation Guidance for the Part N.

Dec. 1. Comments due back to the Commission on the September 1996 Part N draft.

Jan. 15, 1997. Commission to have addressed the Advisory Committee's comments (e.g., including the suggestions and/or reasons for not incorporating suggestions into the new Part N).

Jan. 22. The new Part N along with Rationale mailed to all states and the public for comments. Comment period to extend about 60 days.

CRCPD (continued)
Mar. 31, Comments from states and public due back to NORM Commission.

May1. NORM Commission chairperson report due to CRCPD Board of Directors. (Note: It is recognized that all comments will most likely not have been addressed by this time. However, the acceptance and rejection level of the new direction for Part N will be known.)

Jul. 1. Have a finalized draft of Part N, accompanied by the Rationale and Implementation Guidance submitted to the CRCPD Board of Directors for action.

This is a very ambitious (perhaps even extremely optimistic) schedule. However, the NORM Commission is committed to getting a workable set of suggested state regulations for the control of technologically enhanced naturally occurring radioactive material distributed to the states for their use as soon as possible. ■

Dose Assessments

The following was included in a report presented to the Florida Advisory Council on Radiation Protection by Mr. Guidry, a member of the Council.

The doses which are being calculated as potentially exceeding some criteria are often based on conservative and sometimes unrealistic assumptions. If a piece of contaminated material is found or is being evaluated, the default scenario is often to assume the person is going to be exposed to the radioactivity levels at the surface of that material for 8,760 hours a year. The person would have to be embracing that material for the entire year and that level of dose exceeds these criteria. It has been determined that if you use the standard prescribed assumptions in any dose evaluation for a particular problem and you use the NRC established criteria for the assumption, you get numbers hundreds of times higher than if you do the same analysis and you factor in the probability of occurrence of these assumptions. The example being if you assume a person is going to be in this place for 500 hours per year and would get a dose of 10 mrem, then if you factor in the probability of that person being in that location for 500 hours per year is 50% then you would factor that 50% in your dose calculation. This is also consistent with NCRP guidelines but is not often being done. Because of these differences and ranges in dose estimates, you get a very wide range of what is considered to be acceptable from the standpoint of concentration guidelines and standards. A good example being that in western Canada (***The Guidelines for the Handling of NORM in Western Canada***), their target was to keep doses below 1 millirem per year from NORM. They established an exemption criterion of 270 pCi/per gram of radium-226 as being consistent with keeping doses below 1 millirem per year. In this country we seem to be concluding that, in order to keep doses below 100 millirem per year, the radium concentration has to be less than 5 pCi per gram. That is the kind of range that you can get. Based on the information that has been reviewed, most of this seems to be the result of the type of assumptions that are used in the dose assessment. ■

Letters to the Editor

Dear Mr. Gray:

I would like to respond to some of the comments made by Mr. Michael Mobley, Director of the Division of Radiological Health, Tennessee Department of Environment and Conservation, in his letter published in the Summer 96 issue of **The NORM Report**. Mr. Mobley stated that "...a number of specific exemptions mentioned above present much greater potential radiological risk than do other regulated activities. In particular, free release of contaminated fluids by underground injection appear highly questionable, especially for a radionuclide with a long-lived alpha emitter with a gaseous radioactive daughter. The risks are significant both in the absolute sense and especially in comparison to the risk levels to which regulated AEA radioactive material are held."

Argonne National Laboratory recently published the results of a study that assessed potential radiological doses associated with several different NORM treatment and disposal methods, including subsurface disposal. Extremely conservative assumptions were used in our model of subsurface disposal. It was assumed that (1) 100,000 barrels (4.2 million gallons) of liquid slurry containing 2,000 pCi/L of radium-226 were injected into a subsurface geologic setting of interlayered sandstone and shale formations, including a shallow drinking water aquifer; (2) during injection, a casing failure caused the entire volume of NORM to be injected into a given formation; and (3) upon failure, the NORM present in the slurry dissolved instantaneously. Different scenarios were modeled to estimate the radiological concentrations and doses that would occur at a number of different receptor locations from casing failure in each different formation, including the drinking water aquifer. The receptors were located in the drinking water aquifer at a depth of 300 ft, at distances ranging from 0.2 to 20 miles downgradient of the injection well. The conservative assumptions used to model subsurface injection are representative of downhole encapsulation, as well.

The results of our study indicated that estimated doses associated with subsurface disposal of NORM appear to be so low that the risk to the general public is negligible. In the worstcase scenario, which assumed that casing failure occurred in the drinking water aquifer at a depth equal to that of the receptors, the predicted radium-226 concentration at the closest downgradient receptor (0.2 miles away) was 1.3 pCi/L. This equates to a dose of approximately 1 mrem/yr, using exposure parameters recommended by the EPA for maximum residential exposures. When the failure was assumed to occur near the base of the drinking water aquifer at a depth of 900 ft, the predicted concentration at the closest downgradient receptor dropped to 0.02 pCi/L, which equates to a dose of approximately 0.01 mrem/yr. Assuming this kind of release directly into a drinking water aquifer is extremely conservative given that subsurface injection of NORM occurs at much greater depths into formations that are stratigraphically isolated from drinking water aquifers. Estimated doses associated with all of the other failure scenarios (i.e., scenarios in which failure occurred at depths greater than 900 ft) were at least four orders of magnitude smaller than the 0.01 mrem/yr dose.

Contrary to Mr. Mobley's opinion quoted above, we conclude that subsurface disposal of petroleum industry NORM represents a negligible risk to the general public. Although measurable doses were predicted in our study, if more realistic assumptions were used, the doses would drop dramatically. The currently accepted public limit, recommended by the International Commission on Radiological Protection, is 100 mrem/yr from all sources of radioactivity. The doses predicted in our study are only 1% or less of the acceptable dose limit.

The information summarized here is presented in greater detail in a report titled *Radiological Dose Assessment Related to Management of Naturally Occurring Radioactive Materials Generated by the Petroleum Industry* (authored by K.P. Smith, D.L. Blunt, G.P. Williams, and C.L. Tebes, 1996, Argonne Report ANL/EAD-2) and in a paper titled *Modeling and Dose Assessment of NORM Injection in a Layered Geologic System* (presented by G.P. Williams at the Naturally Occurring Radioactive Material Conference: Forum on NORM Management and Control, sponsored by the American Petroleum Institute and Gas Research Institute, in Houston in October 1995).

Karen P. Smith
Environmental Systems Engineer
Environmental Assessment Division
Argonne National Laboratory
303-986-1140, ext 267

(Continued on page 13)

A clear conscience begins with a poor memory.
--- H. L. Mencken

Letters to the Editor (Continued)

Dear Dr. Gray:

I am responding to Mr. Mobley's letter published in your Summer 96 issue of **The NORM Report**. In his letter Mr. Mobley raises a concern that your newsletter has mislead readers by indicating that only states with specific NORM regulations regulate NORM. From API's perspective most state radiation laws have been derived from a combination and modification of NRC and AEA standards and guidelines. Consequently, their applicability to NORM is not at all clear or direct. Rather the issue of NORM was not directly addressed in most state rules.

What most existing state radiation rules do is require that any person who may use, possess, transfer or acquire any source of radiation or radioactive material be licensed or registered to do so. These same rules then set out a large number of exemptions for things like gas lantern mantels, ceramic fiesta-ware, phosphate fertilizers and even brazil nuts. These exemptions are necessary because otherwise technically you would need a license to fertilize your lawn or even sell brazil nuts! These are the same type of exemptions that are being incorporated into specific NORM regulations as an appropriate way for a state to manage the unique challenges presented by NORM.

In addition, in most oil and gas states, NORM waste disposal practices cannot be regulated by the Radiation Control Agency because they lack the specific authority of the State's Oil and Gas board, or Department of Environmental Quality. Consequently, the oil and gas industry overall has been actively involved with the states in the development and support of reasonable and flexible NORM regulations. The industry continues to believe that this approach is superior to federally-based standards that unnecessarily restrict states' regulatory options.

Mr. Mobley also makes a rather alarming accusation that states with NORM rules are approving exemptions and practices that present significant risk to members of the public. API strongly disagrees with this allegation. Typical theoretical risk paradigms (RESRAD, microshield, etc.) show very low risk when based on realistic rather than overly-conservative assumptions regarding radioactivity levels, exposure scenarios, and accurate depictions of industry operations and NORM disposal practices. Thus, the notion that present practices and exemptions authorized under states' NORM-specific rules present significant risk to the public is not true. API has and continues to support research regarding the environmental, health and safety impact of oil and gas NORM materials. None of this work demonstrates a significant health risk from NORM when managed with common sense. In fact, a great deal of this work, seriously questions the wisdom of spending vast resources to control the theoretical risks from low level radioactive material in general and especially NORM.

The oil and gas industry will continue to support state rules that promote sound and cost effective NORM management practices. In this continuing effort, however, state regulators have an important obligation to understand the impact of rules and the industries they regulate. We look forward to participating in future forums such as the Beneficial ReUse Conference which enhance understanding and the exchange of information among the states, the public and industry on the challenging issues involved in the management of NORM.

Sincerely,

Kevin J. Grice, CIH
API NORM Issue Group Chairman ■

Transportation Directory

The CRCPD has issued an updated report (October 1996) entitled ***Directory of State Agencies Involved with the Transportation of Radioactive Material*** with notes on their statutory authority and regulations. The Directory is available from:

OED-CRCPD
205 Capital Avenue
Frankfort, KY 40601
Tel: (502) 227-4543 ■

New Dosimeter

The Federal Emergency Management Agency patented plastic dosimeter is being manufactured and marketed by ARROW-TECH in Rolla, North Dakota. The dosimeter is direct reading, hermetically sealed, and measures background radiation. Developed for Civil Defense, the dosimeter is used by the military and in state radiological emergency preparedness programs for nuclear power plants. Contact Darryl Charbonneau, 701-477-6461, for information. ■

The following table was prepared by Mike Mobley (Tennessee). See his Letter to the Editor on page 23 of the Summer 96 issue of **The NORM Report**.

STATE REGULATIONS OF NORM – Status as of 12/95*

NO SPECIFIC REGS	USES GEN REG FOR RAM	HAVE SPECIFIC REGS	REGS IN PROCESS
			Alabama
Arizona	Arizona		
		Arkansas	
Alaska?			
California	California		
Colorado?			
Connecticut			Connecticut
Delaware	Delaware		
Florida	Florida		
		Georgia	
Hawaii	Hawaii		Hawaii
Idaho	Idaho		
Illinois	(deals case by case on non discrete, discrete falls under general regs)		
Indiana?			
Iowa	Iowa		
Kansas	Kansas		
Kentucky			
		Louisiana (overview provided)	
Maine	Maine		
Maryland	Maryland		
		Massachusetts	
Michigan	Michigan		Michigan (clean up & disposal is final)
Minnesota	Minnesota (case by case basis)		
Mississippi?			
Missouri	Missouri		
Montana?			
Nebraska	Nebraska		
Nevada	Nevada		

(Continued on page 15)

State Regulations of NORM (Continued)

NO SPECIFIC REGS	USES GEN REG FOR RAM	HAVE SPECIFIC REGS	REGS IN PROCESS
New Hampshire	New Hampshire		
New Jersey			New Jersey
		New Mexico (listed)	
New York?			
North Carolina			
N. Dakota			
Ohio			
Oklahoma?			
	Oregon		
Pennsylvania			
Rhode Island	Rhode Island		
		South Carolina (listed)	
South Dakota			
Tennessee	Tennessee		
		Texas	
Utah	Utah		
Vermont	Vermont		
Virginia	Virginia		
		Washington (included)	
W. Virginia	W. Virginia		
Wisconsin	Wisconsin		
Wyoming			

*Per review of "The NORM Report" and specific phone calls.

NORM Manual Available

The manual which I use in teaching my two-day course, **NORM Contamination in the Petroleum Industry** is now available. The manual contains over 600 copies of the slides used in the course. Although primarily designed for the oil and gas industry the material is equally suitable to other industries with NORM contamination problems. The Table of Contents shown below indicates the range of topics in the manual.

1. Fundamental 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 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 470932
Tulsa, OK 74147
(918) 492-5250
(918) 492-4959
E-mail: pgray@normreport.com

■

The longer I live the more beautiful life becomes.

Frank Lloyd Wright

Stan A. Huber Consultants, Inc. (SAHCI)

Stan A. Huber Consultants, Inc. has specialized for 25 years, in providing nuclear consulting and health physics support services for hospitals, universities, research labs, and a wide variety of manufacturing and industrial facilities that use radioactive materials. Licensing; Regulatory Compliance; Radiation Safety Audits and Training; Nuclear Equipment Calibrations; Leak Tests; Radiation Surveys; Contamination Tests; Radioactive Waste Management Consulting; NORM Consulting; Risk Assessment; Environmental Pathway Analysis; Decontamination and Decommissioning Services; Radiation Safety Training Videotapes; X-Ray Calibrations and related services are also provided. "Regular" or Customized Nuclear Training Courses are available. There is no charge to discuss prospective service needs made by phone/letter or fax and quotations are rapidly issued once the scope of services is defined.

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New Lenox, IL 60451-1751

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Fax: 1-815-485-4433

NORM in the Journals

The following are titles (and summaries where available) of recent articles in the scientific literature.

Presented at the Beneficial Reuse Conference, October 22-24, 1996, Knoxville, Tennessee

The NORM Factor: Managing Liabilities from Naturally-Occurring Radioactive Materials

Charles T. Simmons

Abstract--Since the discovery of radioactivity one hundred years ago, scientists have learned that certain types of radioactive materials can be harmful to living organisms, including some forms of naturally-occurring radioactive materials. Beginning in the mid-1950's, the primary focus of government regulations of radioactive materials has been on the control of exposures to nuclear fuel cycle materials i.e., those radioactive materials that are generated during the course of the mining, processing, and use of uranium to produce weapons and energy. The Nuclear Regulatory Commission and its predecessor agency have had exclusive jurisdiction over nuclear fuel cycle materials, but there has been no comprehensive state or federal regulatory program that governs all other forms of nuclear materials not regulated by NRC, which are collectively referred to as "NORM" in this article.

The past five years, however, have seen a substantial increase in government interest, on the state and federal levels in preventing the potentially harmful effects of human exposures to NORM. As government warnings about the potential hazards of NORM increased and regulations designed to control NORM proliferated, so too have lawsuits alleging property damage or bodily injury from exposures to NORM-containing substances. This litigation in turn has generated disputes between insurers and policyholders over whether standard-form liability policies were meant to provide coverage for such claims.

NORM is found virtually everywhere, and can be concentrated in such common, everyday products, such as mineral sands, refractory materials, demolition debris, fertilizers, tobacco, scrap metal, and many other materials--often without the knowledge of those who handle such materials. Those in business of generating, managing, transporting and using NORM-containing products would be well advised to take precautions against what could well become a significant source of potential liability.

(Continued on page 18)

NORM in the Journals (continued)

Health Phys. 71(5): 644-660: 1996

Technical Basis for EPA's Proposed Regulation on the Cleanup of Sites Contaminated with Radioactivity

A. B. Wolbarst, J. Mauro, R. Anigstein, D. Back, J. W. Bartlett D. Beres, D. Chan, M. E. Clark, M. Doehnert, E. Durman, S. Hay, H.B. Hull, N. Lailas, J. Mackinney, L. Ralston, and P.L. Tsirigotis

Abstract--The U.S. Environmental Protection Agency is proposing a regulation for the protection of the public from radioactive contamination at sites that are to be cleaned up and released for public use. The rule will apply to sites under the control of Federal agencies, and will impose limits on radiation doses to persons living or working on a site following cleanup; it will thereby provide site owners and managers with uniform, consistent cleanup criteria for planning and carrying out remediation. This paper presents an overview of EPA's approach to assessing some of the beneficial and adverse effects associated with various possible values for the annual dose limit. In particular, it discusses the method developed to determine how the choice of cleanup criterion affects (1) the time-integrated potential numbers of non-fatal and fatal radiogenic cancers averted among future populations, (2) the occurrence of radiogenic cancers among remediation workers and the public caused by the cleanup process itself, and (3) the volumes of contaminated soil that may require remediation. The analytic methods described here were used to provide input data and assumptions for the Regulatory Impact Analysis (RIA) that supports the proposed regulation; the RIA also considered non-radiological benefits and costs (i.e., public health, economic, and ecological) of the standards.

(Continued on page 19)

NORM in the Journals (Continued)

International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources, jointly sponsored by the Food and Agriculture Organisation of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the International Labour Organisation (ILO), the Nuclear Energy Agency of the Organisation for Economic Cooperation and Development (OECD/NEA), and the Pan American Health Organisation (PAHO), and the World Health Organisation (WHO), 1996, 353 pp. (paperback), $125.00, UNIPUB, 4611-F Assembly Drive, Lanham, MD 20706-4391; ISBN 92-0-104295-7.

International Basic Safety Standards (BSS) represents the latest in a series of documents representing international consensus in application of radiation protection principles. These principles have come largely from ICRP recommendations, and prior to ICRP Publication 26 (1976), guidance for their application was published by several international organizations, including the IAEA, with their Safety Series No. 9, *Basic Safety Standards for Radiation Protection* (1962, 1967), and the NEA, with their *Radiation Protection Norms* (1963, 1968). With the publication of ICRP 26 the IAEA, the NEA, the ILO and the WHO joined forces and jointly sponsored the publication, in 1982, of a new version of IAEA Safety Series No.9, again titled *Basic Safety Standards for Radiation Protection.* The issuing of ICRP Publication 60 in 1991 updated radiation risk coefficients, and introduced a few new concepts such as dose and risk constraints, and potential exposures among other things, and international consensus on the application was again sought. At this point the group of cosponsoring agencies was enlarged to also include the FAO and the PAHO. The resulting document is now titled Safety Series 115, *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources*, and its scope has been expanded from that of previous documents to include the fundamentals of safety as applied to radiation sources.

Health Physics, Vol 71, No. 4 (October) 1996

Clarke Defends Linear, No Threshold Relationship

A recent press release by the National Radiological Protection Board, UK, reports defense of the linear, no threshold relationship by Prof. Roger Clarke in the NRPB Annual Report.

"At low doses and low dose rates, the risk of radiation induced neoplasia rises as a simple function of dose, without threshold. Those who do propose a threshold for carcinogenesis have not thought out the problems of the level at which to set it, whether it applies to acute or chronic exposure, or how to control work and public exposures in the presence of a threshold."

This statement, by Professor Roger Clarke, Director of NRPB, sets out once again the NRPB's position on a crucial aspect of radiation protection. He continues, "Furthermore, the mortality data for the Japanese atomic bomb survivors to the end of 1990 shows a statistical excess of 50 milligray, comparable to 50 years background radiation without radon."

"The real problem to be addressed is the acceptability of risk - where does society set levels of unacceptability or triviality of risk? These are key issues in setting standards."

Professor Clarke was writing in his review of the year in NRPB's Annual Report for 1995/6. It follows on from the editorial he wrote recently in the June issue of the Board's Radiological Protection Bulletin, "*The Threshold Controversy*". In that article he emphasized the radiobiological role of double strand damage to DNA and the critical importance or misrepair of these lesions. He emphasized the absence of a mechanism basis for a threshold below which the risks of tumor induction would be zero and said it was more appropriate to assume a progressive increase in risk with increasing dose.

In the same editorial, Professor Clarke appealed for scientists, regulators and the public to join forces to determine acceptability of risk in different circumstances - in work and public environments, and under normal and accident conditions.

Information: Press Office, NRPB, Chilton, Kidcot, Oxon OX11 ORQ. Fax. ++44-1235 822746.

Proceedings Available

The Proceedings from the 28th National Conference on Radiation Control are now available. The cost is $35, prepaid, which covers postage and handling. To place an order, please send a check or money order (U.S. currency), made payable to CRCPD, to OED, Attn: Bettye Merriman, 205 Capital Avenue, Frankfort, KY 40601.

(Continued on page 20)

NORM in the Journal (Continued)

Scrap Metal Management Issues Associated with Naturally Occurring Radioactive Material

K. P. Smith
Environmental Assessment Division
Argonne National Laboratory

Presented at Beneficial Reuse '95
Knoxville, Tennessee
July 31-Aug 3, 1995

In view of the increased regulatory activities addressing NORM, the economic burden of managing NORM-contaminated wastes, including radioactive-scrap metal, is likely to continue to grow. Efforts to develop a cost-effective strategy for managing radioactive scrap metal should focus on identifying the least expensive disposition options that provide adequate protection of human health and the environment. Specifically, efforts should focus on better characterizing the quantity available for recycle or reuse, the radioactivity concentration levels, and the potential risks associated with different disposal options.

SPE Paper 29712

Radiological Dose Assessment Related to Management of Naturally Occurring Radioactive Materials Generated by the Petroleum Industry

K.P. Smith, D.L. Blunt, G.P. Williams, and C.L. Tebes
Environmental Assessment Division
Argonne National Laboratory

Abstract-A preliminary radiological dose assessment related to equipment decontamination, subsurface disposal, landspreading, equipment smelting, and equipment burial was conducted to address concerns regarding the presence of naturally occurring radioactive materials in production waste streams. The assessment evaluated the relative dose of these activities and included a sensitivity analysis of certain input parameters. Future studies and potential policy actions are recommended.

Presented at the Beneficial Reuse '95 Conference

Dose Assessment for Management Alternatives for NORM-Contaminated Equipment within the Petroleum Industry

D.L. Blunt and K.P. Smith
Environmental Assessment Division
Argonne National Laboratory

Although based on preliminary and incomplete data, this study provides valuable insight into the relative significance of the radiological health impacts associated with alternatives for recycle and reuse of NORM-contaminated equipment. In general, the results indicate that doses to workers at an equipment decontamination facility could be significant if the workers were continually exposed to contaminated equipment over a long period. Additional information about the dry pipe cleaning processes (e.g., dust loading factors, worker practices) and the source terms are needed to fully quantify the doses related to the inhalation and ingestion pathways. Estimated doses from equipment smelting are the highest for the worker who handles the slag product, but could be kept to acceptable levels by controlling the amount of radioactivity in the initial charge or by modifying worker practices (e.g., by using remote handling). Doses to the general public from reuse of the recycled metal or slag by-product are estimated as negligible. From a health risk perspective, recycle of contaminated equipment may be a viable alternative to disposal or long-term storage.

(Continued on page 21)

NORM in the Journals (Continued)

Health Physics Society, Vol. 71, October 1996

Reflections on the Risk/Benefits of Radiation

In comments made at the Health Physics Society Annual meeting in Seattle in July 1996 the Society's retiring president. William Mills made the following remarks. His message was printed in the October 1996 Health Physics Society's Newsletter.

Several years ago when I wrote the supporting statement for my candidacy, I reflected on my years of federal service in radiation research and in developing radiation control regulations and concluded that the phrase ". . . protection of people and the environment from unnecessary exposure to radiation" in the Society's statement of objectives is overly interpreted in the development of regulations to protect against "unnecessary exposure." In the balancing of risks to health with the benefits derived directly or indirectly from a radiation source, little, if any, attention is given to the societal benefits derived from the availability of the radiation source in question. What is assessed is a RISK/benefit ratio with strong emphasis on "RISK" and minimal emphasis on "benefit." A more balanced approach would be to describe the source BENEFIT as justification for the RISK involved.

In addition, the phrase "NO SAFE LEVEL" has become a term used in justifying current, overly conservative regulatory policy. In the extreme of the "linear, no-threshold" dose-response model, the phrase

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NORM in the Journals (Continued)

implies a potential cancer or genetic effect from the decay of a single atom. This enhanced fear of radiation, for even the smallest of exposures, is symbolized by "cooling towers" and "mushroom clouds." The "No Safe Level" policy is used in the context of "I would rather be safe than sorry!" but does not reflect any reasonable interpretation of existing knowledge of the uncertainties in radiation health risks at the low exposures experienced by the public.

HPS Newsletter, October 1996

Radiation and Other Hazards in the Workplace

Ron Reif

Decisions regarding radiation risk should be integrated into a multidisciplinary risk assessment, where industrial hygiene and safety hazards are also factored into the overall risk management program. If we are spending large amounts of money controlling radiation hazards that are below established regulatory limits (e.g., application of ALARA concepts) while workers are suffering significant amounts of injuries, illnesses, and/or fatalities, we may not be using our precious resources in a fiscally sound manner.

The question of whether radiation risk is in perspective may best be evaluated by assessing all occupational hazards in the workplace with a multidisciplinary and integrated occupational risk assessment approach and assuming all workplace hazards are controlled from the same pot of money. Optimized risk management and resource allocation are only achieved when all hazards are assessed and controlled in an integrated and balanced fashion. ■

Selective Tools, Inc. (STI)

STI was incorporated under the laws of Texas in 1986. The primary activities of the company are oilfield related and over 100 oil and gas firms have been serviced during the past eight years. On August 20, 1993, **STI** received the first Specific License granted by the Bureau of Radiation Control, Texas Department of Health for the decontamination of NORM-contaminated equipment, facilities and land including the minimization of NORM wastes. Under their license, **STI** is authorized to handle NORM as defined in the Texas Regulations for the Control of Radiation, both liquids and solids of unlimited maximum activity. In addition to the petroleum industry, **STI** has serviced the phosphoric acid industry as well as tanker loading and offloading facilities. Relative to their Specific License, **STI** services include.

- Soil remediation
- Pipe and equipment decontamination
- Automated tank/enclosed vessel decontamination
- Pipeline descaling
- NORM slurrification and disposal operations
- NORM surveys
- Worker training and certification
- Project and implementation relating to unique NORM problems
- NORM surveys and core analysis

For additional information on these services, please contact our office:

Mike McClure
Selective Tools, Inc.
2401 Fountain, Suite 600
Houston, TX 77057
(713) 780-1944 or Fax (713) 780-1964

CORPEX Chemistry Proven Effective in NORM Removal

Chemical decontamination products and processes from CORPEX Technologies Inc. have successfully been used to free release a variety of products not readily decontaminated by hydroblasting or mechanical approaches. The chemical solution was the most cost-effective way to safely clean ^{228}Ra, ^{228}Ra, ^{210}Po, and $BaSO_4$ contaminants over a range of applications in the Oil & Gas, Petrochemical and Pulp & Paper industries. Since the products and processes were effective in reducing contamination below regulatory limits without destroying the treated surfaces, some of the parts and equipment were quickly put back into operation.

Petrochemical Turnaround

CORPEX Technologies was called into a major turnaround at this facility to decontaminate valves of various types that were being taken out of the process line and were found to be contaminated with ^{210}Pb. Working with a licensed applicator, the valves were degreased and decontaminated using a vat circulation treatment consisting of a proprietary chemical used at 12oz./gallon applied at 190°F. The activity of the carbon steel valve bodies was reduced to background in 2 to 6 hours using this method.

This technology allowed the client to quickly reduce activity levels, thus enabling immediate reconditioning of critical pathway equipment needed to complete the turnaround operation. No contingency had been planned for NORM contamination until the valve reconditioning contractor required decontamination of all equipment prior to any work being done.

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Pulp & Paper Project

This client requested decontamination of two large stainless steel feedstock pumps that were heavily contaminated with barium sulfate scale. Working in partnership with a licensed applicator, these pumps were decontaminated to background level by employing mechanical means to remove loose scale followed by vat circulation treatment with a 30% solution of chem-

(Continued on page 24)

CORPEX Chemistry Proven Effective in NORM Removal (Continued)

icals applied for 10 hours at 200°F. to remove and dissolve the scale.

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Scale Disposal Project

This independent oil and gas producer had collected approximately twenty (20) drums of NORM-contaminated material from pipe-cleaning operations and site remediation projects. The purpose of the operation was primarily waste reduction: the bulk of the barium/radium sulfate scale was removed from the metal, soil and other constituents and placed in solution for disposal downhole in the field's salt water disposal well.

Working through a licensed applicator, the contents of the drums were sorted and processed using a particle sizing technique. A number of drums were found to contain a type of production by-product for which chelation is not prescribed. This material was separated, and the remainder of the "soil" was treated. This process reduced the activity to a level which allowed for the remaining solids to be combined and disposed at a facility for Non-Hazardous Oilfield Waste (NOW). All remaining fluids were pumped downhole.

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Filter Project

One of the largest independent disposers of oilfield NORM in the U.S. needed help in decontaminating a quantity of filter elements of varying types. The very nature of the products used for construction of these elements made them a poor candidate for decontamination by anything other than a chemical process.

CORPEX Technologies conducted a testing program which concluded that, when properly processed, these filter elements could be decontaminated to a level that allowed for commercial landfilling, with the resultant fluids being disposed downhole as a slurry injection process.

Approximately 25 cubic yards of this material were treated using the techniques developed in this testing program.

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Pump Decontamination

An E&P facility had a pump that needed repair but could not send it offsite because the pump was contaminated with NORM. The readings were from 15,000-17,000 dpm of alpha/beta activity on the pump's surface.

The client used a cylindrical vat with a steam coil and provisions for recirculation using an external centrifugal pump. They immersed the pump components into a solution and let it soak while agitating the solution with nitrogen. After two hours the pump was pulled out and surveyed. There was only one "hot" spot that had 6,000 dpm. The pump was left to soak overnight. The next morning it was resurveyed and the highest reading was 1,700 dpm, which is well below the regulatory limit.

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High Pressure Separator

An oil & gas major producer had some valuable NORM contaminated equipment. They wanted to decontaminate, repair and reuse their separators.

During normal operation, high pressure separators accumulate NORM deposits from the process oil and gaseous streams typically consisting of barium and radium sulfate scales. These deposits have to be removed before selling the equipment to scrap yards, resale or refurbishment by a repair shop.

CORPEX Technologies was called in to provide a solution. The separators were surveyed prior to decontamination. The readings were up to 200μR/hr. A solution was circulated in the high pressure separators at 180°F. At the conclusion of this project the readings were reduced to background level. The entire project was completed in less than 36 hours.

CORPEX is not an applicator but will work with industrial service contractors or directly with the maintenance personnel of equipment / facility owners towards the implementation of this NORM decontamination technology. ■

Health Physics Society Plans to Form an RSO Section

The Health Physics Society Executive Committee recently decided that the HPS would benefit from a new Section for Radiation Safety Officers (RSOs). This Section would represent the needs of RSOs and others interested in operational and applied health physics. To let the Board know of your interest, please contact:

Robert Zoon
9709 Culver Street
Kensington, MD 20895 ■

Regulatory References

Title 10 CFR Part 20 ---- Standards for Protection Against Radiation

Title 10 CFR Part 61 ---- National Emission standards for Radionuclide

Title 29 CFR Part 1910.96 ---- Ionizing Radiation

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

Title 40 CFR Part 190 ---- Environmental Radiation Protection Standards for Nuclear Power Operations

Title 40 CFR Part 192 ---- Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings

Title 40 CFR Part 440 ---- Ore Mining and Dressing Point Source Category

Title 42 U.S.C. 300, et seq.---- Safe Drinking Water Act, as amended

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)

Title 42 U.S.C. 4341, et seq.---- Conservation and Recovery Act of 1976 (RCRA)

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

U.S. AEC 1974 ---- Termination of Operating Licenses for Nuclear Reactors, NUREG 1.86 U.S. Atomic Energy Commission, Washington, D.C. June 1974

ARKANSAS — Rules and Regulations for Control of Sources of Ionizing Radiation. Section 7 NORM

GEORGIA — Rules and Regulations for Radioactive Materials, Chapter 391-3-17, Section 08-Regulation and Licensing of NORM

LOUISIANA — Title 33: Environmental Quality Part XV: Radiation Protection. Chapter 14: Regulation and Licensing of NORM

MISSISSIPPI — Part 801 Section N Licensing of NORM Oil and Gas Board. Rule 69, Control of Oilfield NORM

NEW MEXICO — Subject 14: NORM in the Oil and Gas Industry

OREGON — Regulations and Licensing of NORM Oregon Administrative Rules, Chapter 333, Division 117 -- Health Division

SOUTH CAROLINA — Part IX, Licensing of NORM

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 Waste

CRCPD — Draft SSRCR Part N-June 1994. Regulations and Licensing of NORM ■

MEETING CALENDAR

Energy Week
Conference & Exhibition
George R. Brown Convention Center
Houston, Texas
January 28-30, 1997

The American Petroleum Institute and the American Society of Mechanical Engineers - Petroleum Division '97 Conference & Exhibition. As organizing sponsors of this 8th Annual International Event, both the API and the ASME are seeking papers related to the business, regulatory and technological changes affecting the oil, gas and petroleum industries.

For more information, please contact:
Rebecca Sellers at (713) 963-6255

Environmental Conference '97
SPE/EPA Exploration & Production
Dallas, Texas U.S.A
3-5 March 1997

The Society of Petroleum Engineers (SPE) and the Environmental Protection Agency will sponsor the third SPE/EPA Exploration and Production Environmental Conference in March 1997. Several major engineering, scientific, oil and gas industry, and governmental organizations endorse this comprehensive conference focusing on U.S.A. exploration, drilling, and production areas. Emphasis will be on industry and government working together to address environmental issues and regulations affecting all oil and gas operations.

The program will feature keynote presentations on the conference theme of **"Environmental Leadership Through Technology."**

For more information, please call:
Society of Petroleum Engineers
Technology Transfer Department
P.O. Box 833836
Richardson, TX 75083-3856
Phone: (214) 952-9393
Fax: (214) 952-9435

1997 International Conference on Radiation Dosimetry and Safety
Taipei International Convention Center
Taipei, Taiwan
Republic of China

March 31 - April 2, 1997
(Short courses: Mar. 27-28)

The purpose of this conference is to promote radiation protection and peaceful applications of radiation. Conference participants will share their radiation protection experiences in nuclear energy production, accelerators, industrial and medical applications of radiation, and research activities. The conference scientific program will consist of paper presentations, short courses and an instrumentation exhibition.

For more information:
Prof. C. J. Tung
1997 RDAS
Department of Nuclear Science
National Tsing Hua University
Hsinchu, Taiwan 300
Republic of China
Tel: (886 35) 727300
Fax: (886 35) 718649
Email: cjtung@ins.nthu.edu.tw

NCRP annual meeting

The thirty-third annual meeting of the National Council on Radiation Protection and Measurements (NCRP) will be April 2-3, 1997 at the Crystal Forum, Crystal City Marriott, 1999 Jefferson Davis Highway, Arlington, Virginia. The principal scientific session is "The Effects of Pre- and Postconception Exposure to Radiation." For additional information, contact NCRP at 7910 Woodmont Avenue, Suite 800, Bethesda, Maryland 20814-3095, telephone: 301/657-2652, fax: 301/907-8768.

29th Annual National Conference on Radiation Control
Tacoma, Washington
April 27 - May 3, 1997

This is the annual meeting of the Conference of Radiation Control Program Directors.

American Industrial Hygiene
Conference & Exposition
Dallas Convention Center
Dallas, Texas
May 17-23, 1997
The premier conference for occupational and

(Continued on page 27)

MEETING CALENDAR (Continued)

environmental health and safety professionals

There are many industrial hygienists who have Radiation Safety Officer responsibilities in industries and medical centers across the country. Your willingness to share your health physics experience with this audience would be of value to these professionals, as witnessed by their enrollment in professional development courses for health physics that occur prior to the conference.

American Industrial Hygiene Association
2700 Prosperity Ave.
Suite 250
Fairfax, VA 22031
Phone: (703) 849-8888
Fax: (703) 207-3561

Conference on Radionuclide Metrology and its Application
ICRM '97
National Institute of Standards and Technology
Gaithersburg, Maryland, USA
May 19-23, 1997

The International Committee for Radionuclide Metrology (ICRM) is pleased to announce its next conference, ICRM '97. The Conference goal is to provide an opportunity for the exchange of information on techniques and applications of radionuclide metrology, and to encourage international cooperation in this field.

1997 Rocky Mountain Symposium on Environmental Issues in Oil and Gas Operations
Colorado School of Mines
Golden, Colorado
July 14-15, 1997

The Colorado School of Mines and the U.S. Bureau of Land Management will sponsor the third symposium on all aspects of environmental protection, remediation, and reclamation involved with oil and gas operations.

The Symposium will address a wide range of issues pertaining to oil and gas development and the environment. Papers or poster presentations on any of the following topics are invited. Papers and presentations on any other topic relevant to the theme of the Symposium will also be considered. Proceedings will be published and distributed at the Symposium.

For further information:
Petroleum Engineering Management
Colorado School of Mines
Golden, Colorado 80401
Phone: (303) 273-3746
Fax: (303) 273-3189
Email: rgraves@mines.edu

Workshop on Intakes of Radionuclides
Occupational and Public Exposure
Avignon, France
September 15 -18, 1997

The workshop is cosponsored by the European Community; USDOE; IPSN, France; NRPB, UK; BFS, Germany; and NIRS, Japan.

The Workshop will aim to bring together those involved in radiation protection research related to problems of incorporated radionuclides, and representatives of regulatory authorities and industry. The Workshop will consider the following topics:

- Practical applications of the new Human Respiratory Tract Model;
- Revised dosimetric model for the GI tract;
- Developments in physical dosimetry;
- Data for biokinetic model development;
- Monitoring of workers and assessment of exposure
- Dosimetry of the embryo and fetus;
- Decorporation of radionuclides; and
- Reliability of models and biokinetic data.

Information:
Scientific Scretariat, Dr. H. G. Menzel,
European Commission,
DG XII/F/6 - T61 1/31, 200 rue de la Loi,
B- 1049 Brussels, BELGIUM.
Fax: +32 2 296 6256
Tel: +32 2 295 9298
Email: h.menzel@mhsg.cec.be

The Fourth International Symposium
In Situ and On-Site Bioremediation
Preliminary Program
New Orleans, Louisiana

(Continued on page 28)

MEETING CALENDAR (Continued)

April 28-May 1, 1997

Subsurface soil and groundwater contamination is a complex worldwide. Although considerable bioremediation work is being conducted in situ and on site, the state of development among various technologies varies widely from fundamental research to commercial products and processes.

The response to the first three international symposia on in situ and on-site bioreclamation, held 1991, 1993, 1995, demonstrated in tremendous interest in biological treatment of contaminated soil and groundwater. The 1995 symposium attracted 2,000 delegates representing industry, government, and universities from 38 countries around the world.

The objective of the fourth international symposium is to facilitate technology transfer and to integrate the latest developments in scientific research with engineering applications. Researchers, engineers, site managers, regulatory agents, consultants, and vendors all will benefit from the opportunity to exchange information on case histories of field operation, to examine ongoing research programs, and to investigate public and regulatory acceptance of bioremediation technologies from a global perspective.

For further information:

Carol Young (biorecl@battelle.org)
Environmental Systems and Technology Division
Battelle
505 King Avenue
Columbus, Ohio 43201-2693 USA
Phone: (614)-424-7604
Fax: (614)-424-3667 ■

EPA and NRC Decommissioning Rulemakings and Related Activities

Both the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) have been involved in the process of developing decommissioning rulemakings that will effectively establish radiation site cleanup standards.

The status of the rulemakings is as follows. EPA's proposed rulemaking was sent to the Office of Management and Budget (OMB) in the spring of 1996 and is currently being reviewed by the appropriate agencies. NRC's proposed rulemaking on radiological criteria for decommissioning was published for public comment in August 1994. NRC staff continues to work on the rulemaking and it is expected to be finalized in early 1997. Both of the rulemaking are proposing a dose limit of 15 mrem per year, above ambient background levels.

Much of the support documentation for the rulemaking has been in progress for over three years now, and is nearing completion. The Multiagency Radiation Survey and Site Investigation Manual (MARSSIM) is expected to be the agency consensus document that provides guidance to regulated parties on an acceptable approach for designing and performing surveys to demonstrate compliance with the dose limit. This document is schedules to be out for public review in early 1997. The federal agencies represented on the MARSSIM committee are EPA, NRC, DOE, and DoD. ■

EPA Publishes Proposed Guidelines for Carcinogen Risk Assessment

On 23 April 1996, the U.S. Environmental Protection Agency (EPA) published a document titled Proposed *Guidelines for Carcinogen Risk Assessment* (hereafter "Proposed Guidelines") . The notice is 61 FR 17960.

The Proposed Guidelines were developed as part of an interoffice guidelines development program by a Technical Panel of the Risk Assessment Forum within EPA's Office of Research and Department. These Proposed Guidelines are a division of EPA's 1986 Guidelines for Carcinogen Risk Assessment (hereafter "1986 cancer guidelines") published on 24 September 1986 (51 FR 33992).

When final, these guidelines will replace the 1986 guidelines. In a future Federal Register notice, the Agency intends to publish for comment how it will implement the Proposed Guidelines once they are finalized.

The plan is to propose and seek comment on how the Guidelines will be used for Agency carcinogen risk assessment and, in particular, will address the impact of the Guidelines on the Agency's existing assessment, and any mechanisms for handling reassessments under finalized Guidelines. ■

ELECTRET ION CHAMBER TECHNOLOGY FOR MEASURING RADON AND RADIATION

Paul Kotrappa Ph.D., President
Rad Elec Inc. 5714-C Industry Lane
Frederick, MD 21704

Introduction

Electret ion chamber technology is a new technology, commercially introduced by Rad Elec Inc., in late 1989 for indoor radon measurement. The American Nuclear Society awarded its prestigious 1989 Radiation Industry Award to Dr. Kotrappa for developing practical electret ion chamber technology. It is now the most widely used technology for indoor radon measurement.

What is the Electret Ion Chamber and How Does it work?

It is a simple scientific device. It is a passive integrating ionization monitor consisting of a very stable electret (electrically charged and stabilized piece of Teflon) mounted inside a small chamber made of electrically conducting plastic. The electret serves as both a source of the electric field and as a sensor. Radon diffuses into the chamber through filtered inlets, and the alpha particles emitted by the decay process ionize air molecules. Ions produced inside the chamber are collected onto the electret, causing a reduction of its surface charge. The reduction in charge is a function of the total ionization during a specific monitoring period, the concentration of radon and the volume of the chamber. This change in the charge is measured by the user using Rad Elec's SPER-1 or SPER-2 Electret voltage readers. A programmed hand held pocket computer reduces the data into the required results such as the average radon concentration during the measured period.

The devices require neither power nor batteries and do not have any electronic components. Because these are simple integrating ionization chambers, they are usable for many other applications simply by using different configurations, different types of chambers, different procedures and different data reduction methods.

Further Developments

Through a series of CRADA programs with the Department of Energy, the National Institute of Standards and Technology and several leading universities, Rad Elec Inc. introduced many new products and applications based on the electret ion chamber technology. Many of these developments have direct relevance for addressing NORM-related problems. To date, the following applications have been standardized:

- Radon and thoron in air
- Radon in water
- Radon flux from ground and from mill tailings
- Radium in soil, building materials and in pipes
- Alpha contamination in pipes
- Alpha surface contamination and alpha in soils
- Tritium in air, in water, on surface and in pipes
- Environmental and work place beta/gamma monitoring
- Low energy X-ray monitoring (mammography, video terminals, skyshine)

Many of the above applications address NORM-related problems.

Several hundred of these low cost devices can be used at a time and processed with a single reader/analysis system. This feature brings down the cost per measurement to less than one dollar, making it an attractive method for routine use. Further these are not affected by varying temperatures, humidifies, air flows and shocks rendering them real field worthy. The U.S. EPA measured ambient radon concentrations in all 50 states using E-PERMs.

For further information and consulting on the use of electret ion chambers to solve your NORM related problems, please contact Dr. Kotrappa at 800-526-5482 or e-mail him at: kotrappa@ix.net com.com

Further information is available at Rad Elec's Web Site:
http://www.guidance-inc.com/~radelec ■

"I'm proud to be paying taxes in the United States. The only thing is I could be just as proud for half the money."
--Arthur Godfrey, 1951--

Comparison of NORM Rules by State

	Radium Exemption Concentration	Radium Cleanup Standard
AR	5 pCi/g	5/15 pCi/g(3)
CO (proposed)	5 pCi/g	5 pCi/g
GA	5 pCi/g with high radon factor(1) 30 pCi/g with low radon factor(2)	5/15 pCi/g with high radon factor 30/15 pCi/g(4) with low radon factor
LA	5 pCi/g above background	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	5/15 pCi/g
MS	5 pCi/g with high radon factor 30 pCi/g with low radon factor	5/15 pCi/g with high radon factor 30 pCi/g with low radon factor
NM	30 pCi/g	30/15 pCi/g
ND	5 pCi/g.	5 pCi/g
NJ	Variable- depending on concentrations and volumes- annual dose less than 15 mrem/yr.	Variable- depending on concentrations and volumes- annual dose less than 15 mrem/yr.
OK (proposed)	30 pCi/g	30 pCi/g
OR	5/15 pCi/g	5 pCi/g
SC	5 pCi/g with high radon factor 30 pCi/g with low radon factor	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	5/15 pCi/g with high radon factor 30/15 pCi/g with low radon factor
CRCPD (proposed)	5 pCi/g	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 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.

(Continued on page 31)

NORM Training Course Offered by OGCI & Peter Gray

OGCI (Oil & Gas Consultants International, Inc.), a world leader in petroleum training, has scheduled a 2-day NORM training course for 1997. 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 on the state and Federal level as well as in Canada.

The 1997 schedule for the course **NORM Contamination in the Petroleum Industry** is:

March 18-19, 1997 Lafayette, LA

For further information about the course, contact Joseph Goetz, OGCI. 1-800-821-5933, or contact Peter Gray, 918-492-5250, for information about the course content. ■

Comparison of NORM Rules by State (Continued)

Exemption for Contaminated Equipment

	50 µR/hr including background
CO (Proposed)	Concentration limit only (5pCi/g)
GA	50 µR/hr including background
LA	50 µR/hr including background
MS	25 µR/hr above background 100 cpm above background
NM	50 µR/hr including background
OK	50 µR/hr including background
OR	5 pCi/g
SC	50 µR.hr including background
TX	50 µR/hr including background
CRCPD (Proposed)	Concentration in dpm

NOTES

Before release for unrestricted use, facilities or equipment contaminated with NORM should not exceed specified contamination limits in dpm/100 sq. centimeters. ■