

The NORM Report

Naturally Occurring Radioactive Material Contamination WINTER 1998

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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, the EPA, Canada, and the CRCPD. NORM contamination is not limited to the petroleum industry and several non-petroleum states are drafting rules for the control of NORM in other industries. Each regulatory agency was contacted during January and February, 1998.

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

There currently are no federal regulations specifically for the control of NORM.

Several other countries have NORM regulations, especially the European countries. It is planned to summarize the status of NORM regulations in these countries in the Spring 98 issue of **The NORM Report**.

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

The status of NORM regulations in 16 states, the EPA, Canada and the

ALASKA

Alaska is currently working on regulations to implement the state's participation in the Northwest Interstate Compact for low-level radioactive wastes disposal. The regulations will be sent out for public comment in early 1998. NORM is not considered to be covered in the Compact's responsibilities.

A commitment has been received

for drafting a white paper on the need for NORM regulations in Alaska and what the next step should be. When the paper is completed in 1998, the timetable for the development of regulations for the control of NORM will depend on future budgets.

ARKANSAS

The revisions to the Arkansas

(Continued on page 2)

The NORM Report

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ARKANSAS (continued)

NORM regulations have been completed and certified. The revised regulations are now available to the public.

The Arkansas NORM regulations constitute *Section 7 of the Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation*. The revised regulations were summarized in the Fall 96 issue of *The NORM Report*.

Currently a nitrogen products plant at West Helena, Arkansas is being remediated.

FLORIDA

A study of radiation exposures resulting from technologically enhanced concentrations of NORM in the phosphate industry has experienced delays, but is making progress. Initiated at the Department of Health's request and funded by the Florida Institute of Phosphate Research, the study has so far concentrated on wet phosphoric acid plant maintenance activities that present the highest potential for radiation exposures. However, researchers will investigate all major exposure pathways in an effort to assist the state's effort to determine what revisions to regulatory oversight of phosphate TE-NORM may be appropriate. A draft report should be ready in June 1998 and finalized in July.

In its continuing effort to characterize TE-NORM within the state, site visits to oil fields located in southern Florida were conducted in July. The inspections verified that TE-NORM concentrations at the sites are minimal. The highest recorded gamma reading was 80 μ R/hr, taken at the base of a saltwater storage tank that had been accumulating particulates for at least ten years. No other readings exceeded one-half that total. Analytical sam-

ple results are expected to confirm the low radium content of oilfield pipe scales in the South Florida fields.

The Florida NORM Advisory Committee presented their recommendations to the state Advisory Council on Radiation Protection at the Council's October 1997 meeting. The recommendations were accepted by the Council. (Editor's note: It is hoped to summarize the recommendations in the next issue of *The NORM Report*.)

GEORGIA

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

ILLINOIS

Illinois does not yet have a draft of NORM regulations. Drafting of NORM rules are being delayed until the CRCPD releases the final Part N *Suggested State Regulations for the Control of NORM*.

The regulations, when drafted, will probably focus on areas where NORM problems exist with the expectation that revisions to the rules will be made when new NORM problem areas are recognized.

There have been meetings with some of the industries who have the potential to be contaminated with NORM.

LOUISIANA

An oil company in Louisiana has

applied for a license to dispose of their NORM wastes in their own injection well. The license has been issued. Injection of the wastes should have already begun. Several pits are being remediated. The NORM concentrations are relatively small, 60 to 70 picocuries per gram. The pits will be excavated; the wastes will be ground and pumped into the injection well.

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

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

MICHIGAN

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

Most attention at present is still focused on radium luminous products of military origin and radium contaminated warehouses. The EPA has allotted over 12 million dollars toward the cleanup of two

(Continued on page 3)

MICHIGAN (continued)

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 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. Analysis has shown that this level shows insignificant risk to the public.

The Belding site is now totally clean and returned to the warehouse owner for unrestricted use. The Benton Harbor site is undergoing clean up. The clean up will continue for another year. The worst of the materials have been containerized but are still stored at the site.

Michigan continues to find high concentrations of NORM in pipe scale. Concentrations over 100,000 pCi/gm are commonly seen. The highest level seen has been 200,000 pCi/gm.

MISSISSIPPI

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

However, the Mississippi legislature has enacted legislation that gives the Oil and Gas Board jurisdiction over all oil and gas wastes. The Oil and Gas Board's NORM rules which became effective July 1, 1995 assumes jurisdiction only

over NORM at the wellsite.

The Division of Radiological Health within the Department of Health continues to receive inquiries concerning jurisdictional matters. The Division of Radiological Health continues to process licenses for NORM remediation contractors.

Complaints are being received concerning health problems associated with exposures to NORM. However, very little is being done about the complaints since the Department of Health has been told they have no jurisdiction over NORM. The attorney for the Department of Health believes that any commercial remediation, etc. will still have to be licensed by the Department.

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

A public hearing on Rule 69 was to have been held in January 1996. This was postponed until March and at the request of attorneys on both sides of the issue, the hearing was again postponed until April 2-4, 1996. The changes made to the August 1995 draft were summarized in the Winter 96 issue of **The NORM Report**.

Rule 69 is being implemented. Oil and gas operators are conducting NORM surveys on all their properties. About 1,400-1,500 survey data have been entered in a computer. Once all the surveys submitted have been put in the data base, it

will be determined which oil and gas sites have not submitted survey data.

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

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**. Publication of the rule proposal in the New Jersey Register is planned for late 1998.

NEW MEXICO

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

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

Comments have been received from several oil and gas companies on the guidance document draft for use with the NORM regulations. The document is being finalized and will be available shortly. The guidance document will be summarized in the Spring 98 issue of **The NORM Report**.

(Continued on page 4)

NEW MEXICO (continued)

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

The governor of New Mexico has sent a letter to the Rocky Mountain Compact requesting that this issue be put on the agenda for the next meeting of the Compact Board and urging approval by the Board. The delay is causing problems for the oil and gas industry in New Mexico. Measures have to be taken to allow for the safe disposal of NORM under New Mexico regulations without the issue of the disposal well being declared a regional disposal facility. (The Rocky Mountain Compact claims jurisdiction over NORM. New Mexico is asking the Compact to reinterpret their rules to say that NORM falls under the mining exclusion. The date of the governors letter was February 4, 1998.)

The state has issued its second NORM decontamination license.

OHIO

The revised Ohio regulations for the control of radiation, including NORM and NARM, were summarized in the Spring 97 issue of **The NORM Report**. The regulations were revised to agree with the federal regulations as an initial step in Ohio's application to become an Agreement State. The initial application should have been submitted to the NRC in January, 1998. The recently revised radiation regulations will be revised again later

using the Ohio numbering system rather than the NRC system now in the revised rules.

OKLAHOMA

The Oklahoma Radiation Management Advisory Council has prepared a draft of proposed NORM regulations for discussion at its March, 1998 meeting. The draft will be summarized in The NORM Report after the public hearing.

The Department of Environmental Quality (DEQ)'s position statement on NORM is:

The DEQ will attempt to incorporate contemporary technical and scientific information in decision-making related to Subchapter 19. The DEQ understands that certain aspects of the NORM issue are unique and often demand case by case attention and evaluation. The disposition, including disposal, may vary from site to site. Evaluation criteria may include location, topography, ground and surface waters, accessibility, and other criteria.

The concepts of the International Commission on Radiation Protection (ICRP) and the National Commission on Radiation Protection (NCRP) will be incorporated into decisions regarding NORM. The ICRP has emphasized that adaptive approaches are indispensable in remediating wastes containing NORM. In its Publication 60, 1990, page 51, the ICRP states:

** The necessary remedial actions vary greatly in complexity and scale and may themselves give rise to problems of occupational exposure and waste disposal.*

** The need for and extent of remedial action has to be judged by*

comparing the benefit to the reductions in dose with the detriment of the remedial work. No general solutions are available, but the methods recommended for the optimization of protection can be used to give guidance in each individual case.

The NCRP has also made recommendations regarding non-controlled practices associated with NORM. In a 1993 report, the NCRP stated that "It is recommended that remedial action be undertaken when continuous exposures from natural sources, excluding radon, are expected to exceed five times the average background' or 5 mSv [500 millirem] annually."

Some of the pertinent features of the proposed rules are:

Exempt Levels

(a) 30 picocuries per gram or less (average) of technologically enhanced radium-226 or radium-228 in substances;

(b) 30 picocuries per gram or less of technologically enhanced radium-226 or radium-228 in soil, averaged over 100 square meters and averaged over a 15 centimeter layer of soil below the surface;

(c) Activities involving impacted substances and equipment containing TE-NORM in which the maximum radiation exposure level does not exceed 50 microrentgens per hour including the background radiation level at any accessible point.

Management and Storage Standards.

Norm impacted substances, equipment and sites must be managed in compliance with applicable radiation protection standards of Subchapters 9 and 20. Permittees

(Continued on page 5)

OKLAHOMA (continued) must:

(a) Store impacted waste in closed containers and inspect regularly for leakage.

(b) Store impacted equipment, pipe and drummed waste in areas away from routine activities and general public access.

(c) Cordon off TE-NORM impacted land and pits.

(d) Store impacted substances in loose piles only if the area is cordoned off, easily seen notice has been posted limiting entry, erosion-prevention measures are in place and the substances are moved in no more than three (3) months.

(e) Cap impacted pipe, tubing and drums containing impacted substances.

(f) Document the radioactivity of all impacted waste.

Final Disposition

No person may dispose TE-NORM in the state unless specifically authorized by the DEQ.

Proposed disposal methods include:

1. Plugging and abandonment
2. Burial of impacted equipment
3. Underground injection
4. Soil farming

Remediation and Closure

In no case shall the licensee vacate a facility or release areas or equipment for unrestricted use until the level of TE-NORM remaining at the site is at or below exempt levels.

SOUTH CAROLINA

Part IX-Licensing of Naturally Occurring Radioactive Material (NORM) became effective June 30,

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

TEXAS

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

The Department of Health is still planning to make some modifications to their NORM rules. The changes will primarily be in classifications of NORM and adding some requirements for processing of NORM from other persons. The Department is waiting for the new CRCPD Part N draft before proposing changes. The revisions will be coordinated with the Railroad Commission, particularly where they concern jurisdictional issues.

The Texas 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 94.

The Texas Department of Health is cooperating with the Railroad Commission in setting up training for radiation surveyors.

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 yet, the drafting of specific NORM disposal rules could begin later in 1998.

UTAH

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

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

A preliminary decision has been made that Laidlaw meets the siting criteria which is step one in their application process. A public comment period began February 12.

Envirocare is still under investigation. Semnani, the president and owner of Envirocare resigned from the company for a period of at least three years and also resigned from the Utah Radiation Council. Envirocare remains in operation and continues to pass all regulatory inspections.

The time for Envirocare's relicensing is getting closer.

WASHINGTON

The Department of Health and

(Continued on page 6)

WASHINGTON (continued)

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

The three actions are: renewal of the facility operating license, approval of a closure plan, and a rule making establishing an annual disposal limit for naturally occurring and accelerator produced radioactive materials (NARM). In making the determination of significance, the two agencies have found that among the proposed actions, there are several probable direct or indirect impacts to elements of the environment such as air quality, soils, groundwater, and habitat. When considered together, these impacts may be significant. Therefore, an Environmental Impact Statement (EIS) must be prepared before any of the actions may be taken.

The scoping process for the EIS was scheduled to begin February 26, 1997. Public comments were accepted on the scope of the analysis until March 27, 1997. Following that, a draft and final EIS will be prepared; a process expected to take one to two years to complete. While the EIS is in preparation, US Ecology may continue to operate under the timely renewal provisions of its license.

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

The Department of Health has finished scoping the EIS and is waiting for the Department of Ecology to give their blessing to the draft.

The annual limit for NARM has been retained at 100,000 cubic feet. The scoping document from the Department of Health has been ready since May. After the Department of Ecology agrees with releasing the document, public hearings must be held. It was originally thought the final EIS would be ready in 1998, but it now appears it will be at least 1999.

WISCONSIN

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

Wisconsin has been drafting an enforcement standard for radioactive contaminants in ground water with the primary isotope being radium-226. The main purpose was to establish a ground water enforcement standard for use in monitoring, controlling, and if necessary, limiting human exposure to radioactive materials introduced into ground water by regulated human activities.

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

FEDERAL ACTIONS**ENVIRONMENTAL PROTECTION AGENCY (EPA)**

The EPA is revising the draft report *Diffuse NORM Wastes - Waste Characterization and Preliminary Risk Assessment* issued in April 1993. That draft was reviewed by the Radiation Advisory Committee (RAC) of the Science Advisory Board (SAB). The RAC issued their report *A SAB Report: Review of the Diffuse NORM Draft Scoping Document, Review of the*

Draft Document of Diffuse Naturally Occurring Radioactive Material (NORM): Waste Characterization and Preliminary Risk Assessment in May 1994. The revised report will respond to the comments detailed in the RAC report.

S. Cohen and Associates has prepared a revision of the waste characterization portion of the study. The U.S. Geological Survey is providing further input to the report sections on metal and mining processing industries. After completion of the NAS study (see next paragraph) and with the assistance of TechLaw Inc., EPA expects to issue a final diffuse NORM report later this year.

At the mandate of Congress in 1996 and 1997, EPA contracted with the National Academy of Sciences for a study on the scientific bases for EPA guidance on NORM. The NAS study was begun in 1997, and should be published by this summer.

There are currently two subcommittees which are working on NORM in the Interagency Steering Committee on Radiation Standards (ISCORS). ISCORS is a committee chaired by EPA and the NRC with participation from several other federal agencies which have radiation programs. The first subcommittee is looking at NORM and other radionuclides in sewage sludge and ash generated at publicly owned treatment facilities. A questionnaire will be sent to approximately 600 of these facilities nationwide to request information about their waste processing and disposal practices. From the respondents, approximately 300 will be asked to provide samples for radionuclide laboratory analysis. The results of this study,

(Continued on page 7)

EPA (continued) expected to be completed in 1999 or 2000, will be used by the NRC to evaluate their regulatory control over discharges by nuclear licensees into sewer systems, and by the EPA to evaluate their need to develop radiation standards for sewage sludge and ash.

The second ISCORS subcommittee which is currently being organized will focus on just NORM issues.

EPA is also working on a draft rule for very low-level and mixed waste disposal. The draft would be directed primarily at commercial wastes and provide a means to utilize hazardous waste site technology for licensed AEA material disposal.

CANADA

The Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada was released in August 1995. There are no plans to make the guidelines into regulations at the present time. It is expected that the oil and gas and fertilizer industries will use the NORM guidelines to develop their own code of operating practices in order to give their front-line workers specific guidelines to enable them to work with NORM safely. Some of the rationale used in developing the guidelines was given in the Spring 96 issue of *The NORM Report*.

National NORM guidelines are being drafted for Canada. The national guidelines are expected to be similar to the Western Canadian guidelines. The national guidelines are being pushed with the assistance of three industries: oil and gas, fertilizer, and recyclers. The guidelines are expected to be somewhat generic allowing industries using the guidelines to develop their own code of safe practices for

working with NORM.

The Federal/Provincial Radiation Protection Committee met on October 17, 1997 to consider accepting the national draft of NORM guidelines. The Board did not accept the draft, primarily because of concerns about release limits, i.e., NORM concentrations in materials and land released for unrestricted use.

Health Canada has formed a Working Group to complete the development of the Canadian NORM guidelines. The Board has recommended that the release limits be in alignment with the International Atomic Energy Agency values. The Working Group met February 6, 1998 and it is expected that a new draft document will be completed by summer. This new draft will then be submitted to the Board with the expectation that it will be approved sometime in the fall.

The guidelines will represent a consensus of provincial and federal regulatory agencies in partnership with oil and gas, fertilizer and metal recycling industries.

Conference of Radiation Control Program Directors (CRCPD)

The new draft of *Part N; Regulation and Licensing of Technologically Enhanced Naturally Occurring Radioactive Materials* was released in March 1997 for comments. This draft was summarized in the Spring 97 issue of *The NORM Report*.

Many comments were received by the NORM Commission and considered for revisions to the draft. A summary of the comments received was presented to the CRCPD Board on October 24, 1997.

At the October 24 meeting the Board decided to have two national stakeholder meetings to allow attendees another opportunity to present comments on the Part N draft.

The first meeting will be in Washington, D.C. on July 24 and 25, 1998. The second meeting will be September 11 and 12 in Dallas. The office of the Executive Director of the CRCPD is sending out invitations and announcements. The meetings are open to all interested parties. It is hoped to get broad input from those interested in the Part N suggested regulations. Nothing will change in the Part N draft until after the meetings.

CRCPD Commission on NORM	
Ray Paris, Chair, Oregon	
Tommy Cardwell, Texas	
Sam Finklea, South Carolina	
Walter Cofer, Florida	
Jim Hickey, CRCPD Consultant	
Loren Setlow, EPA	
Ed Tupin, FDA	
Jared Thompson, Arkansas, Advisory Member	
CRCPD NORM Advisory Committee	
Name	Representing Interests
David E. Gernhardt	Environmental Interests
Gregory P. Crinion	Legal Aspects
Jean-Claude Dehmet	HPS
William Geiger	Phosphate Industry
David S. Gooden	Legal Aspects
Kevin Grise	Oil and Gas Industry
Bill Guerard	Oil and Gas Industry
Michael J. Kletter	Rare Earth/Zircon Sand Industry
Michael Mattia	NORM Waste Mgmt. Industry
Kenneth Alkema	NORM Waste Mgmt. Industry
John Richardson	Rare Earth Industry
Charles Roessler	Academia
Michael T. Ryan	National Council on Radiation Protection
Max Scott	Academia
Anthony J. Thompson	Uranium Mining Industry

Sixty years ago I knew everything; now I know nothing; education is a progressive discovery of our own ignorance.

— Will Durant

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Israeli Court Rules Cancer Caused by Radiation

Jerusalem, October 12 (AFP) - An Israeli court has ordered the government to pay 700,000 dollars compensation to the family of a victim of radiation at one of the country's nuclear plants, the Yediot Aharonot Daily said Sunday. The Tel Aviv court accused the management of the Dimona nuclear centre in the southern Negev desert of "having treated the needs of employees for protection with contempt," describing their attitude as "revolting," said the paper.

It ruled during the past week that the cancer which killed Haim Ita, who died in 1989, had been caused by radiation and that his family should be compensated.

Relatives of Ita and other employees who contracted

illnesses while working in the Jewish state's nuclear industry have been fighting a battle for compensation against the state for several years.

The court's ruling goes against the judgment of Israel's Atomic Energy Commission, which has consistently ruled that all secrecy measures surrounding the Dimona plant should be maintained for security reasons.

Israel has never admitted to possessing nuclear weapons, but according to foreign military analysts between 100 and 200 nuclear bombs have been made at Dimona. ■

NORM in the Literature

Radioactive Materials — An Emerging Environmental Problem for Petrochemical Plants Using Light NGLs as Feedstocks

Peter Gray

Naturally occurring radionuclides are widespread in the environment. Many geological formations contain uranium, radium, radon and other radioactive elements together with oil and gas. When oil and gas are produced, traces of these radioactive elements are also produced.

Over time, radioactive elements are deposited in scale and sludges, thus contaminating equipment, vessels and other facilities in the industry.

Copies available from Peter Gray (918) 492-5250.

Health Physics. 72(1): 97-99; 1997

Healthful Radiation

E. Theodore Agard

Abstract- The title of this article sounds paradoxical to most people because the general public is not fully aware of the many benefits radiation has brought to people's healthcare. Radiation has provided the most effective means of noninvasive diagnosis of many diseases, thus reducing the need for exploratory surgery, at significantly reduced risks. Furthermore, radiotherapy has been effective in treating many diseases without surgical removal of the diseased part. The breast is one excellent example of the benefits of radiation in both diagnosis and treatment with preservation. Yet the public still regards radiation as mysterious and dangerous, while trained experts regard it as beneficial with manageable risks. This article suggests ways of presenting this material to the public in a manner that is interesting and informative.

Bibliography Of Reports, Papers, and Presentations On Naturally Occurring Radioactive Material (NORM) In Petroleum Industry Wastes

A NORM Report
by
K.P. Smith

M.L. Wilkey
R.D. Hames

DOE/BC/W-31-109-Eng-38-1, July, 1997

Available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd., Springfield VA 22161.

Health Physics 72(1): 92-96; 1997

Gamma Doses from Phospho-Gypsum Plaster-Board

R.S. O'Brien

Abstract- The use of phospho-gypsum plaster-board and plaster cement in buildings as a substitute for natural gypsum may constitute an additional source of radiation exposure to both workers and members of the public; both from inhalation of radon progeny produced from radon which is exhaled from the plaster-board and from beta and gamma radiation produced by radioactive decay in the plaster-board. The calculations presented in this paper indicate that if phospho-gypsum sheets 1 cm thick containing a Ra-226 concentration of 400 Bq/kg are used to line the walls and ceiling of a room of dimensions up to 5 m X 5 m X 3 m, the annual effective dose from gamma radiation for a person continually occupying the room should not exceed approximately 0.13 mSv. This compares with a measured annual average effective dose from gamma radiation in Australian homes of 0.9 mSv. The annual effective dose from such thin sheets is directly proportional to the Ra-226 concentration in the plaster-board.

Non-Hazardous Oilfield Waste Disposal Into Sub-Pressured Zones

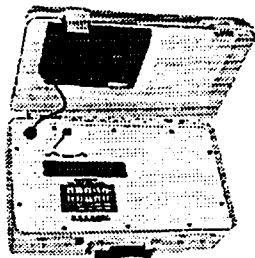
by

Stephen A. Marinello, Newpark Resources, inc.
William T. Ballantine, Newpark Resource, inc.

AIChE 1996 Spring Meeting, New Orleans, LA
Abstract: 61c Session 61: Deep Well Infection Issues.
February 26, 1996.

The problem of non-hazardous oilfield waste (NOW) disposal is a critical consideration in the oil and gas industry. It becomes even more critical when that

(continued on page 10)



N O R M INSTRUMENTS AND SERVICES, INC.

New Radiation Detector Reduces Sampling Costs for Ra-226!

There is now a way for you to get reliable field estimates of equivalent radium-226 in soil within minutes! No more costly waiting for laboratory results that can take weeks for data you need today. It's the *RadInSoil*, an improved version of an earlier instrument used in the U.S. Department of Energy's Uranium Mill Tailings Remedial Action (UMTRA) Program. It will be available soon from NORM Instruments and Services, Inc. Some of the *RadInSoil's* features are:

- ✓ Measures Equivalent Radium-226 in Soil within Minutes
- ✓ Measurement Costs are Lower than Laboratory Sample Analysis
- ✓ Minimal Operator Training Required; Key Functions are Password Protected
- ✓ Easy-to-Use Keypad Interface
- ✓ Weighs 30 lbs (13.5 kg); W: 17" (43cm); D: 11.5" (29cm); H: 7" (18cm)
- ✓ Sturdy Water-Resistant Case; Uses Standard D-Cell Batteries
- ✓ Corrects for soil moisture, radon escape, Thorium-232, and Potassium-40
- ✓ Automatic Readout in Picocuries per Gram or Bq per Gram
- ✓ Default Parameters Provided - User Can Input Site-Specific Parameters
- ✓ Can Count Benchtop Samples with Additional Calibration

Contact: NORM Instruments and Services,
P.O. Box 3936, Grand Junction, CO 81502;
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NORM in the Literature (continued)

waste contains naturally occurring radioactive material (NORM). The primary concern here is the disposal of the waste solids, predominantly from drilling operations or site remediation efforts. Many companies have investigated the injection of slurried solid waste for disposal into depleted production boreholes. They have all included the need for controlled fracturing, either classic, dissolution or both, in order to provide a conduit for waste passage and the storage volume in which to place the waste. This requires that the operator exceed the fracture pressure and cause the formation to part to allow fluid passage. Regulatory agencies are very concerned with such efforts due to the perceived potential for "uncontrolled" fractures intersecting USDW aquifers or other boreholes and allowing contamination, directly or indirectly, of those aquifers.

sub-pressured or underpressured zones are utilized to take slurried waste at pressures below the theoretical fracture pressure. As such, the required injection pressure is often provided by the head of the fluid in the borehole. In oilfield vernacular, the well takes the fluids "on vacuum". Under this scenario, the likelihood of the formation being hydraulically fractured is very low due to the inability for pressure to build to the fracture gradient. The chance of injected fluids migrating back to the surface is also extremely low as a subpressured zone exists due to isolation/compartmentalization through structural seals (such as well sealed fractures). Additionally, the hydraulic head of the normally pressured formations geologically above the disposal zone is greater than the injection pressure and provides a secondary impediment to upward mobility

This paper describes a concept and process by which

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NORM in the Literature (continued)

Naturally Occurring Radioactive Material (NORM) Contamination and Control in a World Scale Olefins Manufacturing Complex

by

Gordon Taylor, Novacor Chemicals Ltd.
Mike Cleghorn, Novacor Chemicals Ltd.

1996 Spring Meeting, New Orleans, LA Abstract: 21d Session 21: Effect of Contaminants in Ethylene Plants. February 28, 1996.

This presentation represents survey data from ethylene manufacturers in North America. The survey addresses the timely topic of oxygenate contaminants in various ethylene feedstocks that are of concern to ethylene producers. The survey's concept is based on the prevalence of motor gasoline additives and other oxygenates in the marketplace. This paper follows on the 1992 work of the Ethylene Producers Committee: Subcommittee on Feedstock and Product Issues which identified various impurities as topics for study. It is the intent of this sub-committee to present survey results, rather than interpretation, for the benefit of our industry, suppliers and customers.

67 p., 7 tables, 1 app., 1995. GC9503, \$6.50

Geological Circular 95-3. Naturally Occurring Radioactive Materials (NORM) in Produced Water and Scale from Texas Oil, Gas, and Geothermal Wells: Geographic, Geologic, and Geochemical Controls

by

R.S. Fisher

Abstract- Water produced from oil, gas, and geothermal reservoirs contains natural radioactivity that ranges from background levels to levels found in uranium mill tailings. Radioactivity in fluids and in the scale that forms in oil-producing and gas-processing equipment increases concerns for workers and public safety as well as costs of handling and disposing of naturally occurring radioactive materials (NORM), which include water, sludge, scale, and affected equipment. This study explored natural controls on such radioactivity to identify screening criteria by which

high NORM activity can be anticipated on the bases of geologic of geochemical information. Such criteria can help State and Federal agencies target disposal regulations for situations likely to incur high radioactivity levels and can also prevent operators from making costly measurements if the likelihood of encountering elevated NORM activity is low. NORM in oil and gas operations is caused mainly by radium-226 (226Ra) and radium-228 (228Ra), daughter products of uranium-238 (238U) and thorium-232 (232Th), respectively, in barite scale. To explore natural controls on radioactivity, we considered the (1) geographic distribution of NORM in oil-producing and gas-processing equipment, (2) geologic controls on uranium, thorium, and radium in sedimentary basins and reservoirs, (3) mineralogy of NORM scale, (4) potential of Texas formation waters to precipitate barite scale, (5) radium activity in Texas formation waters, and (6) geochemical controls on radium isotope activity in barite scale. Our approach combined compilations of published data, collection and analysis of new water and scale samples, and geochemical modeling of scale precipitation and radium incorporation in barite.

Naturally Occurring Radioactive Material (NORM) Contamination Encountered During Propylene Fractionator Modifications

by

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Geismar, LA

AICHE 1997 Spring Meeting Session 34 Paper 34b March 12, 1997.

NORM Disposal by Well Injection with Cement Stabilization

Steven Wood

Many companies and regulating authorities have wondered what is the best method for disposing of Naturally Occurring Radioactive Material (NORM). This paper covers a process which grinds and slurries this material then combines it with cement to provide a slurry acceptable for injection into a well

The process consists of (1) classification of material.

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