The *NORM* Report

Naturally Occurring Radioactive Material Contamination
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The NORM Report

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Peter Gray &
Associates
P.O.Box 470932
Tulsa, Ok 74147

Tel: 918/492-5250
Fax: 918/492-4959
E-mail
pgray@normreport.com

Regulations for the Control of NORM - Update

The status of regulations for the control of NORM is summarized below for 21 states, the federal government, Canada, and the CRCPD. Since NORM contamination is not limited to the petroleum industry, some of the non-petroleum states are also drafting or preparing to draft NORM regulations to control NORM in other industries, e.g., mineral extraction and phosphates. Each regulatory agency was contacted during May and June 1997.

The last state to enact NORM regulations was Ohio. Ohio's regulations became effective June 9, 1997 and are summarized in this 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.

Enactment of regulations specifically for the control of NORM will require 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 regulation in 21 states, the federal government and Canada follows:

ARKANSAS

The revised regulations are in effect. The revised regulations should be available to the public by September, 1997.

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

The revised regulations were summarized in the Fall 96 issue of **The NORM Report.**

COLORADO

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

Both Envirocare cases have been

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COLORADO (continued)

dismissed with prejudice. (See the Winter 97 issue.)

CONNECTICUT

The Connecticut Department of Environmental Protection (DEP) has withdrawn the Request for Proposal (RFP) to have a contractor draft proposed regulations for the control of low-level radioactive wastes, including NORM and NARM. It is not known when or if the proposal will be reactivated.

FLORIDA

The 18 month study of phosphate NORM, funded by the Florida Institute of Phosphate Research at the state's request, began in July, 1996. 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.

It appears now that the phosphate study will be extended beyond the original date. The Park County Health Unit was responsible for collecting hard data and they have had delays. A status meeting will be held on July 16, to determine how long the delay will be.

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. 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.

A NORM problem has been discovered in Illinois which has national and international implications.

The U.S. import division of a tin mining company in Brazil has been importing a tin-lead-bismuth mixture from the mines in Brazil. Since December 1996, it has been noted that the lead has been contaminated with lead-210 and its radioactive daughters from the small quantities of uranium present in the ore. Consequently solder-like material containing 65% tin, 34.5% lead, and 0.5% bismuth was found to contain 4±2 nanocuries (4,000±2000 picocuries) of total activity per gram of solder. The lead-210 concentration is further diluted by about a factor of 10 while being made into lead products.

All the lead imported was sent to a St. Louis company who sent it to an Illinois company for processing. This company is a large supplier of lead powder used to make medical products such as aprons. For about 7 or 8 months there has been lead-210, bismuth-210, and polonium-210 contamination in these products.

KENTUCKY

The Kentucky Department of Environmental Protection continues to work on a satisfactory long term disposal site for NORM. In the meantime, remediation activities continue as weather and field conditions permit. Remediated materials are being stored in a temporary site pending the resolution of discussions on long term storage.

LOUISIANA

The DEQ has an application from an oil company for a license to dispose of their own NORM in an injection well. The license which is being prepared by the DEQ could be issued shortly. There are no commercial injection wells for the disposal of NORM wastes in Louisiana.

Meetings have been held with the Hazardous Waste Division to discuss disposal of NORM contaminated mixed waste in a hazardous waste landfill. A recent shipment of RCRA waste triggered the radiation gate monitor at a landfill. The waste had a radiation reading of about 200 microrem/hr.

The meeting with the Hazardous Waste Division was an attempt to come to an agreement which would allow this kind of wastes to continue to be disposed of in hazardous waste landfills.

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. 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 build

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MICHIGAN (continued)

ing 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 EPA superfund cleanup of the warehouses should begin at any time.

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 well site (effective July 1, 1995). After the petroleum leaves the well site the Department of Health has jurisdiction for any NORM contamination.

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

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 will find that the Oil and Gas Board has jurisdiction over all NORM associated with oil and gas production in Mississippi.

In the interim, the Department of Health continues to function. Licenses are still being processed for remediation contractors, etc. Complaints are being received by the Department of Health 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. Many of the surveys have been turned in and a computer program is being developed to enter survey information to determine which operators have not yet submitted their survey data.

As of May 5, 1997, the Mississippi Department of Health's Part 801 Section N is still in effect. Section N is entitled ***Licensing of Naturally Occurring Radioactive Materials (NORM).***

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 early 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.**

New Mexico is currently finalizing a guidance document for use with the NORM regulations.

New Mexico has received the first application for a specific license for NORM decontamination.

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NORTH DAKOTA

North Dakota is currently revising their Radiation Control Regulations. No changes are expected with respect to NORM.

OHIO

Ohio has revised its regulations for the control of radiation including NARM (in the Ohio regulations NARM includes NORM).

These rules, under Chapter 3701-39 of the administrative Code, govern the requirements for licensure for "persons who receive, possess, use, process, transfer, transport, store or commercially distribute NARM or products that contain NARM or are contaminated with NARM...". De minimus levels are provided for exemption from licensure under these rules.

The radiation regulations entitled "Standards for Handling Radioactive Material" are found in the Ohio Administrative Code 3701-39-021.

(A) In accordance with section 3748.21 of the revised code, this rule does not apply to any person to the extent that the person is subject to regulation by the United States Nuclear Regulatory Commission. Except for a facility that is licensed for the disposal of low-level radioactive waste, and except as otherwise provided in paragraphs (B) to (E) of this rule, any facility that handles radioactive material for which a license is required by Chapter 3748 of the Revised Code and this rule shall comply with standards and requirements set forth in 10 C.F.R. parts 19 to 20, parts 30 to 36, parts 39 to 40, part 61, parts 70 to 71, and part 150, as those parts exist on the effective date of this rule, and as if those parts had included naturally occurring or accelerator-produced material. This rule supersedes provisions of Chapters 3701-38, 3701-39, 3701-40, 3701-70 and 3701-71 of the Administrative Code that were effective prior to September 1, 1995, relating to standards and requirements for the receipt, possession, use, storage, installation, transfer, servicing, and disposal of radioactive material, including the closure, decontamination, decommissioning, reclamation, and long-term surveillance and care of radioactive material. Standards set forth for byproduct material in 10 C.F.R. parts 19 to 20, parts 30 to 36, part 39, part 61, part 71, and part 150 shall apply to NARM. Standards set forth for source material in 10 C.F.R. part 40 shall apply to NARM. 10 C.F.R. part 70 shall not apply to NARM. As used in this rule, "Naturally Occurring Radioactive Material" or "NORM" means any nuclide that is radioactive in its natural physical state; but does not include source material, byproduct material, or special nuclear material. As used in this rule, "Naturally Occurring or Accelerator-Produced Radioactive Material" or "NARM" means naturally occurring or accelerator-produced radioactive material, including naturally occurring material that is technologically enhanced, and those nuclides that are generated in a charged-particle accelerator, but does not include source material, byproduct material, or special nuclear material. As used in this rule, "technologically enhanced" means the chemical properties or physical state of natural sources of radiation have been altered or the potential exposure pathways of natural sources of radiation to humans have been altered to increase the human radiation exposure.

The rules which went into effect June 9, 1997 are summarized below, particularly those parts which include NORM.

(B) Not Withstanding Paragraph (A) of this rule, in addition to the exemptions listed in 10 C.F.R. 30.71, the following activities are exempt form licensure, unless the director determines that the dose received by workers or the public would reach the occupational dose limits set forth in 10 C.F.R. 20.1502:

(1) The handling, distribution, or processing of:

(a) Soil containing technol cally enhanced radium-226 or radium-228 with a radon emanation rate less than 7.4E-1 becquerels per square meter per second (20 picocuries per square meter per second), provided that the concentration of technologically enhanced radium-226 or radium-228 in the soil, averaged over any one hundred square meters, and averaged over the first fifteen centimeters of soil below the surface, does not exceed 1.0 becquerel per gram (27 picocuries per gram);

(b) Soil containing technologically enhanced radium-226 or radium-228 with a radon emanati rate equal to or greater than 7.4E-1 becquerels per square meter per second (20 picocuries per square meter per second) provided that the concentration of technologically enhanced radium-226 or radium-228 in the soil, averaged over any one hundred square meter, and averaged over the first fifteen centimeters of soil below the surface does not exceed 1.85E-1 becquerels per gram (5 picocuries per gram);

(c) Media, other than soil, containing technologically enhanced radium-226 or radium-228 with a radon emanation rate less than 7.4E-1 becquerels per square meter per second (20 picocuries per square meter per second) provided

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OHIO (continued)
that the concentration of technologically enhanced radium-226 or radium-228 does not exceed 1.0 becquerel per gram (27 picocuries per gram);

(d) Media, other than soil, containing technologically enhanced radium-226 or radium-228 with a radon emanation rate equal to or greater than 7.4E-1 becquerels per square meter per second (20 picocuries per square meter per second) provided that the concentration of technologically enhanced radium-226 or radium-228 does not exceed 1.85E-1 becquerel per gram (5 picocuries per gram) or less;

(e) Soil containing NARM other than technologically enhanced radium-226 or radium-228 provided that the concentration of NARM averaged over any one hundred square meters, and averaged over the first fifteen centimeters of soil below the surface is 4.995 becquerels per gram (135 picocuries per gram) or less;

(f) Media, other than soil, containing NARM other than technologically enhanced radium-226 or radium-228 provided that the concentration of NARM is 4.995 becquerels per gram (135 picocuries per gram) or less; or

(g) Materials in the recycling process contaminated with scale or residue not otherwise exempted or other equipment containing NARM with a radiation exposure level that does not exceed 0.25 micrograys (25 microrads) per hour above background at any accessible point.

(2) The manufacture, wholesale or retail commercial distribution, use, or disposal of the following products or materials, or the recycling of equipment used to produce, contain, or transport the following:

(a) Potassium or potassium compounds that have not been isotopically enriched in the radionuclide potassium-40;

(b) Fossil fuel or byproducts from fossil fuel combustion, including bottom ash, fly ash, and flue-gas emission control byproducts; or

(c) Material used for building construction, industrial processing. sandblasting, metal casings, or other NARM in which the radionuclide content has not been concentrated to a level higher than is found in its natural state, or zirconium-bearing sands and products produced from those sands provided that the radioactive constituent is consistent with the radioactive levels stated in the material safety data sheet accompanying the zirconium-bearing materials,

(3) The wholesale and retail commercial distribution, including custom blending, possession, and use of the following products or materials or the recycling of equipment or containers used to produce, contain, or transport these products as follows:

(a) Phosphate or potash fertilizer;

(b) Phosphogypsum for agricultural uses if such commercial distribution and uses meet the requirements of 40 C.F.R. 61.204; or

(C) Materials used for building construction if the materials contain NARM that has not been concentrated to higher levels than found in its natural state.

The exemptions contained in this paragraph do not apply to the manufacture of phosphate or potash fertilizer.

(4) The possession, storage, use, transportation, or commercial distribution of natural gas and natural gas products or of crude oil and crude oil products containing NARM. The exemptions contained in this paragraph do not apply to the processing of natural gas or crude oil or the manufacture of natural gas products or crude oil products containing NARM.

(5) Possession of produced waters from crude oil or natural gas production provided that the produced waters are reinjected in a well approved by the United States Environmental Protection Agency or discharged under the authority of the United States Environmental Protection Agency.

(6) The possession, storage, use, transportation or commercial distribution of compressed gases or compressed gas products containing NARM.

OKLAHOMA

The Radiation Management Advisory Council met June 5, 1997 but there were only minor discussions concerning NORM. The NORM draft will be discussed at the September meeting of the Council.

OREGON

There are no new developments regarding NORM in Oregon. Ray Paris, Manager of Radiation Protection Services in the Oregon Department of Human Resources is also the Chairman of CRCPD's NORM Commission. Oregon is "waiting" for the CRCPD NORM Commission to complete its work before revising or writing new NORM rules for the state.

Oregon does have NORM regulations entitled ***Regulation and Licensing of Naturally Occurring Radioactive Materials (NORM).*** The rules which became effective

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OREGON (continued)

in January 1990 are found in the Oregon Administration Rules, Chapter 333, Division 117 - Health Division. The Oregon NORM rules were summarized in the Winter 96 issue of **The NORM Report.**

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 regulation 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. Rules 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 1997.

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. Laidlaw is currently on step one.

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.

WASHINGTON

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

The three actions are: renewal of the facility operating license, approval of a closure plan, and a rule making establishing an annual disposal limit for naturally occurring and accelerator pr iced 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 EIS process is continuing. Notices are being sent out informing interested parties the e: t of the EIS process. 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.

WISCONSIN

Wisconsin has no specific regulations for the control of NORM, except those imposed by the

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WISCONSIN (continued)
Department of Natural Resources for the disposal of materials containing radium-226. The state does have general regulations for the control of radiation.

Wisconsin is drafting an enforcement standard for radioactive contaminants in ground water with the primary isotope being radium-228. The main purpose is to establish a ground water enforcement standard for use in monitoring, controlling, and if necessary, limiting human xposure to radioactive materials introduced into ground water by regulated human activities.

The rule making is proceeding with the next step a public hearing which should be held this summer or early fall.

FEDERAL ACTIONS

ENVIRONMENTAL PROTECTION AGENCY (EPA)

The EPA has a contract with S. Cohen and Associates to revise the draft report *Diffuse NORM Wastes - Waste Characterization and Preliminary Risk Assessment* issued in April 1993. The report was reviewed by EPA's Science 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 S. Cohen and Associates draft will be limited to the characterization of NORM wastes, postponing the risk assessment section. It is expected the waste characterization section will be completed by the end of the year.

A contract has been issued to the National Academy of Science for a study of the scientific basis for EPA recommendations on NORM. The study was mandated in the last session of Congress. The NAS study will begin this summer and be completed in 1998.

When the NAS study is complete, the EPA will decide on further risk assessment studies and the completion of the EPA diffuse NORM document.

EPA is participating with the NRC, the Department of Energy, and the Department of Defense in looking at NORM in sewage sludge in publicly owned treatment facilities, including the disposal of the sludge.

EPA is currently working on a draft rule for low-level waste disposal. The draft is directed primarily at Department of Energy contaminated sites.

NUCLEAR REGULATORY COMMISSION (NRC)

The NRC "Decommissioning Rule"

After issuing a proposed rule on this subject in 1994, the NRC has approved an amendment to its regulations which would establish maximum permissible radiation levels when a nuclear facility permanently shuts down, is released for other uses, or if the license is terminated. Commonly known as the "Decommissioning Rule," this rule has attracted lots of attention at both the federal agencies as well as Congress recently.

In NRC Commission correspondence issued by Chairman Jackson on 21 May 1997 to interested members of Congress on this subject, the following redacted portions below highlight the reasons why the Commission voted for the rule despite the noted differences between the EPA and NRC proposed standards.

"I am writing in response to your letter . . . in which you expressed concern over differences between the Nuclear Regulatory Commission (NRC) and the Environmental Protection agency (EPA) regarding the content of the Commission's draft final rule for cleanup of groundwater and soil at decommissioned sites.

"Differences between the two agency staffs have focused primarily on two specific elements of the NRC's draft final rule addressing radiological criteria for license termination: (1) the selection of an appropriate all-pathways dose standard to be met before a license could be terminated and (2) the desirability of a separate standard for the groundwater pathway as a supplement to the all-pathway dose standard.

"NRC proposed the 25 mrem/yr, all-pathways criterion in the draft final rule after careful consideration of stakeholder comments and considers it to be adequately protective of public health and safety. It must be remembered from the outset that this criterion is not a radiation protection standard for members of the public. That standard is 100 mrem/yr and was previously defined through an NRC rule making (10 CFR Part 20). The 25 mrem/yr, all-pathways criterion is a value intended to insure that no individual member of the public could receive an annual dose

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approaching 100 mrem as a result of exposure to more than one source of man-made radiation other than those used for medical purposes. The value of 25 mrem/yr is fully consistent with the recommendations made by the leading national and international scientific bodies that recommend radiation protection standards. . .

"Further, unlike the EPA's proposed standard of 15 mrem/yr whenever this is reasonably achievable; that is, to apply the concept that doses should be as low as is reasonably achievable (ALARA). Incorporation of the ALARA concept requires licensees to achieve further reductions in contamination levels below the dose criterion based on a site specific evaluation of the benefits obtained from further reduction in dose levels compared to the costs and risks resulting from that reduction. For the vast majority of NRC-licensed sites, achieving doses below 25 mrem/yr (and even 15 mrem/yr or lower) will be reasonable based on such a comparison. Because there are a number of licensed facilities for which this would not be reasonable, the NRC rule has relied on the ALARA principle rather than set a lower dose criterion for all cases.

"The difference between the NRC and EPA standard, 10 mrem/yr, is a dose that is unremarkable when compared to doses received as a result of everyday activities. . . .

". . . Specifically, EPa would have NRC require that local groundwater meet EPA's maximum contamination levels (MCLs), originally established to implement the Safe Drinking Water Act (SDWA). The MCLs were based on an analysis of treated contaminated water in public drinking water systems subject to the SDWA and not on an analysis of the technology and costs of remediating local groundwater at actual contaminated sites. Furthermore, based on using EPA's dose conversion methodology presented in EPA's dose conversion methodology presented in EPA's Federal Guidance Report Number 11, the current MCL values result in inconsistent levels of protection because they can result in a wide range of doses for different radionuclides (e.g., less than 0.1 mrem/yr to over 30 mrem/yr) and, additionally, do not include all radionuclides (e.g., uranium).

"NRC's analysis of the costs associated with decontaminating groundwater to the MCLs indicates that reducing the in-situ groundwater contamination to these MCLs could be extraordinarily expensive in some cases. For example, an NRC analysis of the cost for remediation of groundwater containing strontium-90 (the current MCL value for which corresponds to 0.07 mrem/yr) by pumping and treatment estimated that the cost to meet the MCL value could be as high as $23 billion dollars per theoretical fatality averted. . . .

"NRC believes that the pathway-by-pathway approach is unwise because it encourages the compartmentalization of issues that should instead be looked at as part of the whole. . .

"In summary, NRC believes that its all pathways 25 mrem/yr criterion coupled with ALARA provisions:

* Is fully protective of public health and safety and of groundwater,

* Is consistent with the recommendations of national and international radiation safety organizations, and

* Provides an appropriate balance between protecting public health and the costs to meet public health goals. . . ."

CANADA

National NORM guidelines are being drafted for Canada. The draft is funded by the federal government. The project is about half done with completion expected in the late fall.

The national guidelines are expected to be similar to the western Canada guidelines. These are **The Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada).** These guidelines were promulgated in August 1995.

The national guidelines are being pushed by regulators with the assistance of three industries, oil and gas, fertilizer, and recyclers. However, the guidelines are expected to be generic with industries using the 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 western Canada guidelines were reported in the Spring 96 issue of **The NORM Report.** However, the Canadian guidelines were never summarized in this newsletter. Such a summary follows.

The document comprises guidelines for the detection, classification, handling, transportation and waste management of NORM.

The objective of the NORM committee in writing the draft was twofold: first, to produce definitive guidance for industries that

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CANADA (continued)
encounter NORM on a regular basis; and second, to set requirements for the control of NORM that will be acceptable to all regulatory agencies involved.

An attempt has been made to accommodate the needs of three distinct groups of readers:

* The first consists of senior administrators and managers who may need to know what NORM is, what the responsibilities of their company are, and what the budgetary implications of handling NORM may be. Part I of this report has been written specifically for such individuals and contains general background material.

* The second group of readers consists of engineers, environmental specialists, occupational hygienists and safety personnel who may have no experience in dealing with radioactive materials but who could be responsible for preparing detailed plans for handling NORM. Part II is directed towards meeting their needs.

* The third group of readers consists of on-site foremen and supervisors who may encounter NORM problems and need to make immediate decisions on what precautions are required. The industry-specific guidelines in Part III have been prepared primarily to meet the needs of this group.

The Committee believes that the same standards should be applied to all sources of radiation. To that end, materials containing NORM have been classified in accordance with the recommendations of the International Commission on Radiological Protection (ICRP) and the Canadian requirements for other types of radioactive material that are enforced under both the Atomic Energy Control Act (AECA) and regulations issued by the AECB.

In keeping with the philosophy of the ICRP, two categories of NORM have been established. The first defines those radioactivity levels to which the general public is normally exposed; the second defines the radioactivity levels acceptable only in the context of occupational exposure.

Natural radioactivity is so widespread it cannot be avoided. The public exposure, or *de minimis*, level is the point above which special attention must be paid to radioactivity of any material, including NORM.

Radioactivity below *de minimis* levels is considered to be of no importance in terms of potential effect on individuals or the ecosystem. Materials whose radioactivity does not exceed these levels do not require any labeling to identify their content of radionuclides.

Occupational exposure may be at two levels depending on the concentration of radioactivity workers encounter - in bulk materials, on the surface of manufactured materials, or in the release of radon gas.

Materials that exceed *de minimis* levels, but do not exceed the levels listed at which they would be classified as radioactive, are termed N O R M - c o n t a m i n a t e d. Special work procedures must be followed for NORM-contaminated material.

Materials classified as radioactive are subject to certain legal requirements and stricter work procedures.

ICRP-recommended dose limits for occupational radiation exposure are all based on a maximum permissible effective dose. The dose limits currently (January 1995) enforced in Canada by the Atomic Energy Control Board (AECB) and most provinces are based on earlier recommendations of the ICRP. However, the AECB and provinces have indicated their intent to implement the most recent ICRP recommendations as soon as possible. The NORM Committee recommendations incorporated in these guidelines have therefore been prepared to meet the recommendations of ICRP Publications 60, 61, 65 and 68 as interpreted by the International Atomic Energy Agency (IAEA). See Table 1 page 10.

Primary limits for annual effective dose equivalents provide the basis for many secondary limits of radiation exposure. For internal radiation exposure, the most important of these is the annual limit on intake (ALI). This is the quantity of any radioactive isotope that can be ingested or inhaled each year over a fifty-year working lifetime without that individual receiving an annual effective dose equivalent greater than 20 millisieverts (mSv). The ALI represents the limit for radioactive materials taken into the body by either ingestion or inhalation and is based on ICRP Publication 68. It is the recommendation of the NORM Committee that annual intake by ingestion and inhalation be limited to the ALI values given in ICRP Publication 68. See Table 2 page 10.

The Atomic Energy Control Board's Advisory Committee on Radiation Protection has defined the *de minimis* dose of radiation as 10 microsieverts (μSv) per year from any one source or procedure. Based on this concept, the IAEA has developed exempt quantities of

(continued on page 10)

CANADA (continued)

Table 1
NORM Committee
PRIMARY RADIATION EXPOSURE LIMITS[1]

AFFECTED GROUP	ANNUAL LIMIT	5 YR. CUMULATIVE TOTAL
Occupationally exposed workers	50 mSv (20 average)*	100 mSv
General Public	1 mSv	5 mSv

Table 2
Annual Limit of Intake for NORM Radionuclides[2]

Radionuclide	Inhalation		Ingestion
	Type*	ALI (Bq)**	ALI (Bq)**
^{226}Ra	M	130	3,000
^{210}Pb	F	900	800
^{228}Ra	M	700	3,500
^{238}U	F	2,000	22,700
	M	360	132,000
	S	130	
^{232}Th	M	50	800
	S	20	
^{228}Th	M	20	7,000
	S	20	

* The column "Type" reflects the relative rate of absorption of deposited material from the respiratory tract into the blood stream hence the probability of uptake of the material in biological systems. Types F, M, and S materials have Fast, Moderate and Slow absorption rates respectively.

** ALI values are based solely on radiological considerations. For some long-lived NORM radionuclides, chemical toxicity may be more restrictive. Chemical and radiological toxicity should be reviewed prior to setting workplace exposure limits.

(continued on page 11)

CANADA (continued)
radioactivity for various radionuclides.

From the primary exposure limits and from the ALI, other derived working limits or DWLs may be derived. DWLs that may be derived in the workplace include:

* the level of activity at which a substance is legally defined as being radioactive

* the radiation exposure rate at which work areas would become restricted (i.e., in μSv/h)

* the concentration of radioactive dust above which a respirator must be used

* allowable radioactivity (in becquerels per litre [Bq/l]) in water released to the environment

* allowable levels of radioactivity in recycled materials

As described in Part I, NORM is classified into three categories: *de minimis*, NORM-contaminated and radioactive.

This classification is based upon two division points recognized by the International Atomic Energy Agency (IAEA), the Canadian Atomic Energy Control Board and the Western Canadian Committee on Naturally Occurring Radioactive Materials.

De minimis
Materials with levels of radioactivity below the *de minimis* decision point are considered for all practical purposes as non-radioactive. Continuous public and occupational exposures to these levels of radioactivity will not result in radiation doses exceeding those stipulated for the protection of members of the public, by the International Commission on Radiological Protection in its recently published report ICRP 60. The concept of *de minimis* proposed by the Western Canadian Committee on Naturally Occurring Radioactive Materials supports the position of the AECB's Advisory Committee on Radiation Protection (ACRP), which advocates the use of a *de minimis* approach in the assessment and control of public risk.

Materials or environments with radioactivity above the *de minimis* level but below the level for radioactive classification require further evaluation to determine the extent of protective measures to be applied. See Tables 3 and 4 page 12 and Table 5 page 13.

NORM-Contaminated
Materials containing levels of naturally occurring radioactivity in excess of the *de minimis* level but below the level designated as radioactive, are considered NORM-contaminated. At these levels, exposure, if uncontrolled, has the potential to exceed the public exposure limits recommended in ICRP Publication 60. Workplace exposures at these levels are not expected to exceed the recommended limits for the occupational exposure of adult workers proposed in ICRP Publication 60; however, the ICRP have also formulated the general requirement that all unnecessary exposures should be eliminated or, if this is not possible, maintained As Low As Reasonably Achievable, (ALARA). One of the intentions of this document is to provide specific guidelines that can be applied to help ensure that both public and occupational exposures are always controlled in accordance with this principle. See Table 6 page 14.

These standards are based on the limits allowed on the outside of packages under the Transport Packaging of Radioactive Materials Regulations for alpha- and beta-contaminated packages. The gamma standard is based on an annual dose limit for an occupationally exposed worker of 20 mSv.

The **Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada** is an excellent NORM reference source and readers are encouraged to obtain a copy. The document comprises guidelines for the detection, classification, handling, transportation and waste management of NORM. Copies are available from:

Radiation Health and Safety Services
Occupational Health and Safety Division, Alberta Labor
10808-99 Avenue,
Edmonton, T5K OG5
Telephone: (403) 427-2691
Fax: (403) 427-3410

NOTE: The Canadian guidelines use SI units (becquerels and sieverts, etc.). The conversion factors for changing to classical units (curies and rems) are:

1 becquerel = 27 picocuries

1 millisievert = 100 millirem ■

CANADA (continued)

Table 3
Standards and Guidelines for Classification of Diffuse NORM as *de minimis*

(Maximum activity in bulk materials intended for general releases, e.g., water treatment sludge, phosphogypsum and fly-ash)

BULK MATERIAL	EXEMPTION CONCENTRATIONS	CONDITIONS
Solids	<1 IAEA exempt activity concentration. Units: Bq/g of solid diffuse NORM (see Table 5, column 1)	provided the radioisotopes are uniformly distributed and not readily separable from the host material
Aqueous Solutions	<0.001 IAEA exempt activity concentration. Units: Bq/ml of aqueous NORM released (See Table 5, column 1)	provided the radioisotopes are water soluble
Gases	Refer to Table 6	Refer to Table 6

Table 4
Standards and Guidelines for Classification of Discrete NORM as *de minimis*

(Maximum activity on equipment, tools or scrap intended for general release)

SURFACE ACTIVITY	CONDITIONS
<0.5 μSv/h at 0.5 metres	Derived from the ICRP 60 public dose limit divided by 2000 work hours per year and set at arms-length from the source.
<1.0 Bq/cm^2	Contamination by removable beta- and gamma-emitting radioisotopes averaged over an area <300 cm^2 for non-fixed radioactive contamination[4]

Table 5

IAEA Exempt Activity Levels for NORM Isotopes[5]

ISOTOPE	DIFFUSE NORM Concentration (Bq/g)	DISCRETE NORM Activity (Bq/item)
Uranium-238 (which is allowed to be in equilibrium with thorium-234 and protactinium-234)	10	10 000
Radium-226 (which is allowed to be in equilibrium with its progeny)*	10	10 000
Lead 210 (which is allowed to be in equilibrium with bismuth-210 and polonium-210	10	10 000
Radium-228 (which is allowed to be in equilibrium with actinium-228)	10	100 000
Uranium (natural)	1	1 000
Thorium-228 (which is allowed to be in equilibrium with short-lived progeny)	1	10 000

* The values published by the IAEA relate to the long-lived parent radionuclide in equilibrium with its progeny. The quoted values are specifically titled "Rounded Activity", reflecting the value to the closest power of 10. The use of Uranium (natural) is considered appropriate for NORM-contaminated substances where the natural equilibrium of the material has not been disturbed by physical or chemical partitioning of the Uranium (natural) decay chain, eg. In natural ore samples.

For materials where the decay chain is not in equilibrium or where *partitioning* has occurred, the activity of *each* long-lived radionuclide must be found and compared to the appropriate Exempt Activity Level. Where more than one long-lived radionuclide is present in a sample, the appropriate sum of the ratios of the activity or concentration of each long-lived radionuclide and its corresponding exempt activity or exempt concentration, must not exceed 1.0,
e.g.,

$$\frac{\text{Activity Radionuclide A}}{\text{Exempt Activity A}} + \frac{\text{Activity Radionuclide B}}{\text{Exempt Activity B}} + \ldots + \frac{\text{Activity Radionuclide N}}{\text{Exempt Activity N}} \leq 1.0$$

Table 6

Criteria for the Classification of Areas or Equipment as Radioactive

Radiation Type	Threshold Level for Classification
Gamma	>10μSv/h at 0.5 m
Beta surface activity[10]	>10 Bq/cm^2, as averaged over 300 cm^2
Alpha surface activity[4]	>1 Bq/cm^2, as averaged over 300 cm^2

Compliance with the beta surface activity value, as measured with a standard β/γ pancake probe will, under most circumstances, indicate compliance with the alpha surface activity value.

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 for public comments. Comments were due by June 30.

Revisions will be considered based on the comments received and it is hoped the report can be finalized by the end of the year.

The following is a summary of the new draft as released for public comment.

PART N
(February 1997 Draft)
REGULATION AND LICENSING OF TECHNILIGICALLY ENHANCED NATURALLY OCCURRING RADIOACTIVE MATERIALS (TENORM)

Sec. N.1 Purpose. This Part establishes radiation protection standards for the possession, use, transfer, and disposal of technologically Enhanced Naturally Occurring Radioactive Materials (TENORM).

Sec N.2 Scope

a. These regulations apply to any person who possesses, uses, transfers, or disposes of TENORM.

Sec. N.3 Definitions. As used in this Part, the following definitions apply:

Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) means naturally occurring materials not regulated under the AEA whose radionuclide concentrations have been increased by or as a result of human practices. TENORM does not include the natural radioactivity of rocks or soils, or background radiation, but instead refers to materials whose radioactivity is techonologically enhanced by controllable practices (or by past human practices). For purposes of Part C, TENORM is "radioactive material."

Sec. N.4 Exemptions

a. i. Persons who receive, own, possess, use, process, transfer, distribute, and dispose of TENORM are exempt from the requirements of Part N if the materials contain or are contaminated at concentrations less then 5 picocuries per gram (185 Bq/kg) of Radium-226 or Radium-228.

ii. States may establish alternative exemption criteria site and industry specific data provided that the criteria are consistent with Section N.5. b through e.

iii. Purposeful dilution to render TENORM exempt shall not be allowed.

b. Persons who receive products or materials containing TENORM distributed in accordance with a specific license issued by the Agency pursuant to N.20. a or an equivalent license issued by another Licensing State are exempt from these regulations with regard to those products or materials.

c. The distribution including custom blending, possession, and use of phosphate and potash fertilizers are exempt from the requirements of this Part.

Sec. N.5 Standards for Radiation Protection for TENORM

a. No person licensed under N.10 or N.20 shall conduct operations, use, or transfer TENORM in a manner such that a member of the public will receive an annual Total Effective Dose Equivalent in excess of 100 millirem/yr from all licensed sources including TENORM;

b. Persons subject to a license under this Part shall comply with radiation protection standards set out in [Part D];

c. Doses from indoor radon and its progeny shall not be included in Total Effective Dose Equivalent calculations;

d. Use, transfer or disposal of TENORM shall be done in such a way as to prevent accumulation of radon in residential structures, schools and other public buildings in concentrations exceeding 4 pCi/l. Compliance with this standard may be demonstrated by imposition of institutional controls or adherence to building codes;

e. No person shall dispose or release TENORM for unrestricted use in such a manner that the reasonably maximally exposed individual will receive an annual TEDE in excess of [some fraction of 100 mrem/yr]

(continued on page 15)

CRCPD (continued)

excluding natural background.

Sec. N.6 Protection of Workers During Operations. Each person subject to a specific license under this Rule shall conduct operations in compliance with the standards for radiation protection set out in Parts D and J except for releases of radioactivity in effluents, which shall be governed by the Clean Water Act, Safe Drinking Water Act and other applicable requirements of the U.S. EPA, and disposal which shall be governed by Section N.8.

Sec. N.7 Release for Unrestricted Use

Each person subject to a license under this Rule shall:

a. Ensure that facilities and equipment contaminated with TENORM in excess of the levels set forth in Appendix A of this Part:

i. shall not be transferred or released for unrestricted use; or

ii. shall be evaluated prior to release for unrestricted use to ensure that the levels in Appendix A of this Part are not exceeded.

iii. [Screening levels]

b. Not transfer land for unrestricted use where the concentration of Radium-226 or Radium-228 in soil averaged over any 100 square meters exceeds the background level by more than 5 pCi/gm (185 Bq/g), averaged over any 15 cm layer of soil below the surface, unless compliance with Sec. N.5 . b through e. can be demonstrated.

Sec. N. 8 Disposal and Transfer of Waste for Disposal

a. Each person subject to a license under this Rule shall manage and dispose of wastes containing TENORM in accordance with [the Clean Water Act, Safe Drinking Water Act and other applicable requirements of the U.S. Environmental Protection Agency] for disposal of such wastes and:

i. by transfer of the wastes for disposal to a facility licensed under requirements for uranium and thorium byproduct materials in 40 CFR 192; or 10 CFR 40 Appendix A.

ii. by transfer of the wastes for disposal to a disposal facility licensed by the U.S. Nuclear Regulatory Commission, an agreement state, or a Licensing State; or

iii. in accordance with alternate methods authorized by the Agency upon application or upon the Agency's initiative, and consistent with Sec. N.5.

b. Equipment contaminated with TENORM in excess of levels specified in Appendix A which is to be disposed of as waste shall be disposed of:

i. So as to prevent any reintroduction into commerce or unrestricted use; and

ii. Within disposal areas specifically designed to meet the criteria of N.8.a.

c. Transfers of waste containing TENORM for disposal shall be made only to a person specifically authorized by the Agency to receive such waste.

d. Records of disposal, including manifests, shall be maintained pursuant to the provisions of Part D of these regulations.

e. Disposal practices and/or sites shall be subject to institutional controls as appropriate and determined by the Agency in accordance with Sec. N. 8.

Sec. N.10 General License

a. i. Subject to the requirements of this section and Section N.5 through N.8 a general license is hereby issued to possess, own, use, transfer and dispose of TENORM without regard to quantity.

iii. Decontamination other than that incidental to routine maintenance by a general licensee of its own equipment or facilities shall be conducted pursuant to a specific license.

b. Any person subject to the general license issued by this section shall notify the Agency. Such notification shall include:

i. Name and address of the registrant;

ii. location and description of the facility or operation;

iii. description of the TENORM including estimates

(continued on page 16)

CRCPD (continued)

of the amount and extent of TENORM.

Sec. N.20 Specific Licenses

Unless otherwise exempt, a specific license is required to:

a. Manufacture and distribute any material or product containing TENORM unless otherwise exempted under the provisions of N.4 or licensed under the provisions of Part C of the regulations,

b. Except as provided in Section N.10.a.iii, decontaminate equipment or land not otherwise exempted under the provisions of Sec. N.4 or facilities contaminated with TENORM in excess of the levels set forth in Sec. N.7, as applicable; for purposes of this subsection, the term 'decontaminate' includes maintenance which incidentally results in removal of contamination;

c. receive TENORM from other persons for disposal.

Other sections of Part N discuss the requirements for general and specific licenses, applying for and the issuance of specific licenses, safety criteria for products containing TENORM, and other aspects of licensure. Copies of the Part N draft are available from:

Ray Paris
State Health Division
Department of Human Resources
800 N.E. Oregon Street
Portland, Oregon 97232
Tel (503) 731-4014 ext 660
Fax (501) 731-4081

Appendix A

ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR TENORM

	AVERAGE[2, 3, 6]	MAXIMUM[2, 4, 6]	REMOVABLE[2, 3, 5, 6]
Alpha	5,000 dpm/100 cm^2	15,000 dpm /100 cm^2	1,000 dpm /100 cm^2
Beta gamma	5,000 dpm/100 cm^2	15,000 dpm /100 cm^2	1,000 dpm /100 cm^2

[1] Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the the more restrictive limit applies.
[2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
[3] Measurements of average contamination level should not be averaged over more than one square meter. For objects of less surface area, the average should be derived for each object.
[4] The maximum contamination level applies to an area of not more than 100 cm^2.
[5] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
[6] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr (2 μGy/hr) at 1 cm and 1.0 mrad/hr (10 μGy/hr) at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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Waste Control Specialists

Treatment, Storage, and Disposal Facility

Waste Control Specialists (WCS) presents a 21st-Century response to the need for cost-effective waste management and disposal options; safety, compliance, and liability control; and impact technologies for treatment, recycling, and source reduction.

The 1,338-acre fully permitted TSD facility is located in Andrews, Texas and offers treatment, storage, and landfill disposal within a 16,073- acre company-owned buffer. The area has a solid base of red bed clay, extremely low rainfall, no surface water and other superior hydro-geological characteristics. The facility makes use of state-of-the-art design and construction with a double-lined, leak-detection, leachate collection and control system backed by primary and secondary liner systems and redundant natural material barriers. The site has unprecedented support from its host community.

Authorized capabilities include treatment and landfill disposal of all RCRA-and TSCA-coded wastes; and residual radioactive materials, including exempt NORM and NORM-nuclide materials; on-site railcar and truck receipt and unloading; drum-to-bulk and bulk-to-drum materials handling and repackaging operations. It is also permitted for new treatment technologies as needed, particularly for soil separation and volume reduction.

Other features include: 11.2 million cubic yards permitted disposal capacity; 5,000 drum capacity warehouse; 150-bin container storage; on-site laboratory; on-site waste treatment/stabilization facility, offering economies of scale and cost-savings to the customer for consolidation and/or volume reduction.

For further information, contact:

Waste Control Specialist LLC
P.O. Box 1937
Pasadena, Texas 77501
Tel: 713-944-5900
Fax:713-944-2388 ■

Policy on Recycling Radioactively Contaminated Carbon Steel

Department of Defense

Effective immediately, it is the policy of the Office of Environmental Management (EM) that, to the degree that it is economically advantageous and protective of worker and public health, radioactively contaminated carbon steel (RCCS) either in storage or to be generated should be recycled. This EM policy will be in place for three years from the date of this memorandum (September 20, 1996), at which time it will be reevaluated. This policy is fully supportive of the various site-specific recycling initiatives underway or planned. More details on implementation of this policy are in the attachments.

Specifically, the policy for radioactively contaminated materials, including RCCS, generated by the EM Program, shall be: survey. decontaminate as necessary and appropriate (in compliance with DOE Orders), and release for unrestricted use any material that meets the applicable criteria. If decontamination for release for unrestricted use is not economically feasible, then the RCCS that is recycled shall be fabricated into one-time-use containers for disposal of low-level wastes generated by the EM Program, consistent with radiological guidance available. Further information and the attachments are available from:

S. Warren
(301) 903-7673

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RISK ASSESSMENT: DIFFERENT USES, DIFFERENT RULES?

by Stephen L. Brown, Ph.D.

Risk Assessment can be used for several different purposes. Unless the practitioner is wary, a risk assessment procedure that is suited to one purpose may not be suited to another. At least three different purposes come to mind ("the 3 P's"):

***Prevention** (or Protection): Using risk assessment procedures to develop guidelines or regulations designed to prevent excessive risks through control of exposures to hazards. Recent guidelines have asked the assessor to present information on the distribution of risks given uncertain information and variability of exposure and susceptibility, and to leave the issue of the margin of protection to the risk manager. However, the risk assessor still is urged to err on the side of safety (tend to overestimate risk) when assumptions are necessary, and many risk assessments still use point estimates that include a bias toward protection. The resulting guidelines or regulations are thus likely to be at least as stringent as desired.

***Prediction**: Using risk assessment procedures to support a decision in which the most accurate and unbiased risk prediction is desirable. In many cases, the "prediction" is retrospective, as in support of litigation, where justice dictates that the risk estimate be untainted with conservative biases. Accurate risk predictions are also desirable when the purpose is to establish an insurance premium or its functional equivalent.

*** Priority setting**: Using relative risk assessments to set priorities among programs competing for resources. Although priorities would remain appropriate if any biases in the assessment were all consistent (e.g., the risk was consistently estimated at a factor of two too high), doing so is virtually impossible. Typical procedures in risk assessment for prevention purposes result in margins of protection that are (on average) much greater for poorly understood risks than for well-known ones. Unbiased assessment procedures will produce the best priority rankings. If the program manager wishes to place increased emphases on poorly understood risks (to devote more attention to the possibility of higher than expected risks), this preference should be separate and explicit, not hidden and variable in conservative risk assessment practices.

Risk assessment uses should dictate risk assessment rules. Although conservative risk assessment policies may be appropriate for prevention decisions (at least where distributional analyses are not feasible), they are not likely to be appropriate for prediction or priority setting, where unbiased best estimates should be used. Distributional approaches may be best for all three uses, if the treatment of uncertainty is left to the manager, not the assessor.

Note: This article by Stephen Brown was published in the July 1997 Health Physics Society Newsletter and is reprinted here with the kind permission of the author. ■

Cancer Threshold

At a recent Health Physics Society chapter meeting Dr. Otto Raabe gave extensive and convincing evidence that the long-term risks of radiation-induced cancers have a threshold of hundreds of rem. ■

Treatment and Disposal of Hard Sulphate Based Oil and Gas

Naturally Occurring Radioactive Materials (NORM) represent primarily the radionuclides and the decay products of three long-lived primordial radionuclides. namely uranium-238, thorium-232 and uranium-235. The concentrations of these radionuclides vary a great deal in the earth's crust and these are minor contaminants to some degree of all materials on this planet.

The fraction of the fissile uranium-235 is roughly 0.7% of the natural uranium which comprises of 99.3% uranium-238. Therefore, for all purposes, the daughter products of uranium-238 and thorium-232 are the main radionuclides found in the NORM wastes. These natural radionuclides are brought to the surface along with the wellbore fluids - oil, gas, formation (and produced) waters and other solids.

The NORM waste that is produced from certain regions of oil and gas fields around the world consists mainly of barium sulphate which is very insoluble in water at normal temperatures and water pH levels. The ion exchange that takes place when sulphate rich sea water is injected produces radium sulphate which is very similar in chemical properties to barium sulphate (and for that matter - calcium and strontium sulphate). All these are Group II elements of the period able. Radium-226 and 228 are the two main decay products of the primordial uranium-238 and thorium-232 radionuclides. Barium scale formation thus contains all these sulphates (and small amounts of carbonates, chlorides and oxides) leading to deposition on the inside surfaces of the down hole tubings, valves, pumps, separators, manifolds etc.; where it can also accumulate as sludges (in tanks). All the decay products of these two chains are radioactive implying that the total radioactivity contribution of the progeny is significant requiring careful processing, conditioning and disposal.

The other NORM product which is also encountered mainly in the gas producing fields is lead-210 based scale from the decay of radon. Radon is the only gaseous decay product in the two chains and is thus easily transported with the natural gas. The only significant radon isotope in the production of

(continued on page 21)

Treatment and Disposal of Hard Sulphate Based Oil an

(continued)

this type of scale is radon-222 (decay product of radium-226 by alpha decay) which has a long enough half-life (3.82 days) to be transported into the production and gas processing system. All the subsequent decay products of radon-222 have very short half lives (seconds to minutes) except lead-210 (22.3 years) which is found deposited in the gas distribution system where ever there is a pressure differential and velocity changes.

Because of the vast quantities of fluids used and produced, there is a considerable quantity of NORM scales which are required to be removed, treated and disposed of from the oil and gas industry equipment. These quantities will in fact increase as more and more ageing field installations are decommissioned in the future. There is a considerable effort devoted to lessen the problems of hard scale and production sites but all these processes have their advantages and disadvantages.

The main regulatory concerns are primarily compliance issues related to transportation and disposal of NORM waste. In the UK this waste falls under the provisions of the Radioactive Substances Act 1993 - RSA93.

Once the scale is produced, there are only two main options available to the industry. Either clean the equipment or replace it. In both cases there is radioactive scale that has to be considered for disposal. In UK North Sea, some of the operators have facilities to remove the scale offshore by utilizing the services of specialist hydroblast companies and di scale at the production site (sea surface) rization granted by the regulators. For co large descaling operations which cannot b offshore, the equipment is brought onsho ing and disposal.

Clearly, disposal of the radioactive bari based scale requires authorization as spec can be quite high ranging from a few tentl a few hundreds of Bq/g averaging about In UK, the material falls below the regul if it is less than 0.37 Bq/g as defined in th far as these NORM wastes are concerned.

At Scotoil Services Ltd; the most exper disposal company in UK, a patented proc developed that provides a very neat solut operators.

The process, in brief, grinds the mineral sc lection from the descaling operation.

One of the mineral products that is routi the oil companies is baryte (barium su which has a relatively high specific grav lected radioactive scale is finely ground a mixed in the baryte rock grinding proc trolled feed rate to ensure that the resultar total specific activity of radium of less th or even lower. This means that the initia ty of radium of say 20 Bq/g (head of cha mately. 200 - 280 Bq/g total includin would easily be reduced by a factor of up specific activity of any batch of scale gamma spectroscopic analysis undertake assurance and compliance regulatory rec

As the baryte scale is recycled into a usef radioactive waste stream is eliminated. mixed with polymer brines to produce phase when used downhole resulting in activity level much lower than 0.1 Bq/g. barium sulphate (including radium, calci sulphate in minute quantities) and the b also barium sulphate, there are no kn chemical processes that would sepa radioactive component anywhere in the p final system where it is used.

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Treatment and Disposal of Hard Sulphate Based Oil and Ga
(continued)

As the specific activities of the baryte based mud is very low there is no regulatory control needed and effectively the waste treatment authorization ends at the grinding facility.

The second advantage is that as the baryte mud is used downhole, the scale is effectively utilized where it is produced with significant downhole losses and about 70% is recovered for recycling. This way of using the product is in no way detrimental environmentally than the processes or activities (!) undertaken as at present for onshore or offshore scale treatment and surface disposal/dispersal.

Under the International Atomic Energy Agency Basic Safety Standards (1995) (IBSS) and the European Communities Basic Safety Standard (Council Directive 96/29/Euratom of 13th May 1996 - L159 - ISSN 0378 - 6978) no individual would receive more than a few tens of µSv of dose and the collective dose would be less than 1 mSv in any year. Scotoil's experience over many years operation demonstrates exposures to workers at insignificant levels.

For more information, contact:

B. Jani
Scotoil Group plc
Sandilands Centre. Links Road
Aberdeen AB9 5QQ. Scotland
United Kingdom
Telephone 01224 571491
Fax 01224 580861

■

NORM Manual Available

The manual which I use in teaching my course **NORM Contamination - An Emerging Environmental Problem** is available. The manual contains over 600 copies of the slides used in the course. Although designed originally for the oil and gas industry, the manual offered contains material about NORM contamination in other industries with NORM contamination problems.

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

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

1. Fundamentals of Radiation Protection
2. Radiation / Radioactivity Units
3. Biological Effects of Radiation
4. Radiological Protection
5. Introduction to NORM Contamination
6. NORM Contamination - Radium
7. NORM Contamination - Radon
8. NORM in 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 ■

Selective Tools, Inc. (STI)

STI was incorporated under the laws of Texas in 1986. The primary activities of the company are oil field 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 off loading 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

ENVIROCARE UPDATE

Envirocare of Utah, Inc. is a commercial radioactive waste disposal facility located near Clive, Utah 80 miles west of Salt Lake City. Envirocare is licensed by the Utah Division of Radiation Control (DRC) to dispose of naturally occurring radioactive materials (NORM) and low-level radioactive waste (LLRW) within Class A. The Department of Justice is currently conducting a criminal investigation involving payments made by Khosrow Semnani, former President of Envirocare, to Larry Anderson, former Utah Division of Radiation Control Director.

A Consent Agreement between the Department of Energy (DOE), Semnani, and Envirocare was entered into on 14 May 1997, and explains the situation: on 12 October 1996 Anderson and Lavicka, Inc., "filed a Complaint in Utah district court against Envirocare and Semnani, alleging, among other things, breach of contract for Semnani's failure to pay consulting fees for services performed by Anderson in assisting Semnani to create a formal application for siting a waste disposal facility; . . . in response to said Complaint, Semnani denied Anderson's claim but admitted to making payments to Anderson and filed a Counterclaim alleging, among other things, that Anderson used his position as a state employee with regulatory authority over waste disposal licensing issues and the Envirocare facility to extort money from Semnani."

"Semnani denies any misconduct or wrongdoing," continues the Consent Agreement, adding that the facts alleged in Anderson v. Semnani are currently under investigation by the United States Attorney for the District of Utah, and that neither Semnani nor Envirocare have been indicted or convicted of criminal activity.

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Envirocare Updated (continued)

Semnani resigned as President of Envirocare on 14 May 1997, as part of the Consent Agreement with DOE. He stated that his actions "are not, in any way, an admission of any wrongdoing" and noted that the Consent Agreement "acknowledges this important fact."

Semnani was succeeded by Charles Judd, former Executive Vice President of Envirocare, who said, "Envirocare plays a key role in major federal and private cleanup efforts across the country. It was more than 20 years ago when the Department of Energy began the site evaluation process for a uranium mill tailings disposal project. After nearly eight years of study among 29 potential sites nationwide, the Department determined that a location near Clive, Utah, contained the most suitable hydrogeological, ecological, and economical characteristics and issued a favorable Environmental Impact Statement for Clive in July 1984. The site was immediately used for disposal of 2.3 million cubic yards of mill tailings waste from Salt Lake City. Envirocare then developed the property for a cost-effective, much-needed low-level waste disposal facility."

Judd stated that the current investigation should not cause concern for customers and potential customers of Envirocare. "The allegations made by Anderson do not regard the health and safety of Envirocare's operations," he commented. "Envirocare's ability to operate is simply not in question. Since publication of the allegations, both state and federal regulators have examined Envirocare and have found no adverse health and safety impacts. Envirocare cooperated fully during those investigations and is open for scrutiny at any time."

The Environmental Protection Agency (EPA), Region VIII, which issues to envirocare a Hazardous and Solid Waste Amendments (HSWA) permit to cover portions of the Resource Conservation and Recovery Act (RCRA) not yet authorized in the state of Utah, is not directly affected by the civil action Anderson v. Semnani. Rich Lathrop, Region VIII EPA News Officer, said however, "It does cause us to consider whether such management matters have harmed the ability of Envirocare to safely manage hazardous and Superfund wastes being sent there. All the involved agencies have stepped up their compliance reviews and other actions may be forthcoming. We have no evidence to suggest that customers should be concerned."

The Nuclear Regulatory Commission (NRC) issued a radioactive materials license for uranium and thorium mill tailings to Envirocare. "The pending legal action has no impact on NRC," according to Joe Holonich, Chief of NRC's Uranium Recovery Branch. "We are continuing the oversight of our cells. NRC did an inspection in January. We determined that the mill tailings cells are being operated in compliance with the regulations and the license. From our perspective as a regulator, Envirocare is operating a safe facility."

DOE is a major user of the facility and, according to the Consent Agreement, wants to continue using Envirocare "as available sources of supply for critical waste management services, including the treatment and disposal of radioactive and mixed radioactive wastes."

The State of Utah conducts permitting/licensing and compliance/enforcement activities at the Envirocare site by the following Department of Environmental Quality Divisions: the **Division of Radiation Control** issues the radioactive materials license for the facility - the NRC has oversight authority of the Division through state authorization; the **Division of Solid and Hazardous Waste** (DSHW) issues the hazardous waste (RCRA) mixed waste permit-EPA Region VIII (Denver) maintains oversight authority of the Division through state authorization.

Envirocare has a radioactive materials license from the Utah DRC and is authorized to receive waste under the conditions of the license. "Pursuant to State rules, the license is undergoing review for a five-year renewal," said DRC Director Bill Sinclair. "A license renewal application was submitted to the DRC on 29 January 1996 by Envirocare. The DRC continues to inspect and monitor the Envirocare site." Sinclair said Anderson v. Semnani should not cause more-than-nor-

(Continued on page 26)

Envirocare Updated (continued)

mal concern to potential users of the facility. "Generators should practice due diligence as they would in making any decision regarding disposal options," he explained. "Generators are encouraged to come and visit the facility, conduct their own audits or have independent audits performed of the facility, and discuss any issue of concern with the Division. The Division fields many questions regarding the facility and maintains an Envirocare mailing list which receives periodic information notices with timely information. This information is also available on the Division Internet site.

Additionally, the Division conducted a review of all past licensing actions in January and concluded that no major problems existed with past licensing. Many of the past licensing actions will be reviewed as a result of the ongoing license renewal process."

"We appreciate hearing from members of the public, generators, regulators, federal agencies, and other interested parties concerning questions regarding Envirocare," Sinclair added. "Please feel free to contact us via Internet e-mail: Bill Sinclair, Director, at <eqrad.bsinclai@state.ut.us> or Dane Finerfrock, Low-Level Waste Program Manager, at <eqard. @state.ut.us>. Envirocare information notices are posted on the DRC homepage (<http://www.eq.state.ut.us/eqrad/drc_hmpg.htm> under Low-Level Waste and/or News) as they are issued (usually on a quarterly basis). The notices contain information relative to current licensing/permitting activities, compliance/enforcement issues, and other information of general interest (e.g., license renewal)." ■

Recent Actions of the NCRP Board of Directors

Contaminated Ecosystems: Remediation or Management? Several hundred sites exist that contain measurable residual contamination with long-lived radionuclides and which fall under CRCLA regulations, yet which have evolved over several decades into sites of significant value to plant and animal communities and which presently are protecting watersheds from erosion and other forms of degradation. A brief, non-technical document will be prepared which will address the question of whether and to what extent radioactively-contaminated sites, particularly those of significant ecological value, need to be aggressively remediated. With the extensive resources being put into cleanup of contaminated sites, this study will be a guide to balancing the cost of remediation against both ecological and human risks. ■

Beneficial Reuse Conference, BR '97

Aug. 5-7, Knoxville, Tenn. The focus will be radioactivity in scrap metal, but the sessions also will address commercial unclear utilities and DOE plans to reindustrialize certain facilities and reuse tritium, transite and concrete. One conference track will be devoted to NORM. Other topics covered by this year's conference include radioactive scrap metals regulations and policy, business and environmental strategies, beneficial reuse initiatives in DOE facilities, stakeholder involvement, risk communications and a session hosted by the Association of Radioactive Metal Recyclers. A tour of DOE's Oak Ridge site will precede the conference. Contact: Gail Ferris, The University of Tennessee, Energy, Environment and Resources Center, 311 Conference Center Building, Knoxville, TN 37996; tel:(423) 974-4251; fax: (423) 974-1838; and the email is: gfarris@utk.edu. ■

LOTUS, L.L.C. GRANTED NORM DIRECT INJECTION PERMIT

Andrews, Texas - On December 17, 1996, LOTUS, L.L.C. was issued a permit by the Texas Railroad Commission which authorizes the direct injection of processed oil and gas waste contaminated with naturally occurring radioactive materials (NORM) into the LOTUS, L.L.C., Lotus Lease, Well No. 1 located at its Andrews County facility.

The permits provide for injection in the subsurface interval of 5,215' to 10,300'. Additionally, the permits authorize processing and management of oil and gas NORM waste at the Andrews County facility with no restrictions placed upon the activity level of radium-226, radium-228 or any associated NORM radionuclides that may be accepted for delivery by the facility.

Officials at Lotus stated that "operations under the unrestricted permit gives Lotus the opportunity to provide disposal services for higher activity level material which previously could not be disposed of by injection. The subsurface geology and depth of our injection well, in addition to the remote location of our facility will provide an extremely cost effective disposal option for oil and gas producers. Being active members of the oil and gas community ourselves, we are pleased to introduce a competitive and realistic disposal alternative with a focus on improved customer service."

For further information, contact Jerry Kelly with LOTUS, L.L.C. at (915) 524-6232. ■

International Atomic Energy Agency (IAEA) Meeting

At the recent IAEA meeting in Vienna in May there was a decided interest from member countries to get some guidance from that international body on what to do about NORM wastes. For example, South Africa has a very active interest. In the Johannesburg area, expansion of the city is limited by the NORM-containing gold mining tailings which are contaminating large areas of land.

Seventy people from 21 countries attended the meeting. The meeting was a follow-up to a technical document released by IAEA in 1995 on clearance, exemption and exclusion levels for very low-level radiation contaminated materials. The meeting discussed these subjects as well as recycling of contaminated metal, available instrumentation and the detection of low-level radioactivity passing through international borders.

Three areas were noted for further action. It was requested that IAEA provide information on (1) Defining and clarifying terminologies used in NORM contaminated material.\ (2) There was a general request for more information on NORM, and (3) there needs to be guidance with respect to instrumentation and detection of very low levels of radioactive material, including material passing through international borders. ■

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 Protection 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

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: Environmenta Quality Part XV: Radiation Protection. Chapter 14: Regulation and Licensing of NOR)
MISSISSIPPI	Part 801 Section N Licensing of NORM Oil and Gas Board, Rule 69, Control of Oil field NORM
NEW MEXICO	Subject 14: NORM in the Oil and Gas Industry
OHIO	3701-39-021 Standards for Handling Radioactive Material
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

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Comparison of NORM Rules by State

	Radium Exemption Concentration	Radium Cleanup Stanc
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 hig 30/15 pCi/g(4) with factor
LA	5 pCi/g above background	5/15 pCi/g, or 30 p(effective dose equiv members of the pub exceed 100 milliren
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 hig 30 pCi/g with low r
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 concentrations and annual dose less tha
OK (proposed)	30 pCi/g	30/15 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 hig 30/15 pCi/g with lo
TX	5 pCi/g with high radon factor 30 pCi/g with low radon factor	5/15 pCi/g with hig 30/15 pCi/g with lo
CRCPD (proposed)	5 pCi/g	5/15 pCi/g

NOTES

(1) High radon factor is a radon emanation rate greater than 20 pCi per square meter per second

(2) Low radon factor is a radon emanation rate less than 20 pCi per square meter per second.

(3) 5/15 pCi/g is 5 pCi/g of radium in soil, averaged over any 100 square meters and averaged over the first 15 centimeters of soil below the surface.

(4) 30/15 pCi/g is 30 pCi/g of radium averaged over any 100 square me averaged over the first 15 centim below the surface.

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NORM Training Course Offered by OGCI & Peter Gray

Extra Course Date Scheduled for November 1997

OGCI (Oil & Gas Consultants International, Inc.), a world leader in petroleum training, has scheduled 2-day training courses in NORM for 1996 and 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 remaining 1997 schedule for the course **NORM Contamination in the Petroleum Industry** is:

Nov. 4-5. 1997 Tulsa, OK

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

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

NOTES

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