The NORM Repor

Naturally Occurring Radioactive Material Contar

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Index

The NORM Report

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

The status of regulations for the control of NORM contamination is summarized for all 50 states, the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC), Canada, and the Conference of Radiation Control Program Directors (CRCPD). NORM contamination is not limited to the petroleum industry and several non-petroleum states are drafting rules for the control of NORM in other industries in their states. Each regulatory agency was contacted during October 2000.

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

There currently are no federal regulations specifically for the control of NORM, although the Environmental Protection Agency appears to be moving in that direction (See page 17)..

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

The following are of particular significance in this issue:

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

Summaries of State and Federal Regulations for the Control of NORM

ALABAMA

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

ALASKA

There is no NORM regulatory activity in Alaska at the present time. Although the price of oil has risen significantly, the budget is still very tight. Nothing will probably be done until the federal government (e.g. the EPA) mandates the Alaskan legislature to do something about NORM, similarly to what is currently happening about radium/radon in drinking water.

There have been no current problems with NORM contamination that have been referred to the State for action. The oil companies take care of their own NORM problems. Contaminated wastes are either being sent to Washington State for disposal or to the EPA-permitted injection well on the North Slope.

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

ARIZONA

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

ARKANSAS

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

CALIFORNIA

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

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

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

The results of the study indicate that NORM is not a serious problem in California oil and gas production facilities - confirming the findings found in an earlier survey (1987). In the 1987 survey, seventy-eight percent of the measurements were at background levels. A few sites had elevated levels of NORM. Further studies of those sites should be considered. Routine protective measures may be all that is necessary to minimize exposure to radiation in these particular areas. Survey results and laboratory analyses are reported in: *A Study of NORM Associated with Oil and Gas Production Operations in California*. The report was issued by:

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

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

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CALIFORNIA (continued)
Copies of the report are available from:

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

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

COLORADO

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

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

CONNECTICUT

Using ***Guidelines for Disposal of Drinking Water Wastes Containing Radioactivity*** (U.S. Environmental Protection Agency draft, June 1994) and Nuclear Regulatory Commission limits for release of licensed material, the Connecticut Department of Environmental Protection put together its first guidelines for an actual water treatment facility. It will (for the present) continue developing guidelines for other facilities, giving case-by-case guidance. Simply put, the guidance will be to apply NRC discharge limits above background radioactivity. EPA Region 1 has given preliminary concurrence on this interpretation of EPA's Draft guidance. The thinking on this — "If it came from the ground and nothing was done to enhance it, it can go back into the ground."

Although an EPA Region 1 health physicist agreed with the proposed scenario that if "there is no radiological concern if it came from the ground, it could be returned to the ground if there had been no technical enhancement." However, An EPA expert on Underground Injection Controls (UIC) stated that the Clean Water Act amendments in its later revision, allows the injection of only water that meets federal drinking water standards. This would seem to exclude the return to the environment of any water treatment residue (salts from water softeners, filter backflush, etc.).

DELAWARE

There are no specific regulations for NORM in Delaware. NORM, NARM and other radioactive materials are considered to be covered in the general regulations for the control of radiation enacted in 1993. A revision of the general regulations became effective September 1, 1995. The revision tightened the compliance aspect of the regulations. NORM is considered to be covered in Sections C and D, Radioactive Materials, in the regulations.

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

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

FLORIDA

The Florida Department of Health, Bureau of Radiation Control (BRC) continues to devote staff resources to research TENORM contamination and exposure issues to support its evaluation of appropriate regulatory approaches to the issue. Its recent focus has been on the pulp and paper (P&P) industry, due to a Florida mill's discovery of TENORM-contaminated piping in a load of their scrap metal. The BRC is working with the company to investigate the extent of contamination at their facility. BRC staff recently conducted a TENORM survey of another (closed) pulp and paper mill, which has been cleared for decommissioning. Based on preliminary results, TENORM in Florida's P&P industry appears to be a site-specific, rather than an industry-wide problem.

GEORGIA

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

HAWAII

Hawaii has revised their general radiation regulations but the CRCPD Part N was withdrawn for

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HAWAII (continued)
now. Part N will probably be incorporated in the regulations during the next revision, probably in 2002. NORM problems that do arise in the meantime can be handled on a case-by-case basis under the general regulations.

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

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

IDAHO

Idaho has no regulations specific to the control of NORM. There are general statutory and regulatory provisions in the existing Idaho law giving the Department of Environmental Quality authority to address problems with NORM should they arise.

The commercial hazardous waste disposal facility in Idaho has been accepting NORM and other radioactively contaminated wastes from the Army Corps' FUSRAP program. Public, legislative and regulatory awareness and concerns have been heightened as a result. This scrutiny could eventually lead to changes in Idaho law to deal with the disposal of NORM waste. No changes are anticipated in the 2001 legislative session.

ILLINOIS

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

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

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

INDIANA

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

IOWA

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

KANSAS

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

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

KENTUCKY

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

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

LOUISIANA

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

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

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

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

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

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

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

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

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

MAINE
Maine has general regulations for the control of radiation, but does not currently have specific regulations for NORM. The CRCPD Draft Part N (TENORM) is being reviewed for possible adoption early in 2001.

Maine does have NORM - contaminated water treatment wastes. Many water supplies in Maine contain significant concentrations of radium, radon and uranium. Ion exchange resins used in water treatment can become "hot" with radium and uranium. Carbon filters used to remove radon from water become contaminated with the radon decay products, i.e. radioactive lead, bismuth and polonium.

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

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

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

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

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

The cleanup and disposal guidelines that are being used in Michigan have been updated with respect to references to applicable state laws and improved ties to federal MARSSIM guides. That is, some regulatory and technical updates have been made, but there have been no really substantial changes to the present guidelines.

There have been some successful remediations at several oil and gas facilities that had slightly contaminated soils. The contaminated soils were sent to solid waste landfills in Michigan. The Michigan guidelines for disposal in a type 2 municipal solid waste landfill allow up to 50 pCi/gm radium-226 to be disposed. This can be a large cost saving. Analysis has shown that this level shows insignificant risk to the

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MICHIGAN (continued)
public.

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

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

MINNESOTA

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

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

The level of concern about NORM is increasing as more people learn about NORM contamination. One problem that has arisen is the zircon sands left when foundries go out of business. Allowing these NORM wastes to be disposed in a landfill will make the disposal easier.

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

MISSISSIPPI

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

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

Although the jurisdictional conflict has not been completely resolved, it has been smoothed out to a degree. If the NORM wastes are generated by E & P activities it is assumed to be under the jurisdiction of the Oil and Gas Board. If the dosage from the NORM reaches a certain level, the Department of Health assumes jurisdiction. The Department of Health does not appear to be disputing this. The Oil and Gas Board has assumed jurisdiction for about 99% of NORM associated with oil and gas.

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

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

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

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

The Oil and Gas Board received a petition to amend statewide Rule 68 to authorize the surface and subsurface landspreading of Naturally Occurring Radioactive Materials (NORM) associated with the exploration and production of oil and gas. The petition was received from the US Oil & Gas Association, Alabama/Mississippi Division. ***Rule 68, Disposal of Naturally Occurring Radioactive***

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MISSISSIPPI (continued)
Materials (NORM) Associated with the Exploration and Production of Oil and Gas became effective in September 1994. The original Rule 68 did not authorize the landspreading as a method of NORM disposal.

Special hearings were held before the State Oil and Gas Board of Mississippi commencing on August 18, 1999. At a hearing held September 15, 1999 arguments and closing statements were heard.

(Editor's Note: Because of the widespread interest by industry on landspreading disposal of NORM wastes, some of the Oil and Gas Board's thinking on the revisions to Rule 68 are discussed below.)

The Board was particularly impressed with the testimony of Ms. Carol D. Berger, a Certified Health Physicist. Ms. Berger testified on behalf of the Petitioners in support of the proposed amendment to authorize the surface and subsurface landspreading of NORM E & P oilfield wastes. Ms. Berger participated in the drafting of the proposed landspreading provisions to Rule 68, as well as in the preparation of the accompanying Background Document and Technical Basis for Revision of Rule 68.

Ms. Berger testified that it is the position of the Health Physics Society, of which she is a member, that doses of radiation of less than 10,000 millirem, in addition to natural background radiation, pose no detectable increase in health risks to humans. In addition, Ms. Berger testified that the highest possible dose rate of 40 millirem per year through all applicable pathways, as contemplated by the proposed landspreading amendments to Statewide Rule 68, is orders of magnitude lower than the 10,000 millirem radiation level recognized by the Health Physics Society as being free of any demonstrable radiological risks.

Ms. Berger testified that the basis of her calculations of the highest possible dose rate of 40 millirem per year, through all applicable pathways, as contemplated by the proposed landspreading amendments is to a hypothetical farm family. This assumes that the hypothetical farm family, including children, lives on a specific piece of property which contains radiation levels equivalent to five (5) picocuries per gram of soil evenly distributed throughout the entire property area. This calculation, which utilizes the RESRAD computer program, assumes that the hypothetical farm family spends twelve (12) hours per day standing outside the family residence on the property, where they receive no shielding from their residence. This calculation further assumes that the hypothetical farm family drinks only percolated water, that is, rain water which has gone through the area of radioactivity, and that radium dissolves in the water. Furthermore, this calculation assumes that the hypothetical farm family eats only vegetables grown on the property where the radiation is located and that they drink milk and eat meat only from cows which have grazed on the property where the radiation is located. In addition, this calculation assumes that the children of the hypothetical farm family eat approximately 200 milligrams of dirt a day which contains a radiation level of five (5) picocuries per gram. Ms. Berger testified that utilizing these calculations, and taking all of these factors and assumptions into account, the hypothetical farm family would only be exposed to a maximum possible radiation dose of 40 millirem per year. Ms. Berger testified that these radiation levels are orders of magnitude below the radiation levels of 10,000 millirem or less which the Health Physics Society has concluded pose no detectable health risk to humans. The Board found the testimony of Ms. Berger with respect to the maximum radiation levels which may result from the approval of the proposed landspreading amendments to be particularly credible and convincing.

Ms. Berger further testified that no studies have ever demonstrated any adverse health effects on humans at acute radiation doses of less than 10,000 millirem. Ms. Berger testified that, according to the BIER IV Report, which was prepared by the National Research Council, 10 to 20 rem (i.e., 10,000 to 20,000 millirem) of radiation is the lowest level of radiation exposure at which any human health risks can be demonstrated.

Ms. Berger further testified that humans are constantly exposed to radiation merely by virtue of being alive. Radioactive materials are ubiquitous. That is, they exist all around us. Radiation exists in the soil and rocks around us, in every human body, in building materials, in a large number of consumer products, in the food we eat, the air we breathe and in, on and around virtually everything with which humans come in contact. Ms. Berger testified that each citizen of the United States receives on average approximately 360 millirem of radiation each year from all natural and medical sources. She testified that there is no credible scientific evidence which would demonstrate that radiation doses of 360 millirem per year have ever caused any radiation-related health effects. Ms. Berger further testified that in areas of higher altitudes and different

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MISSISSIPPI (continued)
geologies, people are exposed to significantly higher levels of naturally occurring radiation. For example, she testified that people living in Leadville, Colorado, are exposed to more than twice the national average levels of radiation. Ms. Berger testified that there is no evidence of any radiation-related health effects occurring in that portion of the national population which receives twice the annual average radiation dose.

Ms. Berger further testified that certain phosphate fertilizers with broad commercial applicability (i.e., for use in golf courses, home use and commercial applications) contain radium at levels exceeding 20 picocuries per gram. This concentration is four (4) times higher than the five (5) picocuries per gram in soil contemplated in the proposed landspreading amendments to Rule 68. Ms. Berger further testified that the United States Environmental Protection Agency (EPA) has authorized the use of phosphogypsum tailings as a soil conditioner containing radiation levels up to 10 picocuries per gram. She testified that these phosphogypsum tailings contain radium of a type similar to that found in NORM E&P oilfield wastes. Ms.Berger also testified that phosphogypsum tailings are more transportable in the environment than are petroleum NORM.

The Board found that the maximum radiation levels contained in the proposed amendments which would authorize the surface and sub-surface landspreading of NORM E&P oilfield wastes, are significantly more restrictive than the radiation levels contained in ***Statewide Rule 69: Control of Oil Field NORM*** which was approved by the Mississippi State Oil and Gas Board and became effective June 1, 1996, and which has recently been upheld on appeal by the Chancery Court of the First Judicial District of Hinds County, Mississippi. The Board found that existing Statewide Rule 69, among other things, prescribes standards for the clean-up or remediation of property containing NORM E&P oilfield wastes. The Board noted that property for unrestricted use could have a maximum ambient exposure rate of 50 microR per hour which is equivalent to concentrations of thirty (30) picocuries per gram. The Board's own expert, Dr. Vern Rogers, previously testified during the hearing on Statewide Rule 69, that this maximum soil concentration would result in no demonstrable health and safety impact on the residents of the State of Mississippi. The Board found that the proposed amendments to Statewide Rule 68, which were before the Board will allow the surface and subsurface landspreading of NORM E&P oilfield wastes only where the maximum possible NORM concentrations do not exceed five (5) picocuries per gram. The Board found that the proposed landspreading amendments to Statewide Rule 68 contain maximum NORM concentrations which are six (6) times more conservative than the NORM concentrations prescribed in existing Statewide Rule 69. In addition, the Board found that the maximum radiation exposure rate of 40 millirem per year, as proposed is fully supported by the overwhelming weight of the credible scientific testimony as being safe and fully protective of both human health and the environment.

It was noted by the Board that New Mexico allows landspreading at levels up to 30 picocuries per gram, a concentration six times greater than the five picocuries per gram in the proposed amendment and is equivalent or more restrictive than the five picocuries per gram specified in Texas regulations.

The Board also found the testimony of Dr. Tate Thigpen, another expert witness for the Petitioners, particularly persuasive and convincing. Dr. Thigpen testified that no scientific studies have ever demonstrated any observable health effects from radiation doses below 50,000 millirem. Dr. Thigpen testified that a very conservative level of radiation exposure below which adverse health effects are medically insignificant would be in the range of 10,000 to 20,000 millirem. Dr. Thigpen testified that, in his professional opinion, the radiation levels contemplated in the proposed landspreading amendments to the Rule were medically insignificant and posed absolutely no threat and would cause no harm to the health of the citizens of the State of Mississippi.

The Board stated that it had carefully listened to and evaluated the testimony of all of the Contestants' witnesses and found the testimony of Ms. Berger, Dr. Thigpen and Mr. Edwards, all of whom testified in support of the proposed landspreading amendments to Statewide Rule 68, to be far more credible and persuasive.

The Board stated that in developing the landspreading rules, it had been the objective of the Board to develop rules which are sufficiently protective of oilfield workers, the general public and the environment, which do not conflict with existing state or federal regulations, which are technically sound, and which are implementable by those subject to their provisions. The Board was of the opinion and found that the landspreading rules being adopted fully meet all of these objectives.

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MISSISSIPPI (continued)

The Board found however, after careful evaluation, that a number of additional revisions should be incorporated into the proposed landspreading amendments to Statewide Rule 68 which differ significantly from the rule as originally proposed. These additional revisions are summarized below.

The Board revised the Rule to provide that no person may dispose oil and gas NORM waste without first obtaining a permit from the Mississippi State Oil and Gas Board

The Board also found that it is necessary to limit the areas in which landspreading may occur. First, on-site landspreading will be limited to the "site of origin" which is defined as that portion of the surface of land reasonably necessary (excluding lease roads) used for the conduct of producing operations of a well. Secondly, off-site landspreading will be limited to surface property in which the Operator owns fee title to the entirety of the surface.

The Board also made the revision to limit subsurface landspreading to six inch layers not to exceed three feet of total blended volume thickness.

Other features of the amended Rule 68 include that landspreading shall not be performed with materials that exhibit ambient exposure rates in excess of 600 microR per hour above background. Also landspreading shall not be performed where the general area exposure rate is significantly elevated above background due to the presence of equipment.

Pre- and post-landspreading radiation surveys are required. The survey of the impacted land area shall be performed to demonstrate that the ambient exposure rate at any given point in the impacted area does not exceed eight microR per hour above background.

The effective date of the amended Rule 68 was January 19, 2000.

Subsequently, an appeal of Rule 68 was filed, but was denied by the courts. Hence, landspreading is allowed in Mississippi.

MISSOURI

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

MONTANA

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

NEBRASKA

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

Like many other states, Nebraska receives comments and questions from recyclers. Some of these recyclers have "requested" NORM rules so they can use NORM limits, e.g., 50 microrem/hr, to know whe they can refuse or accept contam nated scrap.

NEVADA

Nevada has no specific NORM regulations and none have bee proposed. Comprehensive statute for the control of radiation addres NORM and NARM similarly

NEW HAMPSHIRE

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

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

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

NEW JERSEY

Soil Remediation Standards for Radioactive Materials, N.J.A.C. 7:28-12, was adopted on August 7, 2000. The response to the comment document, final rule, guidance manual on characterization and

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NEW JERSEY (continued)
final status surveys, and the spreadsheet used to implement the standards are all available on the Radiation Protection Program's website at http://www.state.nj.us/dep/rop/index. html

NEW MEXICO

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

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

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

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

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

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

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

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

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

Copies of the New Mexico NORM guide are available from:

William M. Floyd
Program Manager
Radiation Licensing &
Registration Program
2044 Galisteo
P.O. Box 28110
Santa Fe, NM 87502
Telephone: (505) 827-1862
FAX: (505) 827-1544

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

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

NEW YORK

On July 31, 2000, the New York State Department of Environmental Conservation amended the Department's ***Rules and Regulations for Prevention and Control of Environmental Pollution by Radioactive Materials*** (6 NYCRR Part 380), which control the disposal of radioactive materials and radioactive wastes in this State. The

(Continued on page 11)

NEW YORK (continued)
amendment was promulgated as an emergency rule (effective July 31, 2000) and added a new category of radioactive waste to those radioactive wastes that are regulated under Part 380. These radioactive wastes may not be accepted for disposal at a facility regulated under the provisions of the State's solid waste management regulation, 6 NYCRR Part 360 (Part 360). The full text of the amended Part 380 is available on the Department's website at

www.dec.state.ny.us/website/regs/380.htm.

Type of Radioactive Wastes Affected
This regulation affects radioactive wastes that were produced when ores were processed to extract uranium and thorium, before November 11, 1978. (Similar wastes produced after that date are regulated by the US Nuclear Regulatory Commission.) Uranium and thorium are both naturally occurring radioactive materials, and the ores in which they are found contain other radioactive elements that are produced by the radioactive decay of the uranium and thorium. When the ores are processed to remove the uranium and thorium, the resulting waste products can contain high concentrations of these radioactive materials. These wastes have been considered by some to be NORM wastes that were heretofore unregulated. Often, the buildings and lands where the ores were processed became contaminated with these radioactive wastes.

Typical Waste Forms Excluded from Landfills by this Amendment
Cleanup of these sites usually involves removing contaminated soil. In addition, buildings and other structures often must be demolished. These result in waste soils and demolition debris. Some of these wastes are not contaminated with radioactive material and their disposal is regulated as solid waste under Part 360. However, some wastes will contain radioactive uranium, thorium, and their decay products at concentrations greater than what normally is found in those wastes due to naturally occurring radioactive materials. Under this amendment, those wastes are radioactive wastes and cannot be accepted at landfills in New York State.

Upcoming Rulemaking Process
This amendment was adopted on an emergency basis and is effective for 90 days. In the near future, the Department will issue a Notice of Proposed Rulemaking, which will be the first step in adopting this regulatory change permanently. At that time, the amendment will be available for public review and comment.

NORTH CAROLINA
Nothing presently is being proposed for NORM regulations for North Carolina. The state recognizes that NORM is an issue that may need further attention, particularly in scrap metal yards. The state is also aware that there are North Carolina industries that generate NORM wastes, such as the phosphate industry, waste water treatment sludge, and metal mining and processing wastes. For the present, North Carolina remains committed to interacting with industry, Federal and state agencies and providing assistance in resolving disposition of NORM wastes.

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

A railcar carrying propylene from a refinery in Canada recently set off a radiation alarm at a Custom's facility at a port-of-entry into North Dakota. The radiation reading was about 30 times background and was identified as due to radon-222. The cars were held for about four half-lives (about 15 days) before being released to allow much of the radon to decay. The level of radiation presented no problems with DOT regulations.

(Continued on page 12)

NORTH DAKOTA (continued)
This was the first time that Customs had experienced high radiation readings on such shipments. This is probably because Custom's agents just recently started wearing personal dosimeters due to lax nuclear policies of the former Soviet Union.

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

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

* 3701:1-38, General Radiation Protection Standards; and

* 3701-77 Low-level Radioactive Waste.

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

Oklahoma became an Agreement State effective September 29, 2000.

OREGON
There are no new developments regarding NORM regulations in Oregon.

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

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

A draft of solid waste regulations has been prepared by the Bureau of Radiation Protection and the Bureau of Land Recycling and Waste Management. This started as guidance about five years ago and has evolved to codify the essential elements so that now all of the 300 landfills, transfer stations and resource recovery facilities (e.g. incinerators) will be required to monitor for radiation.

Maximum performance standards (alarm set points, etc.) and best management practices were set out in the regulations and guidance. That is, what can and what can't be accepted in a solid waste facility. Some 95% of the radioactive materials being disposed of in the landfills are short-lived nuclides, e.g. from nuclear medicine facilities. But occasionally the landfills do receive some NORM waste, and it is expected that when the northwest counties of the state where there is an oil and gas industry start installing monitors many more instances of NORM will be seen.

Particularly noteworthy in these regulations and guidance is that if an alarm goes off as a result of cover materials taken from an undisturbed environment are being taken to a landfill, the materials are exempt from the regulations. That is, if there is no enhancement of the radioactivity, the materials are exempt.

If there is TENORM, i.e. technically enhanced NORM, a small quantity can be accepted by the landfills if certain conditions are met. Or cubic meter of material can be accepted without further approvals if the material contains less than 5 picocuries radium per gram and the dose rate is less than 50 µR/hour. Approval to accept other materials in the landfills will be handled on a case-by-case basis.

The set point for the gate radiation monitors is 10 µR/hour above background.

The title of Document Number:250-3100-001 is:*Final Guidance Document on Radioactivity Monitoring at Solid Waste Processing and Disposal Facilities*
Effective Date: Sept. 16, 2000

The Comment/Response Document entitled *Report to the Environmental Quality Board on the Proposed Guidance Document on Radioactivity Monitoring at Municipal and Residual Waste Processing and Disposal Facilities* can be downloaded from:

http://www.dep.state.pa.us/dep/subject/Rec_Final_Technical_gui

(Continued on page 13)

PENNSYLVANIA (continued)) **dance/Rec_Final_Technical_guidance.htm** (The document is at the bottom of the table.)\

A copy of the document may also be available from:

David J. Allard, CHP
PA DEP, Bureau of Radiation Control
P.O. Box 8469
Harrisburg, PA 17105-8469
Tel: 717-787-2480
E-mail:
allard.david@dep.state.pa.us

The regulations are in internal review and once released by the Regulatory Review Commission should be finalized by the end of the year.

RHODE ISLAND

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

SOUTH CAROLINA

Part IX -- Licensing of Naturally Occurring Radioactive Material (NORM) became effective June 30, 1995 in South Carolina. There have been no changes in the regulations and none are proposed at the present time. Part IX was summarized in the Summer 95 issue of **The NORM Report.**

SOUTH DAKOTA

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

TENNESSEE

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

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

TEXAS

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

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

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

The wording in the revised rule, "Maintenance that provides a different pathway for exposure than is found in daily operations and that increases the potential for additional exposure is not considered routine," was proposed in order to further define the risk the department is concerned about. In discussions with the industry, the TDH determined that the activity that presents the most concern is vessel entry. The industry considers this to be routine maintenance. However, this is the type of operation that the TDH believes presents a significantly increased risk from an enclosed environment where an inhalation risk (a different pathway for exposure than is found in daily operations) from NORM can be present.

(Continued on page 14)

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

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

In July, 1999, the TDH held a workshop to explain the revisions to the rule and to get stakeholder input on the draft language about routine maintenance. Over 75 people attended the workshop and the TDH received a good amount of input on the draft language. Staff will be reviewing the input received during the workshop and will develop new draft revisions to 25 TAC §289.259, probably towards the end of the year.

The three agencies are considering some additional changes to the NORM rules, particularly concerning exemptions.

The Texas Railroad Commission's Statewide ***Rule 94: Disposal of Oil and Gas NORM Wastes*** took effect February 11, 1995. This rule sets forth requirements for the safe disposal of NORM that constitutes, is contained in, or has contaminated oil and gas wastes. Rule 94 was summarized in the Winter 95 issue of The NORM Report.

The Railroad Commission conducted a survey of 612 randomly selected oil and gas sites throughout the State to determine the radioactivity level of various types of oil and gas equipment, including tanks, flow lines, valves, pumps, and well tubulars relative to background levels. NORM radioactivity above the regulatory level of 50 µR/hr was detected at 59 sites. Of a total of 5,916 readings of oil and gas equipment, 203 were higher than 50 µR/hr. To augment the study, the Texas Department of Health surveyed 24 pipe yards around the State. Pipe at four yards had levels of NORM radioactivity above 50 µR/hr. The survey results and other pertinent data will be used to evaluate the effectiveness of the current regulations for the detection, control, and disposal of oil and gas NORM. The study is scheduled to be completed by December, 2000. .

The Texas Natural Resource Conservation Commission (TNRCC) reissued its radiation rules on September 8, 2000, without change to the non-oil and gas NORM requirements. TNRCC's Public Drinking Water, Toxicology and Risk Assessment, and UIC & Radioactive Waste Sections are in the process of reviewing the need for developing NORM drinking water regulations. Results of that review will be presented to management in the near future.

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.

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

A license application was received on November 1, 1999 from Envirocare of Utah to receive and dispose of containerized Class A, B, and C waste. Envirocare is now going through a five-step process that requires a siting and technical review by the Division of Radiation Control and a public process that requires the facility to be approved by the host county, the legislature, and the governor. Envirocare has completed the siting process and received county approval to date.

On October 5, 2000, the Division of Radiation Control approved a new Class A low-level radioactive waste/NORM disposal cell for the Envirocare facility as the existing cell is nearing capacity. Construction is now underway on the new cell which will have a capacity of approximately 3.8 million cubic yards.

VERMONT

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

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VERMONT (continued)
are being watched to see what they decide appropriate concentrations of NORM (radium) should be.

Another interesting situation involves the monitoring of wells from waste treatment facilities. Some facilities are not prepared to take into account the natural radioactivity in the water. There is no mechanism for consideration of ground water naturally containing radionuclides in excess of EPA standards, other than a restriction on the use of such waters as potable water. Much of these waters are used for irrigation and for watering l_ stock. Some facilities are inappropriately applying the U.S. EPA standards for drinking water, neglecting the natural radioactivity in the water. Without allowing for the natural activity in the water, some of the monitoring wells exceed the EPA standard, leading to the conclusion that the treatment facility is contaminating the ground water.

Another issue in Vermont and increasingly in other jurisdictions involves medical radioactive waste shipped from Canada to the United States for treatment and disposal. The regulations in Canada and V ıont are different creating a snag which the state is presently trying to resolve.

Vermont is becoming concerned as to what effect small concentrations of radium-224 (see page 28 in this issue), lead-210 and polonium-210 (all of which have been detected in Vermont waters) will have on regulations to safeguard the health of residents of the state. Concerns have been expressed that no standard method has yet been developed for the determination of radium-224 in water, notwithstanding that this nuclide has been under discussion for more than two years. It appears regulators generally would like to ignore the problem of radium-224 much like was done earlier regarding radon.

None of these issues discussed here have yet been approached for final solution.

VIRGINIA

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

WASHINGTON

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

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

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.

(**Editor's note**: Since the continuing operation of US Ecology's disposal site is important to industries with NORM disposal requirements (there are relatively few options for disposal of some NORM wastes), the following discussion of the Environmental Impact Statement is included here.)

The Washington State Departments of Health and Ecology have issued a Draft Environmental Impact Statement (DEIS) for the commercial low-level radioactive waste disposal site near Richland, Washington. The public, agencies, jurisdictions and the tribes are invited to comment on the three pending actions evaluated in the DEIS. The three pending actions are:

1. Renewal of the US Ecology, Inc. Washington State Radioactive Materials License to operate the commercial LLRW disposal site.

2. Amendment of Chapter 246-249 WAC (Washington Administrative Code) establishing a 100,000 cubic foot per year limit for diffuse naturally occurring or accelerator produced radioactive material (NARM) disposed at the commercial LLRW disposal site.

3. Approval of the July 1996 Site Stabilization and Closure Plan submitted by US Ecology, Inc. to close the site in the year 2056.

The three pending actions may affect your interests concerning radioactive waste disposal in Washington State. These interests may include long-term public health risk, environmental impacts, worker safety, the importation of

(Continued on page 16)

WASHINGTON (continued)
radioactive wastes into Washington State, potential impacts from past disposal of chemical wastes, the transportation of radioactive waste, disposal of United States Department of Energy wastes including wastes from the Fast Flux Test Facility, the application of the State's Model Toxics Control Act, socioeconomic impacts in the Tri-Cities, and cumulative effects to the Columbia River.

The commercial LLRW disposal site is located near the center of the 560 square mile United States Department of Energy (USDOE) Hanford Site on approximately 100 acres of federal land leased to the State of Washington. Although the commercial LLRW disposal site is located at Hanford, it is a licensed state facility and is not operated or regulated by USDOE.

Although the commercial LLRW disposal site is permitted to dispose of 100,000 cubic feet per year of diffuse NARM, the site currently receives an average of less than 30,000 cubic feet per year. Diffuse NARM waste includes phosphate ore, mineral-processing waste, coal ash, phosphate fertilizers, geothermal waste, and oil and gas extraction by-products.

The DEIS evaluates the public health and environmental impacts of the three pending actions and alternatives to those actions. The DEIS does not evaluate political issues related to the use of the commercial LLRW disposal site including the disposal of USDOE waste or the acceptance of foreign NARM waste.

Section 4.0 of the DEIS discusses public health impacts from the three pending actions. Public health impacts for both adults and children were based on the type and activity ("source term") of waste disposed at the site. This source term is used to predict potential health impacts incurred from exposure to the site. For radionuclides, public health impacts are measured by a person's "dose", in units of millirems per year. Computer modeling predicted that there are eight radionuclides that could contribute to a future dose, within 10,000 years, to both the Native American and rural resident individual. The nuclides are Carbon-14, Chlorine-36, Tritium, Iodine-129, Technetium-99, Uranium-235 and -238 and radium-226.

Twenty-five millirem per year is the regulatory standard for a closed commercial LLRW disposal site.

As the operator of the commercial LLRW disposal site, US Ecology is required to have a Radioactive Materials License that is subject to renewal every five years. The DEIS examines two alternatives to renewing the Site License. The first, the "No-Action Alternative", denies the license renewal and closes the commercial LLRW disposal site. The second alternative, called the Enhanced Relicensing Alternative, renews the Site License with operational enhancements designed to further protect public health, worker safety, and the environment. As a result of the DEIS analysis, both the Pending Action and the Enhanced Relicensing Alternative will include source term limits in the Site License for the eight radionuclides identified as contributing to dose after the site is closed. These source term limits will allow the State to control, based on public health, the amounts and type of waste received at the site.

The second pending action would adopt in the Washington Administrative Code an upper limit of 100,000 cubic feet per year for diffuse NARM. Currently, the 100,000 cubic foot per year limit is in effect because of a settlement agreement between US Ecology and the WDOH. There are two alternatives to the pending action. The No Action Alternative would reinstate the previous limit of 8,600 cubic feet per year on NARM. A second alternative, based on past NARM disposal volumes, would set the limit at 36,700 cubic feet per year.

The pending action and all closure alternatives propose to close the site by leaving the waste in place and constructing a cover over the entire site. The DEIS divides site closure into two parts, cover design and closure schedule. The pending action is the approval of a cover design and closure schedule proposed by US Ecology in the 1996 Site Stabilization and Closure Plan.

The public comment period began September 25, 2000. Comments must be received or postmarked no later than November 30, 2000 (a three-week extension of the original comment period). Please provide comments to Nancy Darling, Project Manager, at Washington State Department of Health, Division of Radiation Protection, Mail Stop 47827, Olympia, WA 98504-7827 or e-mail them to nancy.darling@doh.wa.gov.

The public may view a copy of the DEIS at

http://www.doh.wa.gov/ehp/rp/

WEST VIRGINIA
There are no specific regulations for the control of NORM in West Virginia. The general regulations for the control of radiation are in the process of being revised and

(Continued on page 17)

WEST VIRGINIA (continued)
will go to the legislature in March 2001. NORM will be included in these revised regulations. All revisions to regulations in West Virginia must go to the legislature for approval.

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

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

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

Wisconsin's general radiation regulations are being revised as part of the process of becoming an Agreement State. A draft of the revised general regulations is almost ready to hand in and start the promulgation process. This will undoubtedly be a lengthy process because the revised regulations are significantly longer than the previous rules. Specific NORM regulations are not included in the revision. NORM rules will be addressed later -- NORM is an issue onto itself. The current revision focuses on the Atomic Energy Act and NARM.

WYOMING
Wyoming has no regulations for the control of NORM and none have been proposed at this time. Wyoming relies on voluntary cooperation for the control of NORM.

(Continued on page 18)

WYOMING (continued)
For example, scrap yards and other recyclers have installed gate radiation monitors, etc. Considerable scale is found in the Wyoming oil and gas industry but there appears to be no support for NORM regulations at the present time. The problem with that scenario is that there are no controls on NORM/TENORM within the state for the most part - only some restrictions on produced water and ground water. Produced water cannot be discharged if it contains more than 60 picocuries radium per liter.

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

FEDERAL ACTIONS

ENVIRONMENTAL PROTECTION AGENCY (EPA)

In July 2000, EPA sent a report to Congress stating the Agency's views on the need to revise its guidelines for TENORM in light of the 1999 National Academy of Sciences evaluation (see The NORM Report - Fall 1999/Winter 2000 issue). EPA explained the technical and policy basis for its views and submitted the NAS report along with the EPA report. The EPA report is available to be read or downloaded electronically on EPA's TENORM Internet web site at:

http://www.epa.gov/radiation/tenorm/docs/nas_resp.pdf

The Agency's current approach to TENORM is to:

• Study and issue individual technical reports on TENORM-producing industries to determine what's in the wastes from each industry and how much risk they pose. The Agency will focus on TENORM materials from specific sources in a series of separate reports.

• Identify and study existing TENORM sites to assemble a nation-wide view of the problem. This consists of a variety of field projects that will give EPA more information on the sources, characteristics and risks of TENORM.

• EPA will seek to partner with other organizations to enhance data sharing and avoid duplication of efforts. Meetings and partnerships with stakeholders will help to review technical reports plus identify appropriate courses of study and action for each TENORM product or waste.

• Ultimately develop and provide education and guidance for radiation protection, and for safely and economically cleaning up and disposing of TENORM wastes.

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

As described in the last NORM Report newsletter the Agency is currently conducting a number of projects focusing primarily on abandoned uranium mines:

• EPA and the National Park Service have developed a computerized database that describes existing sources of information about abandoned mine lands in 9 western states (EPA's Regions 8 and 9, including Indian reservations). This "database of databases" is now available as a search engine on the Internet to make it easier to locate information about abandoned mining lands that may present TENORM radiation hazards. The search engine is located on the EPA Internet web site at:

http://yosemite.epa.gov/rpd/dataminer.nsf/datasearch

• EPA and the Navajo Abandoned Mine Lands Reclamation Department are conducting a project to investigate the radiation hazards from abandoned uranium mining lands on the Navajo Reservation. Sediment and water collected from boreholes, and other aspects of the environment at an abandoned open pit uranium mine near Cameron, Arizona, have been sampled to identify the types and levels of contamination. The project team will recommend ways to clean up the site.

• EPA is continuing to work with the multi-agency Colorado Plateau Data Coordination Group Steering Committee to develop a pilot geographic information database on uranium mines and mills. A pilot database to identify and show the location of active and inactive uranium mines and mills in Colorado and Utah has been completed, and the effort will be expanded to include data on Arizona and New Mexico sites. This is the first step in developing an ecological atlas about the Colorado Plateau for use by the public and federal, state, tribal, academic, and industrial organizations.

• EPA is providing assistance to the Spokane Indian Tribe to evaluate and clean up the radiological hazards in water and soils from the Midnite Mine Superfund site in

(Continued on page 19)

EPA (continued)
Washington State. Sampling of soil and water from the mine collected for a site assessment is being analyzed by the EPA laboratory in Montgomery, Alabama.

• Using data obtained primarily from state agencies in Arizona, a report on the occurrence of TENORM from copper mines of Arizona was made available on the EPA TENORM web site. The report provides radionuclide sampling data, though not risk assessments for the sites. It can be downloaded from the EPA Internet web site at:

ttp://www.epa.gov/radiation/tenorm/docs/TENORM.pdf

• EPA and U.S. Department of Energy staff participated in a work group of the international Organization for Economic Cooperation and Development's Nuclear Energy Agency in writing a report on *Environmental Remediation of World Uranium Production Facilities.* The report is to be printed in 2001 by the Nuclear Energy Agency and the International Atomic Energy Agency.

As part of efforts being conducted the multi-agency Interagency Steering Committee On Radiation Standards (ISCORS), Sewage Sludge and Incinerator Ash Subcommittee, a survey is currently being conducted by the EPA, NRC, DOE, DOD, and State agencies in looking at TENORM and other radionuclides in sewage sludge and ash from publicly owned sewage treatment facilities. Approximately 350 facilities have been asked to provide samples of sludge and ash for laboratory analysis. It is expected that this study will provide information to the agencies on whether there is a need for revising existing procedures for discharge of radionuclides into sewers, or conducting additional sampling to support revisions to regulations on the use and disposition of biosolids (sludge and ash). The ISCORS Sewage Sludge Subcommittee is also developing a technical support document, *Radionuclides in Sewage Sludge, Dose Assessment.* The July 31, 2000 draft version of this document is available on the EPA Internet web page for downloading at:

http://www.epa.gov/radiation/tenorm/whatare.htm

Contacting EPA about TENORM
.If you have questions or comments about EPA's TENORM Program or TENORM in general, or if you would like to request more information, the EPA can be contacted at:

TENORM Program
U.S. Environmental Protection Agency
Office of Radiation and Indoor Air (6608J)
Washington, DC 20460

Tel: 202-564-9445
Fax: 202-565-2065

NUCLEAR REGULATORY COMMISSION (NRC)

1. On August 28, 2000, the U.S. Nuclear Regulatory Commission published a notice (65 FR 167 50249) of the establishment of two working groups to address regulatory activities concerning the distribution of source materials and the jurisdictional and technical issues relating to the regulation of materials with low concentrations of uranium and thorium. The Rulemaking Working Group held its initial meeting on October 17-18, 2000. The Jurisdictional Working Group held its initial meeting on September 20-21 2000.

2. Dr. Carl Paperiello testified before the Senate Environment and Public Works Committee on July 25, 2000 regarding the disposal of "low-activity" waste, including TENORM. Dr. Paperiello made some statements about TENORM disposals vis a vis AEA materials. This testimony is available from the EPW web site (along with testimony by others on TENORM at that hearing).

3. The Commission issued the staff a Staff Requirements Memorandums (SRMS) on SECY-99-012. *"Use of Uranium Mill Tailings Impoundments for the Disposal of Waste Other than 11e(2) Byproduct Material and Reviews of Applications to Process Material Other than Natural Uranium Ores"*, and SECY-99-13, *"Recommendations on Ways to Improve the Efficiency of NRC Regulation at in Situ Leach Uranium Recovery Facilities,"*in July 2000 which reference TENORM. In the SRM for SF-CY-99-013, the Commission directed that all above ground wastes be considered 11e.2 byproduct material, instead of part TENORM and part 11e.2 byproduct material. SECY-99-012, includes discussion on the disposal of TENORM in mill tailings sites. The SECY papers and SRMs can be found on the NRC website.

4. NRC continues to participate in the NORM Subcommittee of ISCORS, learning mostly what EPA is doing about TENORM. See www.iscors.org for more information.

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MINERALS MANAGEMENT SERVICE (MMS)

The Minerals Management Service Gulf of Mexico OCS Region has released a *NOTICE TO LESSEES AND OPERATORS OF FEDER - AL OIL, GAS, AND SULFUR LEASES AND PIPELINE RIGHT-OF-WAY HOLDERS IN THE OUTER CONTINENTAL SHELF, GULF OF MEXICO OCS REGION: Guidelines for the Sub-Seabed Disposal and Offshore Disposal Storage of Solid Wastes.* This Notice to Lessees and Operators (NTL) supercedes NTL No. 96-03, dated May 8, 1996, on this subject.

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

NTL No. 99-G22
BACKGROUND

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

According to 30 CFR 250.300(b)(2), you must obtain approval from the Minerals Management Service (MMS) of the methods you will use to dispose of drill cuttings, sand, and other well solids. Under this authority, the MMS GOMR requires that you must obtain approval for the sub-seabed disposal of all wastes, and for the offshore storage of E&P wastes that contain naturally occurring radioactive materials (NORM) above background levels. You must obtain these approvals before you may proceed with such disposal or storage operations.

This NTL provides guidance and instructions on the disposal of these E&P wastes, worker safety when handling these wastes, and the contents of application to dispose of or store these wastes. The procedures

(Continued on page 21)

NORM Manuals Available

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

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

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

1. Fundamentals of Radiation Protection
2. Radiation / Radioactivity Units
3. Biological Effects of Radiation
4. Radiological Protection
5. Introduction to NORM Contamination
6. NORM Contamination - Radium
7. NORM Contamination - Radon
8. NORM in Oil & Gas & Other Industries
9. Fundamentals of Radiation Detection
10. NORM Surveys
11. Disposal of NORM Wastes
12. Federal Regulations
13. State Regulations
14. Canadian Guidelines
15. Recommended Industrial Hygiene
16. Program Suggestions for NORM Control
17. Radiation Litigation & Minimization
18. Conclusions
19. Glossary

For further information contact:

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

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

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

regarding waste disposal outlined in this NTL do not supercede, but are supplemental to, those procedures for abandonment of wells as specified in Subpart G of 30 CFR 250.

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

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

CANADA

CANADIAN GUIDELINES FOR THE MANAGEMENT OF NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM)

June 2000

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

(**Editor's note**: This is the version sent for translation into French and accordingly no further changes are expected. The policy is that English documents are not released before the corresponding French version is available. The French version was expected to be completed by the end of September and both documents available for distribution in December.)

A summary of the Guidelines follows:

The Federal Provincial Territorial Radiation Protection Committee (FPTRPC), a Canadian intergovernmental committee established to support federal, provincial and territorial radiation protection agencies in carrying out their respective mandates, recognizes that the potential radiation hazards from NORM are the same as those from radioactive materials controlled by the CNSC. To that end, the Canadian NORM Working Group has, on behalf of the Federal Provincial Territorial Radiation Protection Committee, produced the ***Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM).*** The NORM Working Group represents the interests of provincial and territorial regulators and includes affected industries in the petroleum production, fertilizer manufacturing and metal recycling industry sectors. With the support and encouragement of Health Canada and the Canadian Nuclear Safety Commission, these Guidelines are the result of their efforts.

The Canadian Guidelines set out principles and procedures for the detection, classification, handling and material management of NORM in Canada, and also include guidance for compliance with federal transportation regulations. The basic principle of these guidelines is that where workers or the public are exposed to additional sources or modes of radiation exposure because of activities involving NORM, the same radiation protection standards should be applied as for CNSC regulated activities. These guidelines provide the framework for the development of more detailed NORM management practices and guidelines by regulatory authorities, affected industries and specific workplaces.

Clearly, as radiation doses from NORM cannot be prevented, the question is: At what incremental dose should we begin to apply radiation protection practices to NORM? The Guidelines have been developed to help answer this question.

The Guidelines are an extension of the work done by the Western Canadian Committee on Naturally Occurring Radioactive Materials (NORM) published in August 1995 as the ***Guidelines for the Handling of Naturally Occurring Radioactive Materials (NORM) in Western Canada.*** The differences between the Canadian Guidelines and the Western Canadian Guidelines reflect changes in national and international radiation protection practices and consensus standards for NORM classification and management since 1995.

Recommended Radiation Dose Limits

It is the recommendation of the Federal Provincial Territorial Radiation Protection Committee that the annual incremental effective dose to persons exposed to NORM as the result of a work practice be limited to 20 mSv (2.000 millirem) for the occupationally exposed workers and 1 mSv (100 millirem) for the incidentally exposed workers and members of the public.

These dose limits are the foundation for all other radiation protection program recommendations contained in the Guidelines. The guidelines are harmonized with the radiation dose limits recommended by the Canadian Nuclear Safety Commission for Nuclear Fuel Cycle; and incorporate the recommendations of ICRP Publication 60.

Incremental Dose

Dose limits in this document are defined in terms of incremental dose, which is the dose resulting from the work practice in question. The natural background radiation, including radon, is excluded from

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CANADA (continued)
the dose limitations. Radiation dose arising from the application of medical procedures is also excluded from the dose limitations.

Dose Constraint
A dose constraint is an upper value on the annual dose that members of the public or incidentally exposed workers should receive from a planned operation or single source.

To ensure that the public and incidentally exposed workers do not exceed the annual dose limit of 1 mSv (100 millirem), the ICRP 77 and the IAEA SS115 suggest the use of a dose constraint. The dose constraint would allow for exposures from other sources without the annual limit being exceeded. The retrospective finding that a dose constraint, as opposed to a dose limit, has been exceeded does not imply a failure to comply with the recommendations of the guidelines. Rather it should call for a reassessment of the effectiveness of the program.

ICRP 77 suggests that for the control of public exposure an appropriate value for the dose constraint is 0.3 mSv (30 millirem) in a year. In keeping with this suggestion the Canadian NORM guidelines have adopted 0.3 mSv/a (30 millirem/year) as its first investigation level.

Further Tables in the Guidelines list the amounts of radioactive materials that if released to the environment without further controls will not cause doses in excess of 0.3 mSv/a (30 millirem/year).

ICRP 77 is the *Radiological Protection Policy for the, Disposal of Radioactive Waste.*

Radiation Dose Assessment
An estimate of doses to members of the public and workers is made by conducting a radiation survey of the workplace/worksite. The survey should include evaluations of both gamma dose-rates and airborne radioactivity as required.

Workers with -estimated doses in excess of 1 mSv/a (100 millirem/year) are classified as occupationally exposed workers.

An estimate of doses to members of the public from feedstock, product and waste transport, storage and disposal should be made. Radiochemical analysis of feed stock, products and waste materials may be needed.

NORM Management
Public access would need to be restricted. However, worker access would be unrestricted.

Where the work site, feed and waste materials are subject to change, the work site, feed and waste material should be reviewed periodically to verify that conditions have not changed.

Radiation Protection Management
Assess the work site periodically to measure changes in conditions and to facilitate worker dose calculations.

Periodic Review
Whenever a NORM Management, Dose Management or Radiation Protection Management Program has been implemented, a periodic review is needed . The review is to determine if there have been changes to the system that may affect the radiation dose, to monitor the effectiveness of the NORM program and to determine if modifications are required. The frequency of the periodic review will depend on the ability of conditions to change and the NORM program.

ALARA
The goal is that doses should be As Low As Reasonable Achievable, economic and societal factors being taken into account. From the time a NORM accumulation is expected to the implementation of a NORM Program, the ALARA principle should be the prime decision making criterion used to ensure minimal public and worker radiation dose.

Derived Working Limits (DWLS) have been determined from the annual radiation dose limits to assist in dose assessment. The DWLs provide an estimate of dose from the quantities that may be directly measured in the workplace. A Radiation Assessment program may compare measurement results to derived working limits (DWLs).

Gamma:
The occupational dose-rate that will give an incremental gamma radiation dose of 0.3 mSv/a (30 millirem/year) is 0.15 µSv/h (15 microrem/hour). The DWL for the gamma Investigation Threshold is an incremental dose-rate above off-site background of 0.15 µSv/h (15 microrem/hour.)

The occupational dose-rate that will give an incremental gamma radiation dose of 1 mSv/a (100 millirem/year) is 0.5 µSv/h (50 microrem/hour). The DWL for the gamma Dose Management Threshold is an incremental dose-rate of 0.5 µSv/h (50 microrem/hour).

There is no DWL for the gamma Radiation Protection Threshold as doses are expected to be derived by dosimetry measurement/estimation.

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CANADA (continued)

Inhalation Control Measures

Controls include capture ventilation at the source to prevent escape into the air, and room ventilation rate increase.

Respiratory protection must follow the standards requirements specified for other hazardous dusts under the local jurisdiction.

Respirator Program

A high protection factor can only be obtained if there is an effective respirator selection, service and fitting program

To assist in NORM material management, Derived Release Limits (DRLS) have been determined from the annual radiation dose limits. The DRL's provide an estimate of public dose from measured releases of NORM. A Radiation Assessment or Material Management program may compare measurement results to Derived Release Limits (DRLs).

The radioactive hazard associated with this dose is considered insignificant, and no further control on the material is necessary on radiological protection grounds. It may be necessary to consult and obtain approval from Provincial waste disposal regulatory agencies regarding non-radiological properties.

NORM quantities in excess of the Unconditional Derived Release Limit may, after a specific site review, be released without further consideration. In such instances, the basic premise is that the material, in its final disposition, will not contribute a dose to an individual that is greater than 0.3 mSv/a 30 millirem/year).

Outside those situations or conditions, the material falls within a more restrictive NORM classification.

Pathways Considered

Aquatic

1. Value 10X Guideline for Canadian Drinking Water Quality.

Terrestrial

1. External groundshine from soil contaminated to infinite depth
2. Soil-veg-ingestion//soil ingestion
3. Inhalation of resuspended material

Air

1.Inhalation at concentration resulting in 0.3 mSv (30 millirem).
2.Exposure factor of 25% assumed.

The unconditional release limit for radium in equilibrium with its progeny in diffuse NORM is 300 Bq//kg (8 pCi/g). The release limit for lead-210 in equilibrium with bismuth-210 and polonium-210 is also 300 Bq/kg (8 pCi/g).

Standards for the Transport of NORM

The transport of radioactive material, including NORM, with radioactivity below 70 Bq/g (1890 pCi/g) is not subject to federal transportation regulations. All NORM consignments must initially be analyzed for radioactive content to determine whether the material meets Unconditional Derived Release Limits, and if it does not, whether federal transport regulations apply.

NORM with activity above 70 Bq/g (1890 pCi/g) falls under federal jurisdiction and is therefore subject to the requirements of federal regulations, including the CNSC's *Packaging and Transport Regulations and the Transport of Dangerous Goods Regulations* for all dangerous goods shipments. The CNSC Packaging and Transport Regulations have been harmonized with the IAEA's Safety Series 6, *Regulations for the Safe Transport of Radioactive Materials,* 1985 Edition (amended 1990).

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

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

CONFERENCE OF RADIATION CONTROL PROGRAM DIRECTORS (CRCPD)

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

Tom Hill (Georgia) is chairman of a CRCPD committee that is looking at revising Part N. The Committee met via a conference call on August 29/30, 2000 reviewing suggestions and made writing assignments. It is hoped to have a draft of the revised Part N ready by the end of the year.

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

A conference call will be heid in the near future with the committee to discuss some changes that were

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CRCPD (continued)

suggested during the peer review of the guidance draft. It is hoped to submit the draft to the CRCPD Board by the end of the year to get their approval to publish the draft as a CRCPD document. ■

Upcoming Changes in the Regulations for Transporting Radioactive Material

In 1996 the International Atomic Energy Agency (IAEA) published *Regulations for the Safe Transport of Radioactive Material, 1996 Edition, No. ST-1*. The U.S. Department of Transportation (DOT) and the U.S. Nuclear Regulatory Commission (NRC) have begun the regulatory process of considering which of the international changes should be incorporated into the domestic regulations, as is or in modified form. U.S. regulations which would be affected are DOT's Hazardous Materials Regulations, found in 49 CFR 171-180, and NRC's 10 CFR 71, *Packaging and Transportation of Radioactive Material*.

The term "international regulations," as applied to the above publications, is somewhat of a misnomer. These are really consensus standards, developed through the participation of most of the 130 member states, following procedures administered by the IAEA, which is itself an agency of the United Nations. They become true regulations when adopted by member states for domestic use or by international modal organizations..

On 28 December 1999, DOT published an Advance Notice of Proposed Rulemaking (64 FR 72633) indicating its intention to incorporate changes from ST-1 into the Hazardous Material Regulations. A fairly detailed list of the ST-1 changes was included in the Advance Notice, covering the broad areas of Scope, Nuclide-Specific Thresholds, Communication Changes, Uranium Hexafluoride, Low Specific Activity Materials and Surface Contaminated Objects, Type B and Fissile Material Package Requirements, and Other Changes.

As of late September, 65 comments had been received. These are available for reading or downloading from the Internet, along with both Federal Register notices. Go to http://dms.dot.gov/search and enter 6283 in the Docket Number search field; from the resulting page the documents may be read in pdf or tif (or other) format.

On 17 July 2000, the NRC published a *Request for comment on issues paper, and notice of plans for public meetings (65 FR 44360)*. The Issues Paper is contained in the Federal Register notice and consists of 18 issues under consideration which may lead to changes in 10 CFR 71.

One of the more controversial issues to be decided is whether to adopt for domestic use the nuclide-specific threshold activity concentrations. Materials with activity concentrations below these values would not be subject to the regulations for transporting radioactive material. These nuclide-specific values would replace the single generic 70 Bq/g (2000 pCi/g) activity concentration threshold that has been in use since the mid-1960s. If multiple nuclides are present, the effective threshold would have to be determined through a "sum of the fractions" rule.

DOT and NRC are coordinating their respective rulemakings and intend to publish their Notices of Proposed Rulemaking and Final Rules simultaneously. Present target dates for these are April 2001 and July 2002, respectively. There will probably be a phase-in period after that before compliance with the Final Rules becomes obligatory.

To ease the transition when ST-1 changes are adopted by the modal organizations, DOT intends to implement some minor changes before the end of this year in a separate rulemaking (internal docket number HM-215D). The principal changes projected for this rulemaking are incorporation by reference of ST-1, authorization to use ST-1 or Safety Series No. 6, 1985 Edition (As Amended 1990) for import/export shipments, and the addition of most of the new proper shipping names and UN identification numbers from ST-1 to the Hazardous Materials Table (49 CFR 172.101). The last change will allow domestic shipments by all modes, including rail, highway, and inland waterways, using either the "old" or the "new" shipping names and identification numbers. ■

"Striving for success without hard work is like trying to harvest where you haven't planted."

David Bly in Salt Lake City News

DOE and IOGCC Announce the NORM Technology Connection Website

The U.S. Department of Energy (DOE) and Interstate Oil and Gas Compact Commission (IOGCC) have launched a new website called the NORM Technology Connection providing information specific to the management of naturally occurring radioactive materials (NORM). This website provides access to information about NORM service companies and the regulation of NORM. In addition, the website provides a discussion forum within which users can pose questions and share information relevant to NORM.

Specifically, the NORM Technology Connection website contains a database of information about companies providing all types of NORM services, including site characterization and remediation support, sample collection and analysis, equipment cleaning/reconditioning, radiation safety program development, radiation safety and NORM training, NORM waste treatment and disposal, and general consulting. Company-specific information profiled on the website includes current contact information plus a brief description of the company's capabilities. If available, email addresses and a link to the company's own website also are provided. Company participation in the website is free, meaning that any company wishing to post information about itself will be able to do so at no charge. Similarly, public access to the website also will be free.

The NORM Technology Connection website also provides access to information about the regulation of NORM, including a state-by-state directory of agencies that have jurisdiction over petroleum industry NORM. For each agency, contact information is provided and existing regulations applicable to petroleum industry NORM (if any) are identified. Where available, links to state agency websites and to online copies of the applicable regulations are provided.

A third component of the NORM Technology Connection website is a discussion forum within which individuals can post and respond to specific questions related to NORM management. The discussion forum is served by a mail list and individuals may subscribe and unsubscribe at any time.

The NORM Technology Connection website is available at **http://www.iogcc.state.ok.us/NORM**. The website was developed by Argonne National Laboratory's Environmental Assessment Division. Funding for development of the site was provided to Argonne by the DOE's National Petroleum Technology Office under Contract No. W-31-109-Eng-38. Individuals seeking additional information about this website may contact Karen Smith at Argonne National Laboratory. Ms. Smith's phone number is (303) 986-1140, ext. 267 and her email address is smithk@anl.gov. ■

The Failure List

students believe they are failures, they just need to member that they are in good company.

Einstein was 4 years old before he could speak.

Isaac Newton did poorly in grade school and was considered "unpromising."

Beethoven's music teacher once said of him, "As a composer, he is hopeless."

When Thomas Edison was a youngster, his teacher told him he was too stupid to learn anything. He was counseled to go into a field where he might succeed by virtue of his pleasant personality.

F. W. Woolworth got a job in a dry goods store when he was 21, but his employer would not permit him to wait on customers because he "didn't have enough sense to close a sale.

- Michael Jordan was cut from his high school basketball team. Boston Celtics Hall of Famer Bob Cousy suffered the same fate.
- A newspaper editor fired Wait Disney because he "lacked imagination and had no good ideas."
- Winston Churchill failed the sixth grade and had to repeat it because he did not complete the tests that were required for Promotion. ■

A New NORM-TENORM Listserv

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

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

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

majordomo@mailhub.ornl.gov

In the body of the message type:

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

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

www.normis.com/nindex.htm ■

Radium-224 — An Overlooked Environmental Problem?

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

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

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

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

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

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

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

Polonium-210 — One of the Most Hazardous Radionuclides on Earth

Publication 72 of the International Commission on Radiological Protection (ICRP) provides dose coefficients for the intake of radionuclides by members of the public. A recent discovery while perusing Publication 72 was to learn that, contrary to what the media would have you believe, plutonium, specifically Pu-239, is not the most hazardous radioactive material on earth. In reality, one of the most hazardous is polonium, especially Po-210, one of the most common naturally occurring radionuclides. In fact, if you neglect curium, a transuranium element, from the standpoint of its dose coefficient for ingestion, polonium ranks first among the more than 700 radionuclides for which the ICRP has provided data. Per unit of intake by ingestion, it delivers a committed effective dose that is six times that for plutonium, over four times that for radium, and over five times that for thorium. From the standpoint of inhalation, it ranks among the top ten radionuclides if assumed to be soluble, and among the top dozen, if assumed to be insoluble. Should there be any who doubt about these observations, their authenticity is confirmed by the information provided in Federal Guidance Report No. 13 which was issued in 1999 by the U.S. Environmental Protection Agency.

If one happens to check earlier ICRP Publications, he/she will discover that polonium has not always enjoyed such stature. What then was the reason for the change? Well, it was very simple. Between the time of issuance of ICRP Publication 68 and Publication 72, the Commission found that they had underestimated the GI absorption factor for polonium by a factor of five! That was all that it took to make the difference.

Polonium-210 is an important radionuclide in NORM contamination, particularly in the natural gas and natural gas liquids industry and in industries using natural gas liquids as feedstocks, etc. The hazard of polonium-210 is recognized in the Canadian exempt concentration for polonium-210 (lead-210, the parent of polonium-210) of 8 pCi/g whereas the United States exempt concentration is normally 150 pCi/g for the polonium-210 or lead-210! ■

Revised Draft Sewage Sludge Guidance

Current regulations do not specifically address acceptable levels of radioactivity in sewage sludge. The Sewage Sludge Subcommittee of the Interagency Steering Committee on Radiation Standards (ISCORS) has been assisting the U.S. Environmental Protection Agency (EPA) and Nuclear Regulatory Commission (NRC) in developing guidance on radioactive material in sewage sludge and ash.

The document *Guidance on Radioactive Materials in Sewage Sludge and Ash at Publicly Owned Treatment Works* (Revised Draft, June 2000) is intended to inform Publicly Owned Treatment Works (POTW) authorities of the possibility for radioactive materials to concentrate in sewage sludge and incinerator ash and to help POTW authorities determine what they may want to do about any radioactive materials present in their sewage sludge or ash.

The Subcommittee has issued a revised draft of the guidance, which is available for review and comment. Comments should be provided to the EPA or NRC contact listed in the document. The guidance is available on the ISCORS Web site, at URL http://www.iscors.org. From that home page, go to the Subcommittee page and to the Sewage Sludge page, to download or view the document. The document may also be obtained from the NRC contact: Duane Schmidt, CHP, 301-415-6919, or dws2@nrc.gov.

The Subcommittee is also continuing its survey of POTWs, including analyses of radioactivity in sewage sludge and ash. Work on the survey is expected to be completed in Fall 2001. ■

Meetings Calendar

SPE/EPA/DOE Exploration and Production Environmental Conference

26-28 February 2001 — San Antonio, Texas

Papers have been solicited in the areas of remediation, decommissioning, waste management including NORM, and environmental issues.

Radiation Safety AND ALARA Considerations for the 21st Century

(The 34th Midyear Meeting of the Health Physics Society)

February 4-7, 2001 — Anaheim, California

Topics include Radiation in Personnel Surveillance Applications, Regulatory Considerations, and Decommissioning. The Topic of the International ALARA Symposium is *Excellence in Occupational Dose Reduction in the New Millennium.*

Risk Analysis for Chemicals and Radionuclides: A Review of the State-of-the-Art

March 5-9, 2001 — Kiawah Island, South Carolina

Faculty members will help bring into perspective the differences and similarities between risk from chemicals and radioactive materials.

For more information, visit the website at www.racteam.com.

International Waste Management Symposium 2001

February 25 - March 1, 2001 — Tucson, Arizona

For information, contact:

WM Symposia, Inc.

Email: info@wmsym.org

"Hot" Waste Oils

During my recent communications with the state regulatory agencies I learned of a hot oil sample that measured 10.5 **microcuries** radium per kilogram of material. This sample was an oil sludge from a salt water injection tank. The tank itself measured over 5 milliR/hour (over 5,000 microR/hour!) The sample (approximately 2 kilograms) of the sludge (consistency of tar) taken from the tank was analyzed as containing 10.5 microcuries radium per kilogram or 10,500 picocuries per gram!

This material is usually exempt from NORM regulations — most state regulations exempt oil and gas products while regulating the facilities from which the oil and gas were produced or processed. These waste oils, sludges, etc. are often processed into asphalt with the possibility that some asphalts may contain significant quantities of radioactivity.

Advice is seldom welcome, and those who need it the most, like it the least. .....Lord Chesterfield

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High Natural Radiation Backgrounds around the World

The question arises: why governments of various countries do not relocate populations living in areas where lifetime dose of natural radiation is higher than 50 mSv (5,000 millirem). For example, why are people not evacuated from Norway where the country average lifetime dose is 365 mSv (36,500 millirem), or from high background regions in India with a lifetime dose of >2000 mSv (200,000 millirem) and in Iran with lifetime dose of > 3000 mSv (300,000 millirem)? Perhaps in Iran, for example, the government considered not to follow the ICRP guidelines when it considered the fact that in a house in the city of Ramsar several generations were receiving average individual lifetime doses of natural radiation of 17,000 mSv (1,700,000 millirem), or **240 times** more than the current ICRP limit for exposure of members of the public to natural sources of radiation. Yet these individuals show no increased incidence of any disease, and some of them lived to 110 years of age. ■

NORM in the Literature

A National Survey on Naturally Occurring Radioactive Material (NORM) in Petroleum Production and Gas Processing Facilities

American Petroleum Institute
Exploration and Production Department
API Publication 7101
November, 1997

The data summarized in this report are a compilation of over 36,000 individual observations submitted by a number of participating petroleum companies using similar equipment and collection protocols. The purpose of the study was 1) to identify the geographic areas of producing and gas processing facilities (gas plants) which have the greatest occurrence of NORM and 2) to identify items of equipment at these facilities which have the highest NORM activity levels.

Applied Radiation and Isotopes

Volume 49 Number 3
March 1998

This entire issue contains a Forward and 12 contributed papers on naturally occurring radioactive material (NORM) in the environment, including papers on surveying and analytical techniques, disposal and regulations.

Naturally Occurring Radioactive Material Technical Bulletin No. 767

December 1998
National Council for air and Stream Improvement
Publications Coordinator
P.O. Box 13318
Research Triangle Park, NC 27709-3318
(919) 558-1999

Workers at several pulp and paper mills have identified some scales formed in primarily bleach plant and paper machine area pipes, valves, and other equipment as containing naturally occurring radioactive material (NORM). As is the case for the more common oilfield NORM scale which results from deposits of radionuclides from naturally occurring materials in groundwater, this material is composed of naturally occurring radionuclides that appear at a level which is low to the degree that human health is not likely endangered by occasional or even routine exposure to the scale. Nonetheless state NORM regulations and some worker protection considerations may require action when such NORM is discovered.

New Radiation Protection Text

A new book, *Physics for Radiation Protection* by James E. Martin, CHP, a Charter member of the Health Physics Society, has just been published by John Wiley and Sons. It is the outcome of over 15 years of teaching radiation physics to University of Michigan graduate students.

The book presents basic physics concepts needed by health physicists and other radiation protection specialists as practitioners as well as students. It resists the theoretical approach one finds in many books on nuclear or modern physics as well as the temptation to try to cover everything in the field of health physics. Numerous real-world examples and practice problems are provided to demonstrate concepts and hone skills and, even though its limited uses are thoroughly developed and explained, some familiarity with calculus would help the reader to grasp some of the subjects more quickly. Extensive data resources are also provided both in the text and in appendices which together number 713 pages. For example, decay schemes and associated radiation emissions are included for about 100 of the most common radionuclides encountered in health physics. Resources are also provided on activation cross sections, fission yields, fission-product chains, photon absorption coefficients, buildup factors, nuclear masses, and abbreviated excerpts of the Chart of the Nuclides. Each of these is current from the National Nuclear Data Center.

(Continued on page 32)

NORM in the Literature (continued)

The first three chapters of the book describe the atom as a source of the radiant energy addressed by the profession. Chapters 4 and 5 deal with nuclear interactions. Modes of transformation and mathematical methods, including series decay, are developed extensively in Chapter 5. Natural sources of radiation and radioactive materials, including radon, are described in Chapter 6.

Interactions of radiation and matter and the resulting deposition of energy are covered in Chapter 7 along with the corollary subjects of radiation exposure and dose. Radiation shielding, which is also related to interaction processes, is described in Chapter 8. Chapters 9 and 10 address activation products and fission, including the physics and designs of nuclear reactors. These are followed by specialty chapters on the radiation physics associated with nuclear criticality (Chapter 11); radiation detection and measurement (Chapter 12); applied statistics (Chapter 13); sources, interactions, shielding, and detection of neutrons (Chapter 14); and finally x rays (Chapter 15).

Further information can be obtained from James E. Martin 734-936-0727; fax: 734-764-9424; or email jemartin@umich.edu or from John Wiley and Sons, 800-CALL-WILEY, or 605 Third Avenue, New York, NY 10158 (ISBN: 0-471-35373-6).

Practice for Occupational Radiation Exposure Records Systems
American National Standard
ANSI/HPS N13.6-1999
Published by:
Health Physics Society
1313 Dolley Madison Blvd.
Suite 402
McLean, VA 22101

This standard provides guidance to the facility operator for systematic creation, scheduling, retention, and disposition of records related to occupational radiation exposure. The principal goal of a radiological records system, is the compilation of complete and accurate individual exposure histories with supporting documentation. Exposure histories assist in the protection of the individual by providing information that is useful in controlling dose.

National Research Council Report on TENORM

The National Research Council report, Evaluation of Guidelines for Exposures to TechnologicaUy Enhanced Naturally Occurring Radioactive Materials, has been published and is available to all interested individuals.

The regulation of public exposures to technologically enhanced naturally occurring radioactive materia (TENORM) by- the Environmental Protection Agency (EPA) and other regulatory and advisory organizations is the subject of this report by the National Research Council. Technologically enhanced naturally occurring radioactive materials were defined to be any naturally occurring radioactive materials not subject to regulation under the Atomic Energy Act whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the natural state by human activities. The primary question considered was whether the differences in the guidelines for TENORM developed by EPA and other organizations are based upon scientific and technical information or on policy decisions related to risk management, and if the guidelines differed in their scientific and technical bases, what were the relative merits o the different scientific and technical assumptions. The guidelines evaluated in this study include those for indoor radon and those for any other TENORM.

The book may be ordered from the National Academy 'Press by phone (1-800-624-6242) or from its Web site (www.nap.edu). Web orders receive a 20 percent discount. The report is also on the Web site in its entirety for reading without cost. It can be found at <http://www.nap.edu/readingroomVenter2.cgi?03090 62977.htmi >.
The report is 294 pages in length. ■

NORM Deposition in the Pulp and Paper Industry

In December 1999, the radiation detectors at a steel-recycling yard in Eastern Ontario found scrap piping from a pulp and paper mill to be radioactive. The piping was returned to the mill. The owners started an internal investigation and contacted the Ministry of Labour, Radiation Protection Service (RPS).

The rejected piping consisted of a few 20 to 30 cm diameter pipe elbows and a pump bowl, all coated on the interior with a mineral scale about 1 cm thick. The pipes had been removed from the pulp bleaching process some years previously. The field on-contact reading with the scale inside the pipe was 200 µR/hr. A scale sample was counted in the RPS laboratory and contained about 15,000 Bq/kg (405 pCi/g) radium-226 and 4,000 Bq/kg (108 pCi/g) thorium-230.

The Process:

This mill processes 1,400 tonnes per day of wood and uses 20,000 tonnes per day of water. Wood chips are pulped at high pressure and temperature in a sodium hydroxide and sulphide solution, which dissolves the lignin that holds the cellulose fibres together. The fibres (brown stock) are separated from the solution and washed. At this stage they can be used to make brown paper (kraft paper).

White paper requires additional lignin removal (bleaching). The pulp is contacted with a bleaching agent, which attacks the lignin structure, followed by separation from the solution and an alkaline wash. This is repeated three times, with recycling of the bleach and washing solutions within the cascade. The bleaching agent ~~used to be dissolved chlorine gas~~, but as result of concerns over releases of chlorinated organics, the mill (and the industry) now uses chlorine dioxide. This is an unstable compound and is generated on site by acidification of sodium chlorate. Sulphuric acid is added with the chlorine dioxide in the first bleaching stage to give a solution pH of about 3. The pH is higher in the later stages.

The Investigation:

A check of the bleaching process area found the presence of radioactive scale indicated by on-contact readings of up to 100 µR/hr on piping, tanks, and pumps associated with the first stage of the process. No activity over back-ground (5 µR/hr) could be detected on equipment used in the second and third stages of the bleaching process. Plant experience was that calcium scale was only seen in the first stage.

A second plant on the premises repulped 300 tonnes per day' of recycled cardboard and then bleached the resulting brown stock. Contact readings of up to 40 µR/hr on pumps and piping associated with the first stage of the bleach process indicated that radioactive scale was also present

.

The plant chemist had contacted other mills and had been told that a pH of around 3 was optimum for calcium sulphate scale deposition. Radium present in the water would be expected to coprecipitate with the calcium. The likely source of both the calcium and radium is the water drawn from the environment. Although concentrations are low, the volume is large, so there is a significant mass flux of both elements through the system.

The Implications:

Pulp mills using chlorine dioxide bleach are, likely to have calcium/radium scales in the first stage of the bleach process. The resulting activity levels will be high enough that scrap equipment will not be accepted for metal recycling.

The external radiation fields around equipment are not likely to be high enough for worker doses to be of concern, but if scale is removed from equipment without proper precautions, there is a possibility of internal contamination.

The specific activity of the scale may depend on the radium/calcium ratio in the feed water. This may be higher in granitic northern areas than in the limestone Great Lakes area.

A follow-up investigation at other mills is planned. ■

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

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

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

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

LOUISIANA

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

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

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

SOUTH CAROLINA — Part IX, Licensing of NORM

TEXAS — Texas Department of Health-- Texas Regulations for Control of Radiation (TRCR) Part 46, Licensing of NORM
Railroad Commission of Texas-- Rule 94, Disposal of Oil and Gas NORM Wastes

Comparison of NORM Rules by State

Radium Exemption Concentration

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

Radium Cleanup Standard

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

NOTES

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

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

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

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

(Continued on page 36)

NORM Training Course Offered by Peter Gray

The course *NORM - An Emerging Enviromental Problem* covers all aspects of NORM contamination and its control, including:

- Fundamentals of Radiation
- Fundamentals of NORM
- Types of NORM Contamination
- Industries Affected
- Radium Contamination
- Radon Contamination
- State & Federal Regulations
- NORM Surveys including Hands-on Training
- Maintenance and Industrial Hygiene 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 and other industrial 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.

The course can be either one day or two days in length. Both courses cover the same material, but the two-day course contains more detail. The cost of the two-day course is $600 and the one-day course $400/ Discounts are available of multiple attendees from the same company. Travel expenses are additional.

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

Contact Peter Gray at 501-646-5142 or email him at pgray@normreport.com for more information

Comparison of NORM Rules by State (Continued)

Exemption for Contaminated Equipment

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

NOTES

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