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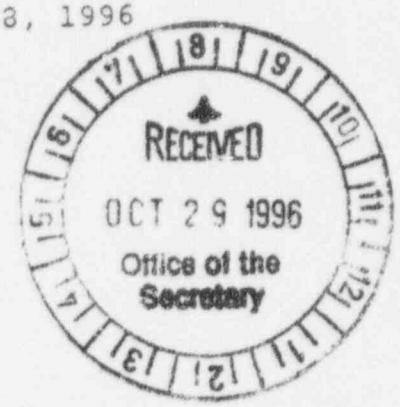

Malcolm R. Knapp, Ph.D.
Deputy Director
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Dear Mal:

Over the past year, I have examined the possible application of the "open-market trading rule" to the cleanup of various nuclear facilities. Areas in which it would be particularly useful would be in the decontamination and decommissioning of commercial nuclear power plants and the remediation and restoration of various nuclear facilities of the U.S. Department of Energy.

I have summarized my thoughts on this subject in the enclosed paper, "Innovative Policies for Radioactive Waste Management and the Cleanup of Contaminated Nuclear Facilities."

It would be appreciated if you could arrange to have this paper included as part of the record of the Strategic Assessment initiative currently underway within the U.S. Nuclear Regulatory Commission.

Thank you in advance for your help.

Best regards,

Dade

Dade W. Moeller, Ph.D.
President

encl.

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INNOVATIVE POLICIES FOR RADIOACTIVE WASTE MANAGEMENT AND THE CLEANUP OF CONTAMINATED NUCLEAR FACILITIES

by
Dade W. Moeller, Ph.D.

INTRODUCTION

Most of the efforts on decommissioning commercial nuclear power plants and managing and disposing the associated wastes have been directed to the development of new and improved technologies. Much the same is true in terms of the major ongoing cleanup efforts within various nuclear installations of the U.S. Department of Energy. Little attention has been paid to the possible application to these problems of new, innovative policies. Yet, experience in other fields of environmental protection shows that the application of such policies might be beneficial. The purpose of this paper is to review one such policy that may prove useful, namely, the "open-market trading rule."

OPEN-MARKET TRADING RULE

Through the "open-market trading rule," the U.S. Environmental Protection Agency (EPA) permits an industry that is having a problem with excessive releases of a given toxic chemical either: (a) to spend whatever is required to reduce the releases; or (b) to "make room" for the releases by purchasing and shutting down other industries discharging the same toxic chemical within the same geographic area, or by assisting other dischargers of the same pollutant in reducing the quantities of their releases.

One of the major benefits of this approach, sometimes called "emissions trading,"(1) is that it enables industrial and governmental organizations to control pollutants in the most cost-effective manner. That is to say, if one company can control their releases of a given toxic agent at a lower cost than another, it is wiser for the second company to assist the first in its cleanup efforts than to spend more money in trying to reduce its own releases.

Initially, the "open-market trading rule" was applied solely to the control of a single toxic chemical within a single environmental medium. Under the Clean Air Act,(2) for example, industries are permitted to optimize releases to the atmosphere based on mitigative technologies, thereby "trading" exposure rights. In effect, this Act permits industries to buy and sell pollution rights and encourages one industry to assist another in reducing its airborne releases, if this can be accomplished at lesser costs. The same type of optimization is permitted under the Clean Water Act to control discharges to lakes and rivers. With the increasing success of this approach, however, its applications have been extended to broader arenas. For example, through an emission allowance program, the rule is being used to control airborne emissions that cause acid rain and global warming, thus providing opportunities for additional low-cost reductions of sulfur dioxide emissions.(3) One outgrowth of these developments has been the establishment by the Chicago Board of Trade of an allowance market for such emissions.(4) The rule is also being applied to trade-offs in which industrial and community organizations have been given permission to create artificial wetlands to replace those that have been (or will be) destroyed by industrial and commercial development.

But the broadening of the applications of this rule has not stopped here. In recent months, still wider applications have been explored and implemented. EPA, for example, is now exploring trade-offs among different pollutants within the same medium (for example, trade-offs between releases of oxides of sulfur and oxides of nitrogen to the atmosphere), as well as trade-offs among several media, so called "cross-media" trading whereby releases of one or more pollutants to the atmosphere can be balanced against releases of other pollutants to the water environment.(5) Another recent development has been the approval by EPA of an expansion of the rule so that it can be applied to non-point sources.(6)

To exploit the benefits of this rule, EPA is proposing that it be applied on a generic basis and they are encouraging State and local agencies to create new, innovative programs for its application.(7) In fact, the EPA Assistant Administrator for Air and Radiation has stated that "EPA's experience with these trading programs, and with our own successful acid rain program, (has) led us to conclude that properly structured programs can reduce emissions earlier and cheaper than would otherwise be possible."(8) Dan W. Reicher, J.D., now Chief of Staff, and formerly Assistant Secretary for Policy, Planning and Evaluation, U.S. Department of Energy, has also indicated interest and support for the concept. Concurrently, application of the "open-market trading rule" has received widespread endorsement from various independent "watch-dog" agencies, such as the U.S. General Accounting Office.(9,10) In addition, the concept has been endorsed by a variety of other groups(11,12) and it is being applied internationally as part of the worldwide efforts to reduce airborne emissions that could lead to global warming. One

of the major benefits of this concept is that it requires that an integrated or systems approach be applied to the control of environmental releases of various pollutants.

APPLICATIONS OF THE CONCEPT

Although the applications cited above have proven extremely successful, it appears that the "open-market trading rule" would have even greater benefits in the cleanup of contaminated nuclear facilities and the control of associated wastes. These benefits, which are unique due to the origin of the radiation sources affecting typical population groups, include those of a technical and economic nature as well as public education and goodwill. Perhaps surpassing all of these benefits, however, is the fact that applications of the "open-market trading rule" to the control of environmental radiation exposures may prove to be exactly the vehicle needed to expedite the cleanup of decommissioned commercial nuclear power plants. It may also enable State and local regulatory groups and nuclear facility operators to ensure that financial resources for the control of radiation exposures are being directed to those sources that contribute the highest dose and can be controlled at least cost.

As an example, consider the cleanup of a nuclear facility that is no longer in operation. As in most such cases, the goal will be to assure that offsite population groups will not be exposed to radiation doses in excess of the applicable limits. The basic steps required in applying the rule to such a facility, and the benefits that would be accrued, are outlined below. As will be noted, in certain cases, application of the concept requires changing the ways in which exposures from such sources have been viewed in the past.

1. As an initial step, there would be a need to assess the full range of radiation sources that affect nearby population groups. Such sources include natural background radiation, medical and dental uses, and consumer products, as well as contributions from the facility itself.

The benefits of this exercise would be several. First of all, it would require all concerned parties, both within and outside the facility, to apply an holistic approach to the assessment and evaluation of the various radiation sources affecting nearby members of the public and stakeholders. Other benefits would be gained in terms of public education since it would reveal to nearby groups the major sources of their exposures. In essentially all cases, the nuclear facility would prove to be a minor contributor.

2. The next step would be to rank the various sources according to their relative contributions to the doses to offsite population groups. Once this had been done, the dose rates from each source would be compared to the relevant mandatory limits, where such limits exist. This would lead to the identification of those sources to which controls must be applied and the quantification of the degree of reduction that is necessary. It is only after these basic reductions in dose rates have been achieved that the "open-market trading rule" would be applied.

Included in such an assessment would be the decision on whether the site on which the facility is located is to be released for unrestricted or restricted use -- with appropriate consideration of the degree to which this affects the amount by which the associated dose rates must be reduced. As a minimum, restoration efforts would probably need to be applied to the nuclear facility to reduce the accompanying dose rates to neighboring population groups to the long-term standard dose rate limit of 1 mSv (100 mrem) per year, as recommended by the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements,[13] and as required by the regulations of the U.S. Nuclear Regulatory Commission.[14] Under terms of the "open-market trading rule," additional cleanup of the facility would be required only if it were more cost-effective as compared to other sources affecting local population groups.

3. Subsequent to this step, each individual contributor (from both onsite and offsite sources) to the radiation dose rates to offsite population groups would need to be evaluated in terms of its feasibility for control, including a review of the applicable control technologies, associated costs, and potential societal impacts. On the basis of this evaluation, each source would then be ranked in terms of its priority for reduction and/or control.

Following this approach, public health and regulatory agencies, as well as members of the public, would soon learn that, in many cases, it would be far more effective and less expensive to reduce exposures from indoor radon or medical sources, than to continue to pursue additional cleanup of the nuclear facility. Studies have shown, for example, that reductions in exposures to indoor radon (and its decay products) can be accomplished at relatively low cost.[15,16] Other steps that could be taken include the installation of a more modern (reduced dose) mammography x-ray unit or improved fluoroscopy screen in the local hospital, as well as encouraging wider scale application of newer techniques, such as endoscopy and colonoscopy, in place of x-ray fluoroscopy as a primary means for conducting gastrointestinal examinations. Additional steps that might be considered include developing better controls for handling the excreta from patients to whom radiopharmaceuticals have been administered.

4. Once doses due to releases from the nuclear facility had been reduced to the basic mandatory standard, attention would be directed to the control of other sources for the required additional dose reductions, for example, down to perhaps 0.1 to 0.25 mSv (10 to 25 mrem) per year. As explained above, this would be accomplished by reducing those sources that can be reduced most effectively and at least cost.

Based on this information, a definitive plan of action for remediating the dose rates to the offsite population living in the neighborhood of the given site would be proposed, taking into account the input of the facility operators, regulatory authorities, the local populace, and related stakeholders.

BENEFITS OF THE OPEN-MARKET TRADING RULE

There is a multitude of benefits that would be generated as a result of the application of the "open-market trading rule" to the cleanup of nuclear facilities. To summarize:

1. First and foremost, this rule would require the use of an integrated or systems approach in assessing and controlling the problem. One of the immediate outcomes would be to provide significant latitude to State and local regulatory officials, as well as facility operators, in selecting which sources should be addressed to accomplish the required dose rate reductions.

a. Having been provided this latitude, they could direct attention to sources such as natural radiation background and medical radiation applications, which currently contribute over 95% of the total dose to the average member of the U.S. public.(17) In essence, this would permit them to "put their money where the risk is."

b. This would also permit them to direct their attention to those sources that can be most effectively controlled at least cost.

2. Another benefit would be the significant reductions in the associated costs of cleanup and the volumes of low-level waste that would be generated.

a. Because of the reduced cleanup required, there would be ancillary reductions in the demands on existing cleanup technologies.

b. There would be similar reductions in the expenditures required for the development of new, improved cleanup technologies.

3. This approach would serve as an outstanding tool for educating the public on the relative importance of various radiation sources. In this regard:

a. The procedures involved would offer unusual opportunities for involving and gaining the approval of offsite populations and stakeholders for programs proposed for the cleanup of various nuclear facilities.

b. This approach would enable nuclear facility operators to demonstrate on a one-on-one basis their interest and concern for controlling dose rates to local population groups. In many cases, application of this approach would enable facility operators to reduce the dose rates to neighboring populations to levels less than they were prior to the original construction and operation of the facilities. This becomes possible, as noted above, because of the relatively high dose rates currently coming from medical and natural background sources, such as indoor radon, and the fact that many of these sources can be readily controlled.

4. Application of this rule would enable nuclear facility operators to begin now to reduce the dose rates to offsite population groups, not having to wait until all the environmental and associated administrative and regulatory requirements had been met.

5. It would provide a cushion in case the engineered barriers installed to control environmental releases did not perform as designed, or unanticipated failures occurred in various natural and engineered control systems. In such cases, facility operators could immediately apply additional controls to other radiation sources while awaiting corrections to be made in the controls being applied to the nuclear facility.

6. Application of this policy would enable State and local regulators to apply a risk-based approach to the cleanup of nuclear facilities. This has long been a major goal of the EPA, the U.S. Congress, and many State and local regulators.

7. A program such as this would provide a stimulus to the efforts of the U.S. Environmental Protection Agency and various State and local environmental and public health groups to encourage the monitoring and control of indoor radon exposures to members of the public. It would also provide a stimulus for increased assessment and evaluation of the radiation doses associated with medical procedures.

8. In the case of the nuclear facilities of the U.S. Department of Energy (DOE), such a program would also provide a new and challenging mission for the National Laboratories. These Laboratories represent a rich resource of scientists and engineers whose expertise would be extremely beneficial in evaluating, analyzing, and applying the concepts associated with

such a program. Participation in such activities would bring them into the mainstream of DOE's environmental restoration program.

9. This approach would provide an initial step in the ultimate development of a system for making similar tradeoffs among the various human and environmental impacts of toxic chemicals and radiation sources. Here, again, the National Laboratories could play a major role.

COMMENTARY

As noted above, application of the "open-market trading rule" would offer a range of benefits to State and local officials and industrial organizations in their efforts to improve the cleanup of nuclear facilities, and in bringing a risk-based approach to associated decision-making.

In addition, it appears that application of such a rule would be entirely consistent with directives issued by the President. Under Executive Order 12866,(19) all Federal agencies, including DOE, are required, in setting regulatory priorities, to "consider, to the extent reasonable, the degree and nature of the risks posed by various substances or activities within its jurisdiction," and to "design their regulations in the most cost-effective manner to achieve the regulatory objectives. In doing so, each agency shall consider incentives for innovation, consistency, predictability, the costs of enforcement and compliance (to the government, regulated entities, and the public), flexibility, distributive impacts, and equity," and "each agency shall indentify and assess alternative forms of regulation and shall, to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt."

What is needed is the conduct of several pilot studies to demonstrate the feasibility of the concept through its application to one or more nuclear facilities. In terms of the commercial nuclear utilities, such studies might be directed to one or more of the plants for which decommissioning operations are contemplated. Prime candidates for such studies would be facilities wherein the owner is no longer present or the funds available for cleanup are limited. In terms of DOE, such studies might be directed, for example, to the cleanup operations at Hanford, Idaho Falls, and/or West Valley. Although application of this approach might not prove viable for the control of facilities in which the principal radionuclide contaminants (for example, ^{239}Pu) are extremely long-lived, it would be directly applicable to the control of doses from facilities in which shorter-lived radionuclides, such as ^{60}Co, ^{90}Sr, and ^{137}Cs, were involved. For many commercial nuclear power plants and DOE facilities, a major share of the contaminants is represented by the shorter-lived radionuclides.

Application of the "open-market trading rule" to the control of doses to offsite populations from nuclear facilities would represent professional environmental and public health practices at their best. Since this approach involves an holistic approach to cleanup, it would represent the epitome of the application of the ALARA concept. This approach would also serve, as indicated above, as a superb tool for educating the U.S. public in gaining a better understanding of the relative significance of various radiation sources in their everyday lives. Success in the radiation area could well lead to more widespread applications of the concept including, for example, tradeoffs of exposures from sites containing both radioactive materials and toxic chemicals.

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