# PROPOSED PETITION TO 40 CFR 264 AND 265, "LABELING"

This petition for rulemaking is submitted to the United States Environmental Protection Agency (EPA) following the provisions of the Resource Conservation and Recovery Act and of Title 40 of the Code of Federal Regulations (CFR) Part 260, Subpart C. It demonstrates the petitioners' need for alternative requirements for management of radioactive mixed waste in tanks, containers and waste piles that are subject to interim status and final status label and sign requirements. These requirements are authorized by RCRA and promulgated under 40 CFR Parts 260 through 265. Alternative requirements are needed in order to avoid inconsistencies with the petitioners' obligations under the Atomic Energy Act of 1954, as amended, to protect workers from radiation hazards.

1) **Date:** September 29, 1989

2) **Petitioners' Name and Address:**

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3) **Petitioners' Interest:**

Petitioner U. S. Department of Energy (DOE) owns and petitioners DOE and Westinghouse Hanford Company (WHC) jointly operate a large number of radioactive mixed waste (RMW) treatment, storage and disposal (TSD) facilities at the Hanford Site in Washington state. Many of these TSD facilities would be affected by the proposed changes.

Submission of this petition is required under The Hanford Federal Facility and Consent Order, signed by DOE, the Washington Department of Ecology (Ecology), and EPA on May 15, 1989. Milestone M-22-01 of that Agreement requires DOE to "submit petitions for ... interim status standards to Ecology and EPA" by September 30, 1989[1]. This petition partially fulfills DOE's obligations under this milestone; however, DOE and WHC expect to submit additional petitions in the future. Although Milestone M-22-01 refers only to interim status requirements, this petition also addresses requirements for permitted facilities, because those requirements are similar in many respects.

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[1]Schedules for addressing compliance issues, not subject to petition under Milestone M-22-01 must, under Milestone M-22-01, be negotiated by December 31, 1989. Most compliance issues will be addressed through compliance schedules.

Petitioner DOE is further interested in the RCRA regulatory requirements addressed in this petition because, under the Atomic Energy Act (AEA), DOE shares responsibility for regulating RMW facilities with Ecology and EPA. Petitioner WHC is also interested in better coordination of RCRA regulations and AEA requirements. WHC must comply with the requirements established under those Acts, and the DOE/AEA regulatory system places significant responsibility on detailed radiation protection requirements for workers at DOE facilities.

Due to the unique nature of radioactive mixed waste, compliance with both the AEA and RCRA regulations is difficult because of the need to protect workers from unreasonable radiation exposure. The DOE and contractor staff would like to eliminate these conflicts. Therefore, the petitioners would prefer to resolve these conflicts by revising RCRA regulations where possible. If conflicts cannot be resolved through regulatory rulemaking, however, DOE may need to take other steps appropriate to its responsibilities as an AEA regulatory agency.

We are firmly committed to protecting human health and the environment from any risk posed by RMW management activities. As DOE Order 5400.1 General Environmental Protection Program states, "... it is DOE policy to conduct the Department's operations in compliance with the letter and the and spirit of applicable environmental statutes, regulations, and standards." Environmental compliance is primarily achieved by compliance with DOE Orders and applicable laws and regulations.[6a] For example, DOE Order 5820.2A "Radioactive Waste Management" states that these wastes "shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees and the environment."

Finally, DOE and WHC are very interested in the matters addressed in this petition because a favorable EPA response would enhance the ability of the petitioners to operate RMW facilities under a consistent set of standards. Because RCRA regulations did not anticipate regulation of RMW when written, the radioactive properties and capabilities of RMW were not considered or incorporated. By considering the radioactive nature of the materials involved and the benefits derived from existing worker protection programs, our relationships in cleaning up Hanford will be strengthened.

**4) Proposed Action:**

We propose more flexible RCRA signing requirements for mixed waste facilities in situations where compliance with current RCRA requirements could involve unreasonable radiation exposures. Under the proposed actions, signs could be posted at alternate locations, but would provide the same degree of access control and protection of human health as posting at the locations required by RCRA.

In order to provide the flexibility in placement of signs described above, we suggest the following changes be made to RCRA regulations:[2]

40 CFR 260.10 (definitions) should be amended by adding the following new terms:

"Radioactive mixed waste" or RMW means a waste that contains both a non-radioactive hazardous component and a radioactive component.

"Radioactive component" refers only to the actual radionuclides dispersed or suspended in the RMW substance.

"Potential for unreasonable exposure to radiation" means:

(a) A likelihood of exposure to a radiation dose or dose-rate that is in excess of a radiation limit established under federal or state law; or

(b) A likelihood of exposure to radiation that can be avoided by using alternative means that are equivalent in effect to the unmodified RCRA requirement, and are consistent with the ALARA program of the owner/operator.

"Radiation limit established under federal or state law" includes any dose or dose-rate limits established under the Atomic Energy Act, or under a federal or state worker health or safety regulatory program, including the following:

(a) a radiation dose or dose-rate limit specified in any federal or state regulation, or administrative or judicial order to a facility; or

(b) a radiation dose or dose-rate limit established in any federal or state license or authorization in effect at a facility; or

(c) a dose or dose-rate limit established in written criteria that are consistently appled at a facility to reduce or control worker exposure to radiation. Such written criteria may include, but is not limited to, administrative guidelines, procedures, or contractual limitations.

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[2] This petition parallels a petition that DOE and WHC have submitted to the Washington Department of Ecology. Some action by EPA is required to allow Washington to maintain its RCRA authorization while modifying requirements for RMW. Our suggested approach involves the addition of specific language to key 40 CFR 260, 264, and 265 sections. This approach preserves the current structure of these regulations, makes it unnecessary for operators of non-mixed-waste facilities to deal with mixed waste complications, and makes it readily apparent how requirements for mixed waste facilities would differ from non-mixed-waste facilities.

"As Low As Reasonably Achievable or the acronym ALARA means minimizing radiological or non-radiological exposure to as far below applicable limits or guidance as social, economic, technical and practical considerations permit. The cost of radiation protection and the reasonable allocations of health protection resources are relevant considerations to ALARA determinations.

"ALARA program" means the program implemented by the owner/operator which minimizes human and environmental exposures to radiation substances and conditions, commensurate with sound economics and operating practices.

40 CFR 264.14 (establishing security requirements for permitted facilities) should be amended to add a new subsection (d) for mixed waste facilities, as follows:

(d) In lieu of subsection (c), the owner or operator of a radioactive mixed waste unit that poses a potential for unreasonable exposure to radiation may place the required signs at the point at which access to the area containing the RMW is controlled for radiation protection purposes.

40 CFR 265.14 (establishing security requirements for interim status facilities) should be amended to add a new subsection (d) for mixed waste facilities, as follows:

(d) In lieu of subsection (c), the owner or operator of a radioactive mixed waste unit that poses a potential for unreasonable exposure to radiation may place the required signs at the point at which access to the area containing the RMW is controlled for radiation protection purposes.

40 CFR 264.17 (establishing general requirements for ignitable, reactive, and incompatible wastes at permitted facilities) should be amended by changing the last sentence of subsection (a) as follows:

(a) ...Except for ignitable or reactive RMW in areas for which smoking is prohibited as part of established radiation protection programs under the Atomic Energy Act, "No Smoking" signs must be placed wherever there is a hazard from ignitable or reactive waste.

40 CFR 265.17 (establishing general requirements for ignitable, reactive, and incompatible wastes at interim status facilities) should be amended by changing the last sentence of subsection (a) as follows:

(a) ...Except for ignitable or reactive RMW in areas for which smoking is prohibited as part of established radiation protection programs under the Atomic Energy Act, "No Smoking" signs must be placed wherever there is a hazard from ignitable or reactive waste.

5) Justification of Proposed Action:

In managing RMW, the petitioners must meet the requirements of RCRA for management of the nonradioactive portion of RMW and the requirements of the AEA for management of the radioactive portion. For the requirements being addressed, i.e., RMW signing requirements, compliance with the strict requirements of RCRA is not always consistent with the requirements of the AEA. We have proposed alternate means of signing to allow for management of RMW in such a manner as to meet the goals of both RCRA and the AEA.

This section of the petition demonstrates why the proposed actions are deemed necessary. It explains that DOE facilities must operate under requirements for radiation protection and describes these requirements. It also explains that although these requirements were specifically developed for the purpose of radiation protection, they also result in other benefits, many of which are the same benefits derived from RCRA requirements (i.e., protection of human health and the environment through prevention of waste releases, detection of releases that do occur, and prevention of exposure to hazardous materials). Finally, it explains that in many cases, it is not possible for DOE to meet both radiation protection requirements and RCRA requirements.

Radiation Protection Goals

Radiation protection is a major component of all DOE operations involving radiation and radioactive materials. Radiation protection policies and procedures are given in DOE Orders [6a]. One radiation protection policy in DOE Orders originates from the EPA. The 1987 Presidentially-approved "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" [6b] incorporates radiation protection standards published by the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). This EPA guidance reaffirms the three basic principles governing radiation protection programs:

> "The first is that any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers; i.e., that a finding be made that the activity is 'justified'... The second is that, for justified activities, exposure of the work force should be as low as reasonably achievable (commonly designated by the acronym 'ALARA') ... Finally, to provide an upper limit on risk to individual workers, 'limitation' of the maximum allowed individual dose is required."

Under Executive Order 10831, DOE Orders are required to be consistent with this EPA guidance on radiation protection. For example, DOE Order 5480.11 "Radiation Protection For Occupational Workers," effective December 21, 1988 states:

> "It is the policy of DOE to implement radiation protection standards that are consistent with the Presidential approved guidance to Federal Agencies promulgated by the EPA and based on the recommendations by authoritative organizations."

Consequently, the DOE has adopted the policy of maintaining all radiation doses as far below the established mandatory limits as social, economic, technical, and practical considerations permit (i.e. ALARA). All occupational workers must comply with DOE Order 5480.11 and with contractor administrative manuals for radiation protection and ALARA.

Similarly, the Nuclear Regulatory Commission (NRC) is amending 10 CFR 20 to incorporate the EPA's Presidentially-approved guidance on radiation protection programs. The definition that we propose for a "potential for unreasonable exposure to radiation" reflects the three radiation protection concepts embodied by the EPA-required guidance.

## Radiation Protection Fundamentals

In order to understand radiation protection requirements, it is necessary to understand the nature of exposure to radiation and radioactive materials and the risk posed by such exposure. The following information briefly explains fundamentals concepts of radiation exposure in order to better understand radiation protection requirements for management of RMW.

Radioactive mixed wastes are dangerous wastes which also contain radioactive materials. Radiation exposure from RMW management can result from two modes. The first is exposure to direct radiation. This mode of exposure results from work around radiation sources, which could be the RMW itself or other radioactive materials in the vicinity of the RMW. Protection from this type of exposure is accomplished through physical barriers which will absorb the radiation. The type of barrier required depends on the type of radiation (i.e., alpha, beta, gamma, neutrons, x-ray). The second mode is internal deposition of radioactive materials (e.g., inhalation, ingestion). This mode of exposure can result from work in areas which are radioactively contaminated (i.e., radionuclides are present which can be taken into the body). Protection from this type of exposure is accomplished through use of personal protective equipment (e.g., air purifying respirators) which will prevent internal deposition.

Radionuclides emit different forms of radiation (e.g. alpha, beta, gamma, neutron and X-ray) which can change biological systems. These changes can produce biological damage with different resultant health effects. For example, ionizing radiation is both an initiator and a promoter of carcinogenesis, capable of producing benign or malignant tumors in any living mammalian cell type [6c].
Radiation dose can be received all at once or for much longer periods. Both acute and chronic radiation exposures will produce health effects. These health effects depend upon three main factors which are:

- the magnitude of radiation dose to tissue (i.e. total absorbed dose),
- linear energy transfer (LET), and
- radiation dose-rate.

The first main factor, the magnitude of radiation dose to tissue (or total absorbed dose) is very important. If the total dose that is absorbed by human cells is high enough, the result is irreversible and irreparable. Illness and death can result from a single acute exposure.

Radiation exposure to occupational workers is foremost required to be maintained within control limits. Operational controls for external (and internal) radiation exposure have been established to provide a basis for exposure control planning, and to minimize the possibility of any person inadvertently exceeding the annual occupational dose limits.

DOE operating contractors are also required by DOE Orders to develop and follow administrative dose guidelines to assure that dose limits are not exceeded. Therefore, dose limits and dose guidelines are control levels that are established below levels known to cause any observable health effects in individuals. Dose limits and dose guidelines, as presented in Table 2, cannot be exceeded during RMW management.

Linear energy transfer or LET, is defined as the number of ionizations produced by a radioactive particle along its pathlength. Alpha particles are heavy (dense) charged particles which have a high LET. Thus, alpha particles are slow-moving and produce thousands of ionizations along their pathlength from a single internal deposition. Once deposited, alpha emitting radionuclides ionize the lung and other tissues and can lead to cancer. Since ALARA programs are designed to eliminate internal depositions, any internal depositions of alpha particles are not ALARA.

Dose rate is the third main factor causing health effects. Dose rate can be defined as the amount of radiation exposure measured over time. Areas of very high dose-rate (i.e. more than 5000 mrem/hour[3]) are <u>never</u> entered routinely. Radiation dose guidelines and dose limits would be exceeded in minutes or even seconds. This precludes any practical purpose to such exposures.

In addition to limiting exposure to very high dose rates, the ALARA concept limits exposure to radiation at lower dose rates. The ALARA concept, as required by DOE Order 5480.11, applies to annual dose, committed dose (dose from internally-deposited, long-lived radionuclides), and collective dose (the total of all individual doses). ALARA is based on the assumption that no dose, regardless of how small, is entirely without risk. Thus, reducing radiation dose to a level that is "as low as social, technical, economic, practical and public policy permit" will meet DOE's policy directive to "reduce health risks".

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[3]This petition uses units of radiation exposure and dose from this exposure in multiples of rem or mrem. In actual practice, measurement techniques, dose-rate measurements, and dose assessments differ slightly. However, because of the type of radiation involved and for the purpose of this petition, it is valid to consider exposure, dose, dose equivalent, and committed dose as interchangeable units.

In summary, radiation exposure presents three main areas of concern related to management of RMW:

- Work in radiation areas must be controlled so that the total absorbed dose by workers is kept below limits established for protection of health.

- Work in radioactively contaminated areas must be controlled to minimize the risk of internal deposition of radionuclides. Consistent with ALARA principles, work in highly contaminated areas must be avoided unless justified by the benefit resulting from the exposure.

- Work in radiation areas must be controlled to avoid exposure to high dose rates. Consistent with ALARA principles, all exposure to radiation, regardless of dose rate, must be justified by the benefit resulting from the exposure.

## DOE's Radiation Protection Program

A variety of radiation protection requirements applicable to management of RMW have been established by DOE to ensure that radiation protection goals are met. These requirements are briefly discussed below. As noted in the discussions, in many cases the benefits derived from these requirements are identical to or consistent with the benefits derived from the signing requirements of 40 CFR 264 and 40 CFR 265.

Facilities in which radioactive materials, including RMW, are handled are required to limit access to authorized personnel. All RMW units are within fenced areas that are not accessible to the general public. In addition, many are within controlled access structures. The degree of access control required is dependent on the specific radionuclides present and their amounts, the radiation dose rate present, and the amount of radioactive contamination present.

In all cases, access by the public to radiation zones and radioactively contaminated areas is prohibited. Access control is accomplished through physical barriers (e.g., fences, buildings) and warning signs. The benefit derived through this requirement to prohibit public access is identical to the benefit derived through the requirements under 40 CFR 264.14 and 40 CFR 265.14.
As required by DOE Orders, worker exposure to radiation and radioactive materials must be controlled and monitored. Employees are protected by an additional fence or other physical barrier, as described above, that prevents accidental access to the radiologically controlled areas where RMW is located. All of these barriers have signs with warnings as required by DOE Orders. These signs identify the type of radiological control zone (e.g., dose rate) and the type of radiation hazard present (e.g., surface contamination). Signs are placed at the boundary of the radiation control zone, consistent with radiation protection requirements.

The above signing requirements provide information to personnel who enter radiological control zones. The signs prevent accidental entry to control zones and, therefore, prevent accidental exposure to radiation, consistent with ALARA. The benefit derived from these requirements (i.e., prevention of accidental entry to RMW management areas) is the same as the benefit derived from the signing requirements under 40 CFR 264.14 and 40 CFR 265.14.

Radiation protection requirements also include identification of the risks to employees through required work procedures. To meet radiation protection requirements, all work with radioactive materials, including RMW, must be performed according to written procedures which identify specific radiation protection requirements. Prior to entering and/or performing work in radiologically controlled areas employees must read and understand the written procedures. The procedures must be strictly followed by employees and only work specified in the procedure may be performed. Through implementation of these mandatory procedures, all employees and emergency response personnel are made aware of the risks associated with the radioactive materials with which they work.

The benefit derived from through use of such procedures is that all workers are informed of the risks associated with the radioactive materials that they work with. In the case of work with RMW, this benefit is identical to the benefit derived through the requirements of 40 CFR 264.14 and 40 CFR 265.14.

Required procedures for work in radiologically controlled areas also prohibit smoking in any of these areas. Smoking is not allowed because it increases the risk for exposure to radioactive materials. Through use of these procedures, all employees entering radiologically controlled areas, including all RMW management, are made aware of the fact that smoking is not allowed.

The major benefit derived from use of procedures which prohibit smoking in radiologically controlled areas is radiation protection of workers. An additional benefit with respect to RMW management is that smoking will never occur in areas used for storage of ignitable or reactive RMW. This benefit is identical to the benefit derived from 40 CFR 264.17(a) and 40 CFR 265.17(a).

## Conflicts Between Radiation Protection Requirements and RCRA Requirements

The above discussions have identified radiation protection requirements that are applicable to management of RMW and explained that these requirements result in the same benefits as would result from RCRA signing requirements. The accomplishment of the same benefits through existing radiation protection requirements as would be accomplished through RCRA requirements is one of the key points of our justification. The other key point is that RCRA requirements in some cases present conflicts with radiation protection requirements. In such cases, it is not possible to meet both sets of requirements. The following discussion addresses these conflicts.

In some cases with RMW TSD units, it may not be possible to comply with RCRA signing requirements and still comply with radiation protection requirements. Placement of RCRA-required signs at RMW management areas will result in

exposure of workers to direct radiation. In addition, if the RMW areas are located in radioactively contaminated areas, placement of the signs presents the risk of radiation exposure through internal deposition. If the RMW areas are located in areas of high dose rate, placement of such signs could result in radiation exposure above established limits. In areas with lower dose rate, or areas which are radioactively contaminated, placement of signs could result in exposure which does not comply with ALARA. Additionally, all exposure to radiation must be justified in terms of the benefit that will result. As discussed previously, the benefits derived through compliance with radiation protection requirements are often identical with the benefits associated with RCRA requirements. In such cases, exposure to radiation from signing, even though it would not exceed established numerical limits or guidelines, would not result in a benefit and should not be allowed.

To identify specific conflicts between radiation protection requirements and RCRA signing requirements, the petitioners have made an assessment of the radiation dose which would result from placement of RCRA signs at a number of RMW TSD units at Hanford. This assessment is described in Appendix 2 and identifies specific instances where RCRA signing requirements could not be met while still meeting radiation protection requirements.

## Analysis of Proposed Action

The regulatory changes that the petitioners' have requested will allow the petitioners to avoid conflicts with radiation protection requirements while still managing RMW in ways that provide the same benefits as RCRA compliance. Alternative measures that the petitioners use for RMW include, but are not limited to, providing signs at the point at which access to RMW is controlled for radiation protection purposes.

A detailed analysis of the requested changes follows.

### Definitions

A definition of "potential for unreasonable exposure to radiation" is proposed that embodies the three principles of radiation protection included in the EPA's Presidentially-approved guidance to federal agencies. The definition is presented in terms of "potential for unreasonable exposure", so that an actual overexposure to radiation does not have to exist before accommodations to RCRA requirements can be made.

Therefore, if placement of signs at RMW management areas or maintaining signs would cause a worker to receive an exposure to radiation in excess of numerical limits or guidelines, the signing task can be deemed to represent a "potential for unreasonable exposure to radiation". The proposed definition makes use of dose guidelines because of the way radiation exposure is controlled at DOE facilities. DOE Orders require that administrative guidelines be set to assure that dose limits are not exceeded. (Facilities regulated by the Nuclear Regulatory Commission have similar requirements.) Since RMW area signing activities and maintenance of signs would be conducted

as routine tasks, radiation exposures for these tasks should be managed to the administrative guideline, and not to the limit.

Another precept of radiation protection that is reflected in the proposed definition is the concept of receiving radiation exposure only if and when it is warranted, i.e. when benefit is derived from the exposure. If the benefit of the RCRA signing requirement is fully met by an alternative that requires substantially less radiation dose to implement, radiation protection standards dictate that the alternative be employed. This remains true, provided that the alternative involves doses that are as low as reasonably achievable (ALARA) with social and economic factors taken into consideration.

The principle of ALARA is complex, as it operates to strike a balance between engineering solutions. This balance can reduce radiation exposures to very low levels, and the costs involved with employing those engineering solutions can be very high. Guidance on how to optimize these cost/benefit determinations is provided in Report #26 of the International Council on Radiation Protection. Most, if not all, DOE and NRC regulated facilities have developed their own guidance on how to make ALARA-based decisions.

Thus, the definition of "potential for unreasonable exposure to radiation", "ALARA," and "ALARA program" encompass the major precepts of a radiation protection program. The definitions are needed to allow a determination of "how much radiation exposure is too much". They also provide guidance on when engineering solutions should be employed.

**Area Posting Requirements**

The access points to some areas where RMW are managed are, themselves, within areas posing a potential for unreasonable exposure to radiation. Since access control is maintained through radiological control zones with specific points of entry, it is possible to convey the necessary information to employees and emergency response staff at points of entry removed from the inner areas containing RMW. Through use of radiological control zones, the benefit of 40 CFR 264.14 and 40 CFR 265.14 posting requirements is achieved without the radiation exposure which might result from placement of signs at the entrance to specific areas where RMW are managed.

**No Smoking Signs**

Smoking is not allowed in any area containing radioactive materials. This rule is administratively implemented and enforced at Hanford. Therefore, the posting of "No Smoking" signs is superfluous and represents a potential for unreasonable exposure to radiation in accordance with proposed 40 CFR 260.10. The benefit of 40 CFR 264.17(a) and 40 CFR 265.17(a), namely prevention of smoking in areas where reactive and ignitable wastes are stored, is achieved without placement of signs.

## Conclusion

In conclusion, the petitioners have reflected an appropriate balance of responsibility, authority, and expertise in this petition-for-rulemaking. Established radiation protection requirements and guidance should be used to identify conflicts between Atomic Energy Act and RCRA requirements. Likewise, facility representatives should initiate alternative means of achieving the benefits of RCRA signing requirements. The results of these determinations should be documented. Such documents should be available for inspection by EPA. If the documented demonstrations are inadequate, recourse remains available to both parties under the provisions of RCRA and The Hanford Federal Facility Agreement and Consent Order. This petition has included all of these concepts.

## 6) References

### 6a. Listing Of Applicable DOE and DOE-RL Orders From 5400 and 5480 series

| DOE Order # | Effective Date | Subject |
|---|---|---|
| 5400.1 | 11/09/88 | "General Environmental Protection Program" |
| N 5400.1 | 11/08/86 | "Environmental Policy Statement" |
| 5400.2A | 01/31/89 | "Environmental Compliance Issue Coordination" |
| 5400.3 | 02/22/89 | "Hazardous and Radioactive Mixed Waste Program" |
| N 5400.4 | 08/02/88 | "Integration of Environmental Compliance Processes" |
| 5440.1C | 04/09/85 | "National Environmental Policy Act" |
| N 5480.1A | 05/13/88 | "Safety and Health Policy Statement" |
| 5480.1B | 09/23/86 | "Environment, Safety & Health Program For DOE Operations" |
| N 5480.3 | 03/09/88 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| 5480.3 | 07/09/85 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| N 5480.4 | 06/21/88 | "Preliminary Notification Of Environment, Safety, and Health Concerns" |

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|---|---|---|
| 5480.4 | 05/15/84 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 09/23/86 | "Safety of Nuclear Facilities" |
| 5480.11 | 12/21/88 | "Radiation Protection For Occupational Workers" |
| 5480.14 | 04/26/85 | "Comprehensive Environmental Response, Compensation & Liability Act Program" |
| 5481.1B | 09/23/86 | "Safety Analysis and Review Program" |
| 5482.1B | 09/23/86 | "Environment, Safety & Health Appraisal Program" |

| DOE-RL Order # | Effective Date | Subject |
|---|---|---|
| 5483.1A | 06/22/83 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated Facilities" |
| 5484.1 | 02/24/81 | "Environmental Protection - Safety & Health Protection Information Reporting Requirements" |
| 5440.1A | 02/03/87 | "Implementation of the National Environmental Policy Act At RL" |
| 5480.1 | 05/21/82 | "Environmental Protection, Safety, & Health Protection Program For RL" |
| 5480.1A | 09/07/88 | "Environment, Safety, & Health Program For DOE Operations For RL" |
| 5480.4A | 12/01/87 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 10/15/84 | "Safety of Nuclear Facilities" |
| 5480.10A | 06/20/88 | "Industrial Hygiene Program" |
| 5481.1 | 10/05/83 | "Safety Analysis & Review Program" |
| 5482.1B | 03/04/87 | "Environment, Safety, Health, & Quality Assurance Appraisal & Surveillance Program" |
| 5483.1A | 09/06/88 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated (GOCO) Facilities" |
| 5484.1 | 09/26/83 | "Environmental Protection - Safety Protection Information Reporting Requirements" |

5484.2A 09/24/84 "Unusual Occurrence Reporting System For RL"

6b 52 FR 2822. Radiation Protection Guidance to Federal Agencies for Occupational Exposure; Approval of Environmental Protection Agency Recommendation, The President, Federal Register, January 27, 1987.

6c Mettler, Fred A. (Jr.), M.D. et. al., 1985. Medical Effects of Ionizing Radiation, Grune & Stratton, Inc., 1985.

6d DOE Publication PNL-6577 "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)", July 1988

## Appendix 2

## RCRA Signs and Radiation at Hanford

### Introduction

This appendix provides information concerning estimated worker radiation doses that would result from implementation of RCRA sign requirements at some Hanford RMW TSDs, and compares these doses to radiation protection requirements that have been established at Hanford. Specific examples of areas where workers could be subjected to a potential for unreasonable exposure to radiation from placement of RCRA are detailed. In addition, this appendix demonstrates that existing environmental protection efforts at Hanford often provide the same kinds of benefits that RCRA signs would provide.

### Scope and Methods

Eight Hanford 200 Area TSD Facilities were evaluated, including the 222-S Laboratory, 241-Z Facility, 242-A Evaporator, B-Plant, the Plutonium Uranium Extraction Facility (PUREX), T-Plant, Double-Shell Tanks, and Single-Shell Tanks.

In order to determine whether or not radiation protection requirements could be met, facility representatives were asked to estimate the dose to perform RCRA signing at each identified facility. Questionnaires were presented in a matrix format with each of the signing tasks identified for each of the TSD units of concern.

Facility representatives were instructed to estimate the worker dose for each signing task at each unit, assuming use of customary radiation protection measures as dictated by DOE Orders and contractor manuals. Because these radiation protective measures were typical of those currently in use, the measures were also considered to be ALARA. Representatives were also cautioned not to overestimate the doses, and were not provided with any information on the applicable numerical limits. In this way, the calculated doses were expected to represent a close approximation of the actual dose.

Dose estimates for each task were assessed against the more protective site specific administrative dose guidelines established by Westinghouse Hanford Company to implement DOE directives, not just against DOE regulatory limits. This was done for several important reasons:

- Federal guidance requires use of administrative guidelines as part of an ALARA program.
- DOE Order 5480.11 requires doses to be maintained at ALARA levels.
- Administrative guidelines tend to be more limiting than the established regulatory limits contained in DOE Order 5480.11.

- Installation and maintenance of signs are routine tasks, and workers must not exceed administrative guidelines on a routine basis.

- Existing contracts between labor unions and WHC require management of radiation exposure at ALARA levels within the administrative guidelines.

Whether the dose received from conducting a set of activities is within administrative guidelines depends on all activities involving radiation dose that are conducted by that individual. Placement of signs is a non-recurring requirement, and for this assessment it was assumed that placement of signs in a single area would be the only radiation work each workers would perform in a weeks time. (This is an unrealistic assumption, because most Hanford radiation workers are assigned to multiple tasks each day where they receive dose). Under this assumption, the controlling does guideline is the WHC administrative limit of 300 mrem/week. Sign posting and maintenance tasks involving doses in excess of 300 mrem or dose rates in excess of 5,000 mrem/hour were considered to involve a potential for unreasonable exposure to radiation.

**Dose Estimate Results**

It was apparent that the dose guidelines or dose rate limits would be exceeded at TSD units where dose rates are very high. Since affected facilities had historical proof of these dose rates, no new measurements were made. Next, a screening dose rate was established in those cases where at least one of the DOE regulatory limits would be exceeded. If whole body dose rates were known to be greater than this screening dose-rate at TSD units, no further justification was needed to confirm radiation risk.

The potential for unreasonable exposure to radiation from posting and maintenance of RCRA signs has been documented for the facilities shown in Table 1. A distinction is made for those units where exposure would be in excess of limits and those units where the placement of signs in areas having dose rates in excess of 1 mrem/hr appears to carry no additional benefit. At each affected unit, the information on the signs required for compliance with RCRA would be placed adjacent to the signs or labels warning of radiation hazards under Atomic Energy Act (AEA) requirements. There are similar requirements under DOE Order 5480.11 for placement of radiation warning signs and labels; however, the DOE Order allows their placement in alternate locations consistent with radiation protection requirements. Thus, placement of signs required under RCRA near those required under the AEA provides a common location for communication of hazards present.

**Example**

B-Plant is a facility that manages RMW in areas having a potential for unreasonable exposure to radiation. The following examples illustrate the conflicts between RCRA sign posting requirements and AEA radiation protection

requirements and also illustrate how the proposed changes to 40 CFR 260, 264, and 265 will allow protection of human health and the environment equivalent to current labeling requirements.

### Placement of "Danger" Signs at Entrances

The AEA requires placement of warning signs at the point of entry to radiologically controlled zones. These radiation warning signs are placed at the entrance to the B Plant Canyon and at the entrance to the B Plant crane. Placement of "Danger - Unauthorized Personnel Keep Out" signs next to these radiation warning signs would be required under the proposed 40 CFR 264.14(d) and 265.14(d). 40 CFR 264.14(c) and 265.14(c) require placement of these at the entrance to active portions of the TSD, which could be interpreted to be on the Cell 4 cover block. Placement of signs on the cover block would result in a potential for unreasonable exposure to radiation. Placement of these signs at the entrance to the control zone prevents unauthorized contact with wastes. Placement of signs on the cover block would achieve no additional benefit over the benefit provided by placement at control points as required by the proposed 40 CFR 264.14(d) and 265.14(d).

### Placement of "No Smoking" Signs

Currently, there are no ignitable or reactive wastes stored in Cell 4; however, administrative controls are in effect which eliminate the need to place "No Smoking" signs. These administrative controls, which are required under AEA include:

- Radiation Work Permits which do not allow smoking in a radiation zone and
- The requirement to wear a supplied air respirator that would preclude smoking or open flames.

Since no smoking is allowed in radiation zones, and smoking would not be allowed under the proposed 40 CFR 264.17(a) and 265.17(a) there is no need for "No Smoking" signs. The controls which are currently in place and which would be required under the proposed regulatory changes provide the same benefit to human health and the environment that RCRA-compliant "No Smoking" signs would provide.

TABLE 1

DOE OCCUPATIONAL EXPOSURE LIMITS (DOE 5480.11)

| | |
|---|---|
| Stochastic Effects (whole-body exposure) | 5 rem/yr* |
| Non-Stochastic Effects | |
| Lens of the eye | 15 rem/yr* |
| Extremity | 50 rem/yr* |
| Skin of the whole body | 50 rem/yr* |
| Organ or tissue | 50 rem/yr* |
| Unborn Child | |
| Entire gestation period | 0.5 rem |

* Annual effective dose equivalent

TABLE 4-2

WESTINGHOUSE HANFORD
ADMINISTRATIVE GUIDELINES (WHC 1988)

| | | |
|---|---|---|
| Whole body, head, trunk gonads, lens of eye, red bone marrow, active blood-forming organs | 3 rem/yr | 1.25 rem/qtr |
| | 0.3 in a seven day period** | |
| Unlimited areas of skin | 9 rem/yr | 3 rem/qtr |
| Other organs, tissues, and organ systems (except bone) | 7.5 rem/yr | |
| Bone | 15 rem/yr | ---------- |
| Hands, feet*, and forearms | 15 rem/yr | 5 rem/qtr |

* Annual effective dose equivalent
** Per Union Contract

TABLE 2
POTENTIAL FOR UNREASONABLE EXPOSURE TO RADIATION
Labeling and Signs

| Category | Placement of "No Smoking" sign in Area Near Reactive Waste<br><br>40 CFR 264.17<br>40 CFR 265.17 | Placement and Maintenance of "Danger-Unauthorized Personnel Keep Out" Sign At Entrance to Area<br><br>40 CFR 264.14 (d)<br>40 CFR 265,14 (d) |
|---|---|---|
| Proposed WAC 173-303-040 (131)(a) | 241-Z (4)<br><br>222-S (1) | - B-Plant - All Units (20)*<br><br>- PUREX - Tanks, Waste Piles (9)<br><br>- T-Plant -Tanks (5) * |
| Proposed WAC 173-303-040 (131)(b) | | PUREX Tunnels (2)<br><br>* If signs are posted on cover blocks or canyon deck areas |

# PROPOSED PETITION TO 40 CFR 264 AND 265, "INSPECTIONS"

This petition for rulemaking is submitted to the United States Environmental Protection Agency (EPA) following the provisions of the Resource Conservation and Recovery Act (RCRA) and of Title 40 of the Code of Federal Regulations (CFR) Part 260, Subpart C. It demonstrates the petitioners' need for alternative requirements for management of radioactive mixed in waste tanks, containers and waste piles that are subject to interim status and final status inspection requirements. These inspection requirements are authorized by RCRA and promulgated under 40 CFR Parts 260 through 265. Alternative requirements are needed in order to avoid inconsistencies with the petitioners' obligations under the Atomic Energy Act of 1954, as amended, to protect workers from radiation hazards.

1) **Date:** September 29, 1989

2) **Petitioners' Name and Address:**


United States Department of Energy
Richland Operations Office
Richland, WA. 99352

Attention: Anthony J. Knepp
Telephone: (509) 376-1471

Westinghouse Hanford Company
P. O. Box 1970
Richland, Washington 99352

Attention: Lisa A. Garner
Telephone: (509) 376-5969


3) **Petitioners' Interest:**

Petitioner U. S. Department of Energy (DOE) owns and petitioners DOE and Westinghouse Hanford Company (WHC) jointly operate a large number of radioactive mixed waste (RMW) treatment, storage and disposal (TSD) facilities at the Hanford Site in Washington state. Many of these TSD facilities would be affected by the proposed changes.

Submission of this petition is required under The Hanford Federal Facility and Consent Order, signed by DOE, the Washington Department of Ecology (Ecology), and EPA on May 15, 1989. Milestone M-22-01 of that Agreement requires DOE to "submit petitions for ... interim status standards to Ecology and EPA" by September 30, 1989[1]. This petition partially fulfills DOE's obligations under this milestone; however, DOE and WHC expect to submit additional petitions in the future. Although Milestone M-22-01 refers only to interim status requirements, this petition also addresses requirements for permitted facilities, because those requirements are similar in many respects.

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[1]Schedules for addressing compliance issues, not subject to petition under Milestone M-22-01 must, under Milestone M-22-01, be negotiated by December 31, 1989. Most compliance issues will be addressed through compliance schedules.

Petitioner DOE is further interested in the RCRA regulatory requirements addressed in this petition because, under the Atomic Energy Act (AEA), DOE shares responsibility for regulating RMW facilities with Ecology and EPA. Petitioner WHC is also interested in better coordination of state regulations and AEA requirements. WHC must comply with the requirements established under those Acts, and the DOE/AEA regulatory system places significant responsibility on detailed radiation protection requirements for workers at DOE facilities.

Due to the unique nature of radioactive mixed waste, compliance with both the AEA and RCRA regulations is difficult because of the need to protect workers from unreasonable radiation exposure. The DOE and contractor staff would like to eliminate these conflicts. Therefore, the petitioners would prefer to resolve these conflicts by revising RCRA regulations where possible. If conflicts cannot be resolved through regulatory rulemaking, however, DOE may need to take other steps appropriate to its responsibilities as an AEA regulatory agency.

We are firmly committed to protecting human health and the environment from any risk posed by RMW management activities. As DOE Order 5400.1 General Environmental Protection Program states, "... it is DOE policy to conduct the Department's operations in compliance with the letter and the and spirit of applicable environmental statutes, regulations, and standards." Environmental compliance is primarily achieved by compliance with DOE Orders and applicable laws and regulations.[6a] For example, DOE Order 5820.2A "Radioactive Waste Management" states that these wastes "shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees and the environment."

Finally, DOE and WHC are very interested in the matters addressed in this petition because a favorable Ecology response would enhance the ability of the petitioners to operate RMW facilities under a consistent set of standards. Because RCRA regulations did not anticipate regulation of RMW when written, the radioactive properties and capabilities of RMW were not considered or incorporated. By considering the radioactive nature of the materials involved and the benefits derived from existing worker protection programs, our relationships in cleaning up Hanford will be strengthened.

## 4) Proposed Action

We propose more flexible inspection requirements for mixed waste facilities, in situations where compliance with current hazardous waste regulation requirements could involve the potential for unreasonable radiation exposures. In order to modify current inspection requirements, operators would be required to document their determination that radiation exposures resulting from hazardous waste regulation compliance could be unreasonable, and would be required to implement and document alternative practices to achieve the same kinds of benefits as are achieved by RCRA inspections.

In order to provide the flexibility and accountability described above, we suggest the following changes be made to RCRA hazardous waste regulations:[2]

40 CFR 260.10 (definitions) should be amended by adding the following new terms:

"Radioactive mixed waste" or RMW means a waste that contains both a non-radioactive hazardous component and a radioactive component.

"Radioactive component" refers only to the actual radionuclides dispersed or suspended in the RMW substance.

"Potential for unreasonable exposure to radiation" means:

(a) A likelihood of exposure to a radiation dose or dose-rate that is in excess of a radiation limit established under federal or state law; or

(b) A likelihood of exposure to radiation that can be avoided by using alternative means that are equivalent in effect to the unmodified RCRA requirement, and are consistent with the ALARA program of the owner/operator.

"Radiation limit established under federal or state law" includes any dose or dose-rate limits established under the Atomic Energy Act, or under a federal or state worker health or safety regulatory program, including the following:

(a) a radiation dose or dose-rate limit specified in any federal or state regulation, or administrative or judicial order to a facility; or

(b) a radiation dose or dose-rate limit established in any federal or state license or authorization in effect at a facility; or

(c) a dose or dose-rate limit established in written criteria that are consistently applied at a facility to reduce or control worker exposure to radiation. Such written criteria may include, but is not limited to, administrative guidelines, procedures, or contractual limitations.

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[2] This petition parallels a petition that DOE and WHC have submitted to the Washington Department of Ecology. Some action by EPA is required to allow Washington to maintain its RCRA authorization while modifying requirements for RMW. Our suggested approach involves the addition of specific language to key 40 CFR 260, 264, and 265 sections. This approach preserves the current structure of these regulations, makes it unnecessary for operators of non-mixed-waste facilities to deal with mixed waste complications, and makes it readily apparent how requirements for mixed waste facilities would differ from non-mixed-waste facilities.

"As Low As Reasonably Achievable or the acronym ALARA means minimizing radiological or non-radiological exposure to as far below applicable limits or guidance as social, economic, technical and practical considerations permit. The cost of radiation protection and the reasonable allocations of health protection resources are relevant considerations to ALARA determinations.

"ALARA program" means the program implemented by the owner/operator which minimizes human and environmental exposures to radiation substances and conditions, commensurate with sound economics and operating practices.

40 CFR 264.15 (establishing general inspection requirements for permitted facilities) should be amended to add a new subsection (e) for mixed waste facilities, as follows:

(e) The requirements in 40 CFR 264.15 (a), (b), (c) and (d) shall be modified for units containing RMW, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under subsection (b)(1), and must include a written summary of the basis for the operator's determination. At mixed waste units where such a determination has been made, the requirements of 40 CFR 264.15 are modified as follows:

(1) For "inspect" in subsection (a), substitute "inspect, monitor, or otherwise manage";

(2) For "schedule for inspecting" in subsection (b)(1), substitute "schedule for inspecting, and/or plan for otherwise assuring the condition of";

(3) For "inspections" in subsections (a), (b)(4) and (d), substitute "inspections or other periodic activities";

(4) For "inspection" in subsections (b)(3), (b)(4), (c) and (d) substitute "inspection or other periodic activity";

(5) For "inspected daily" in subsection (b)(4) substitute "inspected or monitored at an appropriate interval"; and

(6) For "inspection log or summary" in subsection (d) substitute "inspection log or operating record".

40 CFR 265.15 (establishing general inspection requirements for interim status facilities) should be amended to add a new subsection (e) for mixed waste facilities, as follows:

(e) The requirements in 40 CFR 265.15 (a), (b), (c) and (d) shall be modified for units containing RMW, if the owner or operator reasonably determines that compliance with those requirements

would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under subsection (b)(1), and must include a written summary of the basis for the operator's determination. At mixed waste units where such a determination has been made, the requirements of 40 CFR 265.15 are modified as follows:

(1) For "inspect" in subsection (a), substitute "inspect, monitor, or otherwise manage";

(2) For "schedule for inspecting" in subsection (b)(1), substitute "schedule for inspecting, and/or plan for otherwise assuring the condition of";

(3) For "inspections" in subsections (a), (b)(4) and (d), substitute "inspections or other periodic activities";

(4) For "inspection" in subsections (b)(3), (b)(4), (c) and (d) substitute "inspection or other periodic activity";

(5) For "inspected daily" in subsection (b)(4) substitute "inspected or monitored at an appropriate interval"; and

(6) For "inspection log or summary" in subsection (d) substitute "inspection log or operating record".

40 CFR 264.174 (specifying additional weekly container inspection requirements for permitted facilities) should be amended by identifying the current language as subsection (a) and by adding a new subsection (b) for mixed waste facilities, as follows:

(b) The requirements of subsection (a) shall not apply to areas where containers of radioactive mixed waste are stored, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under 40 CFR 264.15(b)(1), and must include a written summary of the basis for the operator's determination. At mixed waste storage areas where such a determination has been made, the owner or operator shall inspect, monitor, or otherwise manage containers and container storage areas to prevent and detect leakage from containers, and deterioration of containers and containment systems.

40 CFR 265.174 (specifying additional weekly container inspection requirements for interim status facilities) should be amended by identifying the current language as subsection (a) and by adding a new subsection (b) for mixed waste facilities, as follows:

(b) The requirements of subsection (a) shall not apply to areas where containers of radioactive mixed waste are stored, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under 40 CFR 265.15(b)(1), and must include a written summary of the basis for the operator's determination. At mixed waste storage areas where such a determination has been made, the owner or operator shall inspect, monitor, or otherwise manage containers and container storage areas to prevent and detect leakage from containers, and deterioration of containers and containment systems.

40 CFR 264.195 (specifying inspection requirements for tank systems at permitted facilities) should be amended by adding a new subsection (e) for mixed waste tank systems, as follows:

(e) The requirements of subsections (a) and (b) shall be modified for tank systems that contain radioactive mixed waste, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under 40 CFR 264.15(b)(1), and must include a written summary of the basis for the operator's determination. For radioactive mixed waste tank systems where such a determination has been made, the requirements of subsections (a) and (b) are modified as follows:

(1) For "inspecting overfill controls" in subsection (a), substitute "verifying the proper operation of overfill control systems";

(2) For "inspect at least once each operating day" in subsection (b), substitute "inspect or monitor, at a frequency appropriate to the radiation exposure and hazard to the environment involved";

(3) For "externally accessible portion of the tank system" in subsection (b)(3), substitute "those portions of the tank system that are reasonably accessible, considering the radiation exposure and hazard to the environment involved"

40 CFR 265.195 (specifying inspection requirements for tank systems at permitted facilities) should be amended by adding a new subsection (e) for mixed waste tank systems, as follows:

(e) The requirements of subsections (a) and (b) shall be modified for tank systems that contain radioactive mixed waste, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the

written schedule required under 40 CFR 265.15(b)(1), and must include a written summary of the basis for the operator's determination. For radioactive mixed waste tank systems where such a determination has been made, the requirements of subsections (a) and (b) are modified as follows:

(1) For "inspecting overfill controls" in subsection (a), substitute "verifying the proper operation of overfill control systems";

(2) For "inspect at least once each operating day" in subsection (b), substitute "inspect or monitor, at a frequency appropriate to the radiation exposure and hazard to the environment involved";

(3) For "externally accessible portion of the tank system" in subsection (b)(3), substitute "those portions of the tank system that are reasonably accessible, considering the radiation exposure and hazard to the environment involved"

## 5) Justification of Proposed Action

In managing RMW, the petitioners must meet the requirements of RCRA for management of the hazardous, nonradioactive component of RMW and the requirements of the AEA for management of the radioactive component. For the requirements being addressed, i.e. inspections, strict compliance with the requirements of RCRA cannot always conform with the requirements of the AEA. We have proposed alternate means of inspection to allow for management of RMW in such a manner as to meet the goals of both RCRA and the AEA.

This section of the petition demonstrates why the proposed actions are deemed necessary. It explains how DOE facilities must operate under requirements for radiation protection and describes these requirements. It also explains that although these requirements were specifically developed for the purpose of radiation protection, they also result in other benefits, many of which are the same benefits derived from RCRA requirements (i.e., protection of human health and the environment). Finally, it explains that in many cases, it is not possible for DOE to meet both radiation protection requirements and RCRA requirements.

### Radiation Protection Goals

Radiation protection is a major component of all DOE operations involving radiation and radioactive materials. Radiation protection policies and procedures are given in DOE Orders. One radiation protection policy in DOE Orders originates from the EPA. The 1987 Presidentially-approved "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" [6b] incorporates radiation protection standards published by the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). This EPA guidance reaffirms the three basic principles governing radiation protection programs:

> "The first is that any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers; i.e., that a finding be made that the activity is 'justified'... The second is that, for justified activities, exposure of the work force should be as low as reasonably achievable (commonly designated by the acronym 'ALARA') ... Finally, to provide an upper limit on risk to individual workers, 'limitation' of the maximum allowed individual dose is required."

DOE Orders are required to be consistent with this EPA guidance on radiation protection. For example, DOE Order 5480.11 "Radiation Protection For Occupational Workers," effective December 21, 1988 states:

> "It is the policy of DOE to implement radiation protection standards that are consistent with the Presidential approved guidance to Federal Agencies promulgated by the EPA and based on the recommendations by authoritative organizations."

Consequently, the DOE has adopted the policy of maintaining all radiation doses as far below the limits as social, economic, technical, and practical considerations permit (i.e. ALARA) in its Orders. All occupational workers must comply with DOE Order 5480.11, Orders from regional DOE offices, and with contractor administrative manuals for radiation protection and ALARA.

Similarly, the Nuclear Regulatory Commission (NRC) is amending 10 CFR 20 to incorporate the EPA's Presidentially-approved guidance on radiation protection programs. The definitions that we propose for a "potential for unreasonable exposure to radiation" reflect the three radiation protection concepts embodied by the EPA-required guidance.

## Radiation Protection Fundamentals

In order to understand radiation protection requirements, it is necessary to understand the nature of exposure to radiation and radioactive materials and the risk posed by such exposure. The following information briefly explains fundamentals concepts of radiation exposure in order to better understand radiation protection requirements for management of RMW.

Radioactive mixed wastes are hazardous wastes which also contain radioactive materials. Radiation exposure from RMW management can result from two modes. The first is exposure to direct radiation. This mode of exposure results from work around radiation sources, which could be the RMW itself or other radioactive materials in the vicinity of the RMW. Protection from this type of exposure is accomplished through physical barriers which will shield only a portion of the radiation. The type of barrier required depends on the type of radiation (i.e., alpha, beta, gamma, neutrons, x-ray). The second mode is internal deposition of radioactive materials (e.g., inhalation, ingestion). This mode of exposure can result from work in areas which are radioactively contaminated (i.e., radionuclides are present which can be taken into the body). Protection from this type of exposure is accomplished through use of

personal protective equipment (e.g., supplied-air respirators) which will prevent internal deposition.

Radionuclides emit different forms of radiation (e.g. alpha, beta, gamma, neutron and X-ray) which can change biological systems. These changes can produce biological damage with different resultant health effects. For example, ionizing radiation is both an initiator and a promoter of carcinogenesis, capable of producing benign or malignant tumors in any living mammalian cell type.[6c]

Radiation dose can be received all at once or for much longer periods. Both acute and chronic radiation exposures can produce adverse health effects. These health effects depend upon three main factors which are:

- the magnitude of radiation dose to tissue (i.e. total absorbed dose),
- linear energy transfer (LET), and
- radiation dose-rate.

The first main factor, the magnitude of radiation dose to tissue (or total absorbed dose) is very important. If the total dose that is absorbed by human cells is high enough, the result is irreversible and irreparable. Illness and death can result from a single acute exposure.

Radiation exposure to occupational workers is foremost required to be maintained within control limits. Operational controls for external (and internal) radiation exposure have been established to provide a basis for exposure control planning, and to minimize the possibility of any person inadvertently exceeding the annual occupational dose limits.

DOE operating contractors are also required by DOE Orders to impose administrative dose guidelines to assure that dose limits are not exceeded. Therefore, dose limits and dose guidelines are control levels that are established below levels known to cause any observable health effects in individuals. Dose limits and dose guidelines, as presented in Table 1, must be maintained during RMW management.

Linear energy transfer or LET, is defined as the number of ionizations produced by a radioactive particle along its pathlength. Alpha particles are heavy (dense) charged particles which have a high LET. Thus, alpha particles are slow-moving and produce thousands of ionizations along their pathlength from a single internal deposition. Once deposited, alpha-emitting radionuclides ionize the lung and other tissues and can lead to cancer. Since ALARA programs are designed to minimize radiation exposure and to eliminate internal depositions, any internal depositions are not ALARA.

Dose-rate is the third main factor which can cause adverse health effects. Dose-rate can be defined as the amount of radiation exposure measured over

time. Areas of very high dose-rate (i.e. more than 5000 mrem/hour[3]) are never entered routinely. Radiation dose guidelines and dose limits would be exceeded in minutes or even seconds. This precludes any practical purpose to such exposures.

In addition to limiting exposure to very high dose-rates, the ALARA concept limits exposure to radiation to lower dose-rates. The ALARA concept, as required by DOE Order 5480.11, applies to annual dose, committed dose (dose from internally-deposited, long-lived radionuclides), and collective dose (the total of all individual doses). ALARA is based on the assumption that no dose, regardless of how small, is entirely without risk. Thus, reducing dose to a level that is "as low as social, technical, economic, practical and public policy permit" will meet DOE's policy directive to "reduce health risks" [7d].

In summary, radiation exposure presents three main areas of concern related to management of RMW:

- Work in radiation areas must be controlled so that the total absorbed dose by workers is kept as far below limits or guidelines as established for protection of human health.

- Work in radioactively contaminated areas must be controlled to minimize the risk of internal deposition of radionuclides. Consistent with ALARA principles, potential exposure to radiation must be avoided unless justified by the benefit resulting from the exposure.

- Work in radiation areas must be controlled to avoid exposure to high dose-rates. Consistent with ALARA principles, all exposure to radiation, regardless of dose-rate, must be justified by the benefit resulting from the exposure.

## Radiation Protection Requirements

A variety of radiation protection requirements, applicable to management of RMW, have been established by DOE to ensure that radiation protection goals are met. As noted in this section, the benefits derived from DOE's management of RMW coincide with the benefits derived from the inspection requirements of RCRA. In many cases, existing programs derive benefits that are fully protective of human health and the environment, without unreasonable dose.

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[3] This petition uses units of radiation exposure and dose from this exposure in multiples of rem or mrem. In actual practice, measurement techniques, dose-rate measurements, and dose assessments differ slightly. However, because of the type of radiation involved and for the purpose of this petition, it is valid to consider exposure, dose, dose equivalent, and committed dose as interchangeable units.

DOE facilities store, treat or dispose of RMW in tanks, containers or waste piles in inaccessible areas in order to minimize radiation dose to workers. Containers and waste piles usually consist of solid materials such as lead, and not liquid materials. Without liquids, the potential for leaks and spills is extremely low. Therefore, benefits derived from physical inspections of solids are questionable, especially with the resultant worker exposures.

Canyon facilities contain the RMW units inside concrete-encased cells that drain to an encased header and to one tank which is very highly radioactive. The stainless-steel tank system is monitored by radiation leak detection equipment and recorded continuously in an operating gallery. It also has overfill spill control equipment, consisting of weight factor (WF) records and alarms, also located in an operating gallery. Calibration of instrumentation occurs at least annually to ensure instrument operability. Constant air monitors also monitor the radioactive concentration of the surrounding air. Personnel are present on every shift to respond to alarms. And, surveillance of tank volumes are continuously monitored at least twice every 8 hours.

Canyon facilities also have cranes which enable the crane operator to remove the concrete cell block that covers the RMW units when operation or maintenance is needed. Using mirrors, the crane operator can visually inspect the inside of the cell without receiving excessive radiation dose, and record the observations in a logbook. The crane operator is, therefore, able to inspect areas subject to spills, construction materials and external tank areas, and above-ground portions of the tank system for corrosion or potential releases.

When combined, the benefits derived from these canyon activities produce the same benefits as those derived from 40 CFR 264 and 265 daily inspection requirements without unreasonable exposure. Administrative control systems such as radiation safety requirements, operating safety requirements and procedures, and maintenance procedures, help maximize these derived benefits.

Other radiation detection systems and physical devices are also present that provide equivalent benefits to the general inspections from 40 CFR 264.15 and 265.15. Examples of safety systems and devices include access control to canyons only by the facility dispatcher, and in-cell fire protection equipment. These systems are operated and monitored from areas where the potential for workers to unreasonable exposure to radiation does not exist. Further, administrative controls help ensure the operating and monitoring capabilities of these systems in order to derive the benefits from these systems.

Double-shell underground storage tanks containing RMW derive similar benefits from the radiation leak detection devices. Leak detection equipment is remotely monitored by the Computer Automated Surveillance System (CASS), which is continuously manned around-the-clock. Physical readings are taken and monitoring data is reviewed every shift. Tank pressures and liquids levels are inspected prior to, and during, liquid transfers, and also monitored by CASS. Transfer pumps automatically shut-down, if this overfill/spill control equipment fails and the transfer automatically ceases. Personnel walk-through the tank farm to note off-standard conditions daily. Above-ground portions of

tank systems are inspected on these walk-throughs. With the administrative controls, benefits derived from these activities are equal to RCRA tank inspections under 40 CFR 264 Subpart J and 40 CFR 265 Subpart J.

In addition, accessible areas to double-shell tank units have monitoring equipment such as constant air monitors and radiation area monitors that also connect to CASS. Tank exhausters and annulus exhausters are also monitored each shift. Tank farm fences are locked when unmanned. Thus, the existing program derives benefits which are like those of RCRA general inspections.

Single-shell underground storage tank units with RMW derive benefits from leak detectors linked to CASS and from manual tape measurements of tank volumes. The units are on a schedule to pump the pumpable liquid out of the tanks, and only the saltcake and interstitial liquids will remain, unless removed, until final closure. Single-shell tanks derive similar benefits as double-shell tanks. Single-shell tanks will be closed under interim status.

## Conflicts Between Radiation Protection Requirements and RCRA Requirements

The above discussions have identified radiation protection requirements that are applicable to management of RMW and explained that these requirements result in the same benefits as would result from RCRA inspection requirements. The accomplishment of the same benefits through existing radiation protection requirements as would be accomplished through state requirements is one of the key points of our justification. The other key point is that RCRA requirements in some cases present conflicts with radiation protection requirements. In such cases, it is not possible to meet both sets of requirements. The following discussion addresses these conflicts.

In some cases with RMW TSD units, it is not possible to comply with RCRA inspection requirements and still comply with radiation protection requirements. Inspection of RMW tanks and containers will result in exposure of workers to direct radiation. In addition, if the tanks or containers are located in radioactively contaminated areas, inspection presents the risk of radiation exposure through internal deposition. If the containers or tanks are located in areas of high dose rate, inspection could result in radiation exposure above established limits. In areas with lower dose rate, or areas which are radioactively contaminated, inspections could result in exposure which does not comply with ALARA.

Under ALARA, all exposure to radiation must be justified in terms of the benefit that will result. As discussed previously, the benefits derived through compliance with radiation protection requirements are often identical with the benefits associated with state requirements. In such cases, exposure to radiation from inspection, even though it would not exceed limits, would not result in a benefit and not comply with ALARA.

To identify specific conflicts between radiation protection requirements and state inspection requirements, the petitioners have made an assessment of the radiation dose which would result from inspections at a number of RMW TSD units at Hanford. This assessment is described in Appendix 1 and identifies

specific instances where state inspections could not be met while still meeting radiation protection requirements.

A detailed analysis of the requested changes will now be described.

## Analysis of Proposed Action

### Definitions

A definition of "potential for unreasonable exposure to radiation" is proposed that embodies the three principles of radiation protection included in the EPA's Presidentially-approved guidance to federal agencies. The definition is presented in terms of "potential for unreasonable exposure", so that an actual overexposure to radiation dose not have to occur before changes to RCRA requirements can be made.

Therefore, if performing an inspection would cause a worker to receive an exposure to radiation in excess of numerical limits or guidelines, the inspection can be deemed to represent the "potential for unreasonable exposure to radiation". The proposed definition makes use of dose guidelines because of the way radiation exposure is controlled at DOE facilities. DOE Orders require that administrative guidelines be set to assure that dose limits are not exceeded. Facilities regulated by the Nuclear Regulatory Commission have similar requirements. Since nearly all inspection activities are routine tasks, radiation doses from these tasks should be managed to the administrative guideline, and not to the federal numerical limit.

Another precept of radiation protection, reflected in the proposed definition, is the concept of receiving radiation dose only if and when it is warranted, i.e. when benefit is derived from the exposure causing this dose. If the benefit of the RCRA requirement is fully met by an alternative that requires substantially less radiation dose to implement, radiation protection standards dictate that the alternative is used. It must be understood, however, that the alternative represents doses that are as low as reasonably achievable (ALARA) with all appropriate factors taken into consideration.

The principle of ALARA is complex, as it operates to strike a balance between engineering solutions, minimization of radiation risk, and the costs involved with minimizing that risk. Guidance on how to optimize these cost/benefit determinations is described in Report # 26 of the International Council on Radiation Protection. Most, if not all, DOE and NRC regulated facilities have developed their own guidance on how to make ALARA-based decisions.

Thus, the definitions for "potential for unreasonable exposure to radiation", "radiation limit established under federal or state law", "As Low As Reasonably Achievable..." and "ALARA program" encompass the major precepts of a radiation protection program as required by EPA guidance. The proposed definitions are needed to allow a determination of "how much radiation exposure is too much". The definitions also provide guidance on how engineering solutions should be implemented when minimizing radiation risk.

### General Inspection Requirements

As long as RCRA general inspection requirements, implicitly or explicitly, require a physical, personal inspection of the vicinity of an RMW unit, there will be conflicts with radiation protection requirements. Appendix 1 to this petition describes some areas at Hanford where these conflicts occur. We are requesting changes to RCRA inspections to resolve these conflicts at RMW units.

We also agree to demonstrate by documentation: (1) areas where situations of the "potential for unreasonable exposure to radiation" exist (i.e. the conflict), and (2) an effective alternative means of meeting the intent of the original RCRA requirement that is consistent with radiation protection requirements (i.e. the resolution).

Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility. RCRA's general requirements for the written inspection plan are retained in this proposal for rulemaking. Changes are sought only to allow different methods of inspection, testing, and monitoring and facility-specified frequencies for inspections, tests and monitoring. In addition, inspection plans will be available for review, and will be reviewed by EPA and the public during the final permitting process.

### Container Inspection Requirements

Petitioners DOE and WHC request changes from the specific method of inspections and the frequency of inspections of RMW containers. The reasons and methods of resolution are the same as those proposed for the RCRA general inspection requirements. Appendix 1 describes some areas of Hanford where these conflicts occur.

The petitioners also agree to demonstrate by documentation both the areas where situations of conflict occur and the resolution of these conflicts. Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility.

### Tank System Inspections

Similarly, the petitioners request changes to the specific method of inspections and the specific frequency of inspections of RMW tanks. Appendix 1 describes some areas of Hanford where these conflicts occur.

The petitioners agree to demonstrate by documentation both the areas where situations of conflict occur and the resolution of these conflicts. Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility.

## Summary

In conclusion, we have reflected an appropriate balance of responsibility, authority, and expertise in this petition-for-rulemaking. Established radiation protection requirements and guidance should be used to identify conflicts between Atomic Energy Act and RCRA requirements. Likewise, facility representatives should initiate alternative means of meeting the intent of state inspection requirements. The results of these determinations should be documented. Such documents will be available for review and will be reviewed by EPA and the public during the final permitting process. If the documented demonstrations are inadequate, recourse remains available to these parties under RCRA provisions and The Hanford Federal Facility Agreement and Consent Order. This petition has included all of these concepts.

## 6) References

### 6a. Listing Of Applicable DOE and DOE-RL Orders From 5400 and 5480 series

| DOE Order # | Effective Date | Subject |
|---|---|---|
| 5400.1 | 11/09/88 | "General Environmental Protection Program" |
| N 5400.1 | 11/08/86 | "Environmental Policy Statement" |
| 5400.2A | 01/31/89 | "Environmental Compliance Issue Coordination" |
| 5400.3 | 02/22/89 | "Hazardous and Radioactive Mixed Waste Program" |
| N 5400.4 | 08/02/88 | "Integration of Environmental Compliance Processes" |
| 5440.1C | 04/09/85 | "National Environmental Policy Act" |
| N 5480.1A | 05/13/88 | "Safety and Health Policy Statement" |
| 5480.1B | 09/23/86 | "Environment, Safety & Health Program For DOE Operations" |
| N 5480.3 | 03/09/88 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| 5480.3 | 07/09/85 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| N 5480.4 | 06/21/88 | "Preliminary Notification Of Environment, Safety, and Health Concerns" |

| | | |
|---|---|---|
| 5480.4 | 05/15/84 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 09/23/86 | "Safety of Nuclear Facilities" |
| 5480.11 | 12/21/88 | "Radiation Protection For Occupational Workers" |
| 5480.14 | 04/26/85 | "Comprehensive Environmental Response, Compensation & Liability Act Program" |
| 5481.1B | 09/23/86 | "Safety Analysis and Review Program" |
| 5482.1B | 09/23/86 | "Environment, Safety & Health Appraisal Program" |

| DOE-RL Order # | Effective Date | Subject |
|---|---|---|
| 5483.1A | 06/22/83 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated Facilities" |
| 5484.1 | 02/24/81 | "Environmental Protection - Safety & Health Protection Information Reporting Requirements" |
| 5440.1A | 02/03/87 | "Implementation of the National Environmental Policy Act At RL" |
| 5480.1 | 05/21/82 | "Environmental Protection, Safety, & Health Protection Program For RL" |
| 5480.1A | 09/07/88 | "Environment, Safety, & Health Program For DOE Operations For RL" |
| 5480.4A | 12/01/87 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 10/15/84 | "Safety of Nuclear Facilities" |
| 5480.10A | 06/20/88 | "Industrial Hygiene Program" |
| 5481.1 | 10/05/83 | "Safety Analysis & Review Program" |
| 5482.1B | 03/04/87 | "Environment, Safety, Health, & Quality Assurance Appraisal & Surveillance Program" |
| 5483.1A | 09/06/88 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated (GOCO) Facilities" |
| 5484.1 | 09/26/83 | "Environmental Protection - Safety Protection Information Reporting Requirements" |

5484.2A 09/24/84 "Unusual Occurrence Reporting System For RL"

6b 52 FR 2822. Radiation Protection Guidance to Federal Agencies for Occupational Exposure; Approval of Environmental Protection Agency Recommendation, The President, Federal Register, January 27, 1987.

6c Mettler, Fred A. (Jr.), M.D. et. al., 1985. Medical Effects of Ionizing Radiation, Grune & Stratton, Inc., 1985.

6d DOE Publication PNL-6577 "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)", July 1988

## Appendix 1

## RCRA Inspections and Radiation at Hanford

### Introduction

This appendix provides information concerning estimated worker radiation doses that would result from RCRA inspections at some Hanford RMW TSDs, and compares these doses to radiation protection requirements that have been established at Hanford. Specific examples of areas where workers could be subjected to a potential for unreasonable exposure to radiation from RCRA inspections are detailed. In addition, this appendix demonstrates that existing environmental protection efforts at Hanford often provide the same kinds of benefits that RCRA inspections would provide.

### Scope and Methods

Eight Hanford 200 Area TSD Facilities were evaluated, including the 222-S Laboratory, 241-Z Facility, 242-A Evaporator, B-Plant, the Plutonium Uranium Extraction Facility (PUREX), T-Plant, Double-Shell Tanks, and Single-Shell Tanks.

In order to determine whether or not radiation protection requirements could be met, facility representatives were asked to estimate the dose to perform RCRA inspection at each identified facility. Questionnaires were presented in a matrix format with each of the inspection tasks identified for each of the TSD units of concern.

Facility representatives were instructed to estimate the worker dose for each inspection task at each unit, assuming use of customary radiation protection measures as dictated by DOE Orders and contractor manuals. Because these radiation protective measures were typical of those currently in use, the measures were also considered to be ALARA. Representatives were also cautioned not to overestimate the doses, and were not provided with any information on the applicable numerical limits. In this way, the calculated doses were expected to represent a close approximation of the actual dose.

Dose estimates for each task were assessed against the more protective site specific administrative dose guidelines established by Westinghouse Hanford Company to implement DOE directives, not just against DOE regulatory limits. This was done for several important reasons:

- Federal guidance requires use of administrative guidelines as part of an ALARA program.
- DOE Order 5480.11 requires doses to be maintained at ALARA levels.
- Administrative guidelines tend to be more limiting than the established regulatory limits contained in DOE Order 5480.11.

- Inspections are routine tasks, and workers must not exceed administrative guidelines on a routine basis.

- Existing contracts between labor unions and WHC require management of radiation exposure at ALARA levels within the administrative guidelines.

Whether the dose received form conducting a periodic activity is within administrative guidelines depends on the frequency at which a given individual repeats that activity, and on the other activities involving radiation dose that are also conducted by that individual. For this assessment, it was assumed that any given individual would perform a RCRA inspection at only one RMW unit, at the frequency required under RCRA. Using this assumption, each recurring inspection task could be conducted in a manner consistent with radiation protection requirements if it resulted in exposure for that worker that was within the administrative guideline. Under these circumstances, the only radiation work each of these workers could do would be the single RCRA inspection at a single RMW unit. This is highly unrealistic, because most Hanford radiation workers are assigned to multiple tasks each day where they receive dose.

To compare estimated doses to administrative dose guidelines, limits were established by a "RCRA Inspection Task Effective Dose Limit" or RITEDL. These limits, based on ALARA principles, are defined by the relationship:

$$\text{RCRA Inspection Task Effective Dose Limit} = \frac{\text{Administrative dose guideline for time period}}{\text{Number of times the RCRA inspection task is performed as required per time interval}}$$

Assuming that an individual worker is assigned to a single daily RCRA inspection task for one year, and this individual works 240 days per year (i.e. 5 days per week for 50 weeks per year, with 10 days off for holidays each year), the daily RITEDL is calculated to be:

$$\text{Daily RITEDL} = \frac{3\ \text{rem/year}}{240\ \text{work-days/year}} = 12.5\ \text{mrem/day}$$

The maximum dose which can be received from a daily RCRA inspection task equals 12.5 mrem. RITEDLs were also calculated for other inspection frequencies as follows:

| Frequency | RITEDL = Maximum Dose Per Task (mrem) |
|---|---|
| Weekly | 60 |
| Monthly | 250 |
| Bi-Monthly or less frequent | 300 |

This means that the daily RITEDL is the most restrictive time frequency for inspections in terms of keeping occupational workers within the administrative dose guidelines. As the RCRA inspection becomes less frequent, the maximum dose that workers can receive per task increases. RITEDLs were used as screening levels to assess the estimated doses from each TSD unit. If an estimated dose for an inspection exceeded the RITEDL for its time frequency, then the RCRA inspection could not be physically conducted at that frequency.

It was apparent that the RITEDLs would be exceeded at many TSD units where dose-rates are very high. Since affected facilities had historical proof of these dose-rates, no new measurements or dose rate calculations were made. Instead, a screening dose-rate was established to identify those cases where at least one of the DOE regulatory limits would clearly be exceeded. If whole body dose-rates were known to be greater than this screening dose-rate at TSD units, no further justification was needed to confirm radiation risk.

An administrative guideline-based dose limit of 100 millirem (mrem) per week, and a regulatory limit-based screening dose-rate of 5,000 mrem/hour were established. These levels were derived by calculating an allowable weekly dose and estimating the shortest time likely to be needed for an inspection. The administrative level assumes the annual exposure limit is 5,000 mrem and that an average employee works 50 weeks per year (5,000 mrem/50 weeks = 100 mrem per week). The screening dose-rate was developed from the assumption that inspections are likely to take > 1.2 minutes to do (5,000 mrem/hour for 1.2 minutes = 100 mrem).

These levels are also appropriate at Hanford for several other reasons:

- Physical entry into radiation areas below 5,000 mrem/hour requires adherence to routine Radiation Work Permits (RWPs), but no special work authorization. Above a 5,000 mrem/hour dose-rate, routine entry is prohibited unless a special RWP is approved. If the RCRA inspection is to be performed routinely, it should be performed with a minimum of paperwork and radiation protection approval.

- The weekly WHC administrative guideline for whole body dose is 300 mrem (0.3 rem) per week. This guideline would allow an individual to occasionally perform more than one RCRA inspection task in a week, or to take in excess of 1.2 minutes to perform a weekly inspection is unusual circumstances were encountered, and not exceed administrative guidelines. Routine exposures cannot be continually managed at the 300 mrem/week guideline because a worker would exceed the quarterly administrative guideline of 1,250 mrem in about one month, and the annual exposure limit in about 4 months.

Aside from the practical and administrative reasons for selecting these screening parameters, it is unreasonable to expect that a higher screening dose rate could have been chosen. Areas under consideration require special radiation protection equipment that impairs movement, vision, and/or access. These are restrictions which increase stay time. As stay time increases, the

screening dose-rate must decrease to remain within the 100 mrem administrative level chosen for routine inspection tasks.

**Dose Estimate Results**

When the dose estimate data were submitted, it was immediately clear that conformance to RCRA regulations requiring physical inspections was inappropriate in some areas. The first set of problems involved inspections in physically accessible areas with dose-rates greater than 5,000 mrem/hour.[4] In a matter of minutes, personnel can exceed federal dose limits at these very high dose-rates. Physical entry for routine RCRA inspections is not permissible under DOE radiation protection requirements, which makes these areas inaccessible for routine inspections. Workers could not meet dose limits or administrative guidelines when performing physical inspections of the following areas: B-Plant canyon tanks, containers, and waste pile; PUREX canyon tanks and tunnels (container storage); and T-Plant tanks. Inspections in these areas would involve a "potential for unreasonable exposure to radiation."

The PUREX tunnels are a special case for RMW container storage units where containers are stored on flatbed rail cars. The tunnels were not designed for manned entry. There is no shielded corridor nor does the tunnel width allow one to pass the intervening non-RMW rail cars to inspect cars with RMW. The last car was loaded into Tunnel 1 in 1965. Tunnel 2 can still receive wastes. It may not be technically feasible to monitor these tunnels, especially Tunnel 1 which is isolated.

Inspections in the 241-Z facility sump tank area would involve a second kind of radiation problem. Here, workers cannot physically perform RCRA inspections at the specified frequencies due to <u>very</u> high contamination levels of alpha particles. (<u>Any</u> internal deposition of alpha particles is not ALARA.) Entries to the tank area are made very infrequently (usually once annually) to perform maintenance. Supplied-air respirators are worn to protect workers from inhaling or ingesting airborne alpha particles.

If entry frequencies were increased at the 241-Z tank area, the potential for skin contaminations and internal depositions would also increase. Decontamination of the 241-Z sump tank area to facilitate inspections is precluded, because of the potential for contamination of workers by airborne alpha particles during any activity in this area. Furthermore, the 241-Z

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[4] Some of the units that were assessed are not physically accessible for inspection due to radiation protection shielding of various forms, but may in theory still be "subject to spills." We do not interpret RCRA regulations to require that inaccessible parts of TSDs be made accessible so that inspections can be conducted. Moreover, for these RMW TSDs, any effort to make these areas physically accessible is precluded by the extremely high dose rates that would be encountered if shielding materials were removed. Examples of inaccessible units include Tank 103 at the 222-S laboratory and Tank T-8 at T Plant.

Facility tank area is considered a Class II confined space, which requires additional precautions because there is a potential lack of oxygen in this area. Considering all of the radiation and industrial hazards, physical entries into this area must be minimized. Therefore, inspections at the 241-Z facility would involve a "potential for unreasonable exposure to radiation."

The areas discussed above are all areas where federal dose limits would be exceeded during RCRA inspections. In other areas, the administrative dose guideline of 100 mrem would be exceeded if RCRA inspections were conducted. This situation exists for at least one RCRA inspection task in the physically accessible areas of 241-BX, 241-BY, and 241-C Single-Shell Tank Farms, 222-S Laboratory Tanks 102 and 103, and 242-A Evaporator (Evaporator Room and Pump Room). In these instances, RCRA inspections would involve a "potential for unreasonable exposure to radiation".

Many dose estimates fell below the administrative guideline of 100 mrem per task and above a dose-rate of 1 mrem/hour, predominantly in the Double-Shell and Single-Shell Tank Farms. Inspection of the physically accessible portions of these TSD areas would not be precluded by dose limits or administrative guidelines, but would still violate AEA requirements and mandatory EPA radiation protection guidelines unless the inspections produced sufficient benefits. EPA's guidance states that "any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers," and goes on to note that "Decisions on whether or not particular tasks should be carried out (such as inspecting control system or acquiring specific experimental data) require judgments which can, in the aggregate, be as significant for radiation protection as those justifying the basic activities these tasks support."

In the case of single-shell and double-shell tanks, the benefits of feasible RCRA inspections are limited. Since the Double-Shell and Single-Shell Tanks are all underground (due to radiation protection concerns and shielding design), only the risers to these tanks are above-ground and physically accessible. It does not appear that the benefits of the general inspection and tank-specific inspection requirements are gained by an inspection program aimed at daily inspections of risers. Furthermore, if any leaks did occur in these tanks, the leaks would be underground, not above-ground.

Dose-rates of less than 1 mrem/hour were also reported for some Hanford TSD units. These areas contain remote readout equipment to gather data or were shielded from radiation by concrete barriers or other materials. A dose-rate of 1 mrem/hour coincides with the level at which exposures to radiation are not actively managed at Hanford. Inspections performed in areas with dose-rates less than 1 mrem/hour do not conflict with AEA requirements, and workers should be able to perform RCRA inspections in these readily accessible areas. Many of these areas are already physically inspected in a manner that meets RCRA requirements.

Table 3 "Categories Of Inspection Requirements" summarizes dose assessment results for two main categories of inspections. The table shows areas where inspections involve a "potential for unreasonable exposure to radiation" for various reasons. Each RCRA inspection requirement is matched with the

corresponding number of TSD units from each facility (in parentheses) for that category. TSD units where the dose-rates fell below 1 mrem/hour or where RCRA requirements did not apply were omitted because radiation exposure is not an issue in these areas. The table shows:

(1) Areas where inspections would expose workers to radiation that would exceed DOE dose limits or administrative dose guidelines. Measures other than physical inspections are typically employed in these areas to provide the kinds of benefits that would be provided by inspections.

(2) Situations where dose limits and administrative dose guidelines are unlikely to be exceeded by workers who perform RCRA inspections, but where the incremental benefits of the RCRA inspection may be minimal. Typically, incremental benefits are low in these cases in part because of physical constraints on inspections, and in part because alternative measures are in place.

It should be noted that the radioactive properties of RMW create additional avenues for release detection which are not possible with a purely hazardous waste--remote reading monitors can readily detect the increased radiation that accompanies any release of RMW. In addition, some typical aspects of DOE RMW facility design (e.g. concrete shielding) offer substantial protection to the environment. Because the development of the overwhelming majority of RCRA regulations did not include RMW, these additional detection properties and capabilities from radiation were not incorporated. Nuclear facilities employ radiation's unique properties wherever possible to alleviate the necessity of routine physical inspections.

**How Existing Waste Management Measures at Hanford Substitute for RCRA Inspections**

Hanford facilities typically employ waste management measures that prevent leaks and spills, and assure that any releases that do occur are promptly detected. The following examples show how typical Hanford practices can effectively substitute for RCRA inspections. The regulatory changes petitioners have proposed would require inclusion of plans for measures of this sort at all facilities where RCRA inspection requirements were modified.

**RCRA Daily Inspection For Tanks: Monitoring data from leak detection equipment/systems**

No conflict with RCRA exists. Data from leak detection equipment/systems is recorded continuously in the operating gallery. Monitoring data is gathered twice each shift for review to detect changes in Tank X-1.

**RCRA Daily Inspection For Tanks: Overfill/spill control equipment**

All canyon cells drain to an encased header and to cell X (Tank X-1). Overfill/spill control equipment consists of weight factor (WF) records and alarms located in the operating gallery. Tank X-1 has two WF alarms (a high level and a high/high level). The WF instrumentation is calibrated on an annual basis. The volume of material in Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. The benefit of RCRA inspections is met by (1) The continuous recording of the volume of the tank contents, (2) Surveillance (twice every 8 hours) of WF records, and (3) Alarm response.

**RCRA Daily Inspection For Tanks: Above-ground portions of tank system for corrosion or releases**

Facility workers cannot physically inspect the above-ground portions of Tank X-1 because the dose-rate is greater than 50,000 mrem/hour in this area. The crane operator can inspect for signs of corrosion by the use of mirrors when removing the cell block covering Tank X-1 during maintenance activities. Any releases from canyon tanks will be detected by WF records and alarms (calibrated annually) in the operating gallery. The benefit of RCRA inspections is effectively met by: (1) The crane operator using mirrors to inspect the tank for signs of corrosion during maintenance, (2) Continuous recording of tank volumes, (3) Surveillance of WF records twice each shift, and (4) Response to WF alarms by shift personnel.

**RCRA Daily Inspection For Tanks: Construction materials and area immediately surrounding externally accessible portions of the tank system, including secondary containment**

Workers cannot physically inspect the construction materials or external portions of Tank X-1 because of the extremely high dose-rate. The crane operator can safely inspect the construction materials and the rest of the tank system from the crane cab. The crane operator can use mirrors during maintenance activities to describe their condition. Any releases from Tank X-1 will be detected by WF records and alarms in the operating gallery. The benefit of RCRA inspections is effectively met by: (1) The crane operator using mirrors to inspect construction materials and the area immediately surrounding externally accessible portions of the tank system, including secondary containment, and (2) Continuous recording of tank volumes, (3) Surveillance of WF records twice each shift, and (4) Response to WF alarms by shift personnel.

**RCRA Daily Inspection For Tanks: Areas subject to spills**

Workers cannot physically inspect areas subject to spills of Tank X-1 because of the extremely high dose-rate. If a spill did occur, WF alarms would annunciate in the operating gallery. Shift personnel can then respond to any WF alarms for Tank X-1 without receiving radiation dose. Because this

facility will remain in use for another 20 years before closing, additional options for assessing unit condition and assuring early detection of releases are being analyzed.

**RCRA General Inspection For Tanks: Monitoring equipment for detecting and preventing releases**

No conflict with RCRA occurs. The facility has continuous recording of Tank X-1 volume, and surveillance of recorded values twice every 8 hours.

**RCRA General Inspection For Tanks: Safety and emergency equipment**

The safety and emergency equipment for canyon cell Tank X-1 would be the in-cell fire protection equipment. Again, the excessive dose-rate of 50,000 mrem/hour in this area means that the physical inspection of this equipment would involve a "potential for unreasonable exposure to radiation". The operability of this equipment is monitored by instrumentation in the operating gallery. This instrumentation is routinely checked each shift and is calibrated on an annual basis. If a fire alarm were to annunciate, it would alarm at both the dispatcher's office which has 24 hour surveillance and at the Hanford fire department. The benefit of RCRA inspections is met by: (1) Use of instrumentation that monitors the operability of the in-cell fire equipment, (2) annual calibration of this instrumentation, and (3) Fire alarms that annunciate at both the dispatcher's office and at the Hanford fire department.

**RCRA General Inspection For Tanks: Security devices**

The security devices for facility canyon tanks would be the cell cover blocks. The movement of these "security devices" requires a crane operator to lift the cover block which weighs several tons. The crane operator cannot enter the canyon without the facility dispatcher activating the electric door lock. Any cover blocks that are removed by the crane operator results in an increase in radioactivity in the canyon which is detected by appropriate instrumentation. Administrative controls are established at this facility in which the crane operator logs an entry into the shift logbook after completing the work. The crane operator states exactly what work was performed in the canyon (e.g. canyon cover block removed, jumper removed from cell, etc.). Another administrative control exists in which a crane job plan must be written which defines the scope of the work for that crane operator. The benefit of RCRA is met for security devices by detection of cell cover block movements, canyon cell control via the facility dispatcher, and administrative controls for the inspection of the security devices.

| | |
|---|---|
| **RCRA General Inspection For Tanks, Container Storage, and Waste Piles:** | **Operating and structural equipment important to preventing, detecting, or responding to environmental or human health hazards** |

Canyon cells contain any releases of solution from tanks. Cell Y contains 55-gallon drums that contain solid waste only. No waste with free liquid is present in the drums. Cell Z contains jumper boxes with lead weights and counterbalances. It is questionable whether any benefit would be derived from physical inspection of either solid waste or lead. Furthermore, if solid hazardous waste or lead did somehow leach, the canyon cells drain to an encased header and to cell X (Tank X-1). The volume of Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. Tank X-1 has two weight factor (WF) alarms (a high level and a high/high level). The high WF alarm is set at 1700 gallons and a high/high WF alarm is set at 3700 gallons on this 10,000 gallon tank.

The benefit of RCRA inspections is met for TSD tanks, container storage, and waste piles. The equipment to prevent, detect or respond to changes inside these cells is continuously recorded by the volume on Tank X-1 on an around-the-clock basis. Surveillance is made twice every 8 hours of the tank recorded values and workers respond to any WF alarms.

| | |
|---|---|
| **RCRA Weekly Inspection For Container Storage:** | **Inspection of areas where containers are stored, looking for leaks and deterioration caused by corrosion or other factors.** |

Canyon cells contain any releases of solution from tanks. Cell Y contains 55-gallon drums that contain solid waste only. No waste with free liquid is present in these drums. Operating procedures prevent the placement of liquid inside the drums. It is questionable whether any benefit would be derived from physical inspection of solid waste. Furthermore, if solid hazardous waste did leach, cell Y drains to cell X (Tank X-1). The volume of Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. Tank X-1 also has two weight factor alarms. The benefit of RCRA inspections is met because the equipment important to preventing or detecting releases (Tank X-1 volume) is continuously recorded with surveillance twice every 8 hours. Furthermore, workers are trained to respond to all alarms.

## Conclusion

This Appendix shows that radiation protection requirements and ALARA concerns preclude RCRA inspections at some Hanford RMW TSDs. The appendix also shows that existing waste management measures can be very effective substitutes for RCRA inspections in many cases and achieve the same benefits as RCRA inspections.

TABLE 1

DOE OCCUPATIONAL EXPOSURE LIMITS (DOE 5480.11)

| | |
|---|---|
| Stochastic Effects (whole-body exposure) | 5 rem/yr* |
| Non-Stochastic Effects | |
| Lens of the eye | 15 rem/yr* |
| Extremity | 50 rem/yr* |
| Skin of the whole body | 50 rem/yr* |
| Organ or tissue | 50 rem/yr* |
| Unborn Child | |
| Entire gestation period | 0.5 rem |

* Annual effective dose equivalent

TABLE 4-2

WESTINGHOUSE HANFORD
ADMINISTRATIVE GUIDELINES (WHC 1988)

| | | |
|---|---|---|
| Whole body, head, trunk gonads, lens of eye, red bone marrow, active blood-forming organs | 3 rem/yr | 1.25 rem/qtr |
| | 0.3 in a seven day period** | |
| Unlimited areas of skin | 9 rem/yr | 3 rem/qtr |
| Other organs, tissues, and organ systems (except bone) | 7.5 rem/yr | |
| Bone | 15 rem/yr | ---------- |
| Hands, feet*, and forearms | 15 rem/yr | 5 rem/qtr |

* Annual effective dose equivalent
** Per Union Contract

TABLE 2
CATEGORIES OF INSPECTION REQUIREMENTS

| Category | Areas Subject to Spills<br>40 CFR 264.15 (b)(4)<br>40 CFR 265.15 (b)(4) | Monitoring Equipment to Detect or Prevent Releases<br>40 CFR 264.15 (b)(1)<br>40 CFR 265.15 (b)(1) | Safety and Emergency Equipment<br>40 CFR 264.15 (b)(1)<br>40 CFR 265.15 (b)(1) | Security Devices<br>40 CFR 264.15 (b)(1)<br>40 CFR 265.15 (b)(1) | Operating and Structural Equipment<br>40 CFR 265.15 (b)(1)<br>40 CFR 264.15 (b)(1) | Container Storage Area<br>40 CFR 264.174<br>40 CFR 265.174 | General Area for Malfunctions, Etc.<br>40 CFR 264.15 (a)<br>40 CFR 264515 (a) |
|---|---|---|---|---|---|---|---|
| Proposed WAC 173-303-040 (131)(a) | B-Plant - All Units (20)<br>PUREX - All Units (11)<br>Single-Shell Tanks - 241-BX 241-BY and 241-C only (40)<br>242-A Evaporator Evaporator Room Pump Room (2)<br>222-S (2)<br>241-Z (4)<br>T-Plant Tanks (5) | 222-S (1) Tank 103<br>241-Z All (4)<br>B Plant - All Units (20)<br>PUREX Tanks (8)<br>T Plant Tanks (5) | B Plant-All Units (20) | B Plant-All Units (20) | 241-Z All (4)<br>B Plant-All Units (20) | B Plant Container Storage Area<br>PUREX Tunnels (2) | B Plant-All Waste Piles (2) |
| Proposed WAC 173-303-040 (131)(b) | All DST (41)<br>Other SST (109) | All DST (41)<br>222-S if frequency >quarterly (1)<br>242-A Evaporator Room (2) Pump Room<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | | PUREX -Waste Piles (1) |

DST = Double-Shell Tank SST = Single-Shell Tank

TABLE 2 (continued)
CATEGORIES OF INSPECTION REQUIREMENTS

| Category | Monitoring Data From Leak Detection Equipment/Systems<br><br>40 CFR 264.195(bX2)<br><br>40 CFR 265.195(aX3) | Overfill/Spill Control Equipment<br><br>40 CFR 264.195(a)<br><br>40 CFR 265.195(aX1) | Above-Ground Portions of Tank System<br><br>40 CFR 264.195(a)<br><br>40 CFR 265.195(aX1) | Construction Material and Area Immediately Surrounding Tank System<br><br>40 CFR 265.195(aX4)<br><br>40 CFR 264.195(bX3) |
|---|---|---|---|---|
| Proposed WAC 173-303-040 (131Xa) | Single-Shell Tanks<br>- 241-BY and 241-C only (28) | 222-S<br>- All Units (2)<br><br>241-Z<br>- All Units (4)<br><br>B Plant Tanks (17)<br><br>T-Plant Tanks (5)<br><br>Single-Shell Tanks (28)<br>-241-BY<br>-241-C only<br><br>242-A Evaporator Evaporator Room Pump Room (2) | PUREX Tanks (8)<br><br>Single-Shell Tanks<br>- 241-BX and 241-C only 241-BY (28)<br><br>242-A Evaporator Evaporator Room Pump Room (2)<br><br>222-S (2)<br><br>241-Z (4)<br><br>B-Plant Tanks (17)<br><br>T-Plant Tanks (5) | PUREX Tanks (8)<br><br>Single-Shell Tanks<br>- 241-BX and 241-C only 241-BY (28)<br><br>242-A Evaporator Evaporator Room Pump Room (2)<br><br>T-Plant Tanks (5)<br><br>222-S (2)<br><br>241-Z (4)<br><br>B-Plant Tanks (17)<br><br>T-Plant Tanks (5) |
| Proposed WAC 173-303-040 (131Xb) | DST - All (41)<br><br>Other SST (121) | DST - All (41)<br><br>Other SST (121) | DST - All (41)<br><br>Other SST (109) | DST - All (41)<br><br>Other SST (121) |

DST = Double-Shell Tank SST = Single-Shell Tank

# PROPOSED PETITION WASHINGTON DANGEROUS WASTE REGULATIONS, "INSPECTIONS"

This petition for rulemaking is submitted to the Washington State Department of Ecology (Ecology) following the provisions of the Revised Code of Washington (RCW) 34.04.060 and 34.04.080, and of the Washington Administrative Code (WAC) 173-303-910(1). It demonstrates the petitioners' need for alternative requirements for management of radioactive mixed waste in tanks, containers and waste piles that are subject to interim status and final status inspection requirements. These inspection requirements are authorized by the Washington Hazardous Waste Management Act and promulgated under the Washington Dangerous Waste Regulations. Alternative requirements are needed in order to avoid inconsistencies with the petitioners' obligations under the Atomic Energy Act of 1954, as amended, to protect workers from radiation hazards.

1) **Date:** September 29, 1989

2) **Petitioners' Name and Address:**


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Richland Operations Office
Richland, WA. 99352

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3) **Petitioners' Interest:**

Petitioner U. S. Department of Energy (DOE) owns and petitioners DOE and Westinghouse Hanford Company (WHC) jointly operate a large number of radioactive mixed waste (RMW) treatment, storage and disposal (TSD) facilities at the Hanford Site in Washington state. Many of these TSD facilities would be affected by the proposed changes.

Submission of this petition is required under The Hanford Federal Facility and Consent Order, signed by DOE, Ecology, and the U.S. Environmental Protection Agency (EPA) on May 15, 1989. Milestone M-22-01 of that Agreement requires DOE to "submit petitions for ... interim status standards to Ecology and EPA" by September 30, 1989[1]. This petition partially fulfills DOE's obligations under this milestone; however, DOE and WHC expect to submit additional petitions in the future. Although Milestone M-22-01 refers only to interim

[1]Schedules for addressing compliance issues, not subject to petition under Milestone M-22-01 must, under Milestone M-22-01, be negotiated by December 31, 1989. Most compliance issues will be addressed through compliance schedules.

status requirements, this petition also addresses requirements for permitted facilities, because those requirements are similar in many respects.

Petitioner DOE is further interested in the dangerous waste regulatory requirements addressed in this petition because, under the Atomic Energy Act (AEA), DOE shares responsibility for regulating RMW facilities with Ecology and EPA. Petitioner WHC is also interested in better coordination of state regulations and AEA requirements. WHC must comply with the requirements established under those Acts, and the DOE/AEA regulatory system places significant responsibility on detailed radiation protection requirements for workers at DOE facilities.

Due to the unique nature of radioactive mixed waste, compliance with both the AEA and state regulations is difficult because of the need to protect workers from unreasonable radiation exposure. The DOE and contractor staff would like to eliminate these conflicts. Therefore, the petitioners would prefer to resolve these conflicts by revising state regulations where possible. If conflicts cannot be resolved through regulatory rulemaking, however, DOE may need to take other steps appropriate to its responsibilities as an AEA regulatory agency.

We are firmly committed to protecting human health and the environment from any risk posed by RMW management activities. As DOE Order 5400.1 General Environmental Protection Program states, "... it is DOE policy to conduct the Department's operations in compliance with the letter and the and spirit of applicable environmental statutes, regulations, and standards." Environmental compliance is primarily achieved by compliance with DOE Orders and applicable laws and regulations.[6a] For example, DOE Order 5820.2A "Radioactive Waste Management" states that these wastes "shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees and the environment."

Finally, DOE and WHC are very interested in the matters addressed in this petition because a favorable Ecology response would enhance the ability of the petitioners to operate RMW facilities under a consistent set of standards. Because state dangerous waste regulations did not anticipate regulation of RMW when written, the radioactive properties and capabilities of RMW were not considered or incorporated. By considering the radioactive nature of the materials involved and the benefits derived from existing worker protection programs, our relationships in cleaning up Hanford will be strengthened.

## 4) Proposed Action

We propose more flexible inspection requirements for mixed waste facilities, in situations where compliance with current dangerous waste regulation requirements could involve unreasonable radiation exposures. In order to modify current inspection requirements, operators would be required to document their determination that radiation exposures resulting from dangerous waste regulation compliance could be unreasonable, and would be required to implement and document alternative practices to achieve the same kinds of benefits as are achieved by dangerous waste inspections.

In order to provide the flexibility and accountability described above, we suggest the following changes be made to state dangerous waste regulations:[2]

WAC 173-303-040 (definitions) should be amended by adding the following new terms:

(129) "Radioactive mixed waste" or RMW means a waste that contains both a non-radioactive dangerous component and a radioactive component.

(130) "Radioactive component" refers only to the actual radionuclides dispersed or suspended in the RMW substance.

(131) "Potential for unreasonable exposure to radiation" means:

(a) A likelihood of exposure to a radiation dose or dose-rate that is in excess of a radiation limit established under federal or state law; or

(b) A likelihood of exposure to radiation that can be avoided by using alternative means that are equivalent in effect to the unmodified dangerous waste requirement, and are consistent with the ALARA program of the owner/operator.

(132) "Radiation limit established under federal or state law" includes any dose or dose-rate limits established under the Atomic Energy Act, or under a federal or state worker health or safety regulatory program, including the following:

(a) a radiation dose or dose-rate limit specified in any federal or state regulation, or administrative or judicial order to a facility; or

(b) a radiation dose or dose-rate limit established in any federal or state license or authorization in effect at a facility; or

(c) a dose or dose-rate limit established in written criteria that are consistently applied at a facility to reduce or control worker exposure to radiation. Such written criteria may include, but is

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[2] The essential features of this program could of course be implemented by modifying existing regulations in other ways instead. Our suggested approach minimizes administrative burdens on Ecology, without limiting Ecology's existing authority to intervene in specific situations if necessary. The specific language proposed adds "substitute" RMW subsections to key WAC 173-303 sections. This approach preserves the current structure of these regulations, makes it unnecessary for operators of non-mixed-waste facilities to deal with mixed waste complications, and makes it readily apparent how requirements for mixed waste facilities would differ from non-mixed-waste facilities.

not limited to, administrative guidelines, procedures, or contractual limitations.

(133) "As Low As Reasonably Achievable or the acronym ALARA means minimizing radiological or non-radiological exposure to as far below applicable limits or guidance as social, economic, technical and practical considerations permit. The cost of radiation protection and the reasonable allocations of health protection resources are relevant considerations to ALARA determinations.

(134) "ALARA program" means the program implemented by the owner/operator which minimizes human and environmental exposures to radiation substances and conditions, commensurate with sound economics and operating practices.

WAC 173-303-320 (establishing general inspection requirements) should be amended to add a new subsection (4) for mixed waste facilities, as follows:

(4) The requirements in WAC 173-303-320 (1), (2) and (3) shall be modified for units containing RMW, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under subsection (2), and must include a written summary of the basis for the operator's determination. At mixed waste units where such a determination has been made, the requirements of WAC 173-303-320 are modified as follows:

(a) For "inspect" in subsection (1), substitute "inspect, monitor, or otherwise manage";

(b) For "schedule for inspecting" in subsection (2), substitute "schedule for inspecting, and/or plan for otherwise assuring the condition of";

(c) For "inspections" in subsections (1) and (2)(b), substitute "inspections or other periodic activities";

(d) For "inspection" in subsections (2)(c), (2)(d), and (3) substitute "inspection or other periodic activity"; and

(e) For "inspected daily" in subsection (2)(c) substitute "inspected or monitored at an appropriate interval".

WAC 173-303-630 (6) (specifying additional weekly inspection requirements for containers) should be amended by identifying the current language as subsection (a) and by adding a new subsection (b) for mixed waste facilities, as follows:

(b) The requirements of subsection (a) shall not apply to areas where containers of radioactive mixed waste are stored, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under WAC 173-303-320 (2), and must include a written summary of the basis for the operator's determination. At mixed waste storage areas where such a determination has been made, the owner or operator shall inspect, monitor, or otherwise manage containers and container storage areas to prevent and detect leakage from containers, and deterioration of containers and containment systems.

WAC 173-303-640 (6) (specifying inspection requirements for tank systems) should be amended by adding a new subsection (e) for mixed waste tank systems, as follows:

(e) The requirements of subsections (a) and (b) shall be modified for tank systems that contain radioactive mixed waste, if the owner or operator reasonably determines that compliance with those requirements would involve a potential for unreasonable exposure to radiation. This finding must be attached to the written schedule required under WAC 173-303-320 (2), and must include a written summary of the basis for the operator's determination. For radioactive mixed waste tank systems where such a determination has been made, the requirements of subsections (a) and (b) are modified as follows:

(i) For "inspecting overfill controls" in subsection (a), substitute "verifying the proper operation of overfill control systems";

(ii) For "inspect at least once each operating day" in subsection (b), substitute "inspect or monitor, at a frequency appropriate to the radiation exposure and hazard to the environment involved";

(iii) For "externally accessible portion of the tank system" in subsection (b)(iii), substitute "those portions of the tank system that are reasonably accessible, considering the radiation exposure and hazard to the environment involved"

WAC 173-303-806(4) (designating contents of Part B permit applications) should be amended by adding a new subsection (i) as follows:

(i) Specific Part B information requirements for radioactive mixed waste facilities. Part B of the permit application for RMW facilities shall include a description of the alternative inspection plans to meet the requirements of WAC 173-303-320, WAC 173-303-630, and WAC 173-303-640. Part B of the permit application for RMW facilities shall also include a description of the alternative placement of signs and labels to meet the

requirements of WAC 173-303-310, WAC 173-303-395, WAC 173-303-630, and WAC 173-303-640.

## 5) Justification of Proposed Action

In managing RMW, the petitioners must meet the requirements of WAC 173-303 for management of the dangerous, nonradioactive component of RMW and the requirements of the AEA for management of the radioactive component. For the requirements being addressed, i.e. inspections, strict compliance with the requirements of WAC 173-303 cannot always conform with the requirements of the AEA. We have proposed alternate means of inspection to allow for management of RMW in such a manner as to meet the goals of both WAC 173-303 and the AEA.

This section of the petition demonstrates why the proposed actions are deemed necessary. It explains how DOE facilities must operate under requirements for radiation protection and describes these requirements. It also explains that although these requirements were specifically developed for the purpose of radiation protection, they also result in other benefits, many of which are the same benefits derived from dangerous waste regulation requirements (i.e., protection of human health and the environment). Finally, it explains that in many cases, it is not possible for DOE to meet both radiation protection requirements and current WAC 173-303 requirements.

### Radiation Protection Goals

Radiation protection is a major component of all DOE operations involving radiation and radioactive materials. Radiation protection policies and procedures are given in DOE Orders. One radiation protection policy in DOE Orders originates from the EPA. The 1987 Presidentially-approved "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" [6b] incorporates radiation protection standards published by the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). This EPA guidance reaffirms the three basic principles governing radiation protection programs:

> "The first is that any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers; i.e., that a finding be made that the activity is 'justified'... The second is that, for justified activities, exposure of the work force should be as low as reasonably achievable (commonly designated by the acronym 'ALARA') ... Finally, to provide an upper limit on risk to individual workers, 'limitation' of the maximum allowed individual dose is required."

DOE Orders are required to be consistent with this EPA guidance on radiation protection. For example, DOE Order 5480.11 "Radiation Protection For Occupational Workers," effective December 21, 1988 states:

> "It is the policy of DOE to implement radiation protection standards that are consistent with the Presidential approved guidance to Federal

Agencies promulgated by the EPA and based on the recommendations by authoritative organizations."

Consequently, the DOE has adopted the policy of maintaining all radiation doses as far below the limits as social, economic, technical, and practical considerations permit (i.e. ALARA) in its Orders. All occupational workers must comply with DOE Order 5480.11, Orders from regional DOE offices, and with contractor administrative manuals for radiation protection and ALARA.

Similarly, the Nuclear Regulatory Commission (NRC) is amending 10 CFR 20 to incorporate the EPA's Presidentially-approved guidance on radiation protection programs. The definitions that we propose for a "potential for unreasonable exposure to radiation" reflect the three radiation protection concepts embodied by the EPA-required guidance.

## Radiation Protection Fundamentals

In order to understand radiation protection requirements, it is necessary to understand the nature of exposure to radiation and radioactive materials and the risk posed by such exposure. The following information briefly explains fundamentals concepts of radiation exposure in order to better understand radiation protection requirements for management of RMW.

Radioactive mixed wastes are dangerous wastes which also contain radioactive materials. Radiation exposure from RMW management can result from two modes. The first is exposure to direct radiation. This mode of exposure results from work around radiation sources, which could be the RMW itself or other radioactive materials in the vicinity of the RMW. Protection from this type of exposure is accomplished through physical barriers which will shield only a portion of the radiation. The type of barrier required depends on the type of radiation (i.e., alpha, beta, gamma, neutrons, x-ray). The second mode is internal deposition of radioactive materials (e.g., inhalation, ingestion). This mode of exposure can result from work in areas which are radioactively contaminated (i.e., radionuclides are present which can be taken into the body). Protection from this type of exposure is accomplished through use of personal protective equipment (e.g., supplied-air respirators) which will prevent internal deposition.

Radionuclides emit different forms of radiation (e.g. alpha, beta, gamma, neutron and X-ray) which can change biological systems. These changes can produce biological damage with different resultant health effects. For example, ionizing radiation is both an initiator and a promoter of carcinogenesis, capable of producing benign or malignant tumors in any living mammalian cell type.[6c]

Radiation dose can be received all at once or for much longer periods. Both acute and chronic radiation exposures can produce adverse health effects. These health effects depend upon three main factors which are:

- the magnitude of radiation dose to tissue (i.e. total absorbed dose),

- linear energy transfer (LET), and
- radiation dose-rate.

The first main factor, the magnitude of radiation dose to tissue (or total absorbed dose) is very important. If the total dose that is absorbed by human cells is high enough, the result is irreversible and irreparable. Illness and death can result from a single acute exposure.

Radiation exposure to occupational workers is foremost required to be maintained within control limits. Operational controls for external (and internal) radiation exposure have been established to provide a basis for exposure control planning, and to minimize the possibility of any person inadvertently exceeding the annual occupational dose limits.

DOE operating contractors are also required by DOE Orders to impose administrative dose guidelines to assure that dose limits are not exceeded. Therefore, dose limits and dose guidelines are control levels that are established below levels known to cause any observable health effects in individuals. Dose limits and dose guidelines, as presented in Table 1, must be maintained during RMW management.

Linear energy transfer or LET, is defined as the number of ionizations produced by a radioactive particle along its pathlength. Alpha particles are heavy (dense) charged particles which have a high LET. Thus, alpha particles are slow-moving and produce thousands of ionizations along their pathlength from a single internal deposition. Once deposited, alpha-emitting radionuclides ionize the lung and other tissues and can lead to cancer. Since ALARA programs are designed to minimize radiation exposure and to eliminate internal depositions, any internal depositions are not ALARA.

Dose-rate is the third main factor which can cause adverse health effects. Dose-rate can be defined as the amount of radiation exposure measured over time. Areas of very high dose-rate (i.e. more than 5000 mrem/hour[3]) are <u>never</u> entered routinely. Radiation dose guidelines and dose limits would be exceeded in minutes or even seconds. This precludes any practical purpose to such exposures.

In addition to limiting exposure to very high dose-rates, the ALARA concept limits exposure to radiation to lower dose-rates. The ALARA concept, as required by DOE Order 5480.11, applies to annual dose, committed dose (dose from internally-deposited, long-lived radionuclides), and collective dose (the total of all individual doses). ALARA is based on the assumption that no dose, regardless of how small, is entirely without risk. Thus, reducing dose

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[3]This petition uses units of radiation exposure and dose from this exposure in multiples of rem or mrem. In actual practice, measurement techniques, dose-rate measurements, and dose assessments differ slightly. However, because of the type of radiation involved and for the purpose of this petition, it is valid to consider exposure, dose, dose equivalent, and committed dose as interchangeable units.

to a level that is "as low as social, technical, economic, practical and public policy permit" will meet DOE's policy directive to "reduce health risks" [7d].

In summary, radiation exposure presents three main areas of concern related to management of RMW:

- Work in radiation areas must be controlled so that the total absorbed dose by workers is kept as far below limits or guidelines as established for protection of human health.

- Work in radioactively contaminated areas must be controlled to minimize the risk of internal deposition of radionuclides. Consistent with ALARA principles, potential exposure to radiation must be avoided unless justified by the benefit resulting from the exposure.

- Work in radiation areas must be controlled to avoid exposure to high dose-rates. Consistent with ALARA principles, all exposure to radiation, regardless of dose-rate, must be justified by the benefit resulting from the exposure.

## Radiation Protection Requirements

A variety of radiation protection requirements, applicable to management of RMW, have been established by DOE to ensure that radiation protection goals are met. As noted in this section, the benefits derived from DOE's management of RMW coincide with the benefits derived from the inspection requirements of WAC 173-303. In many cases, existing programs derive benefits that are fully protective of human health and the environment, without unreasonable dose.

DOE facilities store, treat or dispose of RMW in tanks, containers or waste piles in inaccessible areas in order to minimize radiation dose to workers. Containers and waste piles usually consist of solid materials such as lead, and not liquid materials. Without liquids, the potential for leaks and spills is extremely low. Therefore, benefits derived from physical inspections of solids are questionable, especially with the resultant worker exposures.

Canyon facilities contain the RMW units inside concrete-encased cells that drain to an encased header and to one tank which is very highly radioactive. The stainless-steel tank system is monitored by radiation leak detection equipment and recorded continuously in an operating gallery. It also has overfill spill control equipment, consisting of weight factor (WF) records and alarms, also located in an operating gallery. Calibration of instrumentation occurs at least annually to ensure instrument operability. Constant air monitors also monitor the radioactive concentration of the surrounding air. Personnel are present on every shift to respond to alarms. And, surveillance of tank volumes are continuously monitored at least twice every 8 hours.

Canyon facilities also have cranes which enable the crane operator to remove the concrete cell block that covers the RMW units when operation or

maintenance is needed. Using mirrors, the crane operator can visually inspect the inside of the cell without receiving excessive radiation dose, and record the observations in a logbook. The crane operator is, therefore, able to inspect areas subject to spills, construction materials and external tank areas, and above-ground portions of the tank system for corrosion or potential releases. When combined, the benefits derived from these canyon activities produce the same benefits as those derived from WAC 173-303-630 and 640 daily inspection requirements without unreasonable exposure. Administrative control systems such as radiation safety requirements, operating safety requirements and procedures, and maintenance procedures, help maximize derived benefits.

Other radiation detection systems and physical devices are also present that provide equivalent benefits to the general inspections from WAC 173-303-320. Examples of safety systems and devices include access control to canyons only by the facility dispatcher, and in-cell fire protection equipment. These systems are operated and monitored from areas where the potential for workers to have unreasonable exposure to radiation does not exist. Further, administrative controls help ensure the operating and monitoring capabilities of these systems, in order to derive the benefits from these systems.

Double-shell underground storage tanks containing RMW derive similar benefits from the radiation leak detection devices. Leak detection equipment is remotely monitored by the Computer Automated Surveillance System (CASS), which is continuously manned around-the-clock. Physical readings are taken and monitoring data is reviewed every shift. Tank pressures and liquids levels are inspected prior to, and during, liquid transfers, and also monitored by CASS. Transfer pumps automatically shut-down, if this overfill/spill control equipment fails and the transfer automatically ceases. Personnel walk-through the tank farm to note off-standard conditions daily. Above-ground portions of tank systems are inspected on these walk-throughs. With the administrative controls, benefits derived from these activities are equal to WAC 173-303-640.

In addition, accessible areas to double-shell tank units have monitoring equipment such as constant air monitors and radiation area monitors that also connect to CASS. Tank exhausters and annulus exhausters are also monitored each shift. Tank farm fences are locked when unmanned. Thus, the existing program derives benefits which are like those of state general inspections.

Single-shell underground storage tank units with RMW derive benefits from leak detectors linked to CASS and from manual tape measurements of tank volumes. The units are on a schedule to pump the pumpable liquid out of the tanks, and only the salt cake and interstital liquids will remain, unless removed, until final closure. Single-shell tanks derive similar benefits as double-shell tanks. Single-shell tanks will be closed under interim status.

## Conflicts Between Radiation Protection Requirements and Dangerous Waste Regulation Requirements

The above discussions have identified radiation protection requirements that are applicable to management of RMW and explained that these requirements result in the same benefits as would result from state dangerous waste

inspection requirements. The accomplishment of the same benefits through existing radiation protection requirements as would be accomplished through state requirements is one of the key points of our justification. The other key point is that WAC 173-303 requirements in some cases present conflicts with radiation protection requirements. In such cases, it is not possible to meet both sets of requirements. The following discussion addresses these conflicts.

In some cases with RMW TSD units, it is not possible to comply with state inspection requirements and still comply with radiation protection requirements. Inspection of RMW tanks and containers will result in exposure of workers to direct radiation. In addition, if the tanks or containers are located in radioactively contaminated areas, inspection presents the risk of radiation exposure through internal deposition. If the containers or tanks are located in areas of high dose rate, inspection could result in radiation exposure above established limits. In areas with lower dose rate, or areas which are radioactively contaminated, inspections could result in exposure which does not comply with ALARA.

Under ALARA, all exposure to radiation must be justified in terms of the benefit that will result. As discussed previously, the benefits derived through compliance with radiation protection requirements are often identical with the benefits associated with state requirements. In such cases, exposure to radiation from inspection, even though it would not exceed limits, would not result in a benefit and not comply with ALARA.

To identify specific conflicts between radiation protection requirements and state inspection requirements, the petitioners have made an assessment of the radiation dose which would result from inspections at a number of RMW TSD units at Hanford. This assessment is described in Appendix 1 and identifies specific instances where state inspections could not be met while still meeting radiation protection requirements.

A detailed analysis of the requested changes will now be described.

## Analysis of Proposed Action

### Definitions

A definition of "potential for unreasonable exposure to radiation" is proposed that embodies the three principles of radiation protection included in the EPA's Presidentially-approved guidance to federal agencies. The definition is presented in terms of "potential for unreasonable exposure", so that an actual overexposure to radiation dose not have to occur before changes to state requirements can be made.

Therefore, if performing an inspection would cause a worker to receive an exposure to radiation in excess of numerical limits or guidelines, the inspection can be deemed to represent the "potential for unreasonable exposure to radiation". The proposed definition makes use of dose guidelines because of the way radiation exposure is controlled at DOE facilities. DOE Orders

require that administrative guidelines be set to assure that dose limits are not exceeded. Facilities regulated by the Nuclear Regulatory Commission have similar requirements. Since nearly all inspection activities are routine tasks, radiation doses from these tasks should be managed to the administrative guideline, and not to the federal numerical limit.

Another precept of radiation protection, reflected in the proposed definition, is the concept of receiving radiation dose only if and when it is warranted, i.e. when benefit is derived from the exposure causing this dose. If the intent of the state requirement is fully met by an alternative that requires substantially less radiation dose to implement, radiation protection standards dictate that the alternative is used. It must be understood, however, that the alternative represents doses that are as low as reasonably achievable (ALARA) with all appropriate factors taken into consideration.

The principle of ALARA is complex, as it operates to strike a balance between engineering solutions, minimization of radiation risk, and the costs involved with minimizing that risk. Guidance on how to optimize these cost/benefit determinations is described in Report # 26 of the International Council on Radiation Protection. Most, if not all, DOE and NRC regulated facilities have developed their own guidance on how to make ALARA-based decisions.

Thus, the definitions for "potential for unreasonable exposure to radiation", "radiation limit established under federal or state law", "As Low As Reasonably Achievable..." and "ALARA program" encompass the major precepts of a radiation protection program as required by EPA guidance. The proposed definitions are needed to allow a determination of "how much radiation exposure is too much". The definitions also provide guidance on how engineering solutions should be implemented when minimizing radiation risk.

### General Inspection Requirements

As long as state general inspection requirements, implicitly or explicitly, require a physical, personal inspection of the vicinity of an RMW unit, there will be conflicts with radiation protection requirements. Appendix 1 to this petition describes some areas at Hanford where these conflicts occur. We are requesting changes to state inspections to resolve these conflicts at RMW units.

We also agree to demonstrate by documentation: (1) areas where situations of the "potential for unreasonable exposure to radiation" exist (i.e. the conflict), and (2) an effective alternative means of meeting the intent of the original state requirement that is consistent with radiation protection requirements (i.e. the resolution).

Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility. The state's general requirements for the written inspection plan are retained in this proposal for rulemaking. Changes are sought only to allow different methods of inspection, testing, and monitoring and facility-specified frequencies for inspections, tests and monitoring. In addition, inspection

plans will be available for review, and will be reviewed by Ecology and the public during the final permitting process.

### Container Inspection Requirements

Petitioners DOE and WHC request changes from the specific method of inspections and the frequency of inspections of RMW containers. The reasons and methods of resolution are the same as those proposed for the state general inspection requirements. Appendix 1 describes some areas of Hanford where these conflicts occur.

The petitioners also agree to demonstrate by documentation both the areas where situations of conflict occur and the resolution of these conflicts. Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility.

### Tank System Inspections

Similarly, the petitioners request changes to the specific method of inspections and the specific frequency of inspections of RMW tanks. Appendix 1 describes some areas of Hanford where these conflicts occur.

The petitioners agree to demonstrate by documentation both the areas where situations of conflict occur and the resolution of these conflicts. Documents proving the existence of the conflict and its resolution will be kept as part of the full written inspection plan for the facility.

## Summary

In conclusion, we have reflected an appropriate balance of responsibility, authority, and expertise in this petition-for-rulemaking. Established radiation protection requirements and guidance should be used to identify conflicts between Atomic Energy Act and state requirements. Likewise, facility representatives should initiate alternative means of meeting the intent of state inspection requirements. The results of these determinations should be documented. Such documents will be available for review and will be reviewed by Ecology and the public during the final permitting process. If the documented demonstrations are inadequate, recourse remains available to these parties under state provisions and The Hanford Federal Facility Agreement and Consent Order. This petition has included all of these concepts.

## 6) References

### 6a. Listing Of Applicable DOE and DOE-RL Orders From 5400 and 5480 series

| DOE Order # | Effective Date | Subject |
|---|---|---|
| 5400.1 | 11/09/88 | "General Environmental Protection Program" |

| | | |
|---|---|---|
| N 5400.1 | 11/08/86 | "Environmental Policy Statement" |
| 5400.2A | 01/31/89 | "Environmental Compliance Issue Coordination" |
| 5400.3 | 02/22/89 | "Hazardous and Radioactive Mixed Waste Program" |
| N 5400.4 | 08/02/88 | "Integration of Environmental Compliance Processes" |
| 5440.1C | 04/09/85 | "National Environmental Policy Act" |
| N 5480.1A | 05/13/88 | "Safety and Health Policy Statement" |
| 5480.1B | 09/23/86 | "Environment, Safety & Health Program For DOE Operations" |
| N 5480.3 | 03/09/88 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| 5480.3 | 07/09/85 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| N 5480.4 | 06/21/88 | "Preliminary Notification Of Environment, Safety, and Health Concerns" |
| 5480.4 | 05/15/84 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 09/23/86 | "Safety of Nuclear Facilities" |
| 5480.11 | 12/21/88 | "Radiation Protection For Occupational Workers" |
| 5480.14 | 04/26/85 | "Comprehensive Environmental Response, Compensation & Liability Act Program" |
| 5481.1B | 09/23/86 | "Safety Analysis and Review Program" |
| 5482.1B | 09/23/86 | "Environment, Safety & Health Appraisal Program" |

| DOE-RL Order # | Effective Date | Subject |
|---|---|---|
| 5483.1A | 06/22/83 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated Facilities" |
| 5484.1 | 02/24/81 | "Environmental Protection - Safety & Health Protection Information Reporting Requirements" |

| | | |
|---|---|---|
| 5440.1A | 02/03/87 | "Implementation of the National Environmental Policy Act At RL" |
| 5480.1 | 05/21/82 | "Environmental Protection, Safety, & Health Protection Program For RL" |
| 5480.1A | 09/07/88 | "Environment, Safety, & Health Program For DOE Operations For RL" |
| 5480.4A | 12/01/87 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 10/15/84 | "Safety of Nuclear Facilities" |
| 5480.10A | 06/20/88 | "Industrial Hygiene Program" |
| 5481.1 | 10/05/83 | "Safety Analysis & Review Program" |
| 5482.1B | 03/04/87 | "Environment, Safety, Health, & Quality Assurance Appraisal & Surveillance Program" |
| 5483.1A | 09/06/88 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated (GOCO) Facilities" |
| 5484.1 | 09/26/83 | "Environmental Protection - Safety Protection Information Reporting Requirements" |
| 5484.2A | 09/24/84 | "Unusual Occurrence Reporting System For RL" |


6b 52 FR 2822. Radiation Protection Guidance to Federal Agencies for Occupational Exposure; Approval of Environmental Protection Agency Recommendation, The President, Federal Register, January 27, 1987.

6c Mettler, Fred A. (Jr.), M.D. et. al., 1985. Medical Effects of Ionizing Radiation, Grune & Stratton, Inc., 1985.

6d DOE Publication PNL-6577 "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)", July 1988

## Appendix 1

## Dangerous Waste Regulation Inspections and Radiation at Hanford

### Introduction

This appendix provides information concerning estimated worker radiation doses that would result from Dangerous Waste Regulation inspections at some Hanford RMW TSDs, and compares these doses to radiation protection requirements that have been established at Hanford. Specific examples of areas where workers could be subjected to a potential for unreasonable to radiation from inspections currently required under WAC 173-303 are detailed. In addition, this appendix demonstrates that existing environmental protection efforts at Hanford often provide the same kinds of benefits that dangerous waste inspections would provide.

### Scope and Methods

Eight Hanford 200 Area TSD Facilities were evaluated, including the 222-S Laboratory, 241-Z Facility, 242-A Evaporator, B-Plant, the Plutonium Uranium Extraction Facility (PUREX), T-Plant, Double-Shell Tanks, and Single-Shell Tanks.

In order to determine whether or not radiation protection requirements could be met, facility representatives were asked to estimate the dose to perform inspections required under WAC 173-303 at each identified facility. Questionnaires were presented in a matrix format with each of the inspection tasks identified for each of the TSD units of concern.

Facility representatives were instructed to estimate the worker dose for each inspection task at each unit, assuming use of customary radiation protection measures as dictated by DOE Orders and contractor manuals. Because these radiation protective measures were typical of those currently in use, the measures were also considered to be ALARA. Representatives were also cautioned not to overestimate the doses, and were not provided with any information on the applicable numerical limits. In this way, the calculated doses were expected to represent a close approximation of the actual dose.

Dose estimates for each task were assessed against the more protective site specific administrative dose guidelines established by Westinghouse Hanford Company to implement DOE directives, not just against DOE regulatory limits. This was done for several important reasons:

- Federal guidance requires use of administrative guidelines as part of an ALARA program.
- DOE Order 5480.11 requires doses to be maintained at ALARA levels.
- Administrative guidelines tend to be more limiting than the established regulatory limits contained in DOE Order 5480.11.

- Inspections are routine tasks, and workers must not exceed administrative guidelines on a routine basis.

- Existing contracts between labor unions and WHC require management of radiation exposure at ALARA levels within the administrative guidelines.

Whether the dose received form conducting a periodic activity is within administrative guidelines depends on the frequency at which a given individual repeats that activity, and on the other activities involving radiation dose that are also conducted by that individual. For this assessment, it was assumed that any given individual would perform a Dangerous Waste Regulation inspection at only one RMW unit, at the frequency required under WAC 173-303. Using this assumption, each recurring inspection task could be conducted in a manner consistent with radiation protection requirements if it resulted in exposure for that worker that was within the administrative guideline. Under these circumstances, the <u>only</u> radiation work each of these workers could do would be the single Dangerous Waste Regulation inspection at a single RMW unit. This is highly unrealistic, because most Hanford radiation workers are assigned to multiple tasks each day where they receive dose.

To compare estimated doses to administrative dose guidelines, limits were established by a "WAC 173-303 Inspection Task Effective Dose Limit" or WITEDL. These limits, based on ALARA principles, are defined by the relationship:

$$\text{WAC 173-303 Inspection Task Effective Dose Limit} = \frac{\text{Administrative dose guideline for time period}}{\text{Number of times WAC 173-303 inspection task is performed as required per time interval}}$$

Assuming that an individual worker is assigned to a single daily WAC 173-303 inspection task for one year, and this individual works 240 days per year (i.e. 5 days per week for 50 weeks per year, with 10 days off for holidays each year), the daily WITEDL is calculated to be:

$$\text{Daily WITEDL} = \frac{3\ \text{rem/year}}{240\ \text{work-days/year}} = 12.5\ \text{mrem/day}$$

The maximum dose which can be received from a daily WAC 173-303 inspection task equals 12.5 mrem. WITEDLs were also calculated for other inspection frequencies as follows:

| Frequency | WITEDL = Maximum Dose Per Task (mrem) |
|---|---|
| Weekly | 60 |
| Monthly | 250 |
| Bi-Monthly or less frequent | 300 |

This means that the daily WITEDL is the most restrictive time frequency for inspections in terms of keeping occupational workers within the administrative dose guidelines. As the WAC 173-303 inspection becomes less frequent, the maximum dose that workers can receive per task increases. WITEDLs were used as screening levels to assess the estimated doses from each TSD unit. If an estimated dose for an inspection exceeded the WITEDL for its time frequency, then the WAC 173-303 inspection could not be physically conducted at that frequency.

It was apparent that the WITEDLs would be exceeded at many TSD units where dose-rates are very high. Since affected facilities had historical proof of these dose-rates, no new measurements or dose rate calculations were made. Instead, a screening dose-rate was established to identify those cases where at least one of the DOE regulatory limits would clearly be exceeded. If whole body dose-rates were known to be greater than this screening dose-rate at TSD units, no further justification was needed to confirm radiation risk.

An administrative guideline-based dose limit of 100 millirem (mrem) per week, and a regulatory limit-based screening dose-rate of 5,000 mrem/hour were established. These levels were derived by calculating an allowable weekly dose and estimating the shortest time likely to be needed for an inspection. The administrative level assumes the annual exposure limit is 5,000 mrem and that an average employee works 50 weeks per year (5,000 mrem/50 weeks = 100 mrem per week). The screening dose-rate was developed from the assumption that inspections are likely to take > 1.2 minutes to do (5,000 mrem/hour for 1.2 minutes = 100 mrem).

These levels are also appropriate at Hanford for several other reasons:

- Physical entry into radiation areas below 5,000 mrem/hour requires adherence to routine Radiation Work Permits (RWPs), but no special work authorization. Above a 5,000 mrem/hour dose-rate, routine entry is prohibited unless a special RWP is approved. If the inspection required by WAC 173-303 is to be performed routinely, it should be performed with a minimum of paperwork and radiation protection approval.

- The weekly WHC administrative guideline for whole body dose is 300 mrem (0.3 rem) per week. This guideline would allow an individual to occasionally perform more than one WAC 173-303 inspection task in a week, or to take in excess of 1.2 minutes to perform a weekly inspection is unusual circumstances were encountered, and not exceed administrative guidelines. Routine exposures cannot be continually managed at the 300 mrem/week guideline because a worker would exceed the quarterly administrative guideline of 1,250 mrem in about one month, and the annual exposure limit in about 4 months.

Aside from the practical and administrative reasons for selecting these screening parameters, it is unreasonable to expect that a higher screening dose rate could have been chosen. Areas under consideration require special radiation protection equipment that impairs movement, vision, and/or access.

These are restrictions which increase stay time. As stay time increases, the screening dose-rate must decrease to remain within the 100 mrem administrative level chosen for routine inspection tasks.

**Dose Estimate Results**

When the dose estimate data were submitted, it was immediately clear that conformance to the Dangerous Waste Regulations requiring physical inspections was inappropriate in some areas. The first set of problems involved inspections in physically accessible areas with dose-rates greater than 5,000 mrem/hour.[4] In a matter of minutes, personnel can exceed federal dose limits at these very high dose-rates. Physical entry for routine dangerous waste inspections is not permissible under DOE radiation protection requirements, which makes these areas inaccessible for routine inspections. Workers could not meet dose limits or administrative guidelines when performing physical inspections of the following areas: B-Plant canyon tanks, containers, and waste pile; PUREX canyon tanks and tunnels (container storage); and T-Plant tanks. Inspections in these areas would involve a "potential for unreasonable exposure to radiation."

The PUREX tunnels are a special case for RMW container storage units where containers are stored on flatbed rail cars. The tunnels were not designed for manned entry. There is no shielded corridor nor does the tunnel width allow one to pass the intervening non-RMW rail cars to inspect cars with RMW. The last car was loaded into Tunnel 1 in 1965. Tunnel 2 can still receive wastes. It may not be technically feasible to monitor these tunnels, especially Tunnel 1 which is isolated.

Inspections in the 241-Z facility sump tank area would involve a second kind of radiation problem. Here, workers cannot physically perform inspections required by WAC 173-303 at the specified frequencies due to <u>very</u> high contamination levels of alpha particles. (<u>Any</u> internal deposition of alpha particles is not ALARA.) Entries to the tank area are made very infrequently (usually once annually) to perform maintenance. Supplied-air respirators are worn to protect workers from inhaling or ingesting airborne alpha particles.

If entry frequencies were increased at the 241-Z tank area, the potential for skin contaminations and internal depositions would also increase. Decontamination of the 241-Z sump tank area to facilitate inspections is

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[4] Some of the units that were assessed are not physically accessible for inspection due to radiation protection shielding of various forms, but may in theory still be "subject to spills." We do not interpret WAC 173-303 regulations to require that inaccessible parts of TSDs be made accessible so that inspections can be conducted. Moreover, for these RMW TSDs, any effort to make these areas physically accessible is precluded by the extremely high dose rates that would be encountered if shielding materials were removed. Examples of inaccessible units include Tank 103 at the 222-S laboratory and Tank T-8 at T Plant.

precluded, because of the potential for contamination of workers by airborne alpha particles during any activity in this area. Furthermore, the 241-Z Facility tank area is considered a Class II confined space, which requires additional precautions because there is a potential lack of oxygen in this area. Considering all of the radiation and industrial hazards, physical entries into this area must be minimized. Therefore, inspections at the 241-Z facility would involve a "potential for unreasonable exposure to radiation."

The areas discussed above are all areas where federal dose limits would be exceeded during WAC 173-303 inspections. In other areas, the administrative dose guideline of 100 mrem would be exceeded if dangerous waste inspections were conducted. This situation exists for at least one WAC 173-303 inspection task in the physically accessible areas of 241-BX, 241-BY, and 241-C Single-Shell Tank Farms, 222-S Laboratory Tanks 102 and 103, and 242-A Evaporator (Evaporator Room and Pump Room). In these instances, WAC 173-303 inspections would involve a "potential for unreasonable exposure to radiation".

Many dose estimates fell below the administrative guideline of 100 mrem per task and above a dose-rate of 1 mrem/hour, predominantly in the Double-Shell and Single-Shell Tank Farms. Inspection of the physically accessible portions of these TSD areas would not be precluded by dose limits or administrative guidelines, but would still violate AEA requirements and mandatory EPA radiation protection guidelines unless the inspections produced sufficient benefits. EPA's guidance states that "any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers," and goes on to note that "Decisions on whether or not particular tasks should be carried out (such as inspecting control system or acquiring specific experimental data) require judgments which can, in the aggregate, be as significant for radiation protection as those justifying the basic activities these tasks support."

In the case of single-shell and double-shell tanks, the benefits of feasible dangerous waste inspections are limited. Since the Double-Shell and Single-Shell Tanks are all underground (due to radiation protection concerns and shielding design), only the risers to these tanks are above-ground and physically accessible. It does not appear that the benefits of the general inspection and tank-specific inspection requirements are gained by an inspection program aimed at daily inspections of risers. Furthermore, if any leaks did occur in these tanks, the leaks would be underground, not above-ground.

Dose-rates of less than 1 mrem/hour were also reported for some Hanford TSD units. These areas contain remote readout equipment to gather data or were shielded from radiation by concrete barriers or other materials. A dose-rate of 1 mrem/hour coincides with the level at which exposures to radiation are not actively managed at Hanford. Inspections performed in areas with dose-rates less than 1 mrem/hour do not conflict with AEA requirements, and workers should be able to perform WAC 173-303 inspections in these readily accessible areas. Many of these areas are already physically inspected in a manner that meets requirements under WAC 173-303.

Table 3 "Categories Of Inspection Requirements" summarizes dose assessment results for two main categories of inspections. The table shows areas where inspections involve a "potential for unreasonable exposure to radiation" for various reasons. Each Dangerous Waste Regulation inspection requirement is matched with the corresponding number of TSD units from each facility (in parentheses) for that category. TSD units where the dose-rates fell below 1 mrem/hour or where WAC 173-303 requirements did not apply were omitted because radiation exposure is not an issue in these areas. The table shows:

(1) Areas where inspections would expose workers to radiation that would exceed DOE dose limits or administrative dose guidelines. Measures other than physical inspections are typically employed in these areas to provide the kinds of benefits that would be provided by inspections.

(2) Situations where dose limits and administrative dose guidelines are unlikely to be exceeded by workers who perform dangerous waste inspections, but where the incremental benefits of the WAC 173-303 inspection may be minimal. Typically, incremental benefits are low in these cases in part because of physical constraints on inspections, and in part because alternative measures are in place.

It should be noted that the radioactive properties of RMW create additional avenues for release detection which are not possible with a purely dangerous waste -- remote reading monitors can readily detect the increased radiation that accompanies any release of RMW. In addition, some typical aspects of DOE RMW facility design (e.g. concrete shielding) offer substantial protection to the environment. Because the development of the overwhelming majority of the WAC 173-303 regulations did not include RMW, these additional detection properties <u>and</u> capabilities from radiation were not incorporated. Nuclear facilities employ radiation's unique properties wherever possible to alleviate the necessity of routine physical inspections.

**How Existing Waste Management Measures at Hanford Substitute for Dangerous Wastes Inspections Under WAC 173-303**

Hanford facilities typically employ waste management measures that prevent leaks and spills, and assure that any releases that do occur are promptly detected. The following examples show how typical Hanford practices can effectively substitute for the inspections currently required under WAC 173-303. The regulatory changes petitioners have proposed would require inclusion of plans for measures of this sort at all facilities where WAC 173-303 inspection requirements were modified.

**Daily Inspection For Tanks:** **Monitoring data from leak detection equipment/systems**

No conflict with WAC 173-303 exists. Data from leak detection equipment/systems is recorded continuously in the operating gallery.

Monitoring data is gathered twice each shift for review to detect changes in Tank X-1.

**Daily Inspection For Tanks: Overfill/spill control equipment**

All canyon cells drain to an encased header and to cell X (Tank X-1). Overfill/spill control equipment consists of weight factor (WF) records and alarms located in the operating gallery. Tank X-1 has two WF alarms (a high level and a high/high level). The WF instrumentation is calibrated on an annual basis. The volume of material in Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. The benefit of current WAC 173-303 inspections is met by (1) The continuous recording of the volume of the tank contents, (2) Surveillance (twice every 8 hours) of WF records, and (3) Alarm response.

**Daily Inspection For Tanks: Above-ground portions of tank system for corrosion or releases**

Facility workers cannot physically inspect the above-ground portions of Tank X-1 because the dose-rate is greater than 50,000 mrem/hour in this area. The crane operator can inspect for signs of corrosion by the use of mirrors when removing the cell block covering Tank X-1 during maintenance activities. Any releases from canyon tanks will be detected by WF records and alarms (calibrated annually) in the operating gallery. The benefit of current WAC 173-303 inspections is effectively met by: (1) The crane operator using mirrors to inspect the tank for signs of corrosion during maintenance, (2) Continuous recording of tank volumes, (3) Surveillance of WF records twice each shift, and (4) Response to WF alarms by shift personnel.

**Daily Inspection For Tanks: Construction materials and area immediately surrounding externally accessible portions of the tank system, including secondary containment**

Workers cannot physically inspect the construction materials or external portions of Tank X-1 because of the extremely high dose-rate. The crane operator can safely inspect the construction materials and the rest of the tank system from the crane cab. The crane operator can use mirrors during maintenance activities to describe their condition. Any releases from Tank X-1 will be detected by WF records and alarms in the operating gallery. The benefit of current WAC 173-303 inspections is effectively met by: (1) The crane operator using mirrors to inspect construction materials and the area immediately surrounding externally accessible portions of the tank system, including secondary containment, and (2) Continuous recording of tank volumes, (3) Surveillance of WF records twice each shift, and (4) Response to WF alarms by shift personnel.

**Daily Inspection For Tanks: Areas subject to spills**

Workers cannot physically inspect areas subject to spills of Tank X-1 because of the extremely high dose-rate. If a spill did occur, WF alarms would annunciate in the operating gallery. Shift personnel can then respond to any WF alarms for Tank X-1 without receiving radiation dose. Because this facility will remain in use for another 20 years before closing, additional options for assessing unit condition and assuring early detection of releases are being analyzed.

**General Inspection For Tanks: Monitoring equipment for detecting and preventing releases**

No conflict with WAC 173-303 occurs. The facility has continuous recording of Tank X-1 volume, and surveillance of recorded values twice every 8 hours.

**General Inspection For Tanks: Safety and emergency equipment**

The safety and emergency equipment for canyon cell Tank X-1 would be the in-cell fire protection equipment. Again, the excessive dose-rate of 50,000 mrem/hour in this area means that the physical inspection of this equipment would involve a "potential for unreasonable exposure to radiation". The operability of this equipment is monitored by instrumentation in the operating gallery. This instrumentation is routinely checked each shift and is calibrated on an annual basis. If a fire alarm were to annunciate, it would alarm at both the dispatcher's office which has 24 hour surveillance and at the Hanford fire department. The benefit of current WAC 173-303 inspections is met by: (1) Use of instrumentation that monitors the operability of the in-cell fire equipment, (2) annual calibration of this instrumentation, and (3) Fire alarms that annunciate at both the dispatcher's office and at the Hanford fire department.

**General Inspection For Tanks: Security devices**

The security devices for facility canyon tanks would be the cell cover blocks. The movement of these "security devices" requires a crane operator to lift the cover block which weighs several tons. The crane operator cannot enter the canyon without the facility dispatcher activating the electric door lock. Any cover blocks that are removed by the crane operator results in an increase in radioactivity in the canyon which is detected by appropriate instrumentation. Administrative controls are established at this facility in which the crane operator logs an entry into the shift logbook after completing the work. The crane operator states exactly what work was performed in the canyon (e.g. canyon cover block removed, jumper removed from cell, etc.). Another administrative control exists in which a crane job plan must be written which defines the scope of the work for that crane operator. The benefit of current WAC 173-303 inspections is met for security devices by detection of cell cover block movements, canyon cell control via the facility dispatcher, and administrative controls for the inspection of the security devices.

**General Inspection For For Tanks, Container Storage, and Waste Piles:** **Operating and structural equipment important to preventing, detecting, or responding to environmental or human health hazards**

Canyon cells contain any releases of solution from tanks. Cell Y contains 55-gallon drums that contain solid waste only. No waste with free liquid is present in the drums. Cell Z contains jumper boxes with lead weights and counterbalances. It is questionable whether any benefit would be derived from physical inspection of either solid waste or lead. Furthermore, if solid dangerous waste or lead did somehow leach, the canyon cells drain to an encased header and to cell X (Tank X-1). The volume of Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. Tank X-1 has two weight factor (WF) alarms (a high level and a high/high level). The high WF alarm is set at 1700 gallons and a high/high WF alarm is set at 3700 gallons on this 10,000 gallon tank.

The benefit of current WAC 173-303 inspections is met for TSD tanks, container storage, and waste piles. The equipment to prevent, detect or respond to changes inside these cells is continuously recorded by the volume on Tank X-1 on an around-the-clock basis. Surveillance is made twice every 8 hours of the tank recorded values and workers respond to any WF alarms.

**Weekly Inspection For Container Storage:** **Inspection of areas where containers are stored, looking for leaks and deterioration caused by corrosion or other factors.**

Canyon cells contain any releases of solution from tanks. Cell Y contains 55-gallon drums that contain solid waste only. No waste with free liquid is present in these drums. Operating procedures prevent the placement of liquid inside the drums. It is questionable whether any benefit would be derived from physical inspection of solid waste. Furthermore, if solid dangerous waste did leach, cell Y drains to cell X (Tank X-1). The volume of Tank X-1 is continuously recorded and reviewed at least twice every 8 hours. Tank X-1 also has two weight factor alarms. The benefit of current WAC 173-303 inspections is met because the equipment important to preventing or detecting releases (Tank X-1 volume) is continuously recorded with surveillance twice every 8 hours. Furthermore, workers are trained to respond to all alarms.

## Conclusion

This Appendix shows that radiation protection requirements and ALARA concerns preclude inspections currently required by WAC 173-303 at some Hanford RMW TSDs. The appendix also shows that existing waste management measures can be very effective substitutes for dangerous waste inspections in many cases and achieve the same benefits as the inspections currently required by WAC 173-303.

TABLE 1

DOE OCCUPATIONAL EXPOSURE LIMITS (DOE 5480.11)

| | |
|---|---|
| Stochastic Effects (whole-body exposure) | 5 rem/yr* |
| Non-Stochastic Effects | |
| Lens of the eye | 15 rem/yr* |
| Extremity | 50 rem/yr* |
| Skin of the whole body | 50 rem/yr* |
| Organ or tissue | 50 rem/yr* |
| Unborn Child | |
| Entire gestation period | 0.5 rem |

* Annual effective dose equivalent

TABLE 4-2

WESTINGHOUSE HANFORD
ADMINISTRATIVE GUIDELINES (WHC 1988)

| | | |
|---|---|---|
| Whole body, head, trunk gonads, lens of eye, red bone marrow, active blood-forming organs | 3 rem/yr | 1.25 rem/qtr |
| | 0.3 in a seven day period** | |
| Unlimited areas of skin | 9 rem/yr | 3 rem/qtr |
| Other organs, tissues, and organ systems (except bone) | 7.5 rem/yr | |
| Bone | 15 rem/yr | ---------- |
| Hands, feet*, and forearms | 15 rem/yr | 5 rem/qtr |

* Annual effective dose equivalent
** Per Union Contract

TABLE 2
CATEGORIES OF INSPECTION REQUIREMENTS

| Category | Monitoring Data From Leak Detection Equipment/Systems<br><br>WAC 173-303-640(6)(b)(ii) | Overfill/Spill Control Equipment<br><br>WAC 173-303-640(6)(a) | Above-Ground Portions of Tank System<br><br>WAC 173-303-640(6)(b)(i) | Construction Material and Area Immediately Surrounding Tank System<br><br>WAC 173-303-640(6)(b)(iii) |
|---|---|---|---|---|
| Proposed WAC 173-303-040 (131)(a) | Single-Shell Tanks<br>- 241-BY and 241-C only (28) | 222-S<br>- All Units (2)<br><br>241-Z<br>- All Units (4)<br><br>B Plant Tanks (17)<br><br>T-Plant Tanks (5)<br><br>Single-Shell Tanks<br>-241-BY<br>-241-C only<br><br>242-A Evaporator<br>Evaporator Room<br>Pump Room (2) | PUREX Tanks (8)<br><br>Single-Shell Tanks<br>- 241-BX and 241-C only 241-BY (28)<br><br>242-A Evaporator<br>Evaporator Room<br>Pump Room (2)<br><br>222-S (2)<br><br>241-Z (4)<br><br>B-Plant Tanks (17)<br><br>T-Plant Tanks (5) | PUREX Tanks (8)<br><br>Single-Shell Tanks<br>- 241-BX and 241-C only 241-BY (28)<br><br>242-A Evaporator<br>Evaporator Room<br>Pump Room (2)<br><br>222-S (2)<br><br>241-Z (4)<br><br>B-Plant Tanks (17)<br><br>T-Plant Tanks (5) |
| Proposed WAC 173-303-040 (131)(b) | DST - All (41)<br><br>Other SST (121) | DST - All (41)<br><br>Other SST (121) | DST - All (41)<br><br>Other SST (109) | DST - All (41)<br><br>Other SST (121) |

DST = Double-Shell Tank SST = Single-Shell Tank

TABLE 2 (continued)
CATEGORIES OF INSPECTION REQUIREMENTS

| Category | Areas Subject to Spills<br>WAC 173-303-320 (2) | Monitoring Equipment to Detect or Prevent Releases<br>WAC 173-303-320 (2) | Safety and Emergency Equipment<br>WAC 173-303-320 (2) | Security Devices<br>WAC 173-303-320 (2) | Operating and Structural Equipment<br>WAC 173-303-320 (2) | Container Storage Area<br>WAC 173-303-320 (2) | General Area for Malfunctions, Etc.<br>WAC 173-303-320 (1) |
|---|---|---|---|---|---|---|---|
| Proposed WAC 173-303-040 (131Xa) | B-Plant - All Units (20)<br>PUREX - All Units (11)<br>Single-Shell Tanks - 241-BX 241-BY and 241-C only (40)<br>242-A Evaporator Evaporator Room Pump Room (2)<br>222-S (2)<br>241-Z (4)<br>T-Plant Tanks (5) | 222-S (1) Tank 103<br>241-Z All (4)<br>B-Plant - All Units (20)<br>PUREX Tanks (8)<br>T-Plant (5) | B-Plant - All Units (20) | B-Plant - All Units (20) | 241-Z All (4)<br>B-Plant - All Units (20) | B-Plant - Container Storage Area (1) | B-Plant - All Waste Piles (2) |
| Proposed WAC 173-303-040 (131X b) | All DST (41)<br>Other SST (109) | All DST (41)<br>222-S if frequency >quarterly (1)<br>242-A Evaporator Condenser Room (1)<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | All DST (41)<br>242-A Evaporator (2) Evaporator Room Pump Room<br>All SST (149) | | PUREX -Waste Piles (1) |

DST = Double-Shell Tank SST = Single-Shell Tank

# PROPOSED PETITION TO WASHINGTON DANGEROUS WASTE REGULATIONS, "LABELING"

This petition for rulemaking is submitted to the Washington State Department of Ecology (Ecology) following the provisions of the Revised Code of Washington (RCW) 34.04.060 and 34.04.080, and of the Washington Administrative Code (WAC) 173-303-910(1). It demonstrates the petitioners' need for alternative requirements for management of radioactive mixed waste in tanks, containers and waste piles that are subject to interim status and final status label and sign requirements. These requirements are authorized by the Washington Hazardous Waste Management Act and promulgated under the Washington Dangerous Waste Regulations. Alternative requirements are needed in order to avoid inconsistencies with the petitioners' obligations under the Atomic Energy Act of 1954, as amended, to protect workers from radiation hazards.

1) **Date:** September 29, 1989

2) **Petitioners' Name and Address:**


United States Department of Energy
Richland Operations Office
Richland, WA. 99352

Attention: Anthony J. Knepp
Telephone: (509) 376-1471

Westinghouse Hanford Company
P. O. Box 1970
Richland, Washington 99352

Attention: Lisa A. Garner
Telephone: (509) 376-5969


3) **Petitioners' Interest:**

Petitioner U. S. Department of Energy (DOE) owns and petitioners DOE and Westinghouse Hanford Company (WHC) jointly operate a large number of radioactive mixed waste (RMW) treatment, storage and disposal (TSD) facilities at the Hanford Site in Washington state. Many of these TSD facilities would be affected by the proposed changes.

Submission of this petition is required under The Hanford Federal Facility and Consent Order, signed by DOE, Ecology, and the U.S. Environmental Protection Agency (EPA) on May 15, 1989. Milestone M-22-01 of that Agreement requires DOE to "submit petitions for ... interim status standards to Ecology and EPA" by September 30, 1989[1]. This petition partially fulfills DOE's obligations under this milestone; however, DOE and WHC expect to submit additional

[1]Schedules for addressing compliance issues, not subject to petition under Milestone M-22-01 must, under Milestone M-22-01, be negotiated by December 31, 1989. Most compliance issues will be addressed through compliance schedules.

petitions in the future. Although Milestone M-22-01 refers only to interim status requirements, this petition also addresses requirements for permitted facilities, because those requirements are similar in many respects.

Petitioner DOE is further interested in the dangerous waste regulatory requirements addressed in this petition because, under the Atomic Energy Act (AEA), DOE shares responsibility for regulating RMW facilities with Ecology and EPA. Petitioner WHC is also interested in better coordination of state regulations and AEA requirements. WHC must comply with the requirements established under those Acts, and the DOE/AEA regulatory system places significant responsibility on detailed radiation protection requirements for workers at DOE facilities.

Due to the unique nature of radioactive mixed waste, compliance with both the AEA and state regulations is difficult because of the need to protect workers from unreasonable radiation exposure. The DOE and contractor staff would like to eliminate these conflicts. Therefore, the petitioners would prefer to resolve these conflicts by revising state regulations where possible. If conflicts cannot be resolved through regulatory rulemaking, however, DOE may need to take other steps appropriate to its responsibilities as an AEA regulatory agency.

We are firmly committed to protecting human health and the environment from any risk posed by RMW management activities. As DOE Order 5400.1 General Environmental Protection Program states, "... it is DOE policy to conduct the Department's operations in compliance with the letter and the and spirit of applicable environmental statutes, regulations, and standards." Environmental compliance is primarily achieved by compliance with DOE Orders and applicable laws and regulations.[6a] For example, DOE Order 5820.2A "Radioactive Waste Management" states that these wastes "shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees and the environment."

Finally, DOE and WHC are very interested in the matters addressed in this petition because a favorable Ecology response would enhance the ability of the petitioners to operate RMW facilities under a consistent set of standards. Because state regulations did not anticipate regulation of RMW when written, the radioactive properties and capabilities of RMW were not considered or incorporated. By considering the radioactive nature of the materials and the benefits derived from existing worker protection programs, our relationships in cleaning up Hanford will be strengthened.

**4) Proposed Action:**

We propose more flexible signing and labeling requirements for mixed waste facilities in situations where compliance with current dangerous waste regulation requirements could involve unreasonable radiation exposures. Under the proposed actions, signs and labels could be posted at alternate locations, but would provide the same degree of access control and protection of human health as posting at the locations currently required by the dangerous waste regulations.

In order to provide the flexibility in placement of signs and labels described above, we suggest the following changes be made to state dangerous waste regulations:[2]

WAC 173-303-040 (definitions) should be amended by adding the following new terms:

(129) "Radioactive mixed waste" or RMW means a waste that contains both a non-radioactive dangerous component and a radioactive component.

(130) "Radioactive component" refers only to the actual radionuclides dispersed or suspended in the RMW substance.

(131) "Potential for unreasonable exposure to radiation" means:

(a) A likelihood of exposure to a radiation dose or dose-rate that is in excess of a radiation limit established under federal or state law; or

(b) A likelihood of exposure to radiation that can be avoided by using alternative means that are equivalent in effect to the unmodified dangerous waste requirement, and are consistent with the ALARA program of the owner/operator.

(132) "Radiation limit established under federal or state law" includes any dose or dose-rate limits established under the Atomic Energy Act, or under a federal or state worker health or safety regulatory program, including the following:

(a) a radiation dose or dose-rate limit specified in any federal or state regulation, or administrative or judicial order to a facility; or

(b) a radiation dose or dose-rate limit established in any federal or state license or authorization in effect at a facility; or

(c) a dose or dose-rate limit established in written criteria that are consistently appled at a facility to reduce or control worker exposure to radiation. Such written criteria may include, but is

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[2] The essential features of this program could of course be implemented by modifying existing regulations in other ways instead. Our suggested approach minimizes administrative burdens on Ecology, without limiting Ecology's existing authority to intervene in specific situations if necessary. The specific language proposed adds "substitute" RMW subsections to key WAC 173-303 sections. This approach preserves the current structure of these regulations, makes it unnecessary for operators of non-mixed-waste facilities to deal with mixed waste complications, and makes it readily apparent how requirements for mixed waste facilities would differ from non-mixed-waste facilities.

not limited to, administrative guidelines, procedures, or contractual limitations.

(133) "As Low As Reasonably Achievable or the acronym ALARA means minimizing radiological or non-radiological exposure to as far below applicable limits or guidance as social, economic, technical and practical considerations permit. The cost of radiation protection and the reasonable allocations of health protection resources are relevant considerations to ALARA determinations.

(134) "ALARA program" means the program implemented by the owner/operator which minimizes human and environmental exposures to radiation substances and conditions, commensurate with sound economics and operating practices.

WAC 173-303-310 (establishing security requirements) should be amended to add a new subsection (4) for mixed waste facilities, as follows:

(4) In lieu of WAC 173-303-310(2)(a), the owner or operator of a radioactive mixed waste unit that poses a potential for unreasonable exposure to radiation may place the required signs at the point at which access to the area containing the RMW is controlled for radiation protection purposes.

WAC 173-303-395(1) (establishing precautions for ignitable, reactive, and incompatible wastes) should be amended by changing the last sentence of subsection (a) as follows:

(a) ...Except for ignitable or reactive RMW in areas for which smoking is prohibited as part of established radiation protection programs under the Atomic Energy Act, "No Smoking" signs must be placed wherever there is a hazard from ignitable or reactive waste.

WAC 173-303-395(6) (establishing labeling requirements for tanks and containers) should be amended by identifying the current language as subsection (a) and by adding a new subsection (b) for mixed waste facilities, as follows:

(b) The requirements of subsection (a) shall not apply to tanks and containers of radioactive mixed waste if placement of such labels or maintenance of such labels would cause a potential for unreasonable exposure to radiation. In such cases the owner/operator must instead provide a label at the point at which access to the RMW tanks or containers is controlled for radiation protection purposes. This label must be clearly visible to anyone gaining access to the RMW tanks or containers and must identify the major risk(s) associated with the contents for employees and emergency response personnel. A document demonstrating the existence of a potential for unreasonable exposure to

radiation from placement or maintenance of labels as described in subsection (a) shall be maintained at the facility.

WAC 173-303-630(3) (establishing labeling requirements for containers) should be amended by identifying the current language as subsection (a) and by adding a new subsection (b) for mixed waste facilities, as follows:

(b) The requirements of subsection (a) shall not apply to containers of radioactive mixed waste if placement of such labels or maintenance of such labels would cause a potential for unreasonable exposure to radiation. In such cases the owner/operator must instead provide a label at the point at which access to the RMW tanks or containers is controlled for radiation protection purposes. This label must be clearly visible to anyone gaining access to the RMW containers and must identify the major risk(s) associated with the contents for employees and emergency response personnel. A document demonstrating the existence of a potential for unreasonable exposure to radiation from placement or maintenance of labels as described in subsection (a) shall be maintained at the facility.

WAC 173-303-640(5)(d) (establishing labeling requirements for tanks) should be amended by identifying the current language as subsection (i) and by adding a new subsection (ii) for mixed waste facilities, as follows:

(ii) The requirements of subsection (d)(i) shall not apply to tanks of radioactive mixed waste if placement of such labels or maintenance of such labels would cause a potential for unreasonable exposure to radiation. In such cases the owner/operator must instead provide a label at the point at which access to the RMW tanks is controlled for radiation protection purposes. This label must be clearly visible to anyone gaining access to the RMW tanks and must identify the major risk(s) associated with the contents for employees and emergency response personnel. A document demonstrating the existence of a potential for unreasonable exposure to radiation from placement or maintenance of labels as described in subsection (d)(i) shall be maintained at the facility.

WAC 173-303-806(4) (designating contents of Part B permit applications) should be amended by adding a new subsection (i) as follows:

(i) Specific Part B information requirements for radioactive mixed waste facilities. Part B of the permit application for RMW facilities shall include a description of the alternative inspection plans to meet the requirements of WAC 173-303-320, WAC 173-303-630, and WAC 173-303-640. Part B of the permit application for RMW facilities shall also include a description of the alternative placement of signs and labels to meet the requirements of WAC 173-303-310, WAC 173-303-395, WAC 173-303-630, and WAC 173-303-640.

5) Justification of Proposed Action:

In managing RMW, the petitioners must meet the requirements of the Dangerous Waste Regulations (WAC 173-303) for management of the nonradioactive portion of RMW and the requirements of the AEA for management of the radioactive portion. For the requirements being addressed, i.e., RMW sign and label requirements, compliance with the strict requirements of WAC 173-303 is not always consistent with the requirements of the AEA. We have proposed alternate means of signing and labeling to allow for management of RMW in such a manner as to meet the goals of both the Dangerous Waste Regulations and the AEA.

This section of the petition demonstrates why the proposed actions are deemed necessary. It explains that DOE facilities must operate under requirements for radiation protection and describes these requirements. It also explains that although these requirements were specifically developed for the purpose of radiation protection, they also result in other benefits, many of which are the same benefits derived from the requirements of the Dangerous Waste Regulations (i.e., protection of human health and the environment through prevention of waste releases, detection of releases that do occur, and prevention of exposure to hazardous materials). Finally, it explains that in many cases, it is not possible for DOE to meet both radiation protection requirements and WAC 173-303 requirements.

Radiation Protection Goals

Radiation protection is a major component of all DOE operations involving radiation and radioactive materials. Radiation protection policies and procedures are given in DOE Orders [6a]. One radiation protection policy in DOE Orders originates from the EPA. The 1987 Presidentially-approved "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" [6b] incorporates radiation protection standards published by the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP). This EPA guidance reaffirms the three basic principles governing radiation protection programs:

> "The first is that any activity involving occupational exposure should be determined to be useful enough to society to warrant the exposure of workers; i.e., that a finding be made that the activity is 'justified'... The second is that, for justified activities, exposure of the work force should be as low as reasonably achievable (commonly designated by the acronym 'ALARA') ... Finally, to provide an upper limit on risk to individual workers, 'limitation' of the maximum allowed individual dose is required."

Under Executive Order 10831, DOE Orders are required to be consistent with this EPA guidance on radiation protection. For example, DOE Order 5480.11 "Radiation Protection For Occupational Workers," effective December 21, 1988 states:

"It is the policy of DOE to implement radiation protection standards that are consistent with the Presidential approved guidance to Federal Agencies promulgated by the EPA and based on the recommendations by authoritative organizations."

Consequently, the DOE has adopted the policy of maintaining all radiation doses as far below the established mandatory limits as social, economic, technical, and practical considerations permit (i.e. ALARA). All occupational workers must comply with DOE Order 5480.11 and with contractor administrative manuals for radiation protection and ALARA.

Similarly, the Nuclear Regulatory Commission (NRC) is amending 10 CFR 20 to incorporate the EPA's Presidentially-approved guidance on radiation protection programs. The definitions that we propose for a "potential for unreasonable exposure to radiation" reflect the three radiation protection concepts embodied by the EPA-required guidance.

## Radiation Protection Fundamentals

In order to understand radiation protection requirements, it is necessary to understand the nature of exposure to radiation and radioactive materials and the risk posed by such exposure. The following information briefly explains fundamentals concepts of radiation exposure in order to better understand radiation protection requirements for management of RMW.

Radioactive mixed wastes are dangerous wastes which also contain radioactive materials. Radiation exposure from RMW management can result from two modes. The first is exposure to direct radiation. This mode of exposure results from work around radiation sources, which could be the RMW itself or other radioactive materials in the vicinity of the RMW. Protection from this type of exposure is accomplished through physical barriers which will absorb the radiation. The type of barrier required depends on the type of radiation (i.e., alpha, beta, gamma, neutrons, x-ray). The second mode is internal deposition of radioactive materials (e.g., inhalation, ingestion). This mode of exposure can result from work in areas which are radioactively contaminated (i.e., radionuclides are present which can be taken into the body). Protection from this type of exposure is accomplished through use of personal protective equipment (e.g., air purifying respirators) which will prevent internal deposition.

Radionuclides emit different forms of radiation (e.g. alpha, beta, gamma, neutron and X-ray) which can change biological systems. These changes can produce biological damage with different resultant health effects. For example, ionizing radiation is both an initiator and a promoter of carcinogenesis, capable of producing benign or malignant tumors in any living mammalian cell type [6c].

Radiation dose can be received all at once or for much longer periods. Both acute and chronic radiation exposures will produce health effects. These health effects depend upon three main factors which are:

- the magnitude of radiation dose to tissue (i.e. total absorbed dose),
- linear energy transfer (LET), and
- radiation dose-rate.

The first main factor, the magnitude of radiation dose to tissue (or total absorbed dose) is very important. If the total dose that is absorbed by human cells is high enough, the result is irreversible and irreparable. Illness and death can result from a single acute exposure.

Radiation exposure to occupational workers is foremost required to be maintained within control limits. Operational controls for external (and internal) radiation exposure have been established to provide a basis for exposure control planning, and to minimize the possibility of any person inadvertently exceeding the annual occupational dose limits.

DOE operating contractors are also required by DOE Orders to develop and follow administrative dose guidelines to assure that dose limits are not exceeded. Therefore, dose limits and dose guidelines are control levels that are established below levels known to cause any observable health effects in individuals. Dose limits and dose guidelines, as presented in Table 2, cannot be exceeded during RMW management.

Linear energy transfer or LET, is defined as the number of ionizations produced by a radioactive particle along its pathlength. Alpha particles are heavy (dense) charged particles which have a high LET. Thus, alpha particles are slow-moving and produce thousands of ionizations along their pathlength from a single internal deposition. Once deposited, alpha emitting radionuclides ionize the lung and other tissues and can lead to cancer. Since ALARA programs are designed to eliminate internal depositions, any internal depositions of alpha particles are not ALARA.

Dose rate is the third main factor causing health effects. Dose rate can be defined as the amount of radiation exposure measured over time. Areas of very high dose-rate (i.e. more than 5000 mrem/hour[3]) are <u>never</u> entered routinely. Radiation dose guidelines and dose limits would be exceeded in minutes or even seconds. This precludes any practical purpose to such exposures.

In addition to limiting exposure to very high dose rates, the ALARA concept limits exposure to radiation at lower dose rates. The ALARA concept, as required by DOE Order 5480.11, applies to annual dose, committed dose (dose from internally-deposited, long-lived radionuclides), and collective dose (the total of all individual doses). ALARA is based on the assumption that no

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[3]This petition uses units of radiation exposure and dose from this exposure in multiples of rem or mrem. In actual practice, measurement techniques, dose-rate measurements, and dose assessments differ slightly. However, because of the type of radiation involved and for the purpose of this petition, it is valid to consider exposure, dose, dose equivalent, and committed dose as interchangeable units.

dose, regardless of how small, is entirely without risk. Thus, reducing radiation dose to a level that is "as low as social, technical, economic, practical and public policy permit" will meet DOE's policy directive to "reduce health risks".

In summary, radiation exposure presents three main areas of concern related to management of RMW:

- Work in radiation areas must be controlled so that the total absorbed dose by workers is kept below limits established for protection of health.

- Work in radioactively contaminated areas must be controlled to minimize the risk of internal deposition of radionuclides. Consistent with ALARA principles, work in highly contaminated areas must be avoided unless justified by the benefit resulting from the exposure.

- Work in radiation areas must be controlled to avoid exposure to high dose rates. Consistent with ALARA principles, all exposure to radiation, regardless of dose rate, must be justified by the benefit resulting from the exposure.

DOE's Radiation Protection Program

A variety of radiation protection requirements applicable to management of RMW have been established by DOE to ensure that radiation protection goals are met. These requirements are briefly discussed below. As noted in the discussions, in many cases the benefits derived from these requirements are identical to or consistent with the benefits derived from the signing and labeling requirements of WAC 173-303.

Facilities in which radioactive materials, including RMW, are handled are required to limit access to authorized personnel. All RMW units are within fenced areas that are not accessible to the general public. In addition, many are within controlled access structures. The degree of access control required is dependent on the specific radionuclides present and their amounts, the radiation dose rate present, and the amount of radioactive contamination present.

In all cases, access by the public to radiation zones and radioactively contaminated areas is prohibited. Access control is accomplished through physical barriers (e.g., fences, buildings) and warning signs. The benefit derived through this requirement to prohibit public access is identical to the benefit derived through the requirements under WAC 173-303-310.

As required by DOE Orders, worker exposure to radiation and radioactive materials must be controlled and monitored. Employees are protected by an additional fence or other physical barrier, as described above, that prevents accidental access to the radiologically controlled areas where RMW is located. All of these barriers have signs or labels with warnings as required by DOE Orders. These sign and labels identify the type of radiological control zone

(e.g., dose rate) and the type of radiation hazard present (e.g., surface contamination). Signs and labels are placed at the boundary of the radiation control zone, consistent with radiation protection requirements.

The above signing and labeling requirements provide information to personnel who enter radiological control zones. The signs and labels prevent accidental entry to control zones and, therefore, prevent accidental exposure to radiation, consistent with ALARA. The benefit derived from these requirements (i.e., prevention of accidental entry to RMW management areas) is the same as the benefit derived from the signing requirements under WAC 173-303-310.

The labels and signs required for radiological control zones and radioactive materials identify the radiation hazard present. As such, these signs and labels convey information regarding the radiological risk present. The benefit derived from this requirement is that employees, emergency response personnel, and anyone else gaining access to radiological control zones is informed of the radiological risk present. This benefit is consistent with the benefit derived from the container and tank labeling requirements under WAC 173-303-395(6). In many cases with RMW, the major risk associated with the RMW is the radioactivity. In such cases, the benefit derived from radiation protection signs and labels would be identical to the benefit derived from the requirements of WAC 173-303-395(6).

Radiation protection requirements also include identification of the risks to employees through required work procedures. To meet radiation protection requirements, all work with radioactive materials, including RMW, must be performed according to written procedures which identify specific radiation protection requirements. Prior to entering and/or performing work in radiologically controlled areas employees must read and understand the written procedures. The procedures must be strictly followed by employees and only work specified in the procedure may be performed. Through implementation of these mandatory procedures, all employees and emergency response personnel are made aware of the risks associated with the radioactive materials with which they work.

The benefit derived from through use of such procedures is that all workers are informed of the risks associated with the radioactive materials that they work with. In the case of work with RMW, this benefit is consistent with the benefit derived through the labeling requirements of WAC 173-303-395(6). In cases where radioactivity is the major risk associated with RMW, the benefits are identical to the benefits from WAC 173-303-395(6).

Required procedures for work in radiologically controlled areas also prohibit smoking in any of these areas. Smoking is not allowed because it increases the risk for exposure to radioactive materials. Through use of these procedures, all employees entering radiologically controlled areas, including all RMW management, are made aware of the fact that smoking is not allowed.

The major benefit derived from use of procedures which prohibit smoking in radiologically controlled areas is radiation protection of workers. An additional benefit with respect to RMW management is that smoking will never

occur in areas used for storage of ignitable or reactive RMW. This benefit is identical to the benefit derived from WAC 173-303-395(1).

## Conflicts Between Radiation Protection Requirements and Dangerous Waste Regulation Requirements

The above discussions have identified radiation protection requirements that are applicable to management of RMW and explained that these requirements result in the same benefits as would result from current signing and labeling requirements under WAC 173-303. The accomplishment of the same benefits through existing radiation protection requirements as would be accomplished through WAC 173-303 requirements is one of the key points of our justification. The other key point is that WAC 173-303 requirements in some cases present conflicts with radiation protection requirements. In such cases, it is not possible to meet both sets of requirements. The following discussion addresses these conflicts.

In some cases with RMW TSD units, it may not be possible to comply with labeling requirements under WAC 173-303 and still comply with radiation protection requirements. Placement of labels on RMW tanks and containers as required under WAC 173-303 will result in exposure of workers to direct radiation. In addition, if the tanks or containers are located in radioactively contaminated areas, placement of the labels presents the risk of radiation exposure through internal deposition. If the containers or tanks are located in areas of high dose rate, placement of such labels could result in radiation exposure above established limits. In areas with lower dose rate, or areas which are radioactively contaminated, placement of labels could result in exposure which does not comply with ALARA. Additionally, all exposure to radiation must be justified in terms of the benefit that will result. As discussed previously, the benefits derived through compliance with radiation protection requirements are often identical with the benefits associated with requirements under WAC 173-303. In such cases, exposure to radiation from labeling, even though it would not exceed established numerical limits or guidelines, would not result in a benefit and should not be allowed.

To identify specific conflicts between radiation protection requirements and signing and labeling requirements under WAC 173-303, the petitioners have made an assessment of the radiation dose which would result from placement of signs and labels required under WAC 173-303 at a number of RMW TSD units at Hanford. This assessment is described in Appendix 2 and identifies specific instances where signing and labeling requirements under WAC 173-303 could not be met while still meeting radiation protection requirements.

## Analysis of Proposed Action

The regulatory changes that the petitioners' have requested will allow the petitioners to avoid conflicts with radiation protection requirements while still managing RMW in ways that provide the same benefits as compliance with the Dangerous Waste Regulations. Alternative measures that the petitioners use for RMW include, but are not limited to, providing signs and labels at the

point at which access to RMW tanks and containers is controlled for radiation protection purposes and providing signs and labels which identify the radiological risk associated with the contents of the tanks and containers.

A detailed analysis of the requested changes follows.

## Definitions

A definition of "potential for unreasonable exposure to radiation" is proposed that embodies the three principles of radiation protection included in the EPA's Presidentially-approved guidance to federal agencies. The definition is presented in terms of "potential for unreasonable exposure", so that an actual overexposure to radiation does not have to exist before accommodations to Dangerous Waste Regulation requirements can be made.

Therefore, if labeling RMW tanks or containers or maintaining labels would cause a worker to receive an exposure to radiation in excess of numerical limits or guidelines, the labeling task can be deemed to represent a "potential for unreasonable exposure to radiation". The proposed definition makes use of dose guidelines because of the way radiation exposure is controlled at DOE facilities. DOE Orders require that administrative guidelines be set to assure that dose limits are not exceeded. (Facilities regulated by the Nuclear Regulatory Commission have similar requirements.) Since RMW tank and container labeling activities and maintenance of signs and labels would be conducted as routine tasks, radiation exposures for these tasks should be managed to the administrative guideline, and not to the limit.

Another precept of radiation protection that is reflected in the proposed definition is the concept of receiving radiation exposure only if and when it is warranted, i.e. when benefit is derived from the exposure. If the benefit of the signing or labeling requirements under WAC 173-303 is fully met by an alternative that requires substantially less radiation dose to implement, radiation protection standards dictate that the alternative be employed. This remains true, provided that the alternative involves doses that are as low as reasonably achievable (ALARA) with social and economic factors taken into consideration.
The principle of ALARA is complex, as it operates to strike a balance between engineering solutions. This balance can reduce radiation exposures to very low levels, and the costs involved with employing those engineering solutions can be very high. Guidance on how to optimize these cost/benefit determinations is provided in Report #26 of the International Council on Radiation Protection. Most, if not all, DOE and NRC regulated facilities have developed their own guidance on how to make ALARA-based decisions.

Thus, the definition of "potential for unreasonable exposure to radiation", "ALARA," and "ALARA program" encompass the major precepts of a radiation protection program. The definitions are needed to allow a determination of "how much radiation exposure is too much". They also provide guidance on when engineering solutions should be employed.

### Container and Tank Labeling Requirements

As explained in the above definition of ALARA, if the benefits of current labeling requirements under WAC 173-303 are fully met by alternative measures that require substantially less radiation dose to implement, radiation protection standards dictate that the alternative measures be employed. The benefit of the labeling requirements in WAC 173-303-395(6), -630(3), and -640(5)(d) are that they convey information concerning the major risks posed by the wastes to any employees, emergency response personnel, and members of the public who might come into contact with the wastes. Labels are required to be placed directly on the container or tank since access control cannot be assumed at most dangerous waste TSDs. As pointed out in earlier discussions, radiation protection requirements under the AEA dictate that access to RMW containers and tanks be strictly controlled. Access control is maintained through radiological control zones with specific points of entry. Because access is strictly controlled, and because access can only occur at specific points, it is possible to convey needed information to employees and emergency response staff at these points. Radiation protection requirements preclude inadvertent access of RMW containers and tanks where direct labeling of the container or tank would be required. Through these access control measures and labeling requirements, the benefits of Dangerous Waste Regulation requirements are realized while avoiding the potential for unreasonable exposure to radiation.

### Area Posting Requirements

The access points to some areas where RMW are managed are, themselves, within areas posing a potential for unreasonable exposure to radiation. Since access control is maintained through radiological control zones with specific points of entry, it is possible to convey the necessary information to employees and emergency response staff at points of entry removed from the inner areas containing RMW. Through use of radiological control zones, the benefit of WAC 173-303-310 posting requirements is achieved without the radiation exposure which might result from placement of signs at the entrance to specific areas where RMW are managed.

### No Smoking Signs

Smoking is not allowed in any area containing radioactive materials. This rule is administratively implemented and enforced at Hanford. Therefore, the posting of "No Smoking" signs is superfluous and represents a potential for unreasonable exposure to radiation in accordance with proposed WAC 173-303-131(b). The benefit of WAC 173-303-395(1), namely prevention of smoking in areas where reactive and ignitable wastes are stored, is achieved without placement of signs.

## Conclusion

In conclusion, the petitioners have reflected an appropriate balance of responsibility, authority, and expertise in this petition-for-rulemaking. Established radiation protection requirements and guidance should be used to

identify conflicts between Atomic Energy Act and Dangerous Waste Regulation requirements. Likewise, facility representatives should initiate alternative means of achieving the benefits of signing and labeling requirements under WAC 173-303. The results of these determinations should be documented. Such documents should be available for inspection by Ecology. If the documented demonstrations are inadequate, recourse remains available to both parties under the provisions of the Dangerous Waste Regulations and The Hanford Federal Facility Agreement and Consent Order. This petition has included all of these concepts.

## 6) References

### 6a. Listing Of Applicable DOE and DOE-RL Orders From 5400 and 5480 series

| DOE Order # | Effective Date | Subject |
|---|---|---|
| 5400.1 | 11/09/88 | "General Environmental Protection Program" |
| N 5400.1 | 11/08/86 | "Environmental Policy Statement" |
| 5400.2A | 01/31/89 | "Environmental Compliance Issue Coordination" |
| 5400.3 | 02/22/89 | "Hazardous and Radioactive Mixed Waste Program" |
| N 5400.4 | 08/02/88 | "Integration of Environmental Compliance Processes" |
| 5440.1C | 04/09/85 | "National Environmental Policy Act" |
| N 5480.1A | 05/13/88 | "Safety and Health Policy Statement" |
| 5480.1B | 09/23/86 | "Environment, Safety & Health Program For DOE Operations" |
| N 5480.3 | 03/09/88 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| 5480.3 | 07/09/85 | "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes" |
| N 5480.4 | 06/21/88 | "Preliminary Notification Of Environment, Safety, and Health Concerns" |
| 5480.4 | 05/15/84 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 09/23/86 | "Safety of Nuclear Facilities" |

| | | |
|---|---|---|
| 5480.11 | 12/21/88 | "Radiation Protection For Occupational Workers" |
| 5480.14 | 04/26/85 | "Comprehensive Environmental Response, Compensation & Liability Act Program" |
| 5481.1B | 09/23/86 | "Safety Analysis and Review Program" |
| 5482.1B | 09/23/86 | "Environment, Safety & Health Appraisal Program" |

| DOE-RL Order # | Effective Date | Subject |
|---|---|---|
| 5483.1A | 06/22/83 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated Facilities" |
| 5484.1 | 02/24/81 | "Environmental Protection - Safety & Health Protection Information Reporting Requirements" |
| 5440.1A | 02/03/87 | "Implementation of the National Environmental Policy Act At RL" |
| 5480.1 | 05/21/82 | "Environmental Protection, Safety, & Health Protection Program For RL" |
| 5480.1A | 09/07/88 | "Environment, Safety, & Health Program For DOE Operations For RL" |
| 5480.4A | 12/01/87 | "Environmental Protection, Safety & Health Protection Standards" |
| 5480.5 | 10/15/84 | "Safety of Nuclear Facilities" |
| 5480.10A | 06/20/88 | "Industrial Hygiene Program" |
| 5481.1 | 10/05/83 | "Safety Analysis & Review Program" |
| 5482.1B | 03/04/87 | "Environment, Safety, Health, & Quality Assurance Appraisal & Surveillance Program" |
| 5483.1A | 09/06/88 | "Occupational Safety & Health Program For DOE Contractor Employees At Government-Owned Contractor-Operated (GOCO) Facilities" |
| 5484.1 | 09/26/83 | "Environmental Protection - Safety Protection Information Reporting Requirements" |
| 5484.2A | 09/24/84 | "Unusual Occurrence Reporting System For RL" |

6b 52 FR 2822. Radiation Protection Guidance to Federal Agencies for Occupational Exposure; Approval of Environmental Protection Agency Recommendation, The President, Federal Register, January 27, 1987.

6c Mettler, Fred A. (Jr.), M.D. et. al., 1985. Medical Effects of Ionizing Radiation, Grune & Stratton, Inc., 1985.

6d DOE Publication PNL-6577 "Health Physics Manual of Good Practices for Reducing Radiation Exposure to Levels that are As Low As Reasonably Achievable (ALARA)", July 1988

## Appendix 2

## Dangerous Waste Regulation Signs and Labeling and Radiation at Hanford

### Introduction

This appendix provides information concerning estimated worker radiation doses that would result from implementation of Dangerous Waste Regulation sign and labeling requirements at some Hanford RMW TSDs, and compares these doses to radiation protection requirements that have been established at Hanford. Specific examples of areas where workers could be subjected to a potential for unreasonable exposure to radiation from labeling requirements under WAC 173-303 are detailed. In addition, this appendix demonstrates that existing environmental protection efforts at Hanford often provide the same kinds of benefits that the signs and labels required under WAC 173-303 would provide.

### Scope and Methods

Eight Hanford 200 Area TSD Facilities were evaluated, including the 222-S Laboratory, 241-Z Facility, 242-A Evaporator, B-Plant, the Plutonium Uranium Extraction Facility (PUREX), T-Plant, Double-Shell Tanks, and Single-Shell Tanks.

In order to determine whether or not radiation protection requirements could be met, facility representatives were asked to estimate the dose to place and maintain signs and labels required by WAC 173-303 at each identified facility. Questionnaires were presented in a matrix format with each of the signing or labeling tasks identified for each of the TSD units of concern.

Facility representatives were instructed to estimate the worker dose for each signing or labeling task at each unit, assuming use of customary radiation protection measures as dictated by DOE Orders and contractor manuals. Because these radiation protective measures were typical of those currently in use, the measures were also considered to be ALARA. Representatives were also cautioned not to overestimate the doses, and were not provided with any information on the applicable numerical limits. In this way, the calculated doses were expected to represent a close approximation of the actual dose.

Dose estimates for each task were assessed against the more protective site specific administrative dose guidelines established by Westinghouse Hanford Company to implement DOE directives, not just against DOE regulatory limits. This was done for several important reasons:

- Federal guidance requires use of administrative guidelines as part of an ALARA program.
- DOE Order 5480.11 requires doses to be maintained at ALARA levels.
- Administrative guidelines tend to be more limiting than the established regulatory limits contained in DOE Order 5480.11.

- Installation and maintenance of signs and labels are routine tasks, and workers must not exceed administrative guidelines on a routine basis.

- Existing contracts between labor unions and WHC require management of radiation exposure at ALARA levels within the administrative guidelines.

Whether the dose received from conducting a set of activities is within administrative guidelines depends on all activities involving radiation dose that are conducted by that individual. Placement of labels is a non-recurring requirement, and for this assessment it was assumed that placement of labels in a single area would be the only radiation work each workers would perform in a weeks time. (This is an unrealistic assumption, because most Hanford radiation workers are assigned to multiple tasks each day where they receive dose). Under this assumption, the controlling does guideline is the WHC administrative limit of 300 mrem/week. Labeling tasks involving doses in excess of 300 mrem or dose rates in excess of 5,000 mrem/hour were considered to involve a potential for unreasonable exposure to radiation.

**Dose Estimate Results**

It was apparent that the dose guidelines or dose rate limits would be exceeded at TSD units where dose rates are very high. Since affected facilities had historical proof of these dose rates, no new measurements were made. Next, a screening dose rate was established in those cases where at least one of the DOE regulatory limits would be exceeded. If whole body dose rates were known to be greater than this screening dose-rate at TSD units, no further justification was needed to confirm radiation risk.

The potential for unreasonable exposure to radiation from WAC 173-303 labeling requirements has been documented for the facilities shown in Table 1. A distinction is made for those units where exposure would be in excess of limits [proposed WAC 173-303-040(131)(a)] and those units where the placement of signs in areas having dose rates in excess of 1 mrem/hr appears to carry no additional benefit [proposed WAC 173-303-040(131)(b)]. At each affected unit, the information on the signs or labels required for compliance with the Dangerous Waste Regulations would be placed adjacent to the signs or labels warning of radiation hazards under Atomic Energy Act (AEA) requirements. There are similar requirements under DOE Order 5480.11 for placement of radiation warning signs and labels; however, the DOE Order allows their placement in alternate locations consistent with radiation protection requirements. Thus, placement of signs and labels required under WAC 173-303 near those required under the AEA provides a common location for communication of hazards present.

**Example**

B-Plant is a facility that manages RMW in areas having a potential for unreasonable exposure to radiation. The following examples illustrate the

conflicts between WAC 173-303 labeling requirements and AEA radiation protection requirements and also illustrate how the proposed changes to WAC 173-303 will allow protection of human health and the environment equivalent to current labeling requirements.

### Placement of Labels on Containers

Containers of RMW are stored in the B Plant Canyon in Cell 4 which do not have labels required under WAC 173-303. Wastes were placed in these containers prior to the time at which RMW were managed under the Dangerous Waste Regulations. These containers are labeled with AEA radiation protection labels since radiation warning labels are placed on containers prior to placement of waste into the container. After remote placement of waste into containers, the containers have dose rates greater than 400 rem/hour. Because of this dose rate, placement of labels directly on the containers, as required by WAC 173-303-395(6) and WAC 173-303-630(3) would result in a potential for unreasonable exposure to radiation.

These containers are stored in the heavily shielded and access-controlled Cell 4 in the B Plant Canyon. In lieu of placement of labels directly on the containers, and in compliance with the proposed WAC 173-303-395(6)(b) and WAC 173-303-630(b), all canyon entrances have been labeled and administrative procedures exist which prevent the casual movement and management of the containers. Cell 4 has a heavily shielded cover block that can be lifted only by crane. Extensive administrative controls govern all operations of the crane including:

- development and approval of a crane job plan;
- obtaining permission of the B Plant Dispatcher; and
- entry into the operator's shift log book.

These administrative controls limit access and movement of wastes and inform workers of the hazards involved with management of the wastes. Placement of signs at each point of access to the areas, as required under the proposed WAC 173-303-310(4), further serves to control access and communicate hazards to workers. Implementation of these controls and signs, which is required under AEA and would be required under the proposed WAC 173-303-310(4), -395(6)(b), and -630(3)(b), provides the same benefit as labeling requirements under the current WAC 173-303-395(6) and -630(3).

### Placement of "No Smoking" Signs

Currently, there are no ignitable or reactive wastes stored in Cell 4; however, administrative controls are in effect which eliminate the need to place "No Smoking" signs. These administrative controls, which are required under AEA include:

- Radiation Work Permits which do not allow smoking in a radiation zone and

- The requirement to wear a supplied air respirator that would preclude smoking or open flames.

Since no smoking is allowed in radiation zones, and smoking would not be allowed under the proposed WAC 173-303-395(1)(a) there is no need for "No Smoking" signs. The controls which are currently in place and which would be required under the proposed WAC 173-303-395(1)(a) provide the same benefit to human health and the environment that the "No Smoking" signs required under WAC 173-303 would provide.

Placement of "Danger" Signs at Entrances

The AEA requires placement of warning signs at the point of entry to radiologically controlled zones. These radiation warning signs are placed at the entrance to the B Plant Canyon and at the entrance to the B Plant crane. Placement of "Danger - Unauthorized Personnel Keep Out" signs next to these radiation warning signs would be required under the proposed WAC 173-303-310(4). WAC 173-303-310(2)(a) requires placement of these at the entrance to active portions of the TSD, which could be interpreted to be on the Cell 4 cover block. Placement of signs on the cover block would result in a potential for unreasonable exposure to radiation. Placement of these signs at the entrance to the control zone prevents unauthorized contact with wastes. Placement of signs on the cover block would achieve no additional benefit over the benefit provided by placement at control points as required by the proposed WAC 173-303-310(4).

TABLE 1

DOE OCCUPATIONAL EXPOSURE LIMITS (DOE 5480.11)

| | |
|---|---|
| Stochastic Effects (whole-body exposure) | 5 rem/yr* |
| Non-Stochastic Effects | |
| Lens of the eye | 15 rem/yr* |
| Extremity | 50 rem/yr* |
| Skin of the whole body | 50 rem/yr* |
| Organ or tissue | 50 rem/yr* |
| Unborn Child | |
| Entire gestation period | 0.5 rem |

* Annual effective dose equivalent

TABLE 4-2

WESTINGHOUSE HANFORD
ADMINISTRATIVE GUIDELINES (WHC 1988)

| | | |
|---|---|---|
| Whole body, head, trunk gonads, lens of eye, red bone marrow, active blood-forming organs | 3 rem/yr | 1.25 rem/qtr |
| | 0.3 in a seven day period** | |
| Unlimited areas of skin | 9 rem/yr | 3 rem/qtr |
| Other organs, tissues, and organ systems (except bone) | 7.5 rem/yr | |
| Bone | 15 rem/yr | ---------- |
| Hands, feet*, and forearms | 15 rem/yr | 5 rem/qtr |

* Annual effective dose equivalent
** Per Union Contract

TABLE 2
POTENTIAL FOR UNREASONABLE EXPOSURE TO RADIATION
Labeling and Signs

| Category | Placement and Maintenance of Lable on Each Tank/Container<br><br>WAC 173-303-395 (6)<br>WAC 173-303-631 (3)<br>WAC 173-303-040(5)(d) | Placement of "No Smoking" sign in Area Near Reactive Waste<br><br>WAC 173-303-395(1) | Placement and Maintenance of "Danger-Unauthorized Personnel Keep Out" Sign At Entrance to Area<br><br>WAC 173-303-310(2) |
|---|---|---|---|
| Proposed WAC 173-303-040 (131)(a) | 241-Z (4)<br><br>B-Plant Tanks E5, F18, F16 F18, G7 and Concentrator E-F11 only (6)<br><br>PUREX Tunnels (2)<br><br>T-Plant Tanks (5)<br><br>B-Plant Drum Storage (1)<br><br>222-S (1) | 241-Z (4)<br><br>222-S (1) | - B-Plant - All Units (20)*<br><br>- PUREX - Tanks, Waste Piles (9)<br><br>- T-Plant -Tanks (5) * |
| Proposed WAC 173-303-040 (131)(b) | PUREX Tanks U-3 & U-4 (2)<br><br>222-S (1)<br><br>242-A Evaporator Evaporator Room Pump Room (2)<br><br>Double-Shell Tanks (41)<br><br>Single-Shell Tanks (149) | * If signs are posted on cover blocks or canyon deck areas | PUREX Tunnels (2) |