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RADIOACTIVE WASTE CLASSIFICATION: A POINT OF CONTINUING DEBATE

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ABSTRACT

The definitions and criteria for classifying radioactive waste streams are based on the relative risk the waste poses to human health and safety and provide general guidance on how the waste should be managed over its life cycle. Over the years, various aspects of the classification system have been debated. The issues have usually involved differences of opinion as to whether the classification criteria appropriately reflect the health and safety risks associated with the life-cycle management of the various waste classes.

Highlights of the evolution of the current Department of Energy=s (DOE) classification system will be reviewed, noting the risk considerations that have influenced these developments. The principal point of debate in recent years concerning the adequacy of the waste classification system has involved the question of whether the criteria for defining HLW are appropriately predicated on risk considerations, i.e. should high-level waste (HLW) be differentiated from low-level waste (LLW) on the basis of quantitative criteria derived from the assessment of potential long-term risks.

The views will be explored of those who favor such criteria, as well as those who feel the present classification system and the companion waste management system adequately take into account the risk considerations. Possible courses of action for implementing either point of view will be presented and discussed.

INTRODUCTION

The principal purpose of grouping the many diverse waste streams into several categories or classes is to identify the relative risk to human health and safety associated with each specific waste class. This information provides general guidance for those responsible for the management of waste through the various phases of storage, treatment, transportation, and disposal. In some instances, the guidance is explicit in that the classification dictates the type of disposal for the waste, as established by law. Economic considerations have been a secondary, but nonetheless important, influence in the development of classification criteria and waste management strategies.

Over the past fifty years, there have been numerous challenges about the performance of the waste management systems in terms of their adequately mitigating risks to human health and safety. In most instances the challenge resulted from concern about how specific waste streams were managed which, in turn, reflected adversely on the classification assigned to the waste streams pursuant to established classification criteria. In some cases, the challenges resulted in the development of new or revised classification criteria and even new classes of waste.

This historical legacy has produced the current radioactive waste classification system employed in the U.S. that is depicted in the attached table. There are some variations in the waste class definitions employed in the Nuclear Regulatory Commission=s (NRC) classification system for the private sector as compared to those used in DOE=s self-regulated system. However, the two systems are quite comparable when reduced to practice through use of the respective guidance documents accompanying the regulations.

A review of some of the highlights of how the current waste classification system evolved over the past fifty years may provide a better understanding of the extent to which the current classification system is based on risk considerations and facilitate conclusions about the adequacy of that system.

BACKGROUND

The nuclear energy era evolved from a national defense program, a centerpiece of which was the production of special nuclear materials for the weapons systems. The production of these defense materials resulted in the generation of radioactive waste by-products. One such waste stream was generated from the chemical reprocessing of the irradiated nuclear fuel from reactors for the purpose of extracting the produced plutonium. This waste stream contains the bulk of the fission products and significant quantities of transuranic and other long-lived radionuclides. It is, therefore, highly radioactive, very long-lived, and poses a major risk to human health and safety for a very long period. The defense program recognized from the beginning that his waste would require indefinite containment and isolation from the human environment; hence, it was segregated and managed as a separate category or class of waste known as high-level waste (HLW). While this class of waste is defined on the basis of its source of generation, it also resulted out of the recognition of the potential risks it posed to the health and safety of humans and their environment.

All non-HLW generated in the defense programs was, not surprisingly, referred to as low-level waste (LLW) and was subjected to a variety of management/disposal strategies based on the radiological, chemical, and physical characteristics of the specific waste streams and the environmental features of the host site. In reality, the most compelling influence in those early days on how the LLW was managed was whether it was generated as a liquid or solid waste. As had been the long-standing practice for solid industrial waste, the solid radioactive waste was emplaced in near-surface land disposal facilities. Liquid non-HLW streams were nominally disposed of by discharge to on-site soil columns in a variety of ways (e.g., wells, cribs, and pits) or by Adilute and discharge@ to sewer system and surface streams.

As early as 1948, a little over a year after the Atomic Energy Commission (AEC) assumed responsibility and control of the U.S. atomic energy programs from the Manhattan Engineering District, a Safety and Industrial Health Advisory Board submitted a report to the Commission that was complimentary with respect to the health and safety program for the employees but was quite critical of protection for the public against radiation and other hazards. In particular, the Board viewed the management of waste disposal to be negligent. The report concluded that both toxic and radioactive waste required immediate laboratory and field work. The report went on to identify specific problems across the complex requiring in the Board=s view immediate attention, including:

- The extent of migration toward underground water supplies of radioactive and toxic wastes disposed in wells, cribs, and pits;
- The extent of travel in rivers and streams of wastes and their deposits and accumulation in banks and beds; and
- Provision for equipment and sampling techniques necessary to monitor air, soil, and water.

While the AEC adopted many of the Board=s recommendations, those pertaining to waste management considerations were not viewed as priority matters and were largely ignored.

Individual sites and laboratories began early to develop their own sub-categories or classes of non-high-level liquid wastes. An intermediate-level waste class was sometimes encountered at various sites. Somewhat different life-cycle management strategies would apply to each of these waste sub-classes. There was no central coordination or requirement for managing these wastes nor was there intersite communications on these matters; therefore, there was no designed uniformity across the complex of sites in classifying or managing the waste in those early years. It should also be noted that the criteria for selecting the sites to host the complex of national laboratories and defense activities across the country did not include considerations relevant to siting waste disposal facilities. It is not surprising that the waste management capabilities deployed at the various sites with diverse host environments and the results of their performances over time have been quiet varied. As a consequence, variations in waste acceptance criteria evolved conducive to the establishment of different sub-classes of LLW across the DOE complex.

Waste management in the early years of the nuclear age was based largely upon:

$ The practices of decades of management and disposal of industrial wastes;

$ An aggressive, high-priority nuclear and industrial safety program to protect the program employees;

$ Interim storage of highly radioactive waste pending development of a long-term management strategy and capability; and

$ Provision for monitoring the containment of the stored and disposed waste.

In addition, the Commission initiated an R&D effort based principally on the need to identify three pieces of information necessary to determine the methods that must be applied in managing radioactive waste:

$ The specific radioactive and chemical nature of the waste under consideration;

$ The physical, chemical, and biological characteristics of the environment in which the waste would be managed (i.e., treated, stored, and/or disposed); and

$ The maximum quantity of specific radioisotopes that research and experience indicate humans can tolerate, either in the total body or in various organs, which translate into maximum concentrations of specific radionuclides that can be safely allowed in water and air (determining these limits was a major effort).

As more information from the R&D projects and operating experience became available, one was able to assess more effectively the potential long-term risks to human health and the environment represented by specific waste streams and the strategies employed for their life-cycle management. For example, a better understanding was emerging as to how various radioactive waste interacts with different types of soil columns and the influence of the emplaced waste forms on the rate of migration of radionuclides in the various geologic media. This information facilitated the development and implementation of methodology for assessing the systems= ability to contain the emplaced waste. The results of the long-term performance assessments of the waste disposal systems has an influence on the waste acceptance criteria.

It is apparent that the preoccupation of the early years was not with establishing classification criteria per se but with the identification of the nature and degree of risk associated with the waste streams and various modes of their management in order to provide a safe human environment, with emphasis on the present and near-term but building data and experience necessary to address the long term. This information would ultimately facilitate the development of waste class definitions and criteria based on health and safety risks considerations spanning the waste management life-cycle.

By the late 1960's - early 1970's, there began to emerge an interest in a more extensive segregation of waste streams for purposes of life-cycle management. The work on the interaction of various types of waste and various waste forms with various host disposal environments indicated, for example, the need for a higher degree of waste form stabilization for disposal of some waste categories and more effective long-term containment by the disposal system for the longer-lived materials. Such considerations contributed to:

$ The Commission=s decision in 1970 to segregate the non-HLW containing long-lived transuranic containments for retrievable storage pending the availability of treatment, as necessary, and enhanced containment disposal capabilities. This was the birth of the transuranic class of waste (TRUW). Any waste containing concentrations of long-lived transuranics in excess of 10 nanocuries per gram would be classified as TRUW. The emergence of the new waste class was based on health and safety risk considerations, but the initial criterion for classifying the waste was an arbitrary, conservative one, based on the upper range of concentrations of radium-226 found in the earth=s crust. This criterion was subsequently increased several years later by an order of magnitude following further study and consultations.

$ The promulgation by the Commission in 1973 of the AEC Manual Chapter (AECM) 0511 dedicated exclusively to the management of radioactive waste. It provided a vehicle for categorizing HLW and non-HLW liquid waste streams and provided operational criteria and guidance for managing each category of liquid waste as well as solid non-HLW, including TRUW. It also represented an effort to establish some complex-wide uniformity of waste management requirements and practices even though the field sites retained a great degree of flexibility in how they managed their waste to ensure compliance with established allowable radiation doses to workers and the public. The big uncertainty, of course, was whether that compliance could be sustained over the long-term.

The 1970's and early 1980's was a period of considerable activity and progress in identifying issues associated with the long-term management of risks associated with radioactive waste and the development of solutions through contributions from on-going operations and R&D projects in both the Federal and private sectors. One result of these efforts was a recognized need to minimize the mobility of waste to be disposed. Therefore, requirements evolved for severely limiting the presence of liquids in the disposed waste. This led to a proliferation of capabilities to treat and solidify liquid wastes, thereby essentially eliminating classes of liquid waste for disposal.

Significant consequences of these developments included:

$ Bringing into sharper focus the need for better defined and more stringent limitations on the source term inventory of radioactive waste for disposal systems;

$ The need for disposal waste forms and containers that are more stable over the long-term; and

$ The need to enhance the engineered disposal facilities in order to provide reasonable assurance they would provide acceptable long-term performance in containing the waste.

All of these developments had an influence on the site-specific classification systems across the DOE complex.

The better understanding of the factors involved in the long-term management of the non-HLW was reflected in the promulgation by the NRC in January 1983 of 10 CFR Part 61 regulating the land disposal by licensees of low-level radioactive waste. It established quantitative criteria for classifying sub-categories of LLW, i.e. Classes A, B, C, and greater-than-Class C (GTCC) LLW.

While these classification criteria (i.e., concentration limits for selected radionuclides) have not been formally adopted by DOE, the Department=s waste classification system and its program for managing the risks associated with these wastes is generally comparable to that for the private sector. One difference in the two systems is that the DOE system establishes a separate waste class for the long-lived transuranic-contaminated, non-HLW streams, i.e. the TRUW class. The 10 CFR Part 61 includes such waste in the GTCC LLW class. Both systems permit, to varying degrees, flexibility for each site to adopt LLW/MLLW management practices and classification codes conditioned by site-specific considerations necessary to comply with established long-term performance objectives.

The methodology for mathematically representing over time the waste interaction with representative disposal environments and the consequences of such interactions thereby facilitating long-term performance assessments of the disposal systems was initially addressed in a serious way around 1970 by the Hanford site in connection with disposal of HLW in a geologic repository. The ability to make credible assessments of the long-term performance of land disposal systems had improved significantly by the 1980's. Such assessments played a major role in the development of the requirements in 10 CFR Part 61.

The importance of utilizing assessments of the long-term performance of the disposal systems in managing the risks associated with the hazardous materials was further emphasized with the promulgation in 1988 of DOE Order 5820.2A, ARadioactive Waste Management.@ The Order requires that a performance assessment (PA) be made for each disposal facility concerning its capability for the long-term containment of the waste it is to receive for disposal. As noted earlier, the results of the PA will have an influence on the waste acceptance criteria for the disposal facility.

DISCUSSION

Recalling that the basic motivation for the waste classification system is a desire to categorize waste streams on the basis of the potential hazard they pose to human health and safety over their lifetime, and thereby facilitating development of appropriate systems for their life-cycle management, any debate concerning the adequacy of the current classification system is usually predicated on the following points of view:

$ The current system is deemed inadequate in that it is not sufficiently risk-based since it does not provide quantitative criteria (i.e., nuclide concentration limits) for differentiating between HLW and LLW. This concern cuts both ways in that some feel that certain GTCC LLW streams have radiological characteristics that require permanent isolation from the human environment and, therefore, should be classified as HLW requiring disposal in a geologic repository. In fact, some efforts have been made in recent years to reclassify by law GTCC LLW as HLW. Others have been concerned that the lack of quantitative concentration limits for classifying HLW results in some stored liquid waste that is classified as HLW under current criteria due to its source of generation could be safely disposed in a more cost-effective and timely manner than in a geologic repository.

$ Those that are satisfied the current classification system and waste management strategies appropriately take into account the potential risks to human health and safety predicate their position on the following views and considerations:

  S The current system is sufficiently conservative to capture all of the source-defined HLW for disposal in a geologic repository. The adoption in recent years of pre-treatment of the stored liquid and calcined HLW, to generate a concentrated high-activity stream for vitrification and disposal in the repository and a low-activity stream for disposal in near-surface facilities, takes care of the concern that some portion of the stored HLW need not be emplaced in a repository.

  S The higher risk LLW should be precluded from acceptance for disposal in currently operating DOE near-surface disposal facilities on the basis of the performance assessments for these facilities. For these wastes alternative disposal options could be evaluated, e.g. greater confinement technologies utilizing intermediate-depth emplacement of the waste or enhanced engineered near-surface disposal facilities employing above or below-grade concrete vaults. Those portions of this category of LLW that do not qualify for acceptance in these disposal facilities could be consigned to the geologic repository. It is not apparent that a modification of the classification system would provide any advantages.

  S Changes to the classification system can result in confusion and misunderstandings that can persist for long periods of time and be very disruptive to effective management of the waste. They can also frustrate intersite communications and transactions. Such problems could be compounded by the current DOE effort to transfer certain responsibilities for waste management from its Environmental Management organization to the generators of new waste, i.e., the program offices, such as energy research, defense programs, and nuclear energy.

There have been efforts in the past to establish risk-based quantitative criteria to differentiate between HLW and LLW, including:

$ The NRC proposed in 1987[1] to develop such quantitative criteria. A principal consideration involved in this initiative was the fact that some LLW exceeding Class C concentrations may have concentrations of radionuclides and associated risks to human health approaching or exceeding those of some HLW. Moreover, the initiative was influenced by an NRC desire to conform more closely to the definition for HLW in the Nuclear Waste Policy Act of 1982 which includes highly radioactive waste resulting from the reprocessing of spent nuclear fuel if that waste Acontains fission products in sufficient concentrations.@ The NRC, however, took the position it would not find tenable the argument that a waste requires permanent isolation just because it is highly radioactive. The need for permanent isolation correlates with the length of time a material remains hazardous. DOE encouraged this initiative by NRC since the Department felt that the long-term risks to human health and safety associated with a significant volume of the stored HLW at Hanford were not sufficiently large to require disposal in a geologic repository.

The analytical methodology NRC proposed to use in developing the quantitative criteria was an extension of the 10 CFR 61 waste classification analysis. This approach utilized performance assessments of designated disposal systems containing various representative source term inventories. In this case, the disposal systems to be assessed would be Aintermediate-depth@ or Agreater confinement@ disposal facilities, which would be less secure than a geologic repository but more secure than the near-surface land disposal facilities employed at that time. The results of the analysis were to serve as a basis for establishing a concentration-based boundary between waste requiring the permanent isolation of a geologic repository, i.e., HLW, and GTCC LLW that could be disposed in less secure facilities.

In a May 18, 1988, Federal Register Notice (FRN), NRC announced it would be impractical at that time to establish quantitative criteria for differentiating between high- and low-level waste based on this methodology[2]. The Commission stated that additional intermediate-depth disposal facility development and demonstration should be completed before there would be an adequate basis for waste classification resulting from this methodology. In an effort to identify a disposal option for all categories of radioactive waste, NRC proposed in the same FRN a rule that ultimately led to the revision of 10 CFR 61.55 which requires all GTCC LLW to be emplaced in a geologic repository unless an alternative proposal is approved by the Commission.

$ ORNL undertook in 1987 a parallel effort to that by NRC to develop a classification system for radioactive waste which it represented as being Aquantitative and a generally applicable risk-based definition of high-level and other radioactive wastes.@ The ORNL study attempted an analysis of the waste isolation capability of a number of conceptual Aintermediate-depth@ disposal facilities (described in ref. 3) and concluded, as NRC had, that such facilities are not sufficiently developed to provide a basis for defining waste classes and that the disposal of wastes using such facilities must be considered on a case-by-case, site-specific basis.

$ DOE, in developing its Order 5820.2A on radioactive waste management, examined the possibility of developing quantitative criteria for differentiating between HLW and LLW and encountered the same uncertainties as those previously discussed in connection with the NRC and ORNL studies, too little was known about the long-term performance of intermediate-depth disposal technologies. Moreover, there was quite a disparity of views across the DOE complex about the desirability of adopting additional quantitative classification criteria in view of the associated risks of reducing the flexibility in making site-specific judgements about managing and disposing of the Department=s waste.

$ The International Atomic Energy Agency (IAEA) felt that its waste classification system was limited in that it did not provide quantitative boundaries between classes, and it did not recognize a class of waste that contains so little radioactive material that it can be exempted from control as radioactive waste. The Agency, therefore, proposed revisions in May 1994 to its classification system designed to correct these deficiencies[4]. The proposal, which is still under consideration, is summarized in Table I. In presenting the quantitative criteria, the Agency noted they are intended as orders of magnitude for typical characteristics of the waste classes; exact boundary levels for each of the waste classes are difficult to quantify without precise planning data for individual facilities. It appears that the Agency encountered the same difficulties that NRC, ORNL, and DOE had experienced in not having at that time sufficient data to develop credible long-term performance assessments for disposal alternatives to geologic repository and shallow-land burial facilities.

TABLE I. TYPICAL CHARACTERISTICS OF WASTE CLASSES (IAEA)*

Waste Classes	Typical Characteristics	Disposal Options
1. Exempt waste (EW)	Activity levels at or below clearance levels given in Ref. 4, which are based on an annual dose to members of the public of less than 0.001 mSv	No radiological restrictions
2. Low- and intermediate-level waste (LILW)	Activity levels above clearance levels given in Ref. [4] and thermal power below about $2kW/m^3$	
2.1 Short-lived waste (LILW-SL)	Restricted long lived radionuclide concentrations (limitation on long-lived alpha emitting radionuclides to 4000 Bq/g in individual waste packages and to an overall average of 400 Bq/g per waste package)**	Near surface or geological disposal facility
2.2 Long-lived waste (LILW-LL)	Long-lived radionuclide concentrations exceeding limitations for short-lived waste	Geological disposal facility
3. High-level waste (HLW)	Thermal power above about 2kW/m3 and long-lived radionuclide concentrations exceeding limitation of short-lived waste	Geological disposal facility

* Excerpt from Reference 4
** IAEA recognized that attention should also be given to inventories of long-lived radionuclides that emit beta or gamma radiation, e.g. I-129 or Tc-99. National authorities may establish limits for those radionuclides based on analysis of specific disposal facilities.

There have been two additional initiatives in recent years that have addressed issues of risk management for certain categories of radioactive waste that have the potential for modifying the classification system:

$ The NRC, EPA, and DOE have individually and collectively examined the possibility of establishing concentration limits for radionuclides in waste below which the material can be disposed of without being regulated as radioactive waste, i.e. a class of waste often referred to as ABelow Regulatory Control@ (BRC). A number of countries have quantitative criteria for identifying BRC waste. Current efforts in this connection by U.S.

agencies are largely dormant, having encountered resistance in Congress to such an undertaking.

$ In the early 1990s, the National Council on Radiation Protection and Measurement (NCRP) appointed a new scientific committee on waste classification based on risk. The Committee was tasked with the preparation of an NCRP report on a risked-based system for classifying radioactive and mixed waste. The Committee convened a symposium on the subject in November 1994 with the focus being primarily on low-level and low-level mixed waste.. A draft report was issued the following year for internal review and comment. A final report has not yet been issued. Reportedly, the principal problem the Committee has confronted in the study is the harmonization of the risks associated with the radioactive and the chemical hazardous contaminants in the waste in order to capture them collectively in a risk-based classification system.

Conditions should be more favorable today to develop credible long-term performance assessments of candidate facilities for the safe disposal of the LLW that does not qualify for disposal in current shallow-land burial facilities, i.e., the Agreater confinement@ disposal systems involving intermediate depth emplacement or enhanced man-made containment. Such information would permit the development of upper concentration limits for selected radionuclides acceptable for disposal in these facilities, which could also serve as the criteria for differentiating between LLW and waste requiring permanent isolation in a geologic repository.

The basis for being more optimistic about success in such an effort today as contrasted to earlier initiatives cited above is: a) the additional studies about and experience with intermediate-depth disposal facilities (e.g., the performance assessment conducted by Sandia National Laboratory for the intermediate depth radioactive waste disposal facility consisting of augered boreholes at the Nevada Test Site); and b) the extensive work that has been done in the private sector in designing and developing PA=s for enhanced engineered LLW disposal facilities proposed for several regional compacts. These facilities involved above and below-grade concrete vaults with enhanced integrity concrete vaults for emplacement of waste packages (e.g., the long-term performance assessment accompanying the license application for the proposed LLW disposal facility in North Carolina).

SUMMARY/CONCLUSIONS:

Based on the foregoing discussion, it is reasonable to conclude that the current DOE radioactive waste classification criteria and the systems for managing each of the classes effectively takes into account the risks to human health and safety except for the uncertainties about how best to provide for the long-term risks associated with LLW that does not qualify for disposal in currently operating near-surface disposal facilities. However, the methodology generally expected to prevail in deciding the adequacy of the risk management of any candidate disposal technologies for this category of waste, i.e. a long-term performance assessment of the proposed disposal system, will certainly be predicated on risk considerations.

The Department could, therefore, provide an effective risk-based management system by proceeding with its current classification system augmented by performance assessments for all disposal systems to identify waste acceptance criteria that provide reasonable confidence in achieving compliance with long-term performance objectives. The challenge is to identify by this methodology the preferred safe, cost-effective, long-term management disposal technology (ies) for the inventory of non-HLW for which an acceptable long-term strategy does not currently exist.

Should the Department and/or the NRC prefer to revisit the earlier efforts to formulate quantitative criteria for differentiating HLW and LLW, such an initiative should now be successful given the current body of experience and research results available for the development of performance assessments for intermediate-depth disposal technologies and the more recent generation of engineered near-surface disposal technologies providing enhanced long-term containment.

References

1. *Advance Notice of Proposed Rulemaking: Definition of AHigh-Level Radioactive Waste,@* Federal Register, Vol. 52, No. 39 pg. 5992, February 27, 1987.

2. *Proposed Rule: Disposal of Radioactive Wastes*, Federal Register, Vol. 53, No. 96, pg. 17709, May 18, 1988.

3. *A Proposed Classification System for High-Level and Other Radioactive Wastes*, ORNL/TM-10289, D.C. Kocher and A.G. Croff, June 1987.

4. AClassification of Radioactive Waste: A Safety Guide,@ Safety Series No. 111-G-1.1, International Atomic Energy Agency, Vienna, May 1994.

Attachment

DEFINITION OF CLASSES OF RADIOACTIVE WASTE

	DOE Order 5820.2A	DOE Order 435.1 (Draft) (a)	NRC Regulations	EPA	STATUTES
HIGH-LEVEL WASTE	The highly radioactive material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.	High-level waste is highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains fission products in sufficient concentrations.; and other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.	AHLW@ means: 1) irradiated reactor fuel, 2) liquid wastes resulting from the operation of the first cycle solvent extraction system, or equivalent, and the concentrated wastes from subsequent extraction cycles, or equivalent, in a facility for reprocessing irradiated reactor fuel; and 3) solids into which such wastes have been converted. (10 CFR 60, 8/1/90, revision 5)	As used in 40 CFR 191, the definition of high-level radioactive waste is represented as being equivalent to that used in the Nuclear Waste Policy Act of 1982 (P.L. 97-425).	High-level waste means: A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and B) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation. (Nuclear Waste Policy Act). (b)
TRANS-URANIC WASTE	Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Head of Field Elements can determine that other alpha contaminated wastes, peculiar to a specific site, must be managed as transuranic waste.	Transuranic waste is radioactive waste containing more than 100 nanocuries (3700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: 1. High-level radioactive waste; 2. Waste that the Secretary of Energy has determined, with the concurrence of the EPA Administrator, does not need the degree of isolation required by disposal regulations (c); 3. Waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Part 61 of Title 10, Code of Federal Regulations , to be managed pursuant to the Atomic Energy Act so that safety requirements and performance objectives for management of low-level waste are satisfied.	NRC does not have a transuranic class of waste, as such. Radioactive waste regulated by NRC with radiological characteristics comparable to DOE=s transuranic waste is included in the category of low-level waste that contain concentrations of alpha-emitting transuranic nuclides that exceed the limits set forth in Table 1 of 10 CFR 61.55. These materials, which would be classified as transuranic in DOE=s classification system, would be classified as greater-than-class-C low-level waste by the NRC system.	As used in 40 CFR 191, this is a class of radioactive waste that contains more than 100 nanocuries of alpha-emitting isotopes, with half-lives greater than twenty years, per gram of waste, except for: 1) high-level wastes; 2) wastes that DOE has determined, with the concurrence of the EPA Administrator, do not need the degree of isolation required for this part; or 3) wastes that the Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.	

	DOE Order 5820.2A	**DOE Order 435.1 (Draft) (a)**	**NRC Regulations** (d)	**STATUTES**
LOW-LEVEL WASTE	Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or 11e(2) b-byproduct material as defined by this Order. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic is less than 100 nCi/g.	Low-level waste is radioactive waste, including accelerator-produced waste that is not classified as high-level waste, transuranic waste , spent nuclear fuel, or by product material as defined in section 11e(2) of the Atomic Energy Act of 1954.	For purposes of 10 CFR Part 61, low-level waste is radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e(2) of the Atomic Energy Act (uranium or thorium tailings and waste).	Means radioactive material that: A) is not high-level waste, spent nuclear fuel, transuranic waste, or byproduct material as defined in section 11e(2) of the Atomic Energy Act of 1954; and B) the Commission, consistent with existing law, classifies as low-level waste. (Low-Level Radioactive Waste Policy Amendments Act). (e)

Footnotes:

a Draft DOE Order 435.1, ARadioactive Waste Management,@ a proposed revision of Order 5820.2
b This Act consists of the Act of January 7, 1983 (P.L. 97-425), as amended by the P.L. 100-203 (Dec. 22, 1987)
c 40 CFR 191, AEnvironmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.@
d This NRC definition of LLW has the same meaning as the Low-Level Radioactive Waste Policy Act of 1980.
e This Act (P.L. 99-240) amended the Low-Level Radioactive Waste Policy Act of 1980.