

RADIOACTIVE WASTE LAWS, REGULATIONS, AND STANDARDS

PRESENTED AT THE ASME COURSE:

**"RADIOACTIVE WASTE MANAGEMENT
FOR NUCLEAR POWER REACTORS
AND OTHER FACILITIES"**

APRIL, 21, 1994

**JOHN O. THOMA
OFFICE OF NUCLEAR MATERIAL SAFETY
AND SAFEGUARDS
NUCLEAR REGULATORY COMMISSION**

- 1 -

OVERVIEW

- LAWS CONCERNING RADIOACTIVE WASTE MANAGEMENT
- DEFINITIONS
- REGULATIONS AND STANDARDS CONCERNING RADIOACTIVE WASTE MANAGEMENT
 - URANIUM MILL TAILINGS
 - HIGH-LEVEL RADIOACTIVE WASTE
 - LOW-LEVEL RADIOACTIVE WASTE
 - DECOMMISSIONING

**LAWS CONCERNING
RADIOACTIVE WASTE
MANAGEMENT**

REGULATIONS AND PRESIDENTIAL ORDERS

- ATOMIC ENERGY ACT OF 1954 (AEA 1954)
 - CREATED ATOMIC ENERGY COMMISSION (AEC).
 - PRINCIPAL FOUNDATION FOR RADIATION REGULATIONS.
 - AMENDED (1978) TO ALLOW AGREEMENT STATE REGULATORY AUTHORITY.
- NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
- PRESIDENTIAL ORDER: REORGANIZATION PLAN NO. 3 OF 1970 {ISSUED PURSUANT TO CHAPTER 9 OF TITLE 5 OF THE UNITED STATES CODE}.
 - TRANSFERRED FROM THE AEC AND OTHER FEDERAL AGENCIES TO THE ENVIRONMENTAL PROTECTION AGENCY (EPA) THE RESPONSIBILITY FOR DEVELOPING GENERALLY APPLICABLE ENVIRONMENTAL STANDARDS FOR PROTECTION OF THE GENERAL ENVIRONMENT. EPA HAS FAIRLY BROAD ENVIRONMENTAL POWERS.
- FEDERAL WATER POLLUTION CONTROL ACT OF 1972.
- ENERGY REORGANIZATION ACT OF 1974.
 - ABOLISHED ATOMIC ENERGY COMMISSION.
 - CREATED ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION. {WHICH EVENTUALLY BECAME THE DEPARTMENT OF ENERGY OR DOE.}
 - CREATED NUCLEAR REGULATORY COMMISSION (NRC).

REGULATIONS (CONTINUED)

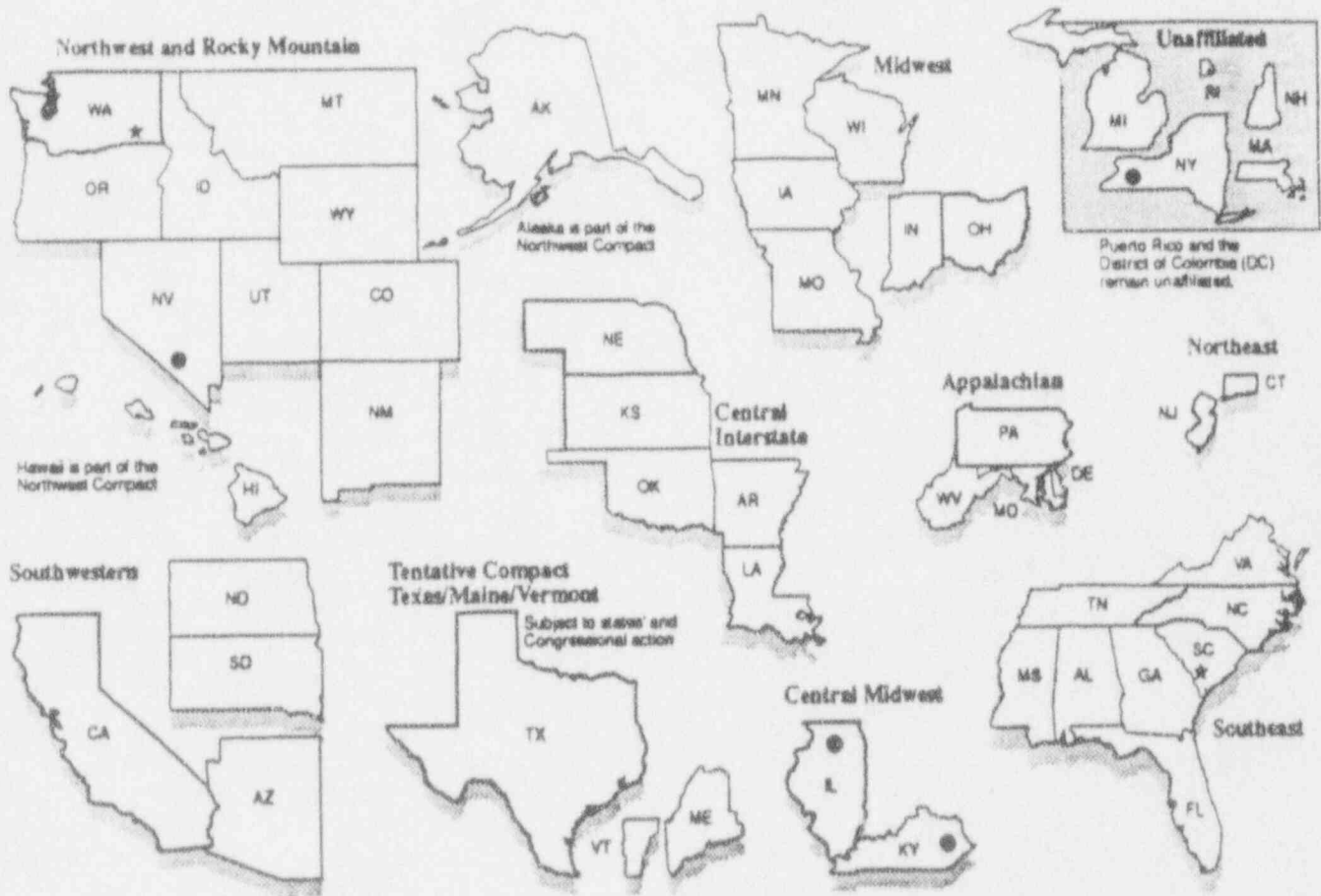
- CLEAN AIR ACT OF 1977, AS AMENDED.
- URANIUM MILL TAILINGS RADIATION CONTROL ACT (UMTRCA) OF 1978, AS AMENDED.
- WEST VALLEY DEMONSTRATION PROJECT ACT OF 1980.
- LOW-LEVEL WASTE POLICY ACT OF 1980
 - ESTABLISHED STATE RESPONSIBILITY FOR DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE.
 - SIGNIFICANTLY AMENDED IN 1985 AND THIS ACT IS GENERALLY REFERRED TO BY ITS 1985 AMENDMENT.
- NUCLEAR WASTE POLICY ACT OF 1982, AS AMENDED.
 - DEFINED BOTH HIGH AND LOW LEVEL RADIOACTIVE WASTE.
 - ADDRESSED DISPOSAL, STORAGE, AND RESEARCH FOR HIGH-LEVEL RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL.
 - ESTABLISHED THE NUCLEAR WASTE NEGOTIATOR FOR HIGH-LEVEL RADIOACTIVE WASTE.
 - ESTABLISHED THE NUCLEAR WASTE TECHNICAL REVIEW BOARD.
 - ADDRESSED DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTE (LLW).

REGULATIONS (CONTINUED)

- **LOW-LEVEL RADIOACTIVE WASTE POLICY AMENDMENTS ACT OF 1985.**
 - **ESTABLISHED RESPONSIBILITIES FOR LLW DISPOSAL AND USED THE NRC WASTE CLASSIFICATION SYSTEM.**
 - **EACH STATE RESPONSIBLE FOR PROVIDING FOR DISPOSAL OF NON-GOVERNMENT GENERATED CLASS A, B, AND C LLW WITHIN ITS BORDERS.**
 - **DOE IS RESPONSIBLE FOR DISPOSAL OF ALL GOVERNMENT GENERATED WASTE AND WASTES WHICH ARE CLASSIFIED AS GREATER THAN CLASS C. NRC TO LICENSE THE GTCC FACILITY.**
 - **ESTABLISHES REGULATORY FRAME-WORK FOR STATE COMPACTS TO DISPOSE OF LLW.**
 - **9 COMPACTS APPROVED BY CONGRESS**
 - **1 COMPACT TO BE APPROVED IN 1994 (TEXAS, MAINE, VERMONT)**
 - **7 UNAFFILIATED STATES OR TERRITORIES DISTRICT OF COLUMBIA, MASSACHUSETTS, MICHIGAN, NEW HAMPSHIRE, NEW YORK, PUERTO RICO, RHODE ISLAND**
 - **ESTABLISHES THE TIME FRAME AND RESPONSIBILITY FOR COMPACTS TO DEVELOP DISPOSAL FACILITIES.**
 - **STATES WITH CURRENT APPLICATIONS UNDER REVIEW OR HEARING: CALIFORNIA, TEXAS, NORTH CAROLINA, NEBRASKA**

REGULATIONS (CONTINUED)

EXISTING COMPACTS



Graphic from paper by John R. Vincenti (ACURI Association, Inc.) and Albert E. Castagnacchi (Duquesne Light Company) titled "Between stop and Go: Managing LLRW in the Appalachian States Compact".

REGULATIONS (CONTINUED)

- NUCLEAR WASTE AMENDMENTS ACT OF 1987 {HIGH-LEVEL WASTE ISSUES}
- HAZARDOUS MATERIAL TRANSPORTATION UNIFORM SAFETY ACT OF 1990
- ENERGY POLICY ACT OF 1992 - PARTIAL LISTING OF CONTENTS:
 - ONE STEP LICENSING OF NUCLEAR POWER PLANTS
 - URANIUM ENRICHMENT REQUIREMENTS
 - HIGH-LEVEL RADIOACTIVE WASTE
 - BELOW REGULATORY CONCERN
 - ADVANCED REACTORS
 - URANIUM MILL TAILINGS - \$250 MILLION TO PAY FOR DEFENSE RELATED WORK.



DEFINITIONS

DEFINITIONS

FROM THE NUCLEAR WASTE POLICY ACT OF 1982

● HIGH-LEVEL RADIOACTIVE 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 {NRC}, CONSISTENT WITH EXISTING LAW, DETERMINES BY RULE REQUIRES PERMANENT ISOLATION. {IN 10 CFR PART 60 SECTION 2 DEFINITIONS, THE NRC DEFINES HIGH-LEVEL WASTE AS (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 LIQUID WASTES HAVE BEEN CONVERTED.}

● LOW-LEVEL RADIOACTIVE WASTE MEANS RADIOACTIVE MATERIAL THAT -

(A) IS NOT HIGH-LEVEL RADIOACTIVE WASTE, SPENT NUCLEAR FUEL, TRANSURANIC WASTE, OR BY-PRODUCT MATERIAL AS DEFINED IN SECTION 11E(2) OF THE ATOMIC ENERGY ACT OF 1954; AND

(B) THE COMMISSION {NRC} CONSISTENT WITH EXISTING LAW, CLASSIFIES AS LOW LEVEL RADIOACTIVE WASTE.

DEFINITIONS (CONTINUED)

FROM THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, SECTION 11. DEFINITIONS

- SECTION 11e: THE TERM "BYPRODUCT MATERIAL" MEANS:

(1) ANY RADIOACTIVE MATERIAL (EXCEPT SPECIAL NUCLEAR MATERIAL) YIELDED IN OR MADE RADIOACTIVE BY EXPOSURE TO THE RADIATION INCIDENT TO THE PROCESS OF PRODUCING OR UTILIZING SPECIAL NUCLEAR MATERIAL, AND

(2) THE TAILINGS OR WASTE PRODUCED BY THE EXTRACTION OR CONCENTRATION OF URANIUM OR THORIUM FROM ANY ORE PROCESSED PRIMARILY FOR ITS SOURCE MATERIAL CONTENT.

- SECTION 11z: THE TERM "SOURCE MATERIAL" MEANS:

(1) URANIUM, THORIUM, OR ANY OTHER MATERIAL WHICH IS DETERMINED BY THE COMMISSION {NRC} PURSUANT TO THE PROVISIONS OF SECTION 61 TO BE SOURCE MATERIAL; OR

(2) ORES CONTAINING ONE OR MORE OF THE FOREGOING MATERIALS, IN SUCH CONCENTRATIONS AS THE COMMISSION {NRC} MAY BY REGULATION DETERMINE FROM TIME TO TIME.

DEFINITIONS (CONTINUED)

- SECTION 11AA: THE TERM "SPECIAL NUCLEAR MATERIAL" MEANS:

(1) PLUTONIUM, URANIUM ENRICHED IN THE ISOTOPE 233 OR IN THE ISOTOPE 235, AND ANY OTHER MATERIAL WHICH THE COMMISSION, PURSUANT TO THE PROVISIONS OF SECTION 51, DETERMINES TO BE SPECIAL NUCLEAR MATERIAL, BUT DOES NOT INCLUDE SOURCE MATERIAL; OR

(2) ANY MATERIAL ARTIFICIALLY ENRICHED BY THE FOREGOING, BUT DOES NOT INCLUDE SOURCE MATERIAL.

{THE NRC USES THIS EXACT DEFINITION IN 10 CFR 150.3(j) AND 10 CFR 20.1003. THE NRC HAS NOT DEFINED ADDITIONAL MATERIAL AS SPECIAL NUCLEAR MATERIAL.}

- SECTION 11EE: THE TERM "TRANSURANIC WASTE" (TRU) MEANS MATERIAL CONTAMINATED WITH ELEMENTS THAT HAVE AN ATOMIC NUMBER GREATER THAN 92, INCLUDING NEPTUNIUM, PLUTONIUM, AMERICIUM, AND CURIUM, AND THAT ARE IN CONCENTRATIONS GREATER THAN 10 NANOCURIES PER GRAM, OR IN SUCH OTHER CONCENTRATIONS AS THE NUCLEAR REGULATORY COMMISSION MAY PRESCRIBE TO PROTECT THE PUBLIC HEALTH AND SAFETY.

**REGULATIONS AND
STANDARDS**

CONCERNING

**RADIOACTIVE WASTE
MANAGEMENT**

RADIOACTIVE WASTE MANAGEMENT REGULATIONS

- URANIUM MILL TAILINGS
 - 10 CFR PART 40 APPENDIX A
- HIGH-LEVEL RADIOACTIVE WASTE
 - 10 CFR PART 60
- LOW-LEVEL RADIOACTIVE WASTE
 - 10 CFR PART 61
- DECOMMISSIONING
 - 10 CFR PART 30 {BYPRODUCT MATERIAL}
 - 10 CFR PART 40 {SOURCE MATERIAL}
 - 10 CFR PART 50 {POWER REACTORS}
 - 10 CFR PART 70 {SPECIAL NUCLEAR MATERIAL}
- AGREEMENT STATE PROGRAM
 - 10 CFR PART 150

URANIUM MILL TAILINGS

FRONT-END OF THE URANIUM FUEL CYCLE.

● MINING

● MILLING

MINED ORE IS CRUSHED, LEACHED, CONCENTRATED, PRECIPITATED, AND CENTRIFUGED TO PRODUCE U_3O_8 (YELLOWCAKE) (SOURCE MATERIAL). AFTER THE REFINING PROCESS, THE TAILINGS (BYPRODUCT MATERIAL) ARE PUMPED IN SLURRY FORM TO A SETTLING POND.

● CONVERSION

THE YELLOWCAKE PRODUCED IS SEALED IN DRUMS AND TRANSPORTED TO A URANIUM HEXAFLUORIDE (UF_6) CONVERSION PLANT.

● ENRICHMENT

AT THE ENRICHMENT PLANT, THE UF_6 IS HEATED TO PRODUCE A GAS WHICH IS PROCESSED TO INCREASE THE CONCENTRATION OF ^{235}U ABOVE THE 0.7% CONTENT OF NATURAL URANIUM. THE UF_6 WITH THE DESIRED ENRICHMENT IS SHIPPED TO FUEL FABRICATION PLANTS WHILE THE DEPLETED UF_6 IS LEFT BEHIND.

● FUEL FABRICATION

THE ENRICHED UF_6 GAS IS CONVERTED TO SOLID URANIUM DIOXIDE (UO_2), WHICH IS ULTIMATELY SHAPED AND INCORPORATED INTO FUEL ASSEMBLIES.

URANIUM MILL TAILING CONCERNS

- URANIUM (U^{234} , $T_{1/2} = 246,000$ YEARS) AND THORIUM (Th^{230} , $T_{1/2} = 75,400$ YEARS) ISOTOPES DECAY BY ALPHA EMISSION.
- THE TWO MOST IMPORTANT DAUGHTERS ARE RADIUM-226 ($T_{1/2} = 1602$ YEARS) AND RADON-222 ($T_{1/2} = 3.8$ DAYS).
- THE OBJECTIVE IS TO MINIMIZE THE RELEASE OF RADON GAS. {THE REGULATIONS FOR URANIUM MILL TAILINGS WERE ORIGINALLY DESIGNED TO PROTECT AGAINST A GASEOUS RELEASE AND WERE MODIFIED IN 1983 TO INCLUDE GROUND WATER PROTECTION AND HAZARDOUS SUBSTANCES (RCRA TYPE) REGULATED BY THE NRC UNDER AN AGREEMENT WITH THE EPA.}
- THE BASIC PROTECTION FOR URANIUM MILL TAILINGS IS TO PROVIDE A SOIL OR CLAY COVER WHICH WILL ALLOW RADON TO DECAY PRIOR TO RELEASE. {THIS CREATES A CONFLICT. TO PREVENT THE GASES FROM BEING RELEASED, IT IS BEST TO MAINTAIN THE CLAY COVER MOIST. BUT TO PROTECT THE GROUND WATER, IT IS BEST TO KEEP THE CLAY COVER DRY.}

URANIUM MILL TAILINGS LEGISLATION

- MUCH PUBLIC CONCERN IN THE MID 1970'S.
- ONE DIRECT RESULT OF THIS PUBLIC CONCERN WAS THE URANIUM MILL TAILINGS ACT OF 1978.

- TITLE I - REMEDIAL ACTION PROGRAM

- ADDRESSED ABANDONED SITES NOT UNDER LICENSE AS OF NOVEMBER 1978.
- DOE WAS GIVEN LEAD RESPONSIBILITY TO CONDUCT REMEDIAL ACTIONS.
- EPA WAS ASSIGNED LEAD RESPONSIBILITY TO DEVELOP GENERAL STANDARDS.

STANDARDS (40 CFR 192) PROPOSED IN 1983. REMANDED BY THE COURTS IN 1987. FINAL RULE IN 1991 (GROUND WATER SECTIONS STILL NOT FINALIZED).

- NRC WILL
CONCUR IN THE REMEDIAL ACTION SELECTION.
CONCUR IN THE PERFORMANCE OF THE
REMEDIAL ACTION.
LICENSE DOE FOR LONG-TERM CARE OF THE
SITES.
- THIS PROGRAM IS STILL IN PROGRESS AND IS
CONSIDERED A SUCCESS.

● **TITLE II - URANIUM MILL TAILINGS LICENSING AND REGULATIONS**

- **THE EPA SHALL, BY RULE, PROMULGATE STANDARDS OF GENERAL APPLICATION TO LICENSEES FOR THE PROTECTION OF THE PUBLIC HEALTH, SAFETY, AND ENVIRONMENT FROM THE RADIOLOGICAL AND NON-RADIOLOGICAL HAZARDS ASSOCIATED WITH (1) RESIDUAL RADIOACTIVE MATERIALS LOCATED AT INACTIVE URANIUM MILL TAILINGS SITES AND DEPOSITORY SITES UNDER TITLE I AND (2) THE PROCESSING AND WITH THE POSSESSION, TRANSFER, AND DISPOSAL OF BYPRODUCT MATERIAL, AS DEFINED IN 11E(2) AT SITES AT WHICH ORES ARE PROCESSED PRIMARILY FOR THEIR SOURCE MATERIAL CONTENT OR WHICH ARE USED FOR THE DISPOSAL OF SUCH BYPRODUCT MATERIAL {THIS SECOND CATEGORY OF SITES ARE GENERALLY REFERRED TO AS TITLE II SITES}.**
- **SITES SHALL BE LICENSED BY THE NRC (OR AGREEMENT STATES) USING REGULATIONS WHICH CONFORM WITH THE APPLICABLE EPA STANDARD.**
- **IN ADDITION, PRIOR TO THE TERMINATION OF A LICENSE FOR BYPRODUCT MATERIAL, THE COMMISSION {NRC} {OR AGREEMENT STATES} SHALL MAKE A DETERMINATION THAT ALL APPLICABLE STANDARDS AND REQUIREMENTS HAVE BEEN MET.**
- **INCLUDES 28 COMMERCIAL MILLS (MOST IN A DECOMMISSIONING MODE) AND 13 IN-SITU SOLUTION OPERATIONS.**

REGULATORY AUTHORITY FOR MILL TAILINGS DISPOSAL

- EPA STANDARDS IN 40 CFR 192 ADDRESS BOTH INACTIVE SITES (SUBPARTS A, B, AND C) AND ACTIVE SITES (SUBPARTS D AND E). GROUND WATER SECTIONS NOT FINALIZED.
- NRC REGULATIONS MUST IMPLEMENT AND CONFORM TO EPA STANDARDS AND ARE IN 10 CFR PART 40, APPENDIX A.
- NRC REGULATIONS CONTAIN REQUIREMENTS IN THE FOLLOWING AREAS:
 - TECHNICAL {3 CRITERIA}
 - FINANCIAL {2 CRITERIA}
 - OWNERSHIP {1 CRITERIA}
 - LONG-TERM SURVEILLANCE {1 CRITERIA}
 - HAZARDOUS CONSTITUENTS {1 CRITERIA, BUT A FAIRLY EXTENSIVE LIST OF CHEMICAL CONSTITUENTS WITH RELEASE LIMITS.}
- NRC CRITERIA IS FLEXIBLE TO ACHIEVE OPTIMUM TAILINGS DISPOSAL ON A SITE SPECIFIC BASIS. BUT ABSOLUTE VALUES REQUIRED (FROM EPA) ON STRUCTURAL STABILITY AND RELEASE OF RADON GAS.

10 CFR PART 40 APPENDIX A

TECHNICAL CRITERIA

- ① GOAL OF PERMANENT ISOLATION OF TAILINGS WITHOUT ON-GOING MAINTENANCE.
- ① AVOID PROLIFERATION OF SMALL WASTE DISPOSAL SITES.
- ① PRIME OPTION IS PLACEMENT BELOW GRADE.
- ① SPECIFIC SITE DESIGN CRITERIA
 - MINIMIZE UPSTREAM RAINFALL CATCHMENT.
 - WIND PROTECTION.
 - MINIMIZE EROSION POTENTIAL.
 - SELF-SUSTAINING VEGETATIVE COVER OR ROCK COVER.
 - EARTHQUAKE CONCERNS.
- ① GROUND WATER PROTECTION
- ① EARTHEN COVER SHALL BE DESIGNED TO BE EFFECTIVE FOR 1,000 YEARS TO THE EXTENT REASONABLE ACHIEVABLE AND, IN ANY CASE, FOR AT LEAST 200 YEARS. ALSO, SPECIFIC RELEASE LIMITS ON RADON ESTABLISHED.
- ① MONITORING PROGRAMS
- ① MINIMIZE AIRBORNE EFFLUENT RELEASES DURING OPERATION (ALARA).

GASEOUS DIFFUSION PLANTS

THE ENERGY POLICY ACT OF 1992 MANDATED THE FOLLOWING ACTIONS:

- CREATED THE U.S. ENRICHMENT CORPORATION (USEC) WHICH IS TO ASSUME OPERATION OF THE GASEOUS DIFFUSION PLANTS (GDPs). UPON DECOMMISSIONING, THE PLANTS REVERT BACK TO DOE CONTROL.
- NRC IS MANDATED TO ASSUME REGULATORY OVERSIGHT OF THE GDPs DURING OPERATION.
- NRC WILL PUBLISH CERTIFICATION PROCEDURES AND STANDARDS BY OCTOBER 1994 (STATUARY DEADLINE).
 - NRC PUBLISHED A PROPOSED RULE WITH TECHNICAL AND PROCEDURAL REQUIREMENTS IN NOVEMBER 1993.
- NRC WILL CERTIFY USEC COMPLIANCE WITH STANDARDS AND REPORT TO CONGRESS ANNUALLY.
- USEC CANNOT OPERATE FACILITIES WITHOUT AFFIRMATIVE NRC FINDINGS.
- NRC MUST COORDINATE WITH EPA.
- OSHA HAS JURISDICTION AS OF 7/1/93.

**HIGH-LEVEL
RADIOACTIVE WASTE**

HLW LEGISLATION

- THE POLICY FOR HIGH-LEVEL WASTE MANAGEMENT IS SET OUT IN THE NUCLEAR WASTE POLICY ACT OF 1982 (NWPA), THE NUCLEAR WASTE AMENDMENTS ACT (1987), AND THE ENERGY POLICY ACT OF 1992. {THIS IS THE PRINCIPAL LEGISLATION BUT OTHER LEGISLATION EXISTS.}
- THESE ACTS SPECIFY THE PROCESS FOR THE DEVELOPMENT OF HIGH-LEVEL WASTE REPOSITORIES AND A MONITORED RETRIEVABLE STORAGE FACILITY.
 - NWPA ASSIGNS THE RESPONSIBILITY FOR DEVELOPING A REPOSITORY TO DOE FOR DISPOSING BOTH COMMERCIAL AND DEFENSE HLW.
 - EPA IS TO DEVELOP GENERALLY APPLICABLE STANDARDS.
 - NRC IS TO LICENSE THE FACILITY BASED ON THE EPA STANDARDS.
 - COSTS ARE THE RESPONSIBILITY OF THE WASTE GENERATORS.
 - STATE AND PUBLIC PARTICIPATION ARE ESSENTIAL TO PROMOTE PUBLIC CONFIDENCE.

EPA HIGH-LEVEL STANDARDS

- THE EPA STANDARD WILL APPLY TO:
 - SPENT NUCLEAR FUEL
 - HIGH-LEVEL RADIOACTIVE WASTE
 - TRANSURANIC WASTE (GREATER THAN 100 NANOCURIES PER GRAM), EXCEPT THOSE WASTES APPROVED FOR DISPOSAL UNDER 10 CFR 61 AS LLW.
 - BOTH CIVILIAN AND DEFENSE WASTES
- EPA DEVELOPED STANDARDS WHICH WERE REMANDED BY THE COURT. EPA WAS DRAFTING NEW STANDARDS WITH A SCHEDULE TO ISSUE THEM BY MID 1992.
- ENERGY POLICY ACT OF 1992
 - DIRECTS EPA TO ENTER INTO A CONTRACT WITH THE NATIONAL ACADEMY OF SCIENCES (NAS). BY DECEMBER 31, 1993, THE NAS SHALL PROVIDE RECOMMENDATIONS ON ENVIRONMENTAL STANDARDS FOR THE LICENSING OF YUCCA MOUNTAIN IN THREE SPECIFIC AREAS.
 - WITH ONE YEAR OF THE NAS REPORT, EPA IS TO PROMULGATE, THROUGH RULEMAKING, PUBLIC HEALTH AND SAFETY STANDARDS FOR PROTECTION OF THE PUBLIC FROM RELEASES TO THE ASSESSABLE ENVIRONMENT FROM RADIOACTIVE MATERIALS STORED OR DISPOSED OF AT YUCCA MOUNTAIN.
 - WITHIN ONE YEAR OF ISSUANCE OF THE REVISED EPA REGULATIONS, THE NRC IS TO MODIFY 10 CFR PART 60 OF ITS REGULATIONS.

NRC HIGH-LEVEL WASTE REGULATIONS

- 10 CFR PART 60
- CONFORM TO EPA REGULATIONS (40 CFR PART 191) WHICH ARE UNDER REVISION.
 - 10,000 YEAR DESIGN LIFETIME.
 - CONTROLLED RELEASE RATE OF 1 PART IN 100,000 PER YEAR OF THE INVENTORY PRESENT 1,000 YEARS AFTER DISPOSAL.
- ELEMENTS:
 - LICENSING REQUIREMENTS
 - PERFORMANCE OBJECTIVES
 - SITING CRITERIA
 - DESIGN CRITERIA
 - PERFORMANCE CONFIRMATION REQUIREMENTS

LOW-LEVEL RADIOACTIVE WASTE

10 CFR PART 61

**LICENSING REQUIREMENTS FOR LAND DISPOSAL
OF LOW-LEVEL RADIOACTIVE WASTE**

HISTORICAL PERSPECTIVE

- SIX COMMERCIAL LLW DISPOSAL SITES OPERATING IN THE 1970'S.
- NO SYSTEMS APPROACH TAKEN IN THE LICENSING PROCESS.
- PROBLEMS DEVELOPED AT SOME SHALLOW LAND BURIAL (SLB) SITES.
 - TRENCH SUBSIDENCE
 - WATER INFILTRATION / BATH TUB EFFECT
 - INADEQUATE FUNDS FOR CLOSURE
 - POOR RECORD KEEPING
- PROBLEMS LED TO THE CLOSURE OF THREE SITES.
- NRC, STATES, CONGRESS , PUBLIC, AND INDUSTRY CONCLUDED THAT NEW LLW REGULATION WAS NEEDED.
- EPA LLW STANDARDS (40 CFR PART 193) NOT ISSUED YET.
- NRC HAS ISSUED REGULATIONS WHICH MAY REQUIRE REVISION WHEN EPA STANDARDS ISSUED.
- CURRENT PROPOSED SITES ARE IN AGREEMENT STATES
 - COMPATIBILITY ISSUES

NRC REGULATIONS

APPLICABLE TO LLW DISPOSAL

- 10 CFR PART 61
 - PUBLISHED AS A FINAL RULE IN DECEMBER 1982.
 - SYSTEMS APPROACH TO REGULATORY REQUIREMENTS. CONTAINS BOTH PRESCRIPTIVE AND PERFORMANCE BASED ELEMENTS.
 - PROGRESSIVE IN NATURE SUCH THAT REQUIREMENTS FOR DISPOSAL INCREASE AS THE HAZARD POTENTIAL OF THE WASTE INCREASES.
 - MAJOR ELEMENTS:
 - PERFORMANCE OBJECTIVES
 - TECHNICAL REQUIREMENTS
 - FINANCIAL ASSURANCES
 - LICENSING PROCEDURES
 - STATE AND TRIBAL PARTICIPATION

- 10 CFR PART 20
 - MANIFESTS
 - WASTE TRANSFERS

10 CFR PART 61 SUBPART C

PERFORMANCE OBJECTIVES

- PROTECTION OF THE GENERAL POPULATION FROM RELEASES OF RADIOACTIVITY.
- PROTECTION OF INDIVIDUALS FROM INADVERTENT INTRUSION.
- PROTECTION OF INDIVIDUALS DURING OPERATIONS.
- STABILITY OF THE SITE AFTER CLOSURE.

10 CFR 61.41

PERFORMANCE OBJECTIVE

- PROTECTION OF THE GENERAL POPULATION FROM RELEASES OF RADIOACTIVITY.

CONCENTRATIONS OF RADIOACTIVE MATERIAL RELEASED TO THE GENERAL ENVIRONMENT SHALL NOT EXCEED AN ANNUAL DOSE EQUIVALENT OF 25 MREM TO THE WHOLE BODY, 75 MREM TO THE THYROID, AND 25 MREM TO ANY OTHER ORGAN OF ANY MEMBER OF THE PUBLIC.
MAINTAIN RELEASES ALARA.

10 CFR 61.42

PERFORMANCE OBJECTIVE

- PROTECTION OF INDIVIDUALS FROM INADVERTENT INTRUSION.

DESIGN, OPERATION, AND CLOSURE OF THE SITE MUST ENSURE PROTECTION OF ANY INDIVIDUAL INADVERTENTLY INTRUDING INTO THE DISPOSAL FACILITY AFTER ACTIVE INSTITUTIONAL CONTROLS OVER THE FACILITY HAVE BEEN REMOVED.

10 CFR 61.43

PERFORMANCE OBJECTIVE

- PROTECTION OF INDIVIDUALS DURING OPERATIONS.

EXCEPT FOR OFF-SITE RELEASES, OPERATIONS AT THE DISPOSAL FACILITY SHALL BE CONDUCTED IN COMPLIANCE WITH THE STANDARDS FOR RADIATION PROTECTION SET OUT IN 10 CFR PART 20. EXPOSURES SHOULD BE MAINTAINED ALARA.

10 CFR 61.44

PERFORMANCE OBJECTIVE

● STABILITY OF THE SITE AFTER CLOSURE.

THE DISPOSAL FACILITY SHALL BE SITED, DESIGNED, UTILIZED, OPERATED, AND CLOSED TO ACHIEVE LONG-TERM STABILITY OF THE SITE AND TO ELIMINATE, TO THE EXTENT PRACTICABLE, THE NEED FOR ON-GOING MAINTENANCE OF THE SITE FOLLOWING CLOSURE SO THAT ONLY SURVEILLANCE, MONITORING, OR MINOR CUSTODIAL CARE ARE REQUIRED.

10 CFR PART 61 SUBPART D

TECHNICAL REQUIREMENTS

- SITE SUITABILITY
- SITE DESIGN, OPERATION, AND CLOSURE
- WASTE CLASSIFICATION AND CHARACTERISTICS
- INSTITUTIONAL REQUIREMENTS

10 CFR 61.50

SITE SUITABILITY TECHNICAL REQUIREMENTS

- PRIMARY EMPHASIS ON ISOLATION OF WASTE AND LONG-TERM OBJECTIVES AS OPPOSED TO SHORT-TERM CONVENIENCE.
- SPECIFIES MINIMUM CHARACTERISTICS FOR NEAR-SURFACE FACILITIES.
- LISTS FEATURES TO AVOID THAT WOULD COMPROMISE MEETING THE PERFORMANCE OBJECTIVES OF SUBPART C, SUCH AS AREAS WITH SIGNIFICANT NATURAL RESOURCES AND POTENTIAL FOR DEVELOPMENT, EXCESSIVE TECTONIC OR EROSION PROCESSES, FLOOD PLAINS, AND SHALLOW WATER TABLES.
- LISTS DESIRABLE FEATURES SUCH AS AN UNDERSTANDABLE SITE AND NO ON-SITE GROUND WATER DISCHARGE TO THE SURFACE.

10 CFR 61.51

SITE DESIGN, OPERATION, AND CLOSURE TECHNICAL REQUIREMENTS

- DESIGN SHOULD EMPHASIZE LONG-TERM ISOLATION.
- DESIGN SHOULD COMPLIMENT AND ENHANCE SITE CHARACTERISTICS.
- DESIGN AND OPERATION SHOULD LEAD TO SITE CLOSURE THAT ASSURES THAT PERFORMANCE OBJECTIVES WILL BE MET.
- DESIGN AND OPERATION SHOULD MINIMIZE CONTACT OF WATER WITH WASTE BEFORE, DURING, AND AFTER DISPOSAL.

10 CFR 61.52 AND 61.53

FACILITY OPERATION AND CLOSURE TECHNICAL REQUIREMENTS

- OPERATIONS SHOULD EMPHASIZE STABILITY.
 - MINIMIZE VOIDS IN PACKAGES.
 - CAREFUL PLACEMENT.
 - EFFICIENT BACKFILL.
 - SEGREGATE UNSTABLE WASTE PACKAGES.
- CLOSE AND STABILIZE AS EACH DISPOSAL UNIT IS FILLED AND COVERED.
- ESTABLISH AN ENVIRONMENTAL MONITORING PROGRAM TO PROVIDE PREOPERATIONAL, OPERATIONAL, AND POST-OPERATIONAL DATA.

10 CFR 61.55

WASTE CLASSIFICATION

- THREE WASTE CLASSES ESTABLISHED: A, B, AND C.
- THE WASTE CLASS IS DETERMINED BY THE RADIOISOTOPE CONCENTRATIONS.
- THE WASTE CLASSIFICATION SYSTEM REQUIRES INCREASED REQUIREMENTS AS THE HAZARD POTENTIAL INCREASES.
- CLASS A WASTE
 - LOWEST RADIOLOGICAL CONCENTRATIONS OF THE THREE CLASSES.
 - MUST MEET MINIMUM WASTE FORM REQUIREMENTS.
 - SEPARATED FROM CLASS B AND C WASTE UNLESS IT MEETS THE WASTE FORM REQUIREMENTS FOR THE B AND C WASTE.
- CLASS B WASTE
 - HIGHER CONCENTRATIONS THAN CLASS A.
 - STRUCTURAL STABILITY REQUIRED.

WASTE CLASSIFICATION (CONTINUED)

● CLASS C WASTE

- HIGHEST CONCENTRATIONS TO BE ALLOWED FOR NEAR SURFACE DISPOSAL.
- STRUCTURAL STABILITY REQUIRED.
- MUST BE PROVIDED WITH ADDITIONAL PROTECTION AGAINST INADVERTENT INTRUSION EITHER BY DEEPER BURIAL (GREATER THAN 5 METERS FROM THE SURFACE) OR ANOTHER BARRIER DESIGNED TO LAST 500 YEARS.

● GREATER THAN CLASS C (GTCC)

- LLW NOT SUITABLE FOR NEAR SURFACE DISPOSAL.

10 CFR 61.56

WASTE CHARACTERISTICS MINIMUM REQUIREMENTS FOR DISPOSAL

- NO CARDBOARD OR FIBERBOARD BOXES.
- LIQUIDS MUST BE ABSORBED.
- NO EXPLOSIVE OR PYROPHORIC MATERIALS.
- TREAT WASTE TO REDUCE BIOLOGICAL, PATHOGENIC, OR INFECTIOUS MATERIAL.
- WASTE SHOULD NOT GENERATE QUANTITIES OF TOXIC GASES, VAPORS, OR FUMES.

10 CFR 61.56

WASTE CHARACTERISTICS STRUCTURAL STABILITY (WHEN REQUIRED)

- THE WASTE FORM WILL MAINTAIN ITS PHYSICAL DIMENSIONS AND FORM UNDER EXPECTED DISPOSAL CONDITIONS. THE STRUCTURAL STABILITY CAN BE PROVIDED BY THE WASTE FORM OR A DISPOSABLE CONTAINER.
- FOR STABILIZED WASTES, THERE SHALL BE AS LITTLE FREE STANDING AND NONCORROSIVE LIQUID AS POSSIBLE (0.5% MAXIMUM LIQUID VOLUME IF THE WASTE FORM PROVIDES THE STABILITY AND 1% MAXIMUM LIQUID VOLUME IF A CONTAINER PROVIDES THE STABILITY).
- VOID SPACES WITHIN THE WASTE AND BETWEEN THE WASTE AND ITS WASTE PACKAGE MUST BE REDUCED TO THE EXTENT PRACTICAL.
- 10 CFR 61.7, "CONCEPTS" CONTAINS THE FOLLOWING ADDITIONAL CONSIDERATION: "TO THE EXTENT THAT IT IS PRACTICAL, CLASS B AND C WASTE FORMS OR CONTAINERS SHOULD BE DESIGNED TO BE STABLE, I.E., MAINTAIN GROSS PHYSICAL PROPERTIES AND IDENTITY OVER, 300 YEARS.

10 CFR 61.60 and 61.61

INSTITUTIONAL REQUIREMENTS

- THE DISPOSAL SITE MUST BE OWNED BY THE FEDERAL OR STATE GOVERNMENT.
- AN ACTIVE INSTITUTIONAL CONTROL PROGRAM MUST EXIST TO PHYSICALLY CONTROL ACCESS TO THE SITE AFTER CLOSURE, CARRY OUT MONITORING, AND PERFORM MINOR CUSTODIAL CARE FOR 100 YEARS FOLLOWING CLOSURE.

10 CFR PART 20

WASTE TRANSFER REQUIREMENTS

- MANIFEST PREPARED FOR EACH WASTE SHIPMENT AND USED TO TRACK SHIPMENTS.
- SHIPPER INVESTIGATES MISSING OR LATE SHIPMENTS AND FILES A REPORT.
- WASTE GENERATOR MUST COMPLY WITH 10 CFR PART 61 REQUIREMENTS FOR WASTE CLASSIFICATION AND CHARACTERISTICS (AND CERTIFY COMPLIANCE).
- WASTE GENERATOR MUST HAVE A QUALITY CONTROL PROGRAM TO ASSURE COMPLIANCE WITH WASTE CLASSIFICATION AND CHARACTERISTICS REQUIREMENTS.

REGULATORY GUIDANCE

- PROVIDES AT LEAST ONE METHOD OR APPROACH ACCEPTABLE TO THE STAFF FOR IMPLEMENTING NRC REGULATIONS.
- NOT STAND ALONE REQUIREMENTS. REGULATIONS ARE REQUIREMENTS.
- TYPES
 - STANDARD FORMAT AND CONTENT GUIDES (SF&C)
 - STANDARD REVIEW PLANS (SRPs)
 - BRANCH TECHNICAL POSITIONS (BTPs)
 - REGULATORY GUIDES (RGs)

REGULATORY GUIDANCE

RELATED TO LLW

- NUREG-1199, "STANDARD FORMAT AND CONTENT OF A LICENSE APPLICATION FOR A LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITY".
 - TELLS THE APPLICANT HOW TO ASSEMBLE AN APPLICATION.
- NUREG-1200, "STANDARD REVIEW PLAN FOR THE REVIEW OF A LICENSE APPLICATION FOR A LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITY".
 - TELLS THE STAFF HOW TO CONDUCT THEIR REVIEW.
- BRANCH TECHNICAL POSITIONS ON WASTE CLASSIFICATION AND WASTE FORM, MAY 11, 1983.
- BRANCH TECHNICAL POSITION ON WASTE FORM, REVISION 1, JAN 24, 1991.
- PROPOSED REVISION TO THE BRANCH TECHNICAL POSITION ON CONCENTRATION AVERAGING AND ENCAPSULATION, SEPT 16, 1993.
- DEVELOPING A BRANCH TECHNICAL POSITION ON PERFORMANCE ASSESSMENT OF A LOW-LEVEL WASTE DISPOSAL FACILITY.

WASTE CLASSIFICATION

BRANCH TECHNICAL POSITION

- SEVERAL NUCLIDES IN WASTE CLASSIFICATION TABLES ARE DIFFICULT TO MEASURE.
- THE BTP PROVIDES ACCEPTABLE METHODS TO IMPLEMENT A WASTE CLASSIFICATION PROGRAM.
- THE EMPHASIS IS ON HAS A REASONABLE EFFORT BEEN MADE TO ENSURE A REALISTIC REPRESENTATION OF THE NUCLIDES IN THE WASTE.
- 10 CFR PART 61 PROVIDES FOR INDIRECT METHODS SUCH AS SCALING FACTORS AND MATERIALS ACCOUNTABILITY {61.55(A)(8)}. THE BTP PROVIDES ADDITIONAL GUIDANCE IN THE AREAS OF:
 - MATERIALS ACCOUNTABILITY
 - CLASSIFICATION BY SOURCE
 - GROSS RADIOACTIVITY MEASUREMENTS
 - DIRECT MEASUREMENTS
- PROVIDES GUIDANCE ON AVERAGING THE CONCENTRATION OF RADIONUCLIDES OVER THE VOLUME OR WEIGHT OF THE WASTE.

WASTE FORM

BRANCH TECHNICAL POSITION

- PROVIDES STAFF VIEWS ON ACCEPTABLE TEST METHODS AND RESULTS FOR DEMONSTRATING STABILITY OF CLASS B AND C WASTE.
 - COMPRESSIVE STRENGTHS.
 - THERMAL DEGRADATION TESTING.
 - RADIATION EXPOSURE.
 - BIODEGRADATION.
 - LEACH TESTING.
 - IMMERSION TESTING.
 - FULL SCALE TESTING.
- INCLUDES GUIDANCE ON:
 - WASTE SOLIDIFICATION.
 - HIGH INTEGRITY CONTAINER DESIGN.
 - RADIATION DEGRADATION OF ORGANIC RESIN.
 - PACKAGING FILTER CARTRIDGES.
 - REPORTING MISHAPS.

DECOMMISSIONING

● NRC REGULATIONS

- 10 CFR PART 30 {DOMESTIC LICENSING OF BYPRODUCT MATERIAL}
- 10 CFR PART 40 {DOMESTIC LICENSING OF SOURCE MATERIAL}
- 10 CFR PART 50 {DOMESTIC LICENSING OF POWER REACTORS}
- 10 CFR PART 70 {DOMESTIC LICENSING OF SPECIAL NUCLEAR MATERIAL}

● DECOMMISSION REVIEWS ARE CONDUCTED ON A CASE-BY-CASE BASIS WITH LITTLE CRITERIA SPECIFIED.

- MUST SUBMIT A DECOMMISSION PLAN FOR NRC REVIEW AND APPROVAL.
- MUST REMOVE RADIOACTIVE CONTAMINATION TO THE EXTENT PRACTICABLE AND PROPERLY DISPOSE OF IT.
- GENERALLY MUST DO A COST EVALUATION AND ADDRESS ALTERNATIVES.
- MUST DEMONSTRATE ADEQUATE FUNDING.
- MAY HAVE TO PROVIDE A PHYSICAL SECURITY PLAN.

POWER REACTOR DECOMMISSIONING

- STANDARD REVIEW PLANS HAVE NOT BEEN DEVELOPED BY THE NRC.
- TWO OFFICES (NMSS AND NRR) WITHIN NRC ARE INVOLVED IN THE DECOMMISSIONING PROCESS FOR POWER REACTORS.
- PROJECT MANAGEMENT RESPONSIBILITY WILL SHIFT FROM NRR TO NMSS UPON APPROVAL OF THE DECOMMISSIONING PLAN.
- 13 COMMERCIAL POWER REACTORS IN DECOMMISSIONING
 - 6 PLANTS HAVE APPROVED DECOMMISSIONING PLANS.
 - 2 PLANTS HAVE DECOMMISSIONING PLAN APPROVAL PENDING.
 - 2 PLANTS HAVE DECOMMISSIONING PLANS UNDER REVIEW.
 - 2 PLANTS HAVE DECOMMISSIONING PLANS SUBMITTALS PENDING.
 - 1 PLANT IS A SPECIAL CASE.

SDMP

SITE DECOMMISSIONING MANAGEMENT PLAN

- INITIATED IN 1990. FORMALLY APPROVED BY THE COMMISSION APRIL 6, 1992.
- ADDRESSES NON-ROUTINE DECOMMISSIONING SITES.
- CRITERIA FOR LISTING ON THE SDMP
 - PROBLEMS WITH VIABILITY OF RESPONSIBLE ORGANIZATION.
 - LARGE AMOUNTS OF CONTAMINATION THAT MAY BE DIFFICULT TO DISPOSE.
 - LONG-TERM PRESENCE OF CONTAMINATED, UNUSED BUILDINGS.
 - LICENSE IS TERMINATED, BUT RESIDUAL CONTAMINATION IS PRESENT IN EXCESS OF UNRESTRICTED RELEASE LIMITS.
 - CONTAMINATION OR POTENTIAL CONTAMINATION OF GROUND WATER.
- 46 SITES IN THE SDMP
- THERE ARE CRITERIA FOR REMOVAL FROM THE SDMP LISTING.

ENHANCED PARTICIPATORY RULEMAKING

- PROPOSED CHANGES TO 10 CFR PART 20 TO DEVELOP RADIOLOGICAL CRITERIA FOR DECOMMISSIONING.
- NEW ENHANCED PUBLIC PARTICIPATION IN THE RULEMAKING PROCESS.
 - 7 WORKSHOPS HELD ACROSS THE COUNTRY FROM JANUARY THROUGH MAY 1993.
 - IN JULY 1993, THE NRC CONDUCTED 8 PUBLIC MEETINGS IN FOUR CITIES ON THE PROPOSED SCOPE OF THE GENERIC ENVIRONMENTAL IMPACT STATEMENT SUPPORTING THE RULEMAKING.
- NRC CIRCULATING A STAFF DRAFT OF THE PROPOSED RULEMAKING TO WORKSHOP PARTICIPANTS FOR COMMENTS (COMMENT PERIOD EXPIRED MARCH 11, 1994).
- FINAL CRITERIA USED WILL BE USED TO DETERMINE THE ADEQUACY OF REMEDIATION OF RESIDUAL ACTIVITY RESULTING FROM THE POSSESSION OR USE OF SOURCE, BYPRODUCT, OR SPECIAL NUCLEAR MATERIAL.
- FOR HIGH-LEVEL WASTE AND LOW-LEVEL WASTE DISPOSAL FACILITIES THESE NEW 10 CFR PART 20 STANDARDS WOULD ONLY APPLY TO ANCILLARY SURFACE FACILITIES USED TO SUPPORT OPERATION.
- CRITERIA WOULD NOT APPLY TO ANY FACILITY WITH AN APPROVED DECOMMISSIONING PLAN AS OF THE DATE THE RULE BECOMES EFFECTIVE.