TA21

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(12-72)
AECM 0270

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(Enter Y (Yes) or N (No))

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U.S. ATOMIC ENERGY COMMISSION

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5. TYPE OF MESSAGE (Enter S, M, T, or B)

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FOR COMMUNICATION CENTER

MESSAGE IDENTIFICATION

NR: DTG:

6. FROM EUGENE M. WEWERKA
H-12 GROUP LEADER
LOS ALAMOS SCIENTIFIC LABORATORY
LOS ALAMOS, NM 87545

7. OFFICIAL BUSINESS (TIME) 2:45 A P.
E. M. Wewerka
(Signature of certifying official)

8. DATE 5-23-79

9. TO DEWEY E. LARGE, PROGRAM MANAGER
ORO RADIOACTIVE WASTE MANAGEMENT, OAK RIDGE, TN

JOHN PEEL IDAHO OPERATIONS OFFICE

COMMUNICATION CENTER ROUT

69 Elite

UNCLASSIFIED/N O N W D/N A R R

AN EXPANDED OUTLINE OF LS-20 RADIOACTIVE WASTE BURIAL TECHNOLOGY FOLLOWS. WE THINK IT IS REPONSIVE TO DOE GUIDANCE AND FILLS URGENT NEEDS. THIS PROJECT IS SEVERAL YEARS OLD AND IS APPROACHING THE HIGH PAYOFF PHASE AND SUGGEST THAT SUPPORT BE CONTINUED AT THE REQUESTED LEVEL. ALSO ATTACHED IS A BRIEF OUTLINE ON HOW WE THINK THAT WE CAN CONTRIBUTE TO THE DOE CRITERIA AND STANDARDS DEVELOPMENT.

BE BRIEF–ELIMINATE UNNECESSARY WORDS

10. ORIGINATOR (On separate lines, Enter Name, Mail Sta., & Tel. Ext)
Eugene M. Wewerka/tj
Group H-12, MS-495
x3331

11. CLASSIFIED BY (If different from Originator)

12. DOWNGRADING/DECLASSIFICATION STAMP (If Required)

13. STAMP CLASSIFICATION (Classified Messages Only)

14. RESTRICTED DATA, FRD, or NSI STAMP (If Required)

10129

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RADIOACTIVE WASTE BURIAL TECHNOLOGY RESEARCH PROPOSAL

INTRODUCTION

EXISTING SHALLOW LAND BURIAL PRACTICES FOR SOLID LOW-LEVEL WASTE ARE COMING UNDER INCREASING ATTACK WITH THE PROBABLE OUTCOME THAT MODIFICATIONS TO PRESENT DISPOSAL PRACTICES WILL BE REQUIRED. AT THE SAME TIME, EXISTING DISPOSAL FACILITIES ARE APPROACHING CAPACITY OR THROUGHPUT LIMITS. RECENT ATTEMPTS TO INCREASE DISPOSAL CAPACITY HAVE NOT BEEN SUCCESSFUL AND THIS SITUATION IS QUICKLY APPROACHING A CRISIS. THESE CIRCUMSTANCES LEAD TO THE CONCLUSION THAT EITHER SHALLOW LAND BURIAL METHODS AND TECHNOLOGY MUST SHOW IMPROVED CAPABILITY, THAT A REASONABLE ALTERNATIVE MUST BE QUICKLY DEMONSTRATED, OR THAT BOTH DISPOSAL MODES BE USED. STUDIES RECENTLY RELEASED BY NRC AND EPA SEEM TO BE LEADING TO AN EVENTUAL REQUIREMENT THAT GREATER PROTECTION MUST BE AFFORDED TO DISPOSED LOW-LEVEL WASTES, BUT THE BASIS FOR SPECIFYING METHODS TO ACHIEVE THE INCREASED PROTECTION REQUIRED IS LACKING.

BOTH IMPROVEMENTS TO SHALLOW LAND BURIAL AND A REASONABLE ALTERNATIVE DISPOSAL METHOD ARE UNDER DEVELOPMENT IN THE LS-20 PROGRAM. AN ADDITIONAL, AND POSSIBLY VERY IMPORTANT BONUS IS THAT BOTH DISPOSAL TECHNIQUES WILL BE EVALUATED UNDER THE SAME CONDITIONS, RESULTING NOT ONLY IN PERFORMANCE CHARACTERIZATION OF EACH TECHNIQUE, BUT ALSO THE RELATIVE MERITS OF EACH. THERE ARE SEVERAL ATTRACTIVE FEATURES IN COUPLING THE WASTE DISPOSAL STUDIES OF SHALLOW-LAND BURIAL TECHNIQUES WITH THOSE OF SHALLOW LAND BURIAL ALTERNATIVES. FUTURE DISPOSAL FACILITIES MUST ACCOMMODATE ALL PRESENT AND FUTURE LOW-LEVEL WASTE FORMS, BUT NEITHER DISPOSAL MODE MAY BE SUITED TO ACCOMMODATE ALL WASTE FORMS EFFICIENTLY. EVALUATION OF EACH DISPOSAL METHOD AND THE RELATIVE ADVANTAGES AND DISADVANTAGES OF EACH NEED TO BE DEFINED TO BETTER IDENTIFY THE PROPER DISPOSAL MODE FOR VARIOUS WASTE FORMS. INFORMATION COLLECTED CONCERNING WASTE COMPOSITION AND FORMS, AND SEVERAL ASPECTS OF DISPOSAL AND MONITORING METHODOLOGIES, RELATE TO BOTH TECHNIQUES FOR WASTE BURIAL. CONSTRUCTION OF PAIRED

IMPROVED SHALLOW LAND BURIAL AND GEOLOGIC TEST FACILITIES AT THE SAME LOCATION, AS PROPOSED HEREIN, WILL PRESENT A UNIQUE OPPORTUNITY TO COMPARE TWO DISPOSAL MODES IN SIMILAR ENVIRONMENTS AND ALLOW MEASUREMENTS TAKEN IN ONE FACILITY TO APPLY TO THE OTHER FACILITY TO FURTHER ELUCIDATE THE PERFORMANCE OF EACH DISPOSAL MODE.

I. SHALLOW LAND BURIAL TECHNOLOGY

PURPOSE:

TO IDENTIFY AND IMPROVE THE TECHNOLOGY RELATED TO THE SHALLOW LAND BURIAL OF LOW LEVEL RADIOACTIVE WASTE.

WORK BREAKDOWN STRUCTURE:

-LITERATURE SURVEY OF EXISTING TECHNIQUES FOR THE DISPOSAL OF NONRADIOACTIVE HAZARDOUS WASTES AND LOW LEVEL RADIOACTIVE WASTES TO EVALUATE NATURAL AND ENGINEERED WASTE BARRIERS AND TO IDENTIFY THOSE METHODS WITH THE GREATEST POTENTIAL FOR APPLICATION AT OTHER DISPOSAL SITES.

-ASSESS THE IMPACTS OF WASTE PROPERTIES AND DISPOSAL SITE CONDITIONS ON THE PERFORMANCE OF THE ENGINEERED WASTE BARRIERS.

-EVALUATE CONTAMINANT TRANSPORT MECHANISMS THROUGH BARRIERS UNDER CONDITIONS OF SATURATED AND UNSATURATED WATER FLOW.

-DEVELOP A PRELIMINARY DESIGN TO BUILD AN IMPROVED SHALLOW LAND BURIAL DEMONSTRATION FACILITY BASED ON CURRENT KNOWLEDGE AND IDEAS GENERATED IN A NATIONAL WORKSHOP TO BE HELD AT LOS ALAMOS.

ACCOMPLISHMENTS TO DATE:

-IDENTIFIED THE STATE-OF-ART IN SHALLOW LAND BURIAL OF LOW LEVEL RADIOACTIVE WASTE AND NONRADIOACTIVE WASTE.

- REVIEWED OVER 500 DOCUMENTS IN THE TECHNICAL LITERATURE.
- ATTENDED AND SPONSORED SEVERAL WASTE TECHNOLOGY CONFERENCES.
- CORRESPONDED WITH 50 STATE AGENCIES AND 10 FEDERAL AGENCIES THAT REGULATE HAZARDOUS WASTE MATERIALS TO ASSESS WASTE DISPOSAL

PHILOSOPHIES ON SITE PERFORMANCE.

•REVIEWED THE WASTE MANAGEMENT PRACTICES AT ALL OF THE LOW LEVEL WASTE SITES AT THE DOE LABORATORIES AND AT COMMERCIAL LOCATIONS.

-ASSESSED EXISTING HAZARDOUS WASTE DISPOSAL PRACTICES AND APPLIED THIS KNOWLEDGE TO PROBLEMS INVOLVING RADIOACTIVE WASTE BURIAL PRACTICES.

•COMPARED AND CONTRASTED LOW-LEVEL AND HAZARDOUS WASTES (CONSTITUENTS, COMPOSITION, FORM, SOURCES AND PRODUCTION VOLUMES) AND WASTE MANAGEMENT PRACTICES.

•ASSESSED PROCEDURES FOR LANDFILL DISPOSAL OF HAZARDOUS WASTES.

•EVALUATED ALTERNATIVES TO LANDFILL DISPOSAL OF WASTES (MINE EMPLACEMENT, DEEP WELL DISPOSAL, SURFACE SPREADING, INCINERATION AND ENCAPSULATION)

-DEVELOPED SITE SELECTION METHODOLOGIES USEFUL FOR DECISION MAKING FOR DISPOSAL OF RADIOACTIVE AND NONRADIOACTIVE WASTE.

•CONSIDERED PARAMETERS IMPORTANT FOR SELECTION AND OPERATION OF POTENTIAL AND CURRENT SITES.

•COMPARED SITE SELECTION FACTORS BETWEEN A HUMID DISPOSAL SITE (MAXEY FLATS) AND AN ARID DISPOSAL SITE (HANFORD).

-INVESTIGATED THE MIGRATION OF WATER AND CONTAMINANTS THROUGH SOILS AND GEOLOGIC MATERIALS.

•DEVELOPED A STATE-OF-ART METHOD TO MEASURE THE RELATIONSHIP BETWEEN PERMEABILITY AND SUCTION FOR THE WETTING OF UNSATURATED SOIL USING THERMOCOUPLE PSYCHROMETERS.

•WROTE A FINITE ELEMENT SOLUTION TO EQUATION DESCRIBED BY DARCY'S LAW FOR RATES OF WATER FLOW THROUGH UNSATURATED SOILS AND USED THIS MODEL TO SUCCESSFULLY PREDICT WATER MOVEMENT IN SOILS.

•DEVELOPED AND EVALUATED A LABORATORY TO MEASURE THE HYDRAULIC CONDUCTIVITY OF BANDELIER TUFF, AND DETERMINED THE NATURAL VARIATION IN

HYDRAULIC CONDUCTIVITY AS INFLUENCED BY GEOLOGIC VARIABLES OF TUFF.

- COLLECTED ABOUT 1000 SAMPLES OF TUFF BENEATH TWO PREVIOUS-USED LIQUID RADIOACTIVE WASTE DISPOSAL BEDS TO CHARACTERIZE THE VERTICAL MOVEMENT OF PLUTONIUM, AMERICIUM, AND NONRADIOACTIVE WASTE COMPONENTS AND TO ELUCIDATE THE ROLE OF ROCK FRACTURE IN WATER AND CONTAMINANT TRANSPORT.

-DEVELOPED A UNIQUE RADIONUCLIDE COUNTING SYSTEM FOR ASSAYING SOIL AND TUFF SAMPLES FOR TRANSURANICS AND GAMMA EMITTERS.

- DESIGNED A SYSTEM CONSISTING OF A 21 CM^2 HYPERPURE GERMANIUM DETECTOR, A LARGE-VOLUME DRIFTED GERMANIUM DETECTOR, A MULTICHANNEL ANALYZER, A COMPUTER SYSTEM, SPECIAL SAMPLE CONTAINERS, AND AN AUTOMATIC SAMPLE CHANGER TO ANALYZE SAMPLES FOR NEAR-FALLOUT LEVELS OF RADIONUCLIDES.
- REFURBISHED AND UPGRADED A 40 X 10 FOOT TRAILER TO HOUSE THIS COUNTING SYSTEM AND PROVIDE A LABORATORY IN WHICH TO PROCESS SAMPLES.

-EVALUATE STABLE ELEMENTS AS EARLY INDICATORS OF CONTAMINANT TRANSPORT BENEATH SHALLOW LAND BURIAL PITS USING NEUTRON ACTIVATION TECHNIQUES.

-INITIATED THE DESIGN OF A SHALLOW LAND DEMONSTRATION FACILITY.

FUTURE WORK:

-DEVELOP AND EVALUATE ENGINEERED WASTE BARRIERS AND SHALLOW LAND MONITORING TECHNIQUES.

-EVALUATE THE INFLUENCE OF WASTE MATERIALS AND ENVIRONMENTAL FACTORS ON ENGINEERED BARRIERS USING LITERATURE SURVEYS AND EXPERIMENTATION.

-IMPROVE UNDERSTANDING OF THE MOVEMENT OF WATER AND WASTE MATERIALS THROUGH UNSATURATED BURIALS SYSTEMS AND DEVELOP A PREDICTIVE CAPABILITY, ALONG THESE LINES TO BE USED AND TESTED IN THE FIELD.

-PLAN, CONSTRUCT, AND EVALUATE AN IMPROVED SHALLOW LAND BURIAL DEMONSTRATION FACILITY.

MILESTONES FOR IMPROVED SHALLOW LAND BURIAL PROGRAM

FY 1979:

-TRANSURANIC ASSAY SYSTEM FOR SOILS (TASS) OPERATIONAL.

-HYDROLOGIC PROPERTIES OF LOS ALAMOS TUFF QUANTIFIED BY LABORATORY AND FIELD EXPERIMENTS.

-PRELIMINARY DESIGN OF AN IMPROVED ARID SHALLOW LAND BURIAL FACILITY.

FY 1980:

-REPORT BY UNIVERSITY OF TEXAS AND LOS ALAMOS ENGINEERS ON EVALUATION OF MANMADE WASTE BARRIERS.

-REPORT BY JRB ASSOCIATES, INC. AND UNIVERISTY OF TEXAS ON RESULTS OF LITERATURE SURVEY ON THE INFLUENCE OF WASTE MATERIALS AND ENVIRONMENTAL FACTORS ON ENGINEERED WASTE BARRIERS.

-COMPLETE ANALYSIS OF 1000 TUFF SAMPLES COLLECTED UNDER A PREVIOUSLY USED LIQUID RADIOACTIVE WASTE DISPOSAL BED.

-DEVELOPMENT OF NEUTRON ACTIVATION TRACERS AND FIELD EQUIPMENT FOR MONITORING TRACER MIGRATION.

-FINAL DESIGN OF AN IMPROVED ARID SHALLOW LAND BURIAL FACILITY.

FY 1981:

-COMPLETE EVALUATION OF ADVANCED ENGINEERED BARRIERS AND HOLD WORKSHOP ON BARRIERS AND MONITORING TECHNIQUES.

-INITIATE EXPERIMENTS ON WASTE BARRIER PERFORMANCE.

-ISSUE REPORT ON MODELING OF WATER FLOW THROUGH UNSATURATED MATERIALS BY UNIVERSITY OF TEXAS AND LOS ALAMOS HYDROLOGIST.

-REPORT ON LOS ALAMOS LABORATORY STUDIES ON SATURATED AND UNSATURATED FLOW OF RADIOACTIVE WASTE SOLUTIONS IN TUFF.

-REPORT ON NEW MEXICO STATES'S LABORATORY STUDIES ON STABLE ELEMENT SOLUTE RETENTION BY LOS ALAMOS SOILS AND TUFF.

-PLAN FOR SHALLOW LAND BURIAL DEMONSTRATION FACILITY WITH LOS ALAMOS ENGINEER AND SUBCONTRACT INFORMATION.

FY 1982:

-DEVELOP MODELS FOR RADIONUCLIDE AND STABLE ELEMENT TRANSPORT IN SOILS AND TUFF.

-PERFORMANCE EVALUATION OF NEUTRON ACTIVATION TRACERS AND NATURALLY-OCCURRING ELEMENTS AS INDICATORS OF ELEMENTAL TRANSPORT IN THE FIELD AT LOS ALAMOS.

-CONSTRUCTION PHASE FOR DEMONSTRATION FACILITY.

II. ALTERNATIVES TO SHALLOW LAND BURIAL

PURPOSE:

-TO INVESTIGATE VIABLE ALTERNATIVES TO SHALLOW LAND BURIAL FOR THE DISPOSAL OF LOW LEVEL RADIOACTIVE WASTE.

-AN ACCEPTABLE ALTERNATIVE TO SHALLOW LAND BURIAL WILL:

- PROVIDE SUBSTANTIALLY IMPROVED CONTAINMENT/ISOLATION AT AND ACCEPTABLE COST.
- APPLY TO THE MOST HAZARDOUS OR LONGEST-LIVED FRACTION OF CURRENT AND FUTURE LOW LEVEL WASTE.
- BE BASED ON CURRENTLY AVAILABLE TECHNOLOGY.
- BE APPLICABLE TO A WIDE VARIETY OF CLIMATIC AND GEOLOGIC CONDITIONS IN ORDER TO PROVIDE REGIONAL DISPOSAL SITES.

WORK BREAKDOWN STRUCTURE:

-IDENTIFY CURRENT PRACTICES AND TECHNOLOGY SUITABLE AS ALTERNATIVES TO SHALLOW LAND BURIAL.

-SELECT CANDIDATE TECHNIQUES AND IDENTIFY TECHNOLOGY GAPS.

-CONSTRUCT GEOLOGIC TEST FACILITY TO IMPROVE TECHNOLOGY.

-PERFORM IN-SITU EXPERIMENTATION.

-IDENTIFY IMPORTANT DESIGN INFORMATION TO INSURE TRANSFER OF TECHNOLOGY TO OTHER SITES AND CONDITIONS.

-DEVELOP DESIGN AND COST DATA COVERING CONSTRUCTION, OPERATION, MONITORING AND BACKFILLING.

ACCOMPLISHMENTS TO DATE:

-SURVEY OF CURRENT PRACTICES IN WASTE DISPOSAL AND MINING.

•MINED CAVITIES ARE PRIME CANDIDATES FOR FURTHER INVESTIGATION.

•ABANDONED MINES OR DUAL PURPOSE FACILITIES ARE UNACCEPTABLE.

•MANY POSSIBLE SITES/GEOLOGIES EXIST THROUGHOUT THE U.S.

•LITTLE TO NO EXPERIENCE EXISTS IN USED MINED CAVITIES FOR WASTE DISPOSAL.

-IDENTIFIED NEED FOR TECHNOLOGY IMPROVEMENTS IN:

•PREDICTING EFFECTS OF TUNNEL EXCAVATION ON SURROUNDING ROCK MASS.

•CONSTRUCTION/OPERATING/BACKFILING COST ESTIMATES.

•VERIFICATION OF SIMULATION MODELS DESCRIBING WATER AND RADIONUCLIDE MIGRATION.

•DESIRABLE WASTE FORM/CONTAINER/BACKFILL OPTIONS.

•MONITORING TECHNIQUES AND INSTRUMENTATION.

-GEOLOGIC TEST FACILITY.

•PREPARED PRELIMINARY DESIGN AND OBTAINED CONSTRUCTION COST ESTIMATES BASED ON NTS TUNNEL EXPERIENCE.

•DEVELOPED SITE SELECTION CRITERIA AND IDENTIFIED SEVERAL POTENTIAL SITES AT LASL.

•DEVELOPED PRELIMINARY DESIGN OF EXPERIMENTAL PROGRAM.

FUTURE WORK:

-SURVEY OF AVAILABLE ALTERNATIVES.

•IDENTIFY SPECIFIC SITES/GEOLOGIES WHERE MINED CAVITY DISPOSAL IS VIABLE, WITH EMPHASIS ON STRATEGIC LOCATIONS RELATED TO ANTICIPATED NEED.

•PRELIMINARY ASSESSMENT OF FEASIBILITY, COST, AND IMPACTS.

-GEOLOGIC TEST FACILITY.

•DEVELOP/VALIDATE PREDICTIVE CAPABILITY REGARDING ROCK MECHANICS & HYDROLOGY.

•DETERMINE ADVANTAGES/DISADVANTAGES OF CONSTRUCTION OPTIONS.

•CONDUCT IN-SITU EXPERIMENTATION.

•INVESTIGATE OPTIONS FOR WASTE FORM/CONTAINER/BACKFILL.

MILESTONES FOR ALTERNATIVES TO SHALLOW LAND BURIAL:

FY 1979:

-SURVEY CURRENT PRACTICES AND IDENTIFY NEEDED TECHNOLOGY IMPROVEMENTS.

-PRELIMINARY DESIGN OF LASL GEOLOGIC TEST FACILITY.

-INITIATE SITE CHARACTERIZATION FOR TEST FACILITY.

FY 1980:

-DESCRIBE SPECIFIC AVAILABLE SITES/GEOLOGIES IN VARIETY OF CLIMATES.

-INITIATE CONSTRUCTION OF GEOLOGIC TEST FACILITY AT LASL.

-INITIATE EXPERIMENTAL PROGRAM IN HYDROLOGY AND ROCK MECHANICS.

FY 1981:

-CONTINUE SPECIFIC SITE DESCRIPTIONS AND DEVELOPMENT IMPACTS.

-CONTINUE EXPERIMENTAL WORK AT TEST FACILITY.

-DESIGN FULL SCALE FACILITY.

FY 1982:

-EXPAND GEOLOGIC TEST FACILITY.

-ISSUE RECOMMENDATIONS FOR FACILITY DESIGN.

-INITIATE WASTE FORM/CONTAINER/BACKFILL EXPERIMENTATION.

III. FUNDING ESTIMATES

	FY			
OPERATING	79	80	81	82
IMPROVED SLB	435	500	498	534
ALTERNATIVES	170	290	450	550
CONSTRUCTION				
IMPROVED SLB	0	0	30	276
ALTERNATIVES	250	150	0	700

EQUIPMENT				
IMPROVED SLB	25	70	70	70
ALTERNATIVES	0	300	0	700

DOE CRITERIA & STANDARDS (3-3-2)

PURPOSE: TO PRODUCE FINAL DOE LLW DISPOSAL CRITERIA BY THE END OF FY-80, AND STANDARDS BY THE END OF FY-83 TO PERMIT COMPLETION OF COMPLIANCE ACTIVITIES BY FY-87.

BASIS: PAST LASL INVOLVEMENT IN THE BELOW ACTIVITIES PROVIDES A BACKGROUND OF EXPERIENCE AND CAPABILITY:

DEVELOPMENT OF INITIAL DISPOSAL CRITERIA.

DEVELOPMENT OF TRANSURANIC DISPOSAL LIMITS.

DEVELOPMENT OF SOIL CONTAMINATION LIMITS.

PRODUCED GUIDELINES FOR THE INTERIM STORAGE OF AEC GENERATED SOLID TRU WASTE, LA-5645, JUNE 1974.

ASSISTED IN PREPARING THE LLW PORTION OF NUREG-0116.

DEVELOPING IMPROVED SLB DESIGN (ARID).

APPROACH: MAINTAIN AWARENESS OF CURRENT TECHNOLOGY STATUS THROUGH STEERING COMMITTEE MEMBERSHIP.

MAINTAIN CONTACTS WITH NRC & EPA TO REMAIN CURRENT ON THEIR CRITERIA/STANDARDS PROGRAMS.

APPLY RESULTS OBTAINED THRU UNIVERSITY OF TEXAS AND JRB ASSOCIATES CONTRACTS.

MAINTAIN CONTACTS WITH ETW AND OR STAFFS.

MAINTAIN CONTACTS WITH AIF/UWMWG/EPRI FOR INDUSTRY INPUTS.

MILESTONES: DOE CRITERIA FY-80.

DOE STANDARDS FY-83.

FUNDING: EST. $90 - $120K/YR THRU 1983.