UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUN 18 1979

STEINDLER

JUN 18 1979

MEMORANDUM FOR: Ragnwald Muller, Senior Staff Engineer
Advisory Committee on Reactor Safeguards

FROM: Frank J. Arsenault, Director
Division of Safeguards, Fuel Cycle
and Environmental Research

SUBJECT: RES WASTE MANAGEMENT RESEARCH PROGRAM

In response to your request, we have prepared the enclosed information, (Enclosure 1) outlining the RES Waste Management Research Program, and showing the changes which have taken place since our briefing of the ACRS on October 11 - 12, 1978.

The various task categories comprising the research program are listed in the left column of Enclosure 1, and cover all elements of our present research program. The other two columns identify tasks which:
a) comprised the waste management research program in October, 1978, and
b) which represent the present program. On-going and planned research tasks are identified by the symbols ● and O, respectively.

It will be noted that a substantial number of planned research tasks have been added subsequent to our October, 1978 meeting with you. A significant fraction of these tasks are directly related to the comments and recommendations made by the ACRS, both during the October 11 - 12 meeting and its Report to Congress in December, 1978 (NUREG-0496). The numerical references (1), (2), . . . (17), placed after selected task descriptions identify those comments or recommendations (listed in Enclosure 2) made by the ACRS during the October 11 - 12 briefing, to which the tasks are responsive. Similarly, the letter references (A), (B), . . . (M), identify comments or recommendations (listed in Enclosure 3) made by the ACRS in their Report to Congress, to which the tasks are responsive.

Some of the other comments and recommendations published in the ACRS Report to Congress, such as ". . . continued development of criteria for the design and operation of radioactive waste disposal and storage facilities," are covered collectively by a large number of the research tasks, and are not identified separately.

Although many research requirements have been identified since last October and included in the program plan, only a few new projects have been funded because of budget restrictions. For the same reason, most of the planned research tasks, identified by "O" in the present program, will not be funded until FY1981. Requires, therefore, careful arrangement of priorities!

Our Waste Management Research Program Plan has obviously benefited from the comments and recommendations offered by the ACRS. We expect to continue to work with the other NRC program offices, particularly NMSS and OSD, to further identify research needs and respond to them.

867

I hope you will find this information useful. Any questions which you have regarding Risk Assessment tasks may be referred to Mike Cullingford, PAS, while Jerry Davis, SAFER, will be available to respond to questions on all other parts of the program.

Frank J. Arsenault, Director
Division of Safeguards, Fuel Cycle
and Environmental Research 6/13

Enclosures:
1. RES Waste Management Program
2. ACRS Comments at October 11-12 Meeting
3. ACRS Comments in their Report to Congress

cc: C. Jupiter, SAFER
J. Davis, SAFER
M. Cullingford, PAS
P. McGrath, PAS
B. Budnitz, RES
J. Martin, NMSS

JUL 1 0 1979

ENCLOSURE 1

SUMMARY
OF THE
NUCLEAR WASTE MANAGEMENT RESEARCH PROGRAM
WITH INDICATED CHANGES
BETWEEN
OCTOBER 1978 AND JUNE 1979

OFFICE OF NUCLEAR REGULATORY RESEARCH

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
WASTE FORM & CONTAINER CHARACTERISTICS			
GLASS/CERAMICS			
MEASUREMENTS-SHORT TERM BULK PROPERTIES	●	CATHOLIC U. (B6330)-(1) Develop quantitative relationship between glass/ceramic bulk properties and its long-term structural stability. (2) Develop tests for chemical durability of glasses/ceramics, applicable for predicting longevity. (I)(A)	Same
SURFACE CORROSION	●	U. OF FLORIDA (B6252)-Evaluate leaching and surface properties of solid nuclear waste encapsulants. (I)(A)	Same
TEST COMBINED EFFORTS OF MULTIPLE DEGRADATION FACTORS		---	O Test combined effects of multiple degradation factors. (I)(A)
LONG TERM CHARACTERISTICS PREDICTION METHODOLOGY		---	O Develop an analytical methodology for predicting long term characteristics of waste encapsulants. (I)(A)
CRYSTALLINES			
EVALUATE SUPERCALCINES	●	U. TOLEDO (B6624)-Evaluate the durability of crystalline nuclear waste forms and their natural analogues at geologic storage conditions.	Same
TEST PROPERTIES OF SYN-ROCK		---	O Test properties of syn-rock. (I)(A)
MULTIBARRIERS			
ASSESS METAL MATRICES		---	O Assess the effectiveness of metal matrices for retention of radionuclides over long time periods. (3), (J), (A)
TEST PARTICLE COATINGS		---	O Experimentally test the effectiveness of particle coatings for retention of radionuclides at repository environmental conditions, as a principal barrier. (3), (J), (A)

I hope this work is being done on waste forms that are under active DOE development i.e glass, supercalcine, etc.!

this duplicates DOE work. Why?

● - ongoing work
O - planned work

The numerical references (1),(2), . . (17), placed after selected task descriptions identify those comments or recommendations (listed in Enclosure 2) made by the ACRS during the October 11-12, 1978 briefing, to which the tasks are responsive. Similarly, the letter references (A),(B), . . (M), identify comments or recommendations (listed in Enclosure 3) made by the ACRS in their Report to Congress - NUREG-0496, to which the tasks are responsive.

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
SPENT FUEL		
TEST URANITE SOLUBILITY	● HARVARD U. (B6662)-Evaluate solubility of uranite in natural ore body form, and as fuel pellets in aqueous solution under repository conditions; study the potential for migration of solution products formed.	Same
ASSESS SPENT FUEL INTEGRITY	---	O Assess the temporal integrity of spent fuel under repository conditions through analytical and laboratory investigations.
FIELD VALIDATION OF DURABILITY	---	O Field test spent fuel assemblies for continued integrity under simulated repository conditions.
CONTAINERS		
CONFIRM CORROSION	---	O Perform laboratory and field tests to confirm corrosion phenomena for waste containers. (I)
ASSESS PROTECTIVE COATINGS	---	O Experimentally confirm effectiveness of protective coatings on nuclear waste containers. (I)
EFFECTS OF THERMAL STRESS	● IOWA ST. (B6340)-Develop means of predicting thermal stress and extent of fracture and identify procedures, specs. & criteria for standards.	Same
OVERPACK		
ASSESS BENTONITE	---	O Assess the effectiveness of bentonite clay in providing a barrier for wastes in a repository. (J)

Swedes will do this for us if we wait long enough!
Is bentonite selected because US is planning on its use?

● - ongoing work
O - planned work

HIGH LEVEL WASTE RESEARCH

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
SELECTED WASTE FORMS		
TEST COMBINED EFFECTS OF MULTIPLE DEGRADATION FACTORS	---	O Experimentally test synergistic effects of multiple processes which influence degradation. (J)
FIELD TEST TO CONFIRM DURABILITY	---	O Field test selected waste forms under repository conditions to confirm their durability.
DEVELOP MODEL TO PREDICT LONG TERM CHARACTERISTICS	---	O Develop analytical models to predict the long term characteristics of selected waste forms.

● - ongoing work
O - planned work

HIGH LEVEL WASTE RESEARCH

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
WASTE/ROCK INTERACTIONS		
CANISTER/ROCK INTERACTIONS		
LABORATORY TESTING OF INTERACTIONS	● SAN JOSE ST. (B6625)-Confirm the interface reaction kinetics between waste/canister/rock as a function of concentration, temperature and pressure. (I)	Same
GEOCHEMICAL PROCESSES		
STUDY RADIONUCLIDE MIGRATION FROM NATURAL AND MAN-MADE DEPOSITS	● STANFORD U. (B6341)-Study the migration of radionuclides in natural ore bodies and nuclear test cavities as it relates to waste repositories - for confirmation of the importance of physical and chemical phenomena. (12) O Expand work (B6661) in the study of natural ore bodies (12)	Same Not clear that this is worth while
GEOCHEMICAL PROCESS CHARACTERIZATION	---	O Characterize those geochemical processes which are important to nuclear waste migration and retention. (12)
THERMAL EFFECTS ON GEOCHEMICAL PROCESSES	---	O Determine effect of temperature on rates of geochemical processes important to migration and retention. (H), (K)
RADIATION AND RADIOCHEMICAL EFFECTS ON GEOCHEMICAL PROCESSES	---	O Determine the effects of radiation and radiolysis on geochemical processes important to migration and retention of radionuclides. (H), (K)
WASTE/ROCK INTERACTIONS OF SELECTED WASTE FORMS	---	O Study the interactions between nuclear waste and rock for selected waste forms and rock types. (H)

● - ongoing work
O - planned work

HIGH LEVEL WASTE RESEARCH

TASK CATEGORY		OCTOBER 1978 PROGRAM		PRESENT PROGRAM
THERMAL IMPACTS				
THERMAL CONDUCTIVITY IN ROCK	●	CORNELL U. (B6626)-Measure the thermal conductivity of disordered minerals and rocks applicable to repositories, including influence of radiation and elevated temperature. (H), (K)		Same
EFFECTS ON SALT INCLUSIONS		---	O	Examine the impact of thermal effects on the movement of salt inclusions for rock masses in the immediate neighborhood of a depository. (H), (K)

● - ongoing work
O - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM		PRESENT PROGRAM
RADIATION EFFECTS				
STRUCTURAL IMPACTS ON REPOSITORY MEDIA		---	O	Study effect of radiation on mechanical properties of repository media. (H)
HYDROGEOLOGICAL CHARACTERISTICS				
GROUNDWATER PROPERTIES				
CHEMICAL CHARACTERISTICS AND EFFECTS ON WASTE		---	O	Characterize the chemical properties of groundwater important to water/waste interactions and characterize the resulting effects. (G)
GROUNDWATER MOVEMENT				
MASS AND ENERGY TRANSPORT	●	U. OF ARIZONA (B5753)-Establish hydrogeological procedures and theory for assessing the subsurface transport of radionuclides from repositories. (G)		Same
SALT PERMEABILITY	O	GEO. TECH. (B6665)-Characterize the permeability of salt for repository conditions. (G)		Same
LABORATORY TEST OF PARTICULATE MIGRATION	●	GA. TECH. (B6338)-Characterize migration rates and mobilization processes of selected radioactive and activable ions in a model aquifer, representative of a repository situation.		Same
FIELD MEASUREMENT OF PARTICULATE MIGRATION	O	Examine selected ore bodies for confirmatory evidence of the contribution of particulate migration to radionuclide movement.		Same
HYDROGEOLOGICAL MODEL TESTING	●	U. OF ARIZONA (B5753)-Conduct confirmatory field tests to characterize groundwater transport of radionuclides.		Same
CLIMATIC CHANGE IMPACTS		---	O	Identify and characterize the impact of natural and man-made climate changes having a potential effect on repositories. (G)

● - ongoing work
O - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
WATER DATING TECHNOLOGY	● U. OF ARIZONA (B6628)-Provide critical information for relating dates of ground water to rates of its movement in the vicinity of potential sites of nuclear repositories. (G)	Same
SITE CHARACTERIZATION		
REFERENCE SITE GEOLOGY & HYDROLOGY	---	O Characterize reference repository sites for domed salt, basalt, granite and other alternate media, as deemed appropriate.(C),(14),(G)
WEST VALLEY HLW	● NYGS (B6350)-Characterize the geomorphology, surface drainage patterns and the associated transport of radionuclides from the site. (G)	Same
TECTONIC PARAMETERS	---	O Characterize tectonic parameters important to repository site evaluation. (G)
MONITORING		
MONITORING TECHNOLOGY	---	O Develop technology for monitoring repositories. (M)
GEOTECHNICAL ENGINEERING		
INDIRECT ROCK ANALYSIS		
BOREHOLE ANALYSIS TECHNIQUES EVALUATION	● U. OF ARIZONA (B6337)-Identify techniques for non-intrusive field studies of rock masses from boreholes and evaluate effectiveness. O Continue work, and conduct field tests in Phase II effort.	Same
SURFACE GEOPHYSICAL TECHNIQUES	● U. OF ARIZONA (B6337)-Identify techniques for non-intrusive field studies of rock masses from the ground surface, and evaluate their effectiveness.	Same

● - ongoing work
O - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
MECHANICAL PROPERTIES OF REPOSITORY MEDIA		
STRESS MEASUREMENTS AND TECHNOLOGY	0 (B6011)- Determine the rock mass response to the construction and operation of a repository.	Same
THERMAL CRACKING	0 (B5825)- Perform in-situ determinations of high temperature effects on rock shear modulus.	Same
PREDICTION AND ANALYSIS OF FRACTURES AND DISCONTINUITIES	0 (B6667)- Determine the character and frequency of discontinuities and fractures in rock masses.	Same
TECTONICS AND REPOSITORY RESPONSE	---	0 Evaluate those tectonic processes which have some potential of creating low-resistance migration paths.
ROCK MASS RESPONSE TO COMBINED STRESSES	---	0 Determine the extent of synergism existing in thermal, mechanical and radiological effects on rock properties.
PLUGGING AND SEALING TECHNIQUES		
SHAFT AND BOREHOLE SEALING TECHNIQUE EVALUATION	● U. OF ARIZONA (B6627)-Evaluate available technology for plugging boreholes and sealing discontinuity planes in rock masses, employing laboratory tests. (15)	Same Same as ONWI program?
TESTING SELECTED TECHNIQUES TO SPECIFIC ROCK TYPES	● U. OF ARIZONA (B6627)-Conduct field tests of rock sealing methods evaluated in previous laboratory work.	Same Premature?
RETRIEVAL TECHNIQUES		
SPENT FUEL	0 (B6629) - Evaluate retrieval techniques for spent fuel.	Same
SOLIDIFIED HLW	---	0 Evaluate retrieval techniques for HLW.

● - ongoing work
0 - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
REPOSITORY DESIGN			
MINE STABILITY	0	COE-WES (B6664) - Conduct engineering geology studies related to mine stability.	Same
ENGINEERED BARRIER ANALYSIS		---	0 Conduct analysis of engineered barriers for repositories.
DESIGN TO REDUCE OCCUPATIONAL EXPOSURE		---	0 Conduct analysis of reference repository designs for the purpose of minimizing occupational exposures.
MONITORING TECHNIQUES			
EVALUATE MONITORING TECHNIQUES		---	0 Identify and evaluate techniques which have potential for application to monitoring the integrity and operational safety features of a repository. (M)
FIELD TESTS OF MONITORING TECHNIQUES		---	0 Conduct field tests to confirm the applicability of selected repository monitoring methods. (M)
REPOSITORY SAFETY ANALYSIS		---	0 Develop an approach for identification of repository hazards during the operational phase, and for analysis of safety.

● - ongoing work
0 - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
SYSTEMS ANALYSIS		
REPOSITORY OPTIONS ASSESSMENT	● HARVARD (B6623)-Develop a procedure for the assessment of options for long term disposal of nuclear waste and establish a system of descriptors to permit decisions between alternatives. (D)	Same
REFERENCE REPOSITORY MODEL	● SANDIA (A1224)-Develop a reference repository model for bedded salt.	O Extend work to domed salt, basalt and other appropriate media. (6), (14)
PREDICTIVE MODEL DEVELOPMENT & INTEGRATION	● SANDIA (A1224)-Develop and integrate simplified models for prediction of waste migration and consequences to human health and the environment. Consider migration of radionuclides from the repository, environmental pathways, and health effects. Use porous flow model. (F), (L)	O Extend work to: domed salt, basalt and other appropriate media; crack flow model adaption of porous flow model. (6), (14), (F), (L) Field test to qualify?
SENSITIVITY ANALYSIS	● SANDIA (A1124)-Conduct consequence calculations, employing statistically - selected input parameters to rank the importance of input parameters on consequence variability, and provide a basis for setting priorities for research to achieve improved understanding of these parameters and their effects. (17)	Same

● - ongoing work
O - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM		PRESENT PROGRAM
REQUIREMENTS FOR SHALLOW LAND BURIAL				
PERFORMANCE AND ACCEPTABILITY OF WASTES				
CORROSION & LEACHABILITY				
PROPERTIES OF RADWASTES AND CONTAINERS	●	BNL (A3027) - Characterize LLW		Same
VOLUME REDUCTION				
REACTOR RADWASTE GENERIC STUDY	●	ORNL (B0171) -Update generic data on performance of filtration, ion exchange, evaporation & solid waste treatment systems.		Same
CHARACTERISTICS OF VOLUME-REDUCED WASTES		---	O	Characterize properties of LLW which has undergone volume reduction.
EVALUATION OF VOLUME REDUCTION METHODS		---	O	Evaluate acceptable methods for volume reduction of wastes.
CONTAINERIZATION				
EVALUATION OF ACCEPTABLE CONTAINERIZATION		---	O	Evaluate acceptable methods for containing LLW and develop criteria. (2), (1)
SITE SUITABILITY				
GENERAL SITE SPECIFIC STUDIES				
FIELD INVESTIGATIONS (HANFORD & BEATTY)	O	B-6669 - Conduct Field Investigations at Hanford, Wash. and Beatty, Nev. to develop criteria for site suitability for shallow land burial of LLW.		Same
BURIAL GROUND SURVEY, N.Y.	●	SUNY (B6008)- Conduct a survey of the waste burial ground at West Valley, N.Y. (8)		Same
BURIAL GROUND SURVEY, KY.		KY (B6192) - Conduct a survey of the waste burial ground at Maxey Flats, Ky. (8)		Same

TASK CATEGORY		OCTOBER 1978 PROGRAM		PRESENT PROGRAM
GEOLOGY				
EROSION STUDIES (WEST VALLEY, N.Y.)	●	NY (B6008) -Conduct erosion studies at the West Valley, N.Y. burial grounds, as a part of the West Valley Survey.		Same
TOPOGRAPHY	●	KY (B6192) - Topographical studies are included in the Maxey Flats Survey.		Same
SOIL CHARACTERIZATION				
WASTE TRANSPORT IN SOILS	●	LASL (A7040)-Investigate migration and retention of waste radionuclides by selected soil types and evaluate correlation between soil properties and radionuclide movement. Evaluate soil sampling methods.		Same) major ONWI (WISAP) program gets the same data (?); done by the same contractor (?).
SOIL MECHANICS - ENGINEERING		---	O	Study soil mechanics, as it applies to burial site engineering.
GROUND WATER HYDROLOGY				
SOURCE TERMS OF RADIONUCLIDES	●	BNL (B3042) - Define the source terms of radionuclides and other solutes in trench water from licensed low-level waste disposal sites in cooperation with USGS.		Same
RADIONUCLIDE DISTRIBUTION, KY.	●	PNL (B2291) - Characterize the distribution of radionuclides at the Maxey Flats burial grounds.		Complete Project
INTER TRENCH TRANSPORT, KY.		---		
RADIOHYDROLOGY TUNNEL, SHEFFIELD	O	USGS (B5760) -Supplement USGS work of studying radionuclide transport under trenches at the Sheffield burial grounds in Illinois.		Implement Planned Project
SURFACE WATER HYDROLOGY & SEDIMENT TRANSPORT				
RADIONUCLIDES IN SURFACE WATER	O	WHOI (B6712) - Study radionuclides in surface waters at the West Valley, N.Y. burial grounds.		Implement Planned Project
CLIMATE AND METEOROLOGY		---	O	Characterize climateological and meteorological influences on site suitability. (9)

● - ongoing work
O - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
POPULATION CONSIDERATIONS	---	O Characterize population considerations as they influence site suitability. (1)

● - ongoing work
O - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM		PRESENT PROGRAM
ECOLOGICAL SYSTEMS & BIOTA				
RADIONUCLIDE TRANSPORT IN AGRICULTURAL SYSTEMS	●	UC-LNM (B3027) - Investigate the soil - to plant pathway of radionuclide element transport through the food chain of man (1)		Same
BIOENVIRONMENTAL PATHWAY (SEE - DECOMMISSIONING)				
ESTABLISHMENT OF INDICATOR SPECIES BY REGION		---	O	Identify species of organisms which would serve to detect the presence of leached radionuclides.
LAND USE (INCLUDING PROXIMITY TO TRANSPORTATION ROUTES)		---	O	Examine land use parameters as they affect site suitability. (1)
SOCIO-ECONOMICS		---	O	Examine socioeconomic parameters as they affect site suitability. (1)
COST/BENEFIT ANALYSIS		---	O	Examine cost/benefit analysis approach as they affect an evaluation of site suitability.
ACCIDENT ANALYSIS				
BASES FOR ACCIDENT EVALUATION CRITERIA	O	(B6670) - Develop basis for accident evaluation criteria, emergency plans, measurements and mitigation.		Same
DESIGN AND OPERATIONS				
SITE & FACILITY ENGINEERING				
BURIAL FACILITY ENGINEERING	●	ARIZ. (B6668)- Conduct engineering studies of waste burial facilities.		Complete Project
REVIEW ADVANCES IN SHALLOW LAND BURIAL ENGINEERING		---	O	Assess new engineering developments as they affect improved safety. (2)
CONSTRUCTION PRACTICES				
TECH. BASIS FOR GUIDE ON ACCEPTABLE CONSTRUCTION PRACTICES		---	O	Provide a technical basis for development of a regulatory guide on acceptable construction practices.

So what?

● - ongoing work
O - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
OPERATION PRACTICES	---	0 Develop a technical basis for development of a regulatory guide on acceptable operational practices.

* - ongoing work
0 - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM		PRESENT PROGRAM
LIMITING CONDITIONS FOR OPERATION TECHNICAL BASIS FOR CRITERIA FOR LIMITING CONDITIONS	---	0	Develop technical basis for criteria for limiting conditions for operation of shallow land burial facility.
STABILIZATION OF WASTES (SEE DECOMMISSIONING)			
OCCUPATIONAL HEALTH	---	0	Develop a basis for evaluation of occupational health as influenced by repository design and operations.
MONITORING			
PREOPERATION SURVEYS AND MONITORING REMOTE SENSING TECHNIQUES FOR DETERMINATION OF SITE SUITABILITY	---	0	Identify and characterize remote sensing techniques for site evaluation. (7)
OPERATIONS MONITORING FIELD TESTING PROTOTYPE CONTINUOUS MONITORS FOR VOLUME REDUCTION FACILITIES	---	0	Field test prototype continuous monitors for volume-reduction facilities. (M)
IN-SITU WELL MONITORING		0	Identify and characterize in-situ monitoring techniques suitable for wells. (7), (M)
DECOMMISSIONING-FOLLOW-UP MONITORING			
BIOENVIRONMENTAL PATHWAYS - LONG TERM	U. OF COLORADO (B665B)-Characterize the bioenvironmental pathways of importance to consideration of impacts of decommissioning. (1)		Same
HYDROLOGY-RADIONUCLIDE TRANSPORT (LONG-TERM)	LAMONT (B671J)-Characterize the transport of natural and transuranic nuclides in water as it supports an evaluation of an assessment of impact of decommissioning.		Same How different from p8, 10 and 12

ongoing?

● - ongoing work
O - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM		PRESENT PROGRAM
SUBSURFACE RADAR	O	GEO CENTERS (B6349) - Field test and evaluate a sub-surface radar system for characterization of trench boundaries and radioisotope migration ranges	● Implement Project
EROSION - REMOTE SENSING TECHNIQUES	---		O Evaluate remote sensing techniques to characterize erosion.

● - ongoing work
O - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
DECOMMISSIONING & LONG TERM CARE			
SITE STABILIZATION GROUTING & TRENCH CAPPING TECH.	0	(B6671) - Evaluation of stabilization techniques for low level waste burial trenches. (16), (B)	Same
INSTITUTIONAL CONSIDERATIONS & LONG TERM FUNDING MULTISTATE ASSESSMENT & AGREEMENTS		---	0 Characterize need for multistate assessments and agreements. (16),(B)
MONITORING - SEE ABOVE (DECOMMISSIONING FOLLOW-UP MONITORING)			
ALTERNATE LAND USE ACCEPTABLE LAND USES FOR DECOMMISSIONED LLW SITES		---	0 Study land use alternatives for decommissioned LLW sites. (16), (B)
SYSTEMS ANALYSIS			
TESTING OF MIGRATION & PATHWAYS MODELS		--- u. important. Start ASAP.	0 Conduct testing of migration & pathways models through employment of tracers in field test & inter-comparison with other models.
ALTERNATIVES TO SHALLOW LAND BURIAL (Need systems approach here.)			
MINED CAVITIES		---	0 Evaluate mined cavities as an alternative to shallow land burial.
INTERMEDIATE DEPTH BURIAL		---	0 Evaluate intermediate depth burial as an alternative to shallow land burial.
OCEAN DUMPING	0	(A3046) - Evaluate approaches to marine disposal of LLW. (5), (10), (13)	Same

● - ongoing work
0 - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
GASEOUS AND PARTICULATE EMMISSIONS			
URANIUM MILL TAILINGS	●	ANL (A2046) - Provide field data at selected uranium mills to: (a) generate estimates of source terms; (b) estimate off-site environmental concentrations resulting from releases; (c) demonstrate monitoring techniques; evaluate potential for entry into food pathways.	Continue Work
OPEN PIT MINING	O	ANL (A2209) - Conduct field measurements on radon exhalation and meterology to provide a basis for assessing the environmental significance of effluents released to the atmosphere by open-pit mining and for up-dating Table S-3.	Implement Work
URANIUM MINE EXHAUST	●	PNL (B2270)-Conduct field measurements of operating mill data, particulate and gas characteristics, atmospheric dispersion deposition and transport, and perform an environmental assessment to support an assessment of the environmental significance of effluents and for updating Table S-3.	Continue Work
RADON EXHALATION FROM TAILINGS	●	PNL (B2269)-Develop a new absolute method for the measurement of radon exhalation from a ground surface, for application to a mill tailings site - by application of a methodology, characterization of radon exhalation rates and making comparisons with surface measuring systems.	Continue Work
RADON RELEASE - OPEN PIT	●	PNL (B2279)-Evaluation of open-pit uranium mining operations to assess the environmental significance of effluents and for updating Table S-3	Continue Work

● - ongoing work
O - planned work

* why no work on field instrument development?
* Particulate release from tailings?

1081 127

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
SEEPAGE & IMPACTS ON GROUNDWATER			
ASSESSMENT OF LEACHATE MOVEMENT	0	PNL (B2292)-Experimentally determine the interaction of tailings leachate with clay liner material and subsurface sediments. Implement numerical methods to predict leachate movement. (J)	Implement Plan Relates to p8, 10 and 12?
MONITORING METHODS VALIDATION		---	0 Study an approach to validation of radon monitoring methods.
PROCESS ENGINEERING		---	0 Exploration of alternate mining and milling methods having a potential for reducing adverse environmental impacts.
STABILIZATION & DECOMMISSIONING			
RESUSPENSION CHARACTERIZATION	●	PNL (B2095)-Determine the distribution of radionuclides in surface and airborne particles resulting from uranium milling. Improve source definition, relationship of airborne wastes to surface contamination, and application of models to predict consequences. (16), (B)	Complete Work
CHEMICAL STABILIZER ALTERNATIVES		---	0 Evaluation of adhesive type chemicals for use in short term control of tailings transport. (16) (B), (J)
ECOLOGICAL SYSTEMS INTERACTIONS		---	Study the impacts of both the tailings pile & biota resulting from burrowing & grazing animals & vegetation. Of particular concern are the rate of radon released from the piles, the impact on the rate of erosion & the potential for animal contamination & plant uptake of radionuclides. (16), (B)

● - ongoing work
0 - planned work

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
GEOMORPHOLOGICAL CHANGE	---	0 .Study approaches to prevent erosion of tailings piles in the very distant future, based on projections of drastic changes in the geologic and hydrologic makeup of the earth. (16), (B)
BELOW GRADE DISPOSAL	---	0 Evaluate the methodology, effectiveness and value of returning tails back to mines - including an assessment of the impact on groundwater. (16), (B)
CONTROL EFFECTIVENESS	---	0 Evaluation of various types of soils and other materials for use as cover materials for the attenuation of radon from tailings piles. (16), (B). (J)

Seems like a low priority problem! →

● - ongoing work
0 - planned work

TASK CATEGORY		OCTOBER 1978 PROGRAM	PRESENT PROGRAM
WASTE MANAGEMENT			
WASTE ISOLATION RISK ASSESSMENT METHODOLOGY DEVELOPMENT	●	SANDIA (A-1192)-(a) Develop a methodology to examine the long-term risk from radioactive waste isolation in deep geologic formations; (b) demonstrate the methodology by application to a hypothetical reference repository in bedded salt; (c) provide insights on the important processes and mechanisms which govern transfer of radionuclides to humans and thus guide the formation of licensing decisions. (C), (E)	Same
SPENT FUEL ISOLATION ALTERNATIVES	●	SANDIA (B-6158)-(a) Characterize elements of the problem of risk assessment of spent fuel isolation in deep geologic formations; (b) modify the risk methodology developed for waste isolation to allow examination of the risk from isolation of spent fuel; (c) demonstrate the methodology by application to a reference spent fuel repository. (E)	Same
SCENARIO ASSESSMENT FOR WASTE REPOSITORIES		---	● SANDIA (A1192)-(a) Examine the relative importance of various release modes; (b) develop guidance on formulation of licensing review procedures.
DYNAMIC SIMULATION OF WASTE/ROCK PROCESSES	●	SANDIA (A1192)-Model and analyze geologic processes which result in feedback mechanisms.	Same

● - ongoing work
○ - planned work

RISK ASSESSMENT RESEARCH

TASK CATEGORY	OCTOBER 1978 PROGRAM	PRESENT PROGRAM
OPERATIONAL & FACILITY RISK ASSESSMENT		
WASTE MANAGEMENT OF RADIOACTIVE GASES	● - Identify least risk alternative for management of gaseous C^{14}, I^{129}, Kr^{85} from fuel cycle facilities. (4)	Same
DECONTAMINATION ALTERNATIVES	---	● Develop a method of choosing optimal decontamination plans.
SPECIAL PROJECTS		
FUEL CYCLE PROJECT REVIEW GROUP	---	O Conduct peer reviews to: (a) establish credibility of fuel cycle work; (b) provide early guidance to projects if a change of direction is required.
INTEROFFICE WASTE ISOLATION MODELING GROUP	---	● Develop expertise within RES, NMSS, SD and NRR in working with models; examine possible use of models in the licensing process for HLW repositories. (11)

● - ongoing work
O - planned work

ENCLOSURE 2

ACRS COMMENTS AT OCTOBER 11-12 MEETING

(1) There is a great need to better determine the effects of low-level waste on the population (Mark).

(2) There is a clear need to develop restrictive elements to restrict migration of low-level waste. Consider in situ treatment (Philbrick).

(3) Research is needed on chemical binders.

(4) Research on management of radioactive gases should be of low priority since, of the principal gases of concern (^{14}C, ^{85}Kr and ^{129}I), Krypton and iodine would be produced chiefly in fuel reprocessing plants - and the present national policy is to not reprocess fuel.

(5) Research on deep sea burial should also be conducted at a low priority since this mode of disposal for high-level waste is forbidden by international agreement.

(6) Models describing migration of high-level waste should be studied for basalt, shale and clay, as well as the on-going work for salt.

(7) There is a need to define monitoring networks at waste repositories for collection of samples, handling of samples, quality assurance, etc. (Orth)

(8) There is a need to define remedial actions for leaky low-level waste sites. What would be the more efficient and more permanent remedial actions? (Orth)

(9) A compilation of environmental parameters of interest to waste management is needed (Orth).

(10) Continue a small research effort regarding sea burial of wastes, in case it is needed (Warren).

(11) The approach to modeling migration of high-level waste and sensitivity analysis looks good, except: (a) the use of an unverified model may lead to trouble; (b) there is a need to use the model more intensively - in a more focused way (Steindler).

(12) The retention of trace elements through chemical reactions should be considered in the modeling work describing migration of waste.

(13) NRC needs to settle the question of its consideration of sea-bed disposal, so that research may be properly prioritized (Steindler).

(14) One should also consider placing the waste in shale, clay or basalt interbed layers between the salt beds, in order to avoid the corrosion problem (Philbrick).

(15) Drill holes should be able to be plugged effectively with an impervious material (Philbrick).

(16) The Committee was very pleased with Bob Bernero's (OSP) presentation and his methodology. Unfortunately, there is nothing in the RES program to support his efforts (Steindler).

(17) We need to arrive at priorities for waste management research (Warren).

ENCLOSURE 3

SELECTED COMMENTS AND RECOMMENDATIONS
MADE BY THE ACRS
IN THEIR
REPORT TO CONGRESS (NUREG-0496)
DECEMBER, 1978

(A) The ACRS believes that a portion of the NRC research effort on waste management should be directed to wastes generated in possible alternate fuel cycles.

(B) The ACRS recommends continued development of licensing criteria to facilitate the decontamination and decommissioning of nuclear facilities.

(C) There is a requirement to develop an acceptable methodology for making suitable risk assessments.

(D) There is a need for comparative evaluations of the several options available within the nuclear fuel cycle.

(E) The ACRS recommends that the NRC intensify its research efforts to identify the dominant contributors to risk in radioactive waste management operations and to quantify their associated uncertainties.

(F) The ACRS recommends that the NRC investigate the research needs for making population dose estimates, and direct attention to the establishment of appropriate numerical values for those parameters where data are lacking. Special attention should be given to the long-term transport of the transuranics and long-lived fission products in geologic structures and to the uptake and retention of such radionuclides by plants and animals.

Priority attention should be given to research on waste management approaches and safe disposal criteria. Factors to be considered include:

(G) Site criteria, from the standpoint of hydrology and geology, meteorology, and seismicity.

(H) Criteria for limiting any potential effects that the wastes might have on the characteristics of the storage site.

(I) Criteria for the types of containers that must be provided for various chemical and physical forms of the wastes.

(J) Criteria for supplemental radionuclide trapping or retention systems as a function of potential changes in the chemical and biological behavior of the wastes with time, and the nature of the products resulting from the decay of the initial wastes.

(K) Criteria for the necessary reliability of heat removal and shielding provisions based upon estimated thermal and radiation release rates from the wastes.

(L) Criteria for determining acceptable levels of migration of radioactive materials from or within a site.

(M) Criteria for acceptable monitoring procedures to detect and evaluate such migration.