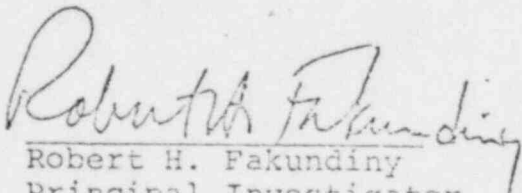


Proposal to the
UNITED STATES NUCLEAR REGULATORY COMMISSION
for a

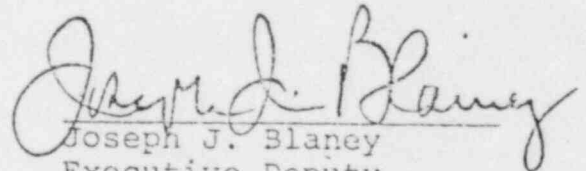
THREE YEAR PROGRAM OF GEOLOGIC/HYDROLOGIC
RESEARCH AT WEST VALLEY NEW YORK
WASTE BURIAL AND STORAGE FACILITIES

Submitted by:

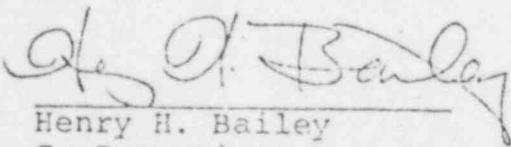
New York State Education Department
State Museum and Science Service
-Geological Survey-



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Objectives

The New York State Geological Survey, Museum and Science Service, New York State Education Department is proposing a three year program of research at the Western New York Nuclear Service Center, West Valley, New York.

This research will yield an understanding of the adequacy of present containment and the probable life span of the waste burial sites at West Valley as natural erosive processes work through time. The potential for movement of radionuclides offsite through surface water or ground water will also be evaluated.

The proposed research will define the geologic and hydrologic context of disposed radionuclides at the State-licensed low-level and Nuclear Regulatory Commission licensed high-level radioactive waste burial sites at West Valley and evaluate the potential pathways for off-site radionuclide migration. To accomplish these objectives research will be carried out in the following areas:

Geology

Stratigraphy: character and distribution of glacial deposits; engineering properties of glacial deposits.

Surface Water (Hydrology)

Stream flow and suspended sediments.

Ground Water (Geohydrology)

Modeling of ground-water flow patterns (This research will be undertaken in cooperation with the United States Geological Survey and reported on by them).

Geomorphology

Stream erosion and landsliding; includes prediction of erosion rates.

Introduction

Site-wide investigations at West Valley have been funded through field season 1980 under Contract No. NRC-04-79-205. This proposal is for the continuation of funding of research at West Valley from November 1980 through November 1981 and includes a general proposal for two additional years of research ending in 1983. The investigations are directed to better define the geologic and hydrologic context of disposed radionuclides and to evaluate potential geologic and hydrologic pathways for off-site radionuclide migration. Those pathways under investigation include surface water and ground water. Also under investigation are the natural processes of erosion at the site, as these processes and pathways are interrelated. These evaluations involve a number of scientific disciplines, principally, geology, hydrology, geohydrology and geomorphology.

Studies coordinated by the New York State Geological Survey (NYSGS) were first sponsored by the United States Environmental Protection Agency (USEPA), then jointly by the USEPA and the United States Nuclear Regulatory Commission (NRC), and then fully by the NRC. These studies through 1979, had been focused on a single area of the West Valley facility, the low-level radioactive waste burial (LLRWB) site. The scope of the investigation funded under Contract No. NRC-04-79-205, has

been expanded and now is an investigation of the entire West Valley site.

Cooperating Investigators

The United States Geological Survey (USGS) is cooperating in the research involving surface-water (hydrology) and ground-water (geohydrology) at West Valley with funding from the NRC being effected by an interagency transfer of funds.

Radiochemical analyses and the interpretation of radiological data in this program have been carried out by the Radiological Sciences Laboratory of the New York State Department of Health under the supervision of Dr. John Matuszek. It is anticipated that this arrangement will continue in the future.

Progress to Date

As the proposed research is a continuation of the work begun under Contract No. NRC-04-79-205 it is appropriate to review progress to date under that contract. At this writing (September, 1980) the work funded under Contract No. NRC-04-79-205 has placed our program on the threshold of obtaining meaningful site-wide data. A high quality topographic map of the site has been prepared and is in use. Three new permanent surface water monitoring and sampling stations have been installed. The design of the new surface water program reflects the experience gained during four previous years of sampling around the LLRWB site. Two of the new stations are sited on streams draining the area to the north of the nuclear fuel reprocessing plant known as the North Plateau. The third is located on the stream draining both the NRC-licensed radioactive waste burial (NRCLRWB) and portions of the LLRWB sites. Upstream of this station a single station from preceding years will be kept in operation. One non-permanent sampling station has been established on the North Plateau and two in Frank's Creek outside of the exclusion fence which receives essentially all stream flow from the two waste burial areas and portions of the plant area drainage. By the end of the 1980 field season approximately ten wells will have been drilled to investigate the geohydrologic regime of the surficial gravel aquifer present in the area of the plant and the North Plateau. The area covered by the aquifer includes the site of the liquid high-level radioactive waste storage tanks north of the plant. Four wells will have been drilled in the area south and west of the NRCLRWB area. These wells will be drilled by the USGS in cooperation with the New York State Geological Survey with funding from Contract No. NRC-04-79-205. Continuous soil cores will be taken at each well. The evaluation of the geohydrology of the site will involve studying the core material to interpret site stratigraphy and its role in ground-water movement. Ground-water bearing zones will be tested to determine their character as effective aquifers; water from them will be sampled and their water levels and flow rates

observed. Appropriate testing is planned for radionuclide content of the earth materials obtained by coring wells and for samples of ground-water. The testing program for radionuclides in samples from these wells will be determined in consultation with NRC with funding furnished by Contract No. NRC-04-79-205.

Geomorphic studies are being carried out under funding from Contracts No. NRC-04-79-205 and No. NRC-04-77-169. The studies in progress are aimed at furnishing a best estimate of denudation rates for the West Valley site in order to be able to predict the length of time that burial containment integrity can be maintained.

Proposed Program Rationale

The foregoing discussion serves to introduce the three year research program which is being proposed. For convenience the discussion of the program rationale which follows is divided into four individual areas of study but it should be kept in mind that these areas of study are interrelated.

Surface-Water Studies (Hydrology)

Basic to the program is the continuation of hydrologic measurements and suspended sediment transport measurements at the stream gaging stations. This area of research will extend over the full three years of the program. The collection and testing of water and suspended sediment samples for the possible presence of radionuclides form an integral part of this program. The hydrologic measurements, coupled with ongoing site meteorologic data collection, which includes the installation of an additional rain gage on the North Plateau and a snow survey for winter 1980/1981, are aimed at characterizing the hydrologic cycle at West Valley. The questions to be answered include: How much precipitation falls? How much of this precipitation runs off as surface water? How much is incorporated into the geohydrologic regime? And how much is lost through evapotranspiration? Run-off volumes serve as basic data for geomorphic studies of site erosion as do the determinations of suspended sediment concentrations at different stream flow rates. As part of the hydrologic research the testing for the presence of radionuclides in surface water run-off or on suspended sediment is deemed prudent for at least the contract year 1980/1981 to establish "ambient" levels for streams being monitored and to identify any deviations from those levels. If no anomalies are encountered this program may be reduced in later years.

Ground-Water Studies (Geohydrology)

Geohydrologic studies, carried out on a cooperative basis with the USGS and funded by agreement between NRC and the USGS will extend over at least the first two years of the proposed program. The first year will involve the collection of data from the test holes drilled during the 1980 field season into the surficial gravel aquifer of the North Plateau. A refraction seismic and earth resistivity survey will be undertaken during the 1981 field season to define the configuration of the contact between the surficial gravel aquifer and the

underlying clayey silt till. An adequate knowledge of the configuration of this surface is needed to best understand the geohydrology of this aquifer.

The cooperative program with USGS for the 1981 field season will involve drilling five holes to bedrock. They will have two interrelated objectives. One will be to determine the stratigraphy of the entire envelope of glacial sediments from surface to bedrock at the site. The second will be to understand in detail the geohydrologic regime of the NRCLRWB area. The geohydrologic regime (and stratigraphy) of the NRCLRWB area will be investigated by three holes to be drilled to bedrock, one each to the west, south and east of the NRCLRWB area. A fourth hole will be drilled to bedrock in the North Plateau. The fifth and deepest hole will be drilled to bedrock east of the LLRWB in order to establish the stratigraphy of the thickest portion of the glacial deposits in the pre-glacial valley of Buttermilk Creek. The drilling of these five holes will furnish a reasonable understanding of the lateral relationships of the glacial deposits of the West Valley site from their feather edge on the west side of the site to their thickest development east of the LLRWB. The present lack of this knowledge constitutes a substantial gap in our understanding regarding the deeper geohydrology of the site.

Geology

During the 1980-1981 contract year geologic data from early construction related borings and from the drilling in this research program will be organized into a series of large scale geologic cross-sections. These cross-sections will constitute a basic means for illustrating stratigraphic relationships and will form a framework for demonstrating the results of geohydrologic studies.

An investigation of the lateral extent of a silt-sand lens immediately east of the LLRWB will be undertaken during the 1980-1981 field season. This feature is not believed to have a potential as an aquifer but the conservatism appropriate for a study of this kind dictates its precise delineation.

Following the 1980-1981 contract year geologic studies will continue with the integration of additional drilling data from studies anticipated in the area of the high-level liquid radioactive waste tanks and other sources. A study of landsliding will begin in the 1980-1981 field season and will be continued through 1981-1982.

Geomorphology

The geomorphic studies in progress, which will be reported on in 1981, are basically designed to understand the processes of stream erosion and to make an estimate of denudation rates for West Valley. Two additional related studies remain to be accomplished after 1981. One is the collection of wood samples for radiometric dating by the carbon-14 method. Wood emplaced in stream deposits of the ancestral Buttermilk Creek has been found in what are now the upper terraces of the present Buttermilk Creek. Although

direct extrapolation into the future of erosional downcutting rates is not advisable, the determination of the past rate yields valuable supplemental data to any prediction regarding site denudation rates. We also plan to conduct a study of the erosional history of Cattaraugus Creek which has acted as the controlling base-level throughout the history of the formation of Buttermilk Creek and its tributaries.

Proposed Research Project Products

The 1980-1981 contract year will be devoted primarily to data gathering. A progress report covering geohydrologic and hydrologic activities for the contract year will be presented. A separate progress report on the site geology presenting geological cross sections and the results of investigations into the lateral extent of the sand lens in the vicinity of Trench 8 will be presented.

Geomorphic studies being subcontracted under Contracts No. NRC-04-79-205 and NRC-04-77-169 will be the subject of the report forthcoming in mid-1981.

For the 1981-1982 contract year progress reports on site geology including updated geological cross-sections and the results of landslide studies, and geohydrologic and hydrologic studies will be prepared.

It is proposed at the end of the three year program to present full reports addressing site geology (which will include interpreted stratigraphic data from all drilling activity), site erosion (including geomorphic studies of various types as outlined and landslide studies), and site surface-water hydrology. The USGS will report separately on site geohydrology.

THREE-YEAR PROJECTED BUDGETARY COSTS

YEAR 1 (1980/81)	\$ 218,000
YEAR 2 (1981/82)	245,000
YEAR 3 (1982/83)	<u>275,000</u>
PROJECTED 3-YEAR TOTAL	\$ <u>738,000</u>

PROPOSED RESEARCH PROGRAM

NOVEMBER 1980 TO NOVEMBER 1981

Background

The West Valley Project under the funding of Contract No. NRC-04-79-205 will have set the stage, during the 1980 field season for the beginning of active research on the geologic, geohydrologic and hydrologic character of the entire Nuclear Regulatory Commission (NRC) Licensed area at West Valley. The research for the November 1980 to November 1981 year will continue the work begun under Contract No. NRC-04-79-205. This research, in contrast to previous studies at West Valley which were limited to the immediate area of the low-level radioactive waste burial (LLRWB) site will encompass the entire site.

Progress to Date

Work so far accomplished includes the preparation of a new photogrametric topographic map of the study area at the scale of 1" = 100' with a contour interval of 2'.

Three new permanent instrumented stream gaging stations, and three new temporary non-instrumented stream gaging stations are operational. One pre-existing permanent stream gaging station is being kept in operation. The installation of the three permanent stream gaging stations by the United States Geological Survey (USGS) was funded by an interagency transfer of funds from the NRC to the USGS. The seven stream gaging stations with varying capabilities for precision cover all drainage from the NRC-licensed radioactive waste burial (NRCLRWB) site, the LLRWB site, the inactive fuel reprocessing plant, and the area north of the plant. Two of the three temporary stream gaging stations will assist in the determination of the optimum location and design for a permanent stream gaging station outside the exclusion fence.

These hydrologic and suspended sediment load measuring stations will be fully operational by the end of 1980. This proposal provides for the collection of stream discharge data under normal stream flow conditions and during storm events. Samples will be collected for suspended sediment load measurements and provision is made for radiochemical analysis of water and suspended sediment to establish baseline data for the possible offsite movement of radionuclides. The stream discharge measurements will furnish basic data to geomorphic studies underway under separate NRC funding.

The 1980 field program calls for the drilling of ten wells to investigate the stratigraphy and geohydrologic character of the ground-water-bearing surficial gravel layer of the North Plateau. Four wells will be drilled south and west of the NRCLRWB area initiating the investigation of the relationship of the known stratigraphy of the LLRWB area with the adjacent NRCLRWB area. This drilling will aid in defining the lateral extent and geometry of the near bedrock ground-water bearing zone indicated to exist near the western margin of the site. These wells will be drilled by the USGS in cooperation with the New York State Geological Survey (NYSGS) with funding from Contract No. NRC-04-79-205. The radiochemical analysis of drilling and ground-water samples from these wells will be funded by Contract No. NRC-04-79-205.

Geologic-Geohydrologic Investigations

A key portion of the proposal for the year November 1980 - November 1981 involves the organization of all existing geologic data, particularly from early construction related drilling, with drilling from this program, into a series of large scale geologic cross sections. Such cross sections will form the framework for geohydrologic studies and will be basic to fully understanding the stratigraphy of the site in its broader aspects.

A very specific geologic problem in the LLRWB area will be addressed in the proposed program. Work by the USGS has indicated the presence of a sub-surface silty sand layer east of Trench 8 which extends eastward towards Frank's Creek. This silty sand layer has been interpreted to be the lateral equivalent of a sand layer encountered beneath Trench 8. Investigation by the USGS has indicated that the silty sand layer does not reach Frank's Creek. While in general we tend to agree with this interpretation we believe that appropriate investigative conservatism requires that the extent of the silty-sand layer should be thoroughly investigated and any uncertainties regarding its extent eliminated.

Five holes to bedrock will be drilled as part of our co-operative program with the USGS during the 1981 field season with funding arranged between the USGS and the NRC. These holes will be cored, the core samples fully described and geohydrologic tests carried out as indicated to be appropriate. One of these holes will be drilled immediately to the west, and another south of the NRCLRWB area with a third deep hole to the east. A fourth hole to bedrock will be drilled on the North Plateau at a location which will give an understanding of the stratigraphy north of the plant area. A fifth hole to bedrock is planned east of the LLRWB area in order to establish the stratigraphy of the thickest portion of glacial deposits in the pre-glacial valley of Buttermilk Creek.

This proposal provides for radiochemical analysis of core and water samples from the holes to be drilled adjacent to the NRCLRWB area and from the hole to be drilled on the North Plateau. These analyses will be undertaken to establish whether or not radionuclides have migrated from the NRCLRWB area via ground-water pathways. All holes will be constructed so as to assure no loss of integrity of the burial till as an inhibitor to ground-water movement.

Hydrologic Investigations

The stream gaging, suspended sediment and sampling activities begun during 1980 will be carried forward over the 1980 - 1981 contract period. Collection of precipitation data will be continued and a snowfall survey will be carried out by the USGS during the winter. A program for establishing ambient and, if present, unusual radionuclide levels in weekly composite samples from streams and entrained suspended sediments is provided for. Provision is also made for detecting the presence of radionuclides in up to seventy individual samples of stream samples and/or sediments. This program will permit the investigation of the relationships of radionuclide transport to stream flow. Funds are included for two detailed radionuclide analyses in the event that higher-than-ambient levels of radioactivity are detected.

Geophysical Survey of Surficial Gravel Layer - North Plateau

This proposal, as part of the co-operative program with the USGS, includes a geophysical survey (resistivity and refraction seismic) of the North Plateau area. This geophysical survey will attempt to delineate the topography of the buried till surface below the ground-water bearing surficial gravel layer. The configuration of this surface must be known in order to understand the geohydrologic regime of the North Plateau.

Video Logging of NRCLRWB Area Excavation

Because of the obvious hazards involved no borings within the NRCLRWB area are planned in this proposal. The site operator, however, conducts periodic deep waste burial operations within the area. It is proposed that a geologic logging operation of one of these excavations be undertaken utilizing a color television camera and video cassette recorder. This system furnishes a unique opportunity to gain a detailed visual examination and analysis of the stratigraphy within the NRCLRWB area proper.

Surface Pulsed Radar Experiment

This proposal, for field season 1981, includes funds for the logistical assistance in installing and for recording the geologic aspects of a research trench for the field testing of the Geo-Centers, Inc., surface pulsed radar equipment at West Valley.

Geomorphic Study

A landslide has occurred immediately north of the LLRWB area. This proposal includes funds for the establishment of a grid of movement monitoring stakes on, and adjacent to this landslide surface so that further movement may be quantified and studied in detail.

Proposed Research Products 1980 - 1981 Contract Year

While the 1980 - 1981 contract year will be devoted primarily to data gathering, a progress report covering geohydrologic and hydrologic research activities for the contract year will be presented. A separate progress report on site geology including geologic cross sections and the results of investigations into the lateral extent of the sand lens in the vicinity of Trench 8 will be presented.

BUDGET

1980-1981

1. Salaries and Wages

Scientific Discipline Personnel

Project Coordinators, R. Dana and
S. Molello - 100% of time \$ 39,347

Project Assistants, L. Dunne, S. Potter
V. Ragan, T. Robak - 100% of time 56,175

Support Personnel

Office Staff - two persons - 100% of time 16,152

TOTAL 111,674

2. Indirect Cost - Rate of 47.18% of
Salaries and Wages 52,688

3. Supplies and Materials 9,000

4. Equipment

Video Camera 1,000
Video Cassette Recorder 1,000
Downhole Lighting 300
Camera Cable 100
Video Tapes 100
Misc. Support Equipment 500

5. Publications 800

6. Travel

Domestic 19,000

7. Other

Radionuclide Analyses 22,240

TOTAL \$ 106,728

218,402

AMOUNT REQUESTED \$ 218,000

DETAILED BUDGET

1980-1981

1. Salaries and Wages

Scientific Discipline Personnel

Project Coordinators, R. Dana and
S. Molello, (Albany) - 100% of time \$ 39,347

Project Assistants, L. Dunne, V. Ragan
(Albany) S. Potter, T. Robak (West Valley) -
100% of time 56,175

Support Personnel

Office Staff (Albany), S. Lewis and
C. Cosgrave - 100% of time 16,152

TOTAL 111,674

2. Indirect Costs - Rate of 47.18% of
Salaries and Wages - This rate is
comprised as follows:

Fringe @ 30.26% 33,793

Departmental Direct Costs @ 4.96% 5,539

Indirect Costs @ 11.96% 13,356

TOTAL 52,688

3. Supplies and Materials 9,000

4. Equipment

Color Video Camera 1,000

Video Cassette Recorder 1,000

Downhole Lighting 300

Camera Cable 100

Video Tapes 100

Miscellaneous 500

TOTAL 12,000

5. Publications 800

6. Travel
Domestic only (includes per diem) 19,000

7. Other

Radionuclide Analyses

7. Continued

Surface water and associated suspended sediment monitoring - weekly basis - total alpha, total beta, and/or tritium.	12,441
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Surface water and associated stream sediment analyses for chosen periods - 70 samples, total alpha, total beta, and/or tritium and two detailed analyses.	5,810
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1981 drilling program analysis of earth and water samples.	<u>3,989</u>
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TOTAL	42,040
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	<u>\$218,402</u>
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AMOUNT REQUESTED	<u><u>\$218,000</u></u>
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BUDGET COMMENTS

Certain portions of the budget presented for the November 1980 - November 1981 proposal are tied to specific research activities. These are discussed below and are related to specific items in our narrative of the Proposed Research Program.

Geologic-Geohydrologic Investigations and Hydrologic Investigations

Under these two categories mentioned is made of radionuclide analyses. In the detailed budget provision is made for "Surface water and associated suspended sediment monitoring" this provides for the monitoring of: weekly composite samples from the four permanent stations; background grab samples from offsite streams; bed sediment samples; and special meteorological event grab samples. This program will establish ambient levels for the site. Analyses for total alpha, total beta, and/or tritium will be performed. The estimated cost for these analyses (to be done by the Radiological Sciences Laboratory of the N.Y.S. Department of Health) is \$12,441.

A second category, "Surface water and associated suspended sediment analyses for chosen periods", is included. The category will provide for radiochemical analyses as described above to be performed on 70 samples. This program will allow us flexibility to accomplish two objectives. Should examination of weekly composite samples exhibit occasional levels either above or below ambient levels for the site we will be able to examine daily and grab samples to pinpoint the time and runoff conditions under which the variations occurred. If no variations occur then day by day comparisons of radionuclide contents of stream and suspended sediments under varying runoff conditions can be made. Provision is also made for two detailed sample analyses for specific isotopes in the event higher than ambient levels are encountered. The estimated cost for this package is \$5,810.

Under the "1981 drilling program analysis of earth and water samples" provision is made for the radiochemical analyses of earth samples from four holes. All samples will be analyzed for total alpha, total beta, and tritium and isotopic gamma radionuclides. From the three holes near the NRCLRWB site, soil samples will be analyzed for U-234/U-238 ratio to detect possible contamination of deep groundwater by U-238. These samples will also be analyzed for stable zirconium which if detected would be evidence for a direct link between zircaloy fuel elements and ground-water movement. These radionuclide analyses are estimated at \$3,989.

Video Logging of NRCLRWB Site Excavation

Funds in the amount of \$3,000 for the video and accessory equipment are itemized in the budget. This specialty equipment is necessary if the video logging of a burial excavation in the NRCLRWB is to be accomplished. An additional \$1,000 for this task is included in travel to cover travel and per-diem expenses for NYSGS personnel from the Albany Office who will carry out this work.

Surface Pulsed Radar Experiment

If the surface pulsed radar experiment is to be conducted at West Valley with NYSGS participation \$1,000 from travel will be needed to cover travel and per-diem expenses of the Albany-based staff involved.