Sandia National Laboratories
Albuquerque, New Mexico 87185

December 15, 1985 DEC 13 P12:18

Neil M. Coleman
Hydrology Section
Geotechnical Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Mr. Coleman:

Enclosed is the monthly report on FIN A-1158, Repository Site Description and Technology Transfer for November 1985. Please feel free to contact me if you have any questions or comments.

Sincerely,

Robert M. Cranwell

Robert M. Cranwell, Supervisor
Waste Management Systems
Division 6431

RMC:6431:jm

Enclosure

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PROGRAM: Repository Site Definitions — FIN#: A-1158
Short-term Technical Assistance — Tasks I, III

CONTRACTOR: Sandia National Laboratories — BUDGET PERIOD: 10/85 - 9/86

NMSS PROGRAM MANAGER: N. M. Coleman — BUDGET AMOUNT: ?

CONTRACT PROGRAM MANAGER: R. M. Cranwell — FTS PHONE: 844-8368

PRINCIPAL INVESTIGATOR: G. F. Wilkinson — FTS PHONE: 844-0074

PROJECT OBJECTIVE

To develop reference repositories in media other than bedded salt (i.e., basalt, domed salt, welded tuff, and granite).

ACTIVITIES DURING NOVEMBER 1985

Activities and Accomplishments

Under short-term technical assistance, we received technical draft positions on groundwater travel time and the disturbed zone. These documents were reviewed by Sandia personnel and comments were telexed to Dick Codell on December 10, 1985. A copy of the comments is attached. We recommend that Sandia personnel who reviewed the draft technical positions and appropriate NRC staff meet to discuss these documents.

PROGRAM: Technology Transfer FIN#: A-1158 Task II

CONTRACTOR: Sandia National Laboratories BUDGET PERIOD: 10/85 - 9/86

NMSS PROGRAM MANAGER: N. M. Coleman BUDGET AMOUNT: ?

CONTRACT PROGRAM MANAGER: R. M. Cranwell FTS PHONE: 844-8368

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PROJECT OBJECTIVE

To insure through technical support, problem definition, and documentation the timely, thorough, and efficient transfer of the information, analysis techniques, and analysis tools developed for the U.S. Nuclear Regulatory Commission (NRC) by the methodology program.

ACTIVITIES DURING NOVEMBER 1985

In a recent telephone conversation, the NMSS Project Manager (PM) advised Sandia that several of the NRC's nuclear waste consultants needed to access some of the computer programs currently maintained on QUALIB. He asked whether it would be possible for these contractors to directly approach Sandia and establish a contract for purchasing computer time. After discussing the idea with representatives of the computing, purchasing and legal departments, we determined that it would not be feasible for Sandia to sell computer time to private consultants. The only way that these consultants could access the Sandia Computing System would be through an account established for the NRC. In addition, several of the larger programs are run more efficiently, and consequently less expensively, on the secure partition of the computing system. Without a Q-clearance, it would be impossible for the consultants to access the secure partition.

In subsequent telephone conversations, the NMSS PM suggested that standard versions of the computer programs be placed in a facility where the NRC currently has timesharing privileges. The computing center at INEL was mentioned as one such facility. After considerable discussion within Sandia, we determined that although this idea seemed to be good in concept, it would be a very difficult and time-consuming job to perform. Our main concern dealt with the constant hardware and operating system changes which are common to all large computer systems. It is difficult enough to keep all of the codes running on the Sandia system, and we would not even be aware of

system changes at some other site. In addition, these computer codes are not machine independent. Even if another site has the same hardware and operating system, minor changes made by the systems people may alter how the code runs and affect the output. Therefore, it would require an extensive amount of time and manpower to verify data sets and output.

These concerns were expressed to the NMSS PM in a recent telephone conversation. He felt that it was still a viable alternative to allowing the consultants access to the Sandia system, and requested that we do further investigation to determine the feasibility of the project. In addition, he stated that he was revising the 189 to add the option of placing computer codes at other sites for use by the NRC and its nuclear waste consultants. He indicated that the NRC would provide additional funding for this work.

TOUGH

Dr. Pruess advises that the draft of the TOUGH user's guide is nearing completion and will be mailed to us shortly.

As part of the testing program, Dr. Pruess brought the TOUGH program up and running on the IBM 3081 on the UC Berkeley campus, and on the VAX 8600 at Lawrence Berkeley Laboratory. Both computers are 32 bit machines, which implement slightly different versions of FORTRAN 77. A substantial number of changes were made in the TOUGH code to improve its portability. Dr. Pruess expects to mail us a tape with the TOUGH source code, as well as input decks for a number of sample problems, by the end of the month.

Comments on Draft Technical Position
on Ground-Water Travel Time

General Comments

1. The Draft Position is not clear on the meaning of "pre-waste-emplacement" ground-water conditions. For example, does "pre-waste-emplacement" ground-water conditions refer to steady-state conditions existing prior to construction of the repository, or present day conditions which inherently include transient effects such as cycles of wet and dry years, local flooding, changes in ground water and surface water use and irrigation practices? Reference is made to "steady-state flow calculations" in determining GWTT (e.g., page 31, paragraph 2), but at the same time it is suggested that "short-term changes to the environment that might alter hydraulic heads" should be factored into the conceptual model for determining GWTT (page 7, paragraph 3). Is the assumption being made that some unspecified "steady-state" conditions exist just prior to construction of the repository which could be affected by these factors but have not been included in the steady-state model? It needs to be made clear if "pre-waste-emplacement" conditions refer to steady-state conditions or transient conditions.

2. The reason for including the discussion on matrix diffusion, sorption, molecular diffusion, and other transport phenomena is not clear. Compliance with the GWTT objective of Part 60 requires identification of the fastest path of likely radionuclide travel. The mechanisms mentioned above tend only to retard radionuclide travel times. It is recommended that any discussions on transport phenomena be eliminated as it seems to distract from the document rather than contribute to its intent; that is, provide guidance on determining pre-waste-emplacement ground-water travel times.

3. Certain areas of the Draft Position are overemphasized while not enough guidance is given in other areas. This seems particularly true in Section 2.5 and Appendix A. Section 2.5, "Special Considerations", reads more as a description of the problems associated with unsaturated media and matrix diffusion rather than giving guidance in these areas. It is expected that the applicant would be aware of the problems associated with unsaturated media in determining GWTT's. What needs to be stated more clearly is guidance from NRC on what is an acceptable approach to addressing these problems. Also, as mentioned earlier, the topic of matrix diffusion is overemphasized. Of more concern is the problem of fracture flow. More discussion and guidance needs to be given on what are the problems associated with fracture flow (e.g., fracture aperture, frequency, etc), and guidance from the NRC on an acceptable approach toward addressing these problems.

   In Appendix A, a tremendous amount of guidance is given on how to calculate a distribution of GWTT's, and yet very little guidance is given on when a "deterministic" modeling approach would be acceptable and when a "stochastic" modeling approach would be acceptable. All that is stated is that both "approaches have their strengths and weaknesses" and that "either approach is acceptable, so long as it is well justified." True, both

approaches have their strengths and weaknesses, but these strengths and weaknesses need to be pointed out and, again, guidance given from the NRC on what is acceptable. That is, what constitutes "well justified?" An applicant should know this a priori.

Finally, no guidance is given anywhere in the Draft Position on how to demonstrate that a conceptual model is likely. That is, how does one determine which conceptual models are "likely" and which are not? Also, how does one reconcile differences in "likely" conceptual models and how do you combine results from different conceptual models into a single CDF?

4. Although the use of a CDF to represent uncertainty in GWTT's is desirable, it is misleading when one consideres the wording of Part 60. Compliance with the GWTT objective of Part 60 requires identification of the fastest path of likely radionuclide travel. A CDF incorporates all possible paths (or trajectories) and does not address which path (or trajectory) is most likely. In fact, in a Monte Carlo simulation the assumption is that all paths (or trajectories) are equally likely. We understand the motives of the author in wanting to use a CDF with a percentile criterion for GWTT, and, if fact, recommend its use. We do, however, feel that various changes in the wording of Part 60, would be needed to correspond to the use of a CDF. For example, as Part 60 now reads, when we encounter a radionuclide travel time of less than 1000 years, we are in violation of the rule. Thus, a CDF of travel times is meaningless as we are concerned only with the first time when the CDF curve moves off the horizontal axis (ie, takes on a non-zero value). If this time is less than 1000 years we are in violation.

   If the use of a CDF of travel times is desired, we feel that the phrase "reasonable assurance" should be included in the wording of the GWTT objective of Part 60. Further, the terms fastest and likely should be dropped since they have little meaning in a CDF of travel times (unless, one is generating a CDF of fastest travel times). Finally, since we are no longer concerned with the absolute fastest GWTT, and in order to maintain the objectives of the GWTT rule (ie, to "assure that ground-water conditions are favorable"), we feel that the 1000 year GWTT be changed to, say, 5000 years (see Specific comments, page 5, paragraph 2). Thus, we suggest rewording the GWTT objective in 10CFR60.113(a)(2) to read as:

   "The geologic repository shall be located so that with reasonable assurance the pre-waste-emplacement ground-water travel time from the edge of the disturbed zone to the accessible environment shall be at least 5000 years or such other time as may be approved or specified by the Commission."

Specific Comments

Page 2 -	Reference to Appendix B, "Definition of Paths," is made. However, the report has no Appendix B except for Figures B.1 and B.2.
Page 3, Paragraph 2 -	Reword GWTT objective in Part 60 as recommended in General Comments.

Page 3, Paragraph 3 - Indicate that "distrubed zone" has been set at 50 meters.

Page 5, Paragraph 2 - Suggest changing "Release of radionuclides to the biosphere..." to "Transport of radionuclide to the biophere..."

Page 5, Paragraph 2 - A 1000 year GWTT does not assure that ground-water conditions are favorable because release points can be found in almost any ground-water flow system which results in travel times larger than 1000 years.

Page 5, Paragraph 3 - What is meant by "different alternatives at the same site?" This cannot mean alternative repository designs because we are considering pre-waste-emplacement conditions (unless different designs could result in a different limit for disturbed zone).

Page 7, Paragraph 1 - "Simplicity" is justified as long as the simple view is still realistic. Simplicity should have little to do with computer costs. Here, and at other points in the Draft Position, it sounds like investigative costs and computer costs will play a part in regulatory discussions. How much of a role will they play?

Page 7, Paragraph 3 - See General Comment on steady-state vs transient conditions for pre-waste-emplacement conditions.

Page 7, Paragraph 3 - "...whenever practicable." What is practicable? Again, does this involve costs?

Page 8, Paragraph 2 - "Each identified path..." May not be able to identify "paths" in fractured and unsaturated rock.

Page 9, Paragraph 1 - No guidance is given as to how a conceptual model can be demonstrated to be unlikely (see General Comment 3).

Page 9, Paragraph 2 - What is "...reasonable estimate of the hydraulic quality..."?

Page 9, Paragraph 3 - Spatial variability and temporal variability do not contribute to uncertainty. The inability to completely characterize and quantify this variability leads to uncertainty.

Pages 11 - 12 - Particles (water) that travel into the matrix are neither the "fastest" nor the "most likely." As stated in the General Comments, given a CDF has been generated, all paths are equally likely and so, only the "fastest" path is of interest.

Page 13 - Again, the only path of interest is the "fastest" path, as no indication has been given as to which one is most "likely." The suggested weighting based on frequency

and duration of recharge events has nothing to do with which path is likely and only the largest, longest event should be considered as it would yield the shortest travel time.

Page 14, Section 2.5.2 - Eliminate discussion on Matrix Diffusion (see General Comments).

Page 16, Paragraph 1 - If one is concerned with ground-water travel times, then it would be correct to characterize the travel time through a dual porosity medium by the speeds along the fractures (since matrix diffusion is meaningless when discussing ground-water travel only).

Page 16, Paragraph 2 - Multiple pathways are not produced by spatial or temporal variability but by the inability to completely characterize the system. Thus, they fall into the realm of data uncertainty, which is already mentioned.

Page 17, Paragraph 1 - "Pre-waste-emplacement pertains to conditions ...whose environmental variability..." is a contradiction. There should be no variability in conditions at the site prior to construction.

Page 18, Paragraph 1 - "...a (1-x)% probability..." Should read "(1-x) probability."

Page 20, Paragraph 1 - Contradiction when talking about particles moving with ground water and molecular diffusion, unless one is talking about "Brownian Motion." Delete discussion on transport phenomena (see General Comment).

Page 20, Paragraph 2 - "...hydraulic properties of the medium at their location." Change to read "...hydraulic properties of the medium and driving forces at their locations."

Page 21, Paragraph 4 - "...indirect inference." Not clear. Inference about what?

Page 21, Paragraph 4 - Delete second sentence, "Experiments with..."

Page 22, Paragraph 2 - Change "partial differential equations (PDE's)" to "governing equations". Mathematical models do not have to consist of PDE's; they can be ordinary differential equations or other.

Page 23, Paragraph 1 - There is no guarantee that "extreme values" will produce "strictly-conservative estimates."

Page 23, Paragraph 2 - In a stochastic model, parameters and dependent variables (not just coefficients of governing equations) are treated as stochastic processes (not probability distributions).

Page 23, Paragraph 2 - "This technique has the distinct advantage..." Eliminate distinct.

Page 24, 1st bullet - Bounding value estimates are usually extreme values of range of a parameter, not extreme range.

Page 25, 2nd bullet - A probability density function is not a distribution. It is exactly what is says it is, a function. Also, the definition given, that is "...the probability associated with the value of a parameter in the range is known" is only true if you are talking about a discrete random variable. For a continuous random variable, the probability associated with the value of any single parameter is zero.

Page 26, Paragraph 1 and 1st bullet -
There is a contradiction here. In the 1st paragraph, it states that "Among the most likely sources (of uncertainty) are:

- o Spatial Variation of Measured Parameters. These variations are true deviations...and not actually "uncertainties."
  If this is not an uncertainty, shouldn't list is as a "likely source" of uncertainty.

Page 26, 1st bullet - State instead that incomplete characterization of spatial variability results in uncertainty.

Page 27, Paragraph 2 - Start new paragraph at "The staff recommends...available data."

Page 29, Paragraph 1 - Highlight major procedures for interpretation of sprase data. "(1) Sophisticated interpolation methods..., (2) Using a ..., (3) Statistical inverse methods..."

Page 29, Paragraph 1 - "Inverse methods will generally produce much more satisfactory results than interpolation methods." Not necessarily true!

Page 29, Paragraph 1 - "...validated with real field data," Validation is not appropriate for computational errors.

Page 31, Paragraph 1 - "Section 2.1" is wrong section.

Page 33, Paragraph 1 - "A large part of ...variability of GWTT is caused by inability to characterize spatial non-uniformity..."

Page 33, Paragraph 3 - Need to discuss advantages and disadvantages of conditional and unconditional simulation.

Page 34, Paragraph 2 - Not sure how a "histogram" can be used to determine spatial co-variance and drift. Also, variogram is not used to determine drift.

Page 34, Paragraph 2 - Kriging or inverse method may be used to infer data between measured points, not refine data. Co-kriging may be used to refine estimates of properties.

Page 34 - No mention is made of the generalized co-variance approach to determine spatial variability. The drift and variogram approach are of questionable reliability.

Page 35, Paragraph 2 - "The random fields are used with a two-dimensional..." Why 2-D?

Review Comments

Gordon, M, Tanious, N., Bradbury, J., Kovach, L., and Codell, R., 1985, Draft generic technical position: Interpretation and identification of the extent of the disturbed zone in the high-level waste rule (10 CFR 60): NRC.

General Comments

1. The document is well written and represents a vast improvement over earlier versions.

2. There still appears to be a disconnect between the proposed 50-meter disturbed zone and the distance to which hydrologic effects may actually cause a significant disturbance. A possible way around this might be to consider the following:

   a. It is conservative to assume that the ground-water travel time through the disturbed zone of rock (say, 50 meters) is zero.

   b. It is also likely that outside the assumed disturbed zone, the post-emplacement travel time to the accessible environment is somewhat shorter than the pre-emplacement travel time.

   c. However, items 1 and 2 act to offset each other in that the engineered backfill will provide a certain delay (i.e., non-zero travel time) within the disturbed zone that tends to make up the "loss" outside the disturbed zone.

3. In determining whether a site meets the 1000-year travel time, both the "disturbed zone" and "the host rock directly adjacent to the underground facility" are not to be included in the calculation. Because of the difficulty in determining the extent and definition of the disturbed zone, why not define the rock adjacent to the underground facility instead? The assigned thickness could include any expected disturbed zone, and definition would not be a problem.

4. Assigning a value of 50 m from the edge of the repository to the outer edge of the disturbed zone is more in keeping with comment 3 above rather than defining a disturbed zone.

5. Propagation of mechanical disturbances (e.g., progressive cracking of the overlaying strata) is not addressed.

6. The presence of a disturbed zone may, in fact, enhance the performance of the repository. This zone is being excluded from the travel-time calculations because of the unknowns involved rather than the assumption of adversity.

7. If NRC accepts the recommendation that the travel-time requirement can be increased, the disturbed zone will not have to be a factor in travel-time calculations.

8. Appendix B needs to have the conceptual model clarified. In the early heating phase of the repository, the maximum temperature will occur at the edge of the repository (as stated in the text) and will be uniform across the entire repository. The analysis presented has the temperature decrease downstream from the midpoint of the repository (page 8, paragraph 2).

Specific Comments on GTP on Disturbed Zone

Page 1, Paragraph 4 - The final EPA Standard has been issued; does that make this "interim" guidance out-of-date and irrelevant?

Page 3, Paragraph 2 - The statement,"...thus this volume of rock may not substantially contribute to repository performance." is somewhat misleading in that the engineered barriers (waste package, room backfill, seals) within that rock volume will provide substantial performance. The point to be made is that this portion of the geologic setting may not provide the natural barrier function in its disturbed state.

Page 3, Paragraph 4 - In the eight line of this paragraph, the phrase "an appropriate measure" should be changed to "a reasonably conservative measure."

Page 4, Paragraph 2 - In the last line of this paragraph "'significant' effect" should be changed to "'significant' adverse effect".

Page 4, Paragraph 3 - How does the lack of ground-water flow in salt satisfy the consideration that the natural geologic barrier at a given site not depend exclusively or predominantly on the portion of the host rock directly adjacent to the underground facility? If salt is impermeable, nothing will reach beyond the rock adjacent to the repository.

This paragraph needs to be reworded to more clearly convey the concept involved.

Page 5, Paragraph 2 - The disturbed zone is defined here based on significant changes in permeability and effective porosity. Elsewhere in the report, the zone is extended out to the area where no stress changes occur. Why discuss "significant" changes when these changes are not used to define the disturbed zone?

Page 6, Item 1 -4 - The viscosity changes in the ground-water due to temperature changes appear not to have been considered.

Page 7, Paragraph 1, Sentence 5 -
THe relation of permeability to stress changes based on lab tests are of marginal value, because the samples are not representative of the in-situ rock.

Page 7, Paragraph 1 - The statement is made that, "...permeability will not change in the volume of rock beyond the surface of no stress changes." in the context of stress redistribution caused by an opening. It is important to recognize that stress changes due to thermal loads alone will occur regardless of whether an opening is created or not.

Page 7, Paragraph 1, bottom - A change in stress, no matter how small, is correlated with a change in permeability. Because of the inherent strength of a rock mass, especially crystalline rocks, this is not necessarily true for small changes in stress.

Page 8, Paragraph 1 - The application of the term "yielding" is unclear because yielding usually occurs before fracture. In line 3, if the term "yielding" were replaced by the term "movement", it would make more sense.

Page 8, Paragraph 2, Sentence 1 - The difference between five diameters and five times the opening height could be considerable. State that the largest cross-sectional dimension of the opening is used.

Page 8, Paragraph 2, bottom - Reword to indicate the intent of the sentence. Site-specific results may not be conservative relative to the 50m.

Page 8, Paragraph 3, Sentence 1 - Figure 2 does not show the range of dimensions indicated in this sentence.

Page 8, Paragraph 4 - Again, creep deformation can and will occur even in the absence of an opening, although the creep rate and total creep (due to thermal stress gradients only) will be small compared to those near an opening with the same thermal load. Laboratory and field evidence indicate that creep occurs when the principal stresses are unequal; any loading that creates larger deviatoric stresses will either result in larger creep strains or higher stress build-up in the rock mass.

In addition to making a distinction between salt rock and other rocks, unique considerations must be given to bedded salt versus domed salt.

Page 9, Paragraph 2 - It is more accurate to say that ,...gas blowouts and brine migration "are know to have occurred." than to say "...are well known."

Page 10, Paragraph 2, Sentence 2 -
The opening and closing of pre-existing fractures depends on the amount and degree of fracture filling.

Page 10, Paragraph 2 - The first paragraph under section 4.3 mentions that permeability changes due to uplift/subsidence may be more significant in salt than in hard rocks. This should be reinforced by adding, at the end of the third sentence, "...in hard rocks due to its creep property and a relatively high coefficient of thermal expansion."

In lines 9 and 10, "temperature range" should be replaced with "temperature distribution".

Page 10 - The last sentence of the first paragraph in 4.3 refers to "joint movements in existing excavations near the site." What site is implied here?

Possible dependence of thermomechanical properties on temperature is not addressed at all in this section. Neither is the observed negative coefficient of thermal expansion in unwelded tuff units given a mention; this behavior is contrary to the intuitive assumption that an increase in temperature results in expansion.

Page 10, Paragraph 3, Sentence 1 -
Tests on lab samples do not necessarily produce results that are representative of the in-situ rock, because the lab samples were removed from the confining stresses, thereby allowing the samples to expand. The greater the initial in-situ stresses, the greater will be the deformation of the sample as a result of removing the stresses. Applying confining pressure in the lab will not restore a sample to the in-situ condition.

Page 10 Bottom - Top - Good points made about the effects of confining pressure and thermal expansion on permeability.

Page 12, Paragraph 2, Last Sentence -
This statement is inaccurate. Precipitation of minerals in pores and fractures can reduce or even stop flow. Mineral alteration generally results in the formation of hydrated minerals that have larger volumes than the unaltered form. These larger volumes can plug pores and fractures, thereby reducing flow.

Page 13, Top - How were these volumes calculated?

For example, an estimated solid-volume decrease of $43cm^3$ is given as resulting from the hydrolysis of alkali feldspar. What is the reference V_s value from

which a $\Delta V_s = -43 cm^3$ results?

Page 13, Paragraph 2 - The change in volume for clinoptilolite to analcime is about 5 percent.

Figure 2 - Should consider using a different example, because the BWIP design now calls for a single canister per horizontal hole emplacement configuration.

Appendix A

Page 2, Paragraph 2, Sentence 3 -
The Kozeny and Carmen equation is for an ideal situation where total porosity equals effective porosity. In most rocks, especially fractured rocks, this relationship is not true. As a result, permeability cannot be related to total porosity. .

Bear, 1976 should be 1979.

Appendix B

Page 1, Sentence 2 - This statement is not accurate. After resaturation, the flux through the repository is controlled by the lower permeability zones surrounding the repository (similar to applying the series equation for calculating vertical hydraulic conductivity for a sequence of rocks having different hydraulic conductivities).

Sentence 4 - This statement presumes a significant flux of water through the repository, which probably will not occur. Also, silica dissolved at the repository would be precipitated in pores and fractures as the water cooled, thereby reducing flow.

Page 4, Equation 1-12 - Need to define C_x and C_{x+dx}.

Page 5, below Equation 5 -
How will the silica be removed from the nonconducting pores?

Page 8, Paragraph 2 - For horizontal flow, having the temperature decrease downstream from the midpoint of the repository is not realistic.

In addition, as the water cools (the water assumed to be saturated with silica), the silica will precipitate in the pores, thereby reducing the flow.

Page 13, Paragraph 2, Sentence 1 - See comment for Page 1, Sentence 2.

Page 15 - The above analysis is very conservative.

Page 16 Bottom-17 top - That silica dissolution can be neglected is a reasonable conclusion.

Appendix B - The figure numbers should be B-1, B-2, -- B-6, etc. to distinguish them from the figures that go with the main text.

References - The reference list (at the very end) should be moved ahead of Appendix A to avoid confusion with the references of Appendix B.

A-1158, Tasks I and III
0976.020
October 1985

THIS IS AN ESTIMATE ONLY AND MAY NOT MATCH THE INVOICES SENT TO NRC BY SANDIA'S ACCOUNTING DEPARTMENT.

		Current Month	Year-to-Date
I.	Direct Manpower (man-months of charged effort)	0.0	0.0
II.	Direct Loaded Labor Costs	0.0	0.0
	Materials and Services	0.0	0.0
	ADP Support (computer)	0.0	0.0
	Subcontracts	0.0	0.0
	Travel	0.0	0.0
	Other	0.0	0.0
	TOTAL COSTS	0.0	0.0

Other = rounding approximation by computer

III. Funding Status

Prior FY Carryover	FY86 Projected Funding Level	FY86 Funds Received to Date	FY86 Funding Balance Needed
43K	To be determined	None	To be determined

A-1158, Task II
0976.010
October 1985

THIS IS AN ESTIMATE ONLY AND MAY NOT MATCH THE INVOICES SENT TO NRC BY SANDIA'S ACCOUNTING DEPARTMENT.

		Current Month	Year-to-Date
I.	Direct Manpower (man-months of charged effort)	1.7	1.9
II.	Direct Loaded Labor Costs	7.0	18.0
	Materials and Services	0.0	0.0
	ADP Support (computer)	0.0	0.0
	Subcontracts	7.0	-1.0
	Travel	0.0	0.0
	Other	0.0	0.0
	TOTAL COSTS	14.0	17.0

Other = rounding approximation by computer

III. Funding Status

Prior FY Carryover	FY86 Projected Funding Level	FY86 Funds Received to Date	FY86 Funding Balance Needed
107K	To be determined	None	To be determined

A-1158

TOTAL FOR 0976.010 and 0976.020

October 1985

THIS IS AN ESTIMATE ONLY AND MAY NOT MATCH THE INVOICES SENT TO NRC BY SANDIA'S ACCOUNTING DEPARTMENT.

		Current Month	Year-to-Date
I.	Direct Manpower (man-months of charged effort)	0.7	1.9
II.	Direct Loaded Labor Costs	7.0	18.0
	Materials and Services	0.0	0.0
	ADP Support (computer)	0.0	0.0
	Subcontracts	7.0	-1.0
	Travel	0.0	0.0
	Other	0.0	1.0
	TOTAL COSTS	14.0	17.0

Other = rounding approximation by computer

III. Funding Status

Prior FY Carryover	FY86 Projected Funding Level	FY86 Funds Received to Date	FY86 Funding Balance Needed
150K	To be determined	None	To be determined